Environmental Impact Assessment

For

Improvement Of The 'Hatirjheel-Rampura-Bonoshree Ideal School and College Sheikherjaiga-Amulia-Demra' Highway Into 4-Lanes (Including Link to Chattogram Road Intersection and Access to Tarabo) Through Public Private Partnership (PPP)

SUBMITTED BY

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EXECUTIVE SUMMARY

To ease traffic in Dhaka, a public-private partnership (PPP) project will convert the Hatirjheel-Rampura-Bonoshree Ideal School and College Sheikherjaiga-Amulia-Demra Highway into a four-lane highway. By creating a new long-term asset that will serve the government goal of improving road transport connections in Dhaka, this Project Road will seek to alleviate the growing urban congestion.

As per the GOB project categorization (ECR 1997) this project is fallen under "Red" category requiring preparation of an EIA report and collection of ECC from the DoE which have already been obtained by the authority. Besides, as per the AIIB's ESF, this project is categorized as "Category A" project (triggered ESS 1 and 2) requiring a full-fledged ESIA. But as per discussion with the AIIB, separate EIA and SIA report has been prepared. Moreover, as per EPFI guideline, the project is categorized as "Category A" project. A critical gap between GOB regulations and AIIB's ESF is the absence of provisions requiring the development of project-specific ES management plans.

A projected junction at Chattogram Road (National Highway N1) serves as the starting point of the Project Highway, and another interchange at Hatirjheel, close to Rampura Bridge Road, serves as the ending point. The Project Highway, which is 12.491 km long and consists of an elevated toll road (including the Rampura interchange section) for 8.414 km and an at-grade toll road for 4.077 km, is expected to create a strong connection between the capital city of Dhaka and the eastern districts of Bangladesh, including Chattogram, Sylhet, Narayanganj, and. The Project comprises of three interchanges, a toll plaza, a four-lane divided access-controlled toll road, and two-lane service roads (on one or both sides). The construction of the access-controlled road will primarily follow the current alignment from Chattogram Road to Rampura. The proposed toll road will have a minimum width of 9.7 meters in each direction and 8.6 meters in each direction (for the elevated stretch, which is 9 km long) (at-grade section, 4.5 km long). There will be grade-separated flyovers built at Rampura Bridge, Demra, and Chattogram Road. Additionally, two new bridges will be built next to the Nandipara and Shekherjaiga bridges. At present, the existing road is very busy and as per seasonal volume variation data, the maximum volume reaches during the month of November (9.65%).

The baseline environmental condition has been analyzed for physical, biological and socio-economic environment. The project area is in south-central climatic region having elevation from 3 to 10m. The project area is part of Jamuna (Young Brahmaputra) and Old Meghna Estuarine Floodplain. The air quality, noise level, vibration level, soil quality and riverbed sediment quality have been assessed and as per the national and international standard they are analysed. As per the analysis, most of the parameters are exceeded the standard level which requiring appropriate mitigation measures (suggested in the EMP). The project area is adjacent to two ECA (Shitalakshya and Balu). But the project intervention work will not have negative impact over these major waterbodies as they are situated well outside the impact zone. The project area is also not prone to hazards e.g., earthquake, flood etc. Besides, a detail flora-fauna and fisheries survey have been carried out and it is found that the project area do not contain any critical species which may get negative impact from the project intervention work. As there are no critical species or critical habitat present within the project area, Biodiversity Management Plan (BMP) is not required and thus has not been prepared. Moreover, as per the socioeconomic survey, at project area total of 2810 population will be affected where 54% are male and 46% are female and mostly affected people would be the owner of the land (75% HHs).

Analysis of alternative section summarizes that Option 3 (Combination of elevated and at grade road with realignment at one location) has the lowest project cost and requires the least amount of physical relocating because it avoids the heavily populated commercial districts close to Demra Staff Circle.

Some consequences, such as emissions and noise, will be residual impacts for which mitigation will necessarily fall short of being completely effective over the operation time notwithstanding some mitigation. Positive effects like greater employment and business prospects as well as improved integration in the local economy will greatly offset these residual effects. It should be noted that air quality and noise impacts from the project may ultimately represent an improvement over the situation that is likely to develop under the current trajectory (the no-project alternative).

Based on the kind of work that will be done and where it will be done, the labor risks for the project can be identified. Risks related to the work being done by the workforce, including those particular to COVID-19.

The ecology around the project region is most at risk from increasing urbanization and the unchecked expansion of industry brought on by the simpler importation of materials from overseas via the sea port. To address this issue, a proactive multi-stakeholder planning procedure involving the RHD, the municipal corporations (Dhaka North, Dhaka South, and Narayanganj), and Pourashava level must be suggested. Although there is no assurance of success, there is a significant possibility for successful mitigation if this endeavor is launched early and with determination. It should be highlighted that the implementation of land use rules is ultimately a political process, and success or failure will depend on the relative strength of interested parties and beneficiaries. After taking all of the aforementioned information into consideration, it is believed that the impacts anticipated from the proposed project investments do not reach a level of magnitude, severity, or complexity that would warrant further in-depth research and the creation of novel or specialized mitigation strategies. This location's investments are correctly categorized as being under “Category A” for the environment. The estimated environmental monitoring cost is presented below.

Phase	Cost Amount (BDT)
Pre-Construction	1,495,000
Construction (3 years)	139,056,000
Operation (per year)	1,322,000
Establishment and Training (per year)	400,000

A total of five (05) focus group discussions have been carried out and the output is satisfactory as the participants have urged to start the project intervention work at their earliest convenience and also to properly compensate the affected peoples. The main issues raised during these consultations were plantation programme, avoiding drainage congestion, adequate compensation for the affected parties should be provided. In response, the company will carry out a tree plantation programme where a total of 17460 trees will be replanted. Besides, the company will ensure proper compensation as full-fledged Resettlement Action Plan (RAP) has been prepared. Besides, the design has already been prepared keeping the drainage issues. Also, mitigative measures suggested in the EMP sections will be strictly followed during the construction and implementation period of the project which will be monitored by the appropriate authority (RHD, PIU). Moreover, the EIA, RAP, SEP documents will be disclosed in the website of the RHD, AIIB and the company.

A three-tier grievance redress mechanism (GRM) has been proposed and also regular monitoring have been suggested. The project director will report to the AIIB quarterly and annually on the progress and

outcomes of the stakeholder engagement efforts, with the assistance of social and environmental specialists, where stakeholder-related activities will be comprehensively discussed.

The executing agency for the project is the Roads and Highways Division (RHD). A project implementation unit (PIU) will be established which will be headed by a full-time project manager. PIU will have an environmental unit who will be assisted by a non-government organization to implement the resettlement plan. Safeguard specialists for environment and resettlement will be a part of the PIU to monitor the EMP implementation and ensure compliance with both AIIB and Government of Bangladesh requirements.

The EMP, as well as its monitoring and mitigation plans, must be specified in the contract agreements for the project's activities. The contract documents state that the Company is responsible for implementing the EMP's requirements through Construction Environmental Management Plan (CEMP), which will include all of the EMP's specifications as well as any site-specific information that is not yet known, like the locations of the borrow pits. By doing this, it is ensured that the Contractor (The Company) is aware of the environmental standards for the project and the costs associated with those requirements.

I. INTRODUCTION

A. Background

1. The city of Dhaka is experiencing a period of rapid economic growth and increased urbanization. Road connectivity is one of the vital indicators of economic progress. Connectivity is fundamental to access and facilitate establishment of certain civic infrastructure and services such as medical, postal, public transport, security, and governance. Consequently, an improved connectivity also helps build business and spur economic activities.

2. The Roads and Highways Department (RHD), Government of Bangladesh (GoB) is planning to upgrade an existing two-lane road with undivided carriageway from the Hatirjheel-Rampura-Bonoshree Ideal School and College Sheikherjaiga-Amulia-Demra Highway into 4-lanes {including link to Chattogram Road intersection and access to Tarabo) through Public-Private Partnership (PPP). This Project Road will aim to provide relief to increasing urban congestion by providing a new long-term asset which will support the government objective of improved road transport connectivity in Dhaka.

3. Overall, the objectives of this road upgradation are:

- To create an alternate and congestion free new gateway to the Dhaka City;
- To provide better connectivity of Dhaka with Narayanganj, Chattogram, Sylhet and other Eastern and South-Eastern districts of Bangladesh;
- To divert Chattogram & Sylhet highway bound traffic from Southern Dhaka thus reducing congestion; and
- To improve the quality of life of the road user of this corridor.

4. The Project has also been screened by the PPP Authority, GoB and has received in-principal approval from the Cabinet Committee on Economic Affairs of GoB on January 26, 2016.

5. Previously an Environmental Impact Assessment Report (EIA) has been prepared and it has been approved by DoE. This report is prepared to match the data gaps under the regulations of the Asian Infrastructure Investment Bank (AIIB). Dhaka RAD Elevated Expressway Company Limited has engaged Development Solutions Consultant Limited to perform the updating work. This updated EIA study report has been prepared based on finalized road design as per approved feasibility study report.

6. The Project Highway starts at a proposed interchange at Chattogram Road (National Highway N1) and ends at another interchange at Hatirjheel near Rampura Bridge Road. The Project Highway is 12.491km in length, including 8.414km elevated Toll Road (including Rampura interchange section) and 4.077km at-grade Toll Road, and is expected to establish a strong connectivity among the capital city Dhaka to Chattogram, Sylhet, Narayanganj and other eastern districts of Bangladesh. The Project consists of a four-lane divided access-controlled Toll Road and two-lane Service Roads (on one side or both sides), with three interchanges and one toll plaza.

7. There is an existing alignment from Chattogram Road to Rampura, which will be followed mostly to construct the access-controlled road. Minimum width of the proposed toll road will be 8.6 m in each direction (elevated portion, 9 km long) and 9.7 m in each direction (at-grade section, 4.5 km long). Grade separated flyover will be constructed at Chattogram Road, Demra and Near Rampura Bridge. Two new bridges will also be constructed next to existing bridges at Nandipara and Shekherjaiga.

B. Objectives of EIA Study

8. The implementation of the project activities has both positive and negative impacts on the surrounding environment. These impacts will be on the physio-chemical, biological/ecological, and socio-economic environment. Hence, to prevent and/or to reduce the negative environmental impacts at an acceptable level and to enhance the positive environmental impacts linked with the implementation of the subproject activities of the project; an EIA is to be required.

9. The overall objective of this study is to ensure that the project is developed in an environmentally sound and sustainable manner ensuring that all possible negative effects are mitigated as best as practical and positive impacts are enhanced. More specifically, the EIA aims to identify the likely potential impacts to be generated by the project and to provide a set of actions that need to be implemented to meet national and international environmental safeguard standards. The key objectives of the study are as follows -

- Present a general description of the project and the process;
- Analyze and compare E&S impacts among alternatives of the project;
- Identification of applicable national and international legal environmental and social requirements
- Establishment of environmental and socio-economic baseline conditions of the study area
- Identify the environmental impacts of the project and quantify them to the extent possible;
- Propose measures to avoid, reduce, minimize and mitigate the negative environmental impacts of the project;
- Development of Environmental Management Plan (EMP)

C. Scope of the EIA Study

10. As per AIIB's Environmental and Social Framework (ESF), The bank determines the Project's category on the basis of the Project's component presenting the highest environmental or social risk and potential impacts (including direct, indirect, cumulative and induced impacts, as relevant, in the Project area). The Project has been tentatively assigned Category A under the Bank's Environmental and Social Policy (ESP). Because a Project is categorized A (i) it has a number of potentially adverse environmental and social impacts; (ii) the impacts are unprecedented; (iii) they are not limited to the Project area; and (iv) but they can be successfully managed using good practice in an operational setting. In this case the project is lying into category A.

11. The scope of work for the EIA study involves environmental & social assessment of the activities involved in the project. This EIA report has been prepared to keep in view the requirement of AIIB. The scope of the present EIA report describes the following most important features:

- A review of the environmental legislative, regulatory and policy guidelines and considerations relating to the implementation of the project;
- A review of the AIIB ESF guidelines and gap analysis between AIIB and GoB policies.
- A general description of the project and existing physical, biological, and socio-economic conditions;
- Analysis of different alternatives and associated facilities to the project in terms of environmental and social perspectives;

- Identification and assessment of the potential impacts on the natural and human environment in the project area due to implementation of the project;
- Consultation with the locals/stakeholder involving concerned people in order to identify and act on any undocumented or perceived environmental issues;
- Identification of mitigation measures in the form of an Environmental Management Plan (EMP); and
- Recommendations and conclusions in order to operate the project work in a sustainable manner.

D. Methodology of EIA Study

1. Approach

12. The study has been conducted in accordance with Environment Conservation Rules (ECR), 1997 and EIA Guidelines for Industries, 2021, and AIIB Environmental and Social Framework (ESF) and its relevant Environmental and Social Standards (ESSs) 2021. The study is based on both primary and secondary data and information. The primary data includes data collected from field observations, discussions with stakeholders and secondary data includes review of the Bangladesh statistical and relevant information from Government Departments. . The main purpose of this approach was to obtain a fair impression on the people's perceptions of the project and its environmental and social impacts.

2. Methodology

13. In order to establish the baseline biophysical conditions within the study area, relevant secondary and primary data were collected and reviewed. Further, a comprehensive field visit was undertaken, and a number of consultations with local people were carried out. For a better assessment, the data collection program was planned as per the DoE approved Terms of References (ToR). The data generated allowed the environmental team to better understand the complex interplay between the various biotic and abiotic factors within the study area and to establish the baseline conditions. Once this baseline was established it was used as a reference point to identify potential changes to the environment that may occur as a result of the proposed project activities, as well as to allow the development of measures to prevent, mitigate or manage these potential impacts. The following methodology was adopted for carrying out the EIA of the proposed project-

a) Environmental Data Collection and Analysis

14. This section describes the methods and techniques used to investigate and describe the potential environmental risks of the Project. In order to establish the baseline biophysical conditions within the Project area, relevant secondary and primary data was identified and reviewed, a comprehensive field visit program established, and a number of specialist studies were carried out. This included the gathering of primary and secondary data from various sources including from discussions with groups, discussion with individuals, Government sources.

15. The assessment of potential environmental impacts requires detailed information on all aspects of the habitats, biodiversity, and physical aspects of the project area. It also requires development of an understanding of how the existing environmental processes work together to form a complex ecosystem. This information can be used to identify potential changes to the environment

that may occur because of the project, and to propose measures to prevent mitigate or manage potential environmental impacts.

16. The potential for environmental impacts was considered for activities during all stages of the proposed Project. This includes site establishment, construction phase, and site decommissioning and decommissioning phases. As the environments within the project area have not been widely studied in the past, knowledge gaps identified within the consultation phase have been filled through detailed investigations and field visits as part of this more comprehensive EIA report.

(1) Secondary Data Collection

17. A review was conducted of the biophysical, ecological, and legal literature relevant to the Project. The review of secondary sources and informal initial field investigations were undertaken in order to prepare a preliminary assessment of the physical and social environment, biodiversity, and conservation significance of the identified study area. This preliminary literature reviews also assisted in identifying data gaps which would require collection of additional primary information through physical field survey. The following activities were included in this phase of the Project -

- Data and information were collected from various government relating to site aspects climate (weather), groundwater quality and soils; secondary ecological data sources were collected and assessed;
- An appraisal was made of all legislation having direct and indirect relevance to environmental management within the Study Area including aspects such as biodiversity conservation, water quality, waste management, natural resource management and spill response;
- Previous EIA report has also been studied for relevant data and information;
- Previous environmental site studies, where available, were reviewed as well as relevant scientific journal articles; and
- Thereafter, an information gap analysis was undertaken to identify the areas where further primary data collection would be required to complete the EIA.

18. Further detail regarding the titles of the relevant literature, policies, acts and other regulations and guidelines reviewed and applied during the course of this process can be found in legal section of this report.

(2) Baseline Data Collection and Analysis

19. Primary data collection was initiated to fill gaps in knowledge resulting from the secondary data review. Further, it aimed to provide a site-specific data set of relevant physical and biological environmental aspects relevant to the Project. The primary data collection program was undertaken in June 2022. During the field visit, stakeholders were consulted, and several important additional secondary sources of environmental information, data and literature were collected.

(a) Geographical Information Systems (GIS)

20. Geographical Information Systems (GIS) was used as a specialized analysis and presentation tool. Before commencing field investigations, spatial analysis of satellite imagery and present administrative areas and other boundaries/constraints was considered for the environmental assessments. For example, forest areas, spawning grounds, infrastructures, environmental protected

areas and the alignment were identified. It also supports more detailed on-ground survey, particularly spatial features that may be directly or indirectly influenced by Project activities.

21. Detailed on-ground validation of spatial information – particularly land use – was undertaken using a hand-held, non-differential GPS. The spatial data acquisition team took detailed transect walks through the Project area in order to identify various land use types and confirm the findings of the satellite imagery analysis. This extensive ground-truthing exercise both validated the land use mapping and identified additional sensitive areas to include within the environmental fieldwork for sampling.

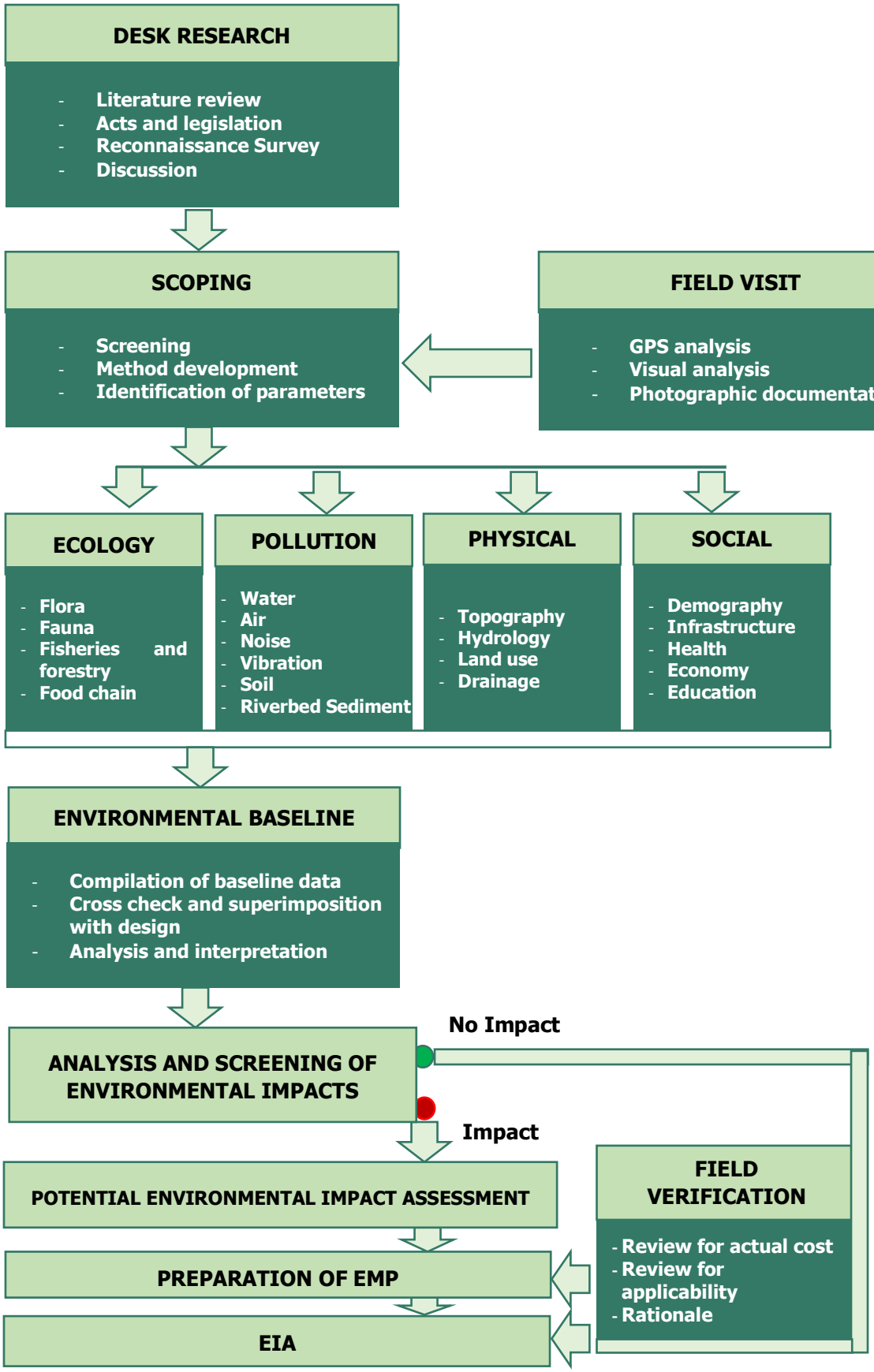


Figure I.1: Route Map of Environmental Impact Assessment (EIA)

(b) Physical Environment Field Survey

22. To comprehensively evaluate the existing Project area baseline conditions, a field visit and data collection program incorporating a number of biophysical investigations was developed and implemented. A desktop assessment was then prepared to enable the collection of refined and verifiable information. The field survey program was conducted throughout the project area by a specialist environmental team.

23. This survey aimed to identify important environmental components and environmental issues within the study area. It included investigation and observation of the local landforms, market location, habitat types, drainage patterns, species abundance and distribution, soil types, water quality (surface water and groundwater), air quality, noise, vibration and hydro-morphology.

24. The study area and surrounds were surveyed on foot and by boat. Important environmental features were identified and logged. Hand-held geographic positioning systems (GPS) were used to identify specific features for mapping and further analysis in the Project office. Features that were recorded or ground-truthed with GPS included:

- ✓ Habitation and settlement areas;
- ✓ Plantations;
- ✓ Habitat areas;
- ✓ Sensitive environments; and
- ✓ Transportation routes;

25. Direct observation and key informant interview techniques were employed within the field survey. Direct observations were subject to accessibility and were guided by satellite image maps and local information. Observations were made along project alignment. An environmental observation checklist was completed.

(c) Ecological Field Survey

26. Initially, secondary data sources were reviewed in order to compile a potential presence/absence list of significant fauna and flora species. Thereafter two members among the field survey team were deployed to undertake the required sampling and assessment. Sampling and survey were conducted for both aquatic and terrestrial ecosystems; validation checks were confirmed against the earlier-compiled species lists in order to establish a comprehensive baseline.

27. The following activities were undertaken during the terrestrial and aquatic field surveys -

(i) Direct Observation

28. Direct observation on the occurrence and abundance of flora and fauna was made while travelling along road edges, across the agricultural fields, the forest areas and within village groves. As well as direct sightings, identification of animal presence was also based on identification of tracks, foot prints, feeding signs and animal/bird calls. Appropriate field guides and data preforms were used for this activity so that information was accurately recorded.

(ii) Interviews with Locals

29. Many of the mammalian and reptilian species are cryptic and unlikely to be encountered using standard field sampling methods. As such, experience suggests that interviews with local people are a very useful method for collecting information on local biodiversity. This data is subjective and as

such should not form the core of any assessment; however, it does nonetheless provide useful supplementary information. During the field survey period, extensive interviews with local people were conducted to collect information on animal and plant presence, including occurrences, behavior, breeding, distribution and seasonal appearance.

(d) Socioeconomic Field Survey

30. The EIA study mostly used the socio-economic data collected by the Social and Resettlement Team for social assessment. However, during the environmental survey some consultations were conducted with the local people on environmental issues but social conditions were also discussed along with status of Cultural Property Resources (CPR);

(i) Consultations

31. For this report, Focus Group Discussions (FGD) were conducted along the project alignment. A team of experienced professional and support staff has conducted surveys and consultation meetings after being briefed about the project. The respondents were selected by random sampling method from each of the locations. Respondents' contact information was collected for further verification, if and when required.

b) Impact Assessment Methods

32. The EIA process identifies the potential environmental impacts that may result from the implementation of the project. Both positive and negative potential impacts for the project were identified through the application of standardized international best practice methods of environmental & social impact assessment. Some of the methods of environmental impact assessment utilized include:

- Ad-hoc methods;
- Application of expert judgment;
- Risk based approach including residual risk assessment;
- Systematic and sequential approaches; and
- Spatial analysis methods (including GIS).

33. Further to these methods, social potential impacts were assessed based on previous experiences and opinions of local people and important stakeholders e.g.; government agencies and through literature review relevant to the Project area. Social impacts were identified through public consultations, focus group discussions and from BBS 2011.

34. The principal method for assessing the potential impacts of the project on the biophysical and social environments utilized for this EIA was risk assessment. Details on the risk assessment process and how it was utilized to identify impacts, the likelihood and consequence of the actions and implement appropriate mitigation measures to reduce any potential impacts to an acceptable level is detailed within the following sections.

(a) Risk Assessment Matrix of Proposed Project

35. Relevant environmental issues were taken from the EIA and further investigated within the EIA utilizing a risk-based assessment methodology. Risk assessment is a process that supports the analysis of potential negative impacts that may result from implementation of a Project. It provides a means of categorizing how potential impacts are to occur, and of categorizing what the potential

consequences might be if impacts were to occur. Risk assessment is the primary method of impact assessment that is applied in this EIA.

36. Risk assessment was utilized in this EIA as the primary tool to support environmental and socio-economic impact assessments. It provides a means of categorizing the frequency and magnitude of potential impacts and provides a basis for the application of different degrees of mitigation and management measures.

37. By successfully categorizing the likelihood and consequence of potential impacts, direction can be given to those potential impacts that should be subjected to the most rigorous attention. Such impacts are designated as potentially significant impacts. Alternatively, potential impacts that are shown to be infrequent and a low magnitude of consequence can be treated as less significant. Figure I-2 presents a schematic of the risk assessment process adopted for the developed of this EIA.

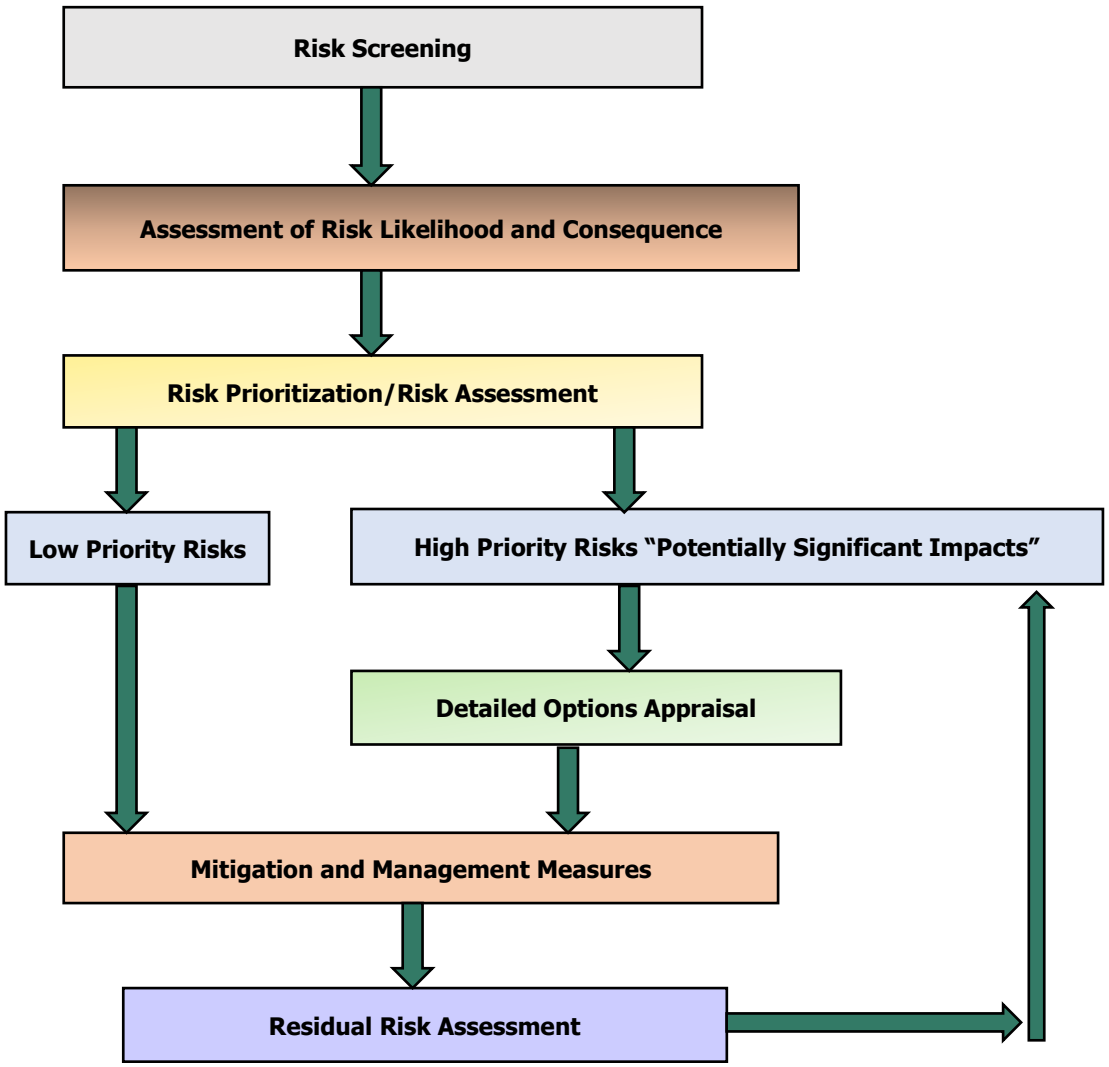


Figure I.2: Risk Assessment Process

II. ENVIRONMENTAL POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. Regulatory Requirements for the Project

38. According to the national environmental legislation of Bangladesh all development projects are governed by some legal and institutional requirements. As such, assessment of relevant legal provisions, policies, strategies and institutional issues are very important for any project proponent or developer before execution of a program or plan. The proponent has to be well aware of these requirements and comply with the provisions as applicable and necessary. Before initiating any development project, it is hence required to obtain environmental clearance from DOE. Department of Environment (DoE), under the Ministry of Environment, Forests and Climate Change (MoEFCC) is the regulatory body responsible for enforcing the environmental laws and regulations like ECA'95 (amended in 2010) and ECR'97.

39. Regulatory requirements toward protection and conservation of environment and various environmental resources and toward protection of social environment from adverse impact of projects and activities associated with them have been enunciated by the GoB as well as the AIIB relevant requirements are summarized below.

Table II-1: Applicable National Policy/Acts/Rules

SI	Policy/Acts/Rules	Key provisions and purpose	Applicability to the Project
1.	National Environmental Policy, 2018	Major elements of the policy are • Natural equilibrium provision and overall development of the country through environmental protection and sustainable management • Encourage collection and promotion of low carbon emission technology in the country • Identifying and controlling all types of environmental pollution and degradation activities • Ensure environmental development in all fields • Ensure sustainable, long term, and environmentally friendly use of all-natural resources • Maintain and streamline the environmental policies and strategies among other policy strategies in the interest of sustainable development • Ensure the Environmental Impact Assessment and Strategic Environmental Assessment in all necessary sectors • Actively involved as possible with all international environmental initiatives and take necessary actions at local and national levels.	The environmental policy aims at prevention of pollution and degradation of resources.
2.	National Environmental Management Action Plan (NEMAP), 1995	The NEMAP was developed with the following objectives: • to identify key environmental issues affecting Bangladesh; • to identify actions to halt or reduce the rate of environmental degradation;	The plan proposes developing and applying guidelines to avoid environmental pollution due to transport and communication system. It emphasizes different environmental pollution,

SI	Policy/Acts/Rules	Key provisions and purpose	Applicability to the Project
		• to improve management of the natural environment; • to conserve and protect habitats and biodiversity; • to promote sustainable development; and • to improve the quality of life.	hampers of natural drainage patterns, and agricultural land acquisition due to the development of the transport system.
3.	Environment Conservation Act (ECA), 1995 (with all amendments)	The main objectives of ECA are: • Conservation and improvement of the environment; and • Control and mitigation of pollution of the environment. • The main focuses of the Act can be summarized as: • Declaration of ecologically critical areas and restriction on the operations and processes, which can or cannot be carried out/ initiated in the ecologically critical areas (ECA); • Regulations in respect of vehicles emitting smoke harmful to the environment; • Environmental clearance; • Regulation of industries and other development activities' discharge permits; • Promulgation of standards for quality of air, water, noise, and soil for different areas for different purposes; • Promulgation of a standard limit for discharging and emitting waste; and • Formulation and declaration of environmental guidelines.	According to this law, no industrial unit or project shall be established or undertaken without obtaining an Environmental Clearance Certificate from the Director General in the manner prescribed by rules.
4.	The Water Act, 2013	The Act recognizes the significance of managing all water resources in the natural flow of surface water and recharge of groundwater. The private landowners will use the surface water inside their property for all purposes per the Act. No individuals or organizations will be allowed to extract, distribute, use, develop, protect, and conserve water resources, nor will they build any structure that impedes rivers and creeks' natural flow.	To regulate the water quality during the construction phase
5.	Environment Conservation Rules, 1997 (with all amendments)	The Environment Conservation Rules, 1997, were issued by the GOB to exercise power conferred under the Environment Conservation Act (Section 20), 1995. Under these Rules, the following aspects, among others, are covered: • Declaration of ecologically critical areas; • Classification of industries and projects into four categories; • Procedures for issuing the Environmental Clearance Certificate (ECC); and • Determination of environmental standards.	Following the Environment Conservation Rules (ECR) of 1997, the Project is classified as a Red Category, requiring a complete Environmental Impact Assessment (EIA) for RHD to obtain clearance for construction
6.	Environmental Court Act, 2000	This Act sets out policy for effective pursuance and completion of legal proceedings related to environmental crimes. Under this Act, the Director General	According to this act, the government can take legal actions if any environmental

SI	Policy/Acts/Rules	Key provisions and purpose	Applicability to the Project
		of the DoE has the power to impose heavy penalties on industrial polluters who are dumping untreated wastewater into the environment or not operating their legally mandated ETPs.	problem occurs due to project interventions.
7.	National Land Transport Policy, 2004	The objectives of this policy are: • To introduce long-term network planning. • To develop an integrated planning approach in road construction. • To involve the private sector more in infrastructure, services, and maintenance.	According to the policy, major improvements, tolled or otherwise, are subjected to an Environmental Impact Assessment (EIA).
8.	Wetland Protection Act, 2000	The latest Wetland Act -- The Playground, Open Spaces, Gardens, and Wetland Conservation Act 2000 -- suffers from loopholes and inadequacies regarding the protection of water bodies. Section 1 of this Act suggests that it applies to the water bodies of the cities, divisional and district towns, and municipalities. The water bodies in the rural areas are outside the jurisdiction of this Act	The Act specifies the fine and imprisonment term for violation of its provisions. It does not direct the government to recover the original characteristics of the water bodies if someone fills them up.
9.	Environmental Guideline of RHD, 2004	RHD will seek to minimize the impact of its activities on the environment, including those activities of its consultants, contractors and agents. The Department's specific environmental goals and objectives are: • Minimize air pollution, including dust, from all RHD activities and planned projects. • Reduce noise emanating from vehicles and plant operated by RHD and minimise the potential effects of noise from new roads and traffic. • Avoid water sedimentation and minimize the pollution of surface water from road run-off, maintenance and construction activities, site camps and depots. • Avoid impeding the free flow of surface waters and make all bridges and culverts 'fish friendly' by allowing the free movement and migration of all aquatic species. • Encourage the involvement of local people, especially women and disadvantaged groups, in the construction and maintenance of all road projects. Ensure that work conditions for those employed directly or indirectly by RHD are in accordance with national labour regulations and international obligations. • Avoid disrupting businesses and agricultural, fishing and social activities, including minimizing delays to traffic during road maintenance and construction. • Minimize the need to resettle people in any road building or widening activities	According to the guideline, any impacts due to road construction activities needed to be minimized and proper compensation should be paid to the affected people.

SI	Policy/Acts/Rules	Key provisions and purpose	Applicability to the Project
		by avoiding existing housing areas and homesteads, industries and businesses. • Protect areas and places of cultural heritage. • Avoid the waste of material and energy, and recycle materials, including road scrapings materials, wood, metal, oil, paper and other products. • Minimize land acquisition when planning and constructing new roads, especially land in productive use for fishing, or forestry. • Reduce dangers from accidents for all road users, especially pedestrians, through the design of safe roads, bridges and ferry ghats. • Dispose of all waste materials in a safe and hygienic manner. • Ensure that adequate drinking water is available for all employees and contractor's staff. • Ensure that sewage and waste disposal facilities are provided for employees and contractor's staff and that they are sited an adequate distance away from sources of human and animal water supplies. • Control pests in all temporary and permanent sites, including those of contractors. • Ensure that RHD workers and their contractors are educated regarding health care, including issues such as sexually transmitted diseases.	
10.	RHD's Road Master Plan	The objectives of RHD's road master plan are: • Protecting the value of RHD's road and bridge assets • Improving the connectivity of the road network • Enhancing and developing the strategic road network to meet economic and traffic growth targets • Improving the zilla road network to enhance connectivity to the country's growth targets • Improving road safety to reduce road accidents • Provide environmental and social protection • Outline the institution improvements required for RHD	According to the plan, the physical and social environment must be protected from adverse effects of road construction
11.	The Forest Act (1927) and the Forest (Amendment) Act (2000)	It is the main legislative context for forestry protection and management in Bangladesh. It was enacted to control trespass illegal resources extraction from forests and to provide a framework for the forestry revenue collection system	The Act is relevant to the sub-project as construction of the project intervention will require cutting some trees.
12.	National Forest Policy (amendment), 1994	The policy is designed to conserve the existing forest areas, bring about 20 % of the country's land area under the Forestation Programme, and increase	The Act is relevant to the sub-project as construction of the project intervention will

SI	Policy/Acts/Rules	Key provisions and purpose	Applicability to the Project
		reserve forests by 10 percent per year to 2015.	require cutting and trimming some trees.
13.	The Private Forests Ordinance, 1959	An Ordinance to provide for the conservation of private forests and the afforestation in some wetlands in Bangladesh.	According to Section 61 of this Ordinance, any land is required for any of the purposes of this Ordinance; such land shall be deemed to be needed for a public purpose.
14.	Bangladesh Wildlife (Conservation & Security) Act, 2012 (previously known as Bangladesh Wildlife (Preservation) Order, 1973; amended as Bangladesh Wildlife (Preservation) Act, 1974	This Act protects 1,307 species of plants and animals under four schedules that mandate imprisonment and fines for wildlife poaching, capturing, trapping, and trading.	This Act is relevant to the sub-project as an intervention may affect wildlife habitation obstruct movement.
15.	National Water Policy, 1999	The policy emphasizes efficient and equitable management of water resources, proper harnessing and development of surface and groundwater, availability of water to all concerned, and institutional capacity building for water resource management	Measures must be taken to minimize disruption to the natural aquatic environment in streams and water channels (Clause 4.9b).
16.	National Fisheries Policy, 1999	National Fisheries Policy focuses on aquaculture and marine fisheries development. The policy suggests, among others, that biodiversity will be maintained in all-natural water bodies and marine environment, and control measures will be taken against activities that harm fisheries, resources, and vice-versa	The project required proper action to prevent biodiversity in all-natural water bodies and the aquatic environment.
17.	Protection and Conservation of Fish Act 1950 (Amended 1982)	This is framework legislation with rulemaking powers. Among others, some of these rules may prohibit the destruction of, or any attempt to destroy, fish by the poisoning of water or the depletion of fisheries by pollution, by industrial effluent, or otherwise.	The project requires proper action to prevent biodiversity in all-natural water bodies and the marine environment.
18.	National Land Use Policy, 2001	The main contents of this policy are: •Stopping the high conversion rate of agricultural land to nonagricultural purposes; • Utilizing agro-ecological zones to determine maximum land-use efficiency; • Adopting measures to discourage the conversion of agricultural land for urban or development purposes; • Improving the environmental sustainability of land-use practices.	The proposed project must adhere to this policy to ensure the environmental sustainability of land-use practices.
19.	The Embankment and Drainage Act, 1952	It provides provision for the construction, maintenance, management, removal, and control of embankments and watercourses for the better drainage of lands.	Disposal of dredged spoil may create drainage obstruction. So, adherence to the relevant section of the Act must be addressed in the environmental and social assessment.

SI	Policy/Acts/Rules	Key provisions and purpose	Applicability to the Project
20.	Bangladesh Climate Change Strategy and Action Plan (BCCSAP) 2009	This is a comprehensive strategy to address climate change challenges in Bangladesh. Bangladesh Climate Change Strategy and Action Plan built on and expanded the NAPA.	Relevant as the sub-project area is vulnerable to climate change effect
21.	Constitution of the People's Republic of Bangladesh, 04 November 1972	Bangladesh's Constitution defines the rights of every citizen irrespective of their ethnicity and religion where the State is responsible for the provision of Basic Necessities for the citizens	This is applicable to ensure the health and safety of the laborers and project-related persons.
22.	The Acquisition and Requisition of Immovable Property Act 2017 (ARIPA)	It is the principal legislation governing eminent domain land acquisition in Bangladesh. The Act requires that compensation be paid for: (i) land and assets permanently acquired (including standing crops, trees, houses); and (ii) any other damages caused by such acquisition. The Act also provides the acquisition of properties belonging to religious organizations like mosques, temples, pagodas, and graveyards if acquired for the public interest. The Ministry of Land (MoL) is the authorized government agency to undertake the process of land acquisition. The MoL partly delegates its authority about the land acquisition to the Commissioner at the Divisional level and the Deputy Commissioner at the District level. The Deputy Commissioners (DC) is empowered by the MoL to process land acquisition under the act and pay compensation to the legal owners of the acquired property. Khas (government-owned land) should be acquired first when a project requires both Khas and private land. If a project requires only khas land, the land will be transferred through an inter-ministerial meeting following the acquisition proposal submitted to DC or MoL. The Government of Bangladesh does not have a national policy on involuntary resettlement. The new Act of 2017 has incorporated specific provisions to address social and economic impacts that were not previously included in the 1982 land acquisition ordinance. Therefore, these provisions under the new law would reduce the gaps between the national legislative framework of the government and AIIB policies.	The nature of the civil works related to the project like land purchased, acquisition will entail the land purchase and subsequent economic and physical displacement. ARIPA 2017 defines the land acquisition process and contains appropriate compensation paid to titleholders.
23.	Bangladesh Wildlife (Conservation & Security) Act, 2012	This Order aims to protect and conserve wildlife in Bangladesh. Wildlife preservation, conservation and management fall within the jurisdiction of the Forestry Department. The previous Wildlife (Preservation) Order, 1973 & Wildlife (Preservation) (Amendment) Act, 1974 have been revamped to Wildlife (Conservation & Security) Act of 2012.	The Act has adopted new types of protected areas for conservation and protection of wildlife resources, created avenue for community conserved areas and also community-based management of protected areas.
24.	Public Procurement Rule,2008	This is the public procurement rules of Bangladesh and this rule shall apply to the Procurement of Goods, Works or Services	Applies to the procurement of goods, works or services including measures regarding

SI	Policy/Acts/Rules	Key provisions and purpose	Applicability to the Project
		by any government, semi-government or any statutory body established under any law. Conditions of service and employment including wages and payment, the establishment of Wages Boards, employment of young people, maternity benefits, working hours, and leave; (i) Safeguard the health and safety of all workers working on the Site and other persons entitled to be on it, and to keep the Site in an orderly state and (ii) Protect the environment on and off the Site and to avoid damage or nuisance to persons or to property of the public or others resulting from pollution, noise or other causes arising as a consequence of the Contractors methods of operation.	the safety, security and protection of the environment in construction works; requires contractors to take all reasonable steps to safeguard the health and safety of all workers on site, protect the environment on and off the site, and avoid damage or nuisance to persons or to property of the public or others
25.	National 3R Strategy for Waste Management, 2010	The National 3R Strategy for waste management has been established by Department of Environment on December, 2010. Sector specific strategies for promotion of 3R are depicted in this national 3R strategy. The national 3R goal for waste management is achieve complete elimination of waste disposal on open dumps, rivers, flood plains by 2015 and promote recycling of waste through mandatory segregation of waste at source as well as create a market for recycled products and provide incentives for recycling of waste.	During the construction period, some solid, non-hazardous waste may generate. So, this policy is fit in this regard.
26.	Cultural Heritage	The Antiques Law of 1968 law consolidates all laws relating to the preservation and protection of antiquities under the auspices of the Department of Archaeology. The law empowers the Director of the Department of Archaeology to take steps necessary for antiquity's custody, preservation, and protection. The Environment Conservation rules (1997) states that GoB will consider the presence of human habitat, ancient monuments, or archeological sites, among other factors, in declaring an area as ecologically critical.	Project activities may lead to unearthing antiques or impact cultural heritage by chance. Therefore, laws related to cultural heritage and antiques apply to this project to protect these finds.
27.	Bangladesh Labor Act (Amendment), 2013	The Bangladesh Labor Act (Amendment) Bill was enacted by parliament in 2013, to make the present legislation more time-appropriate for workers' wellbeing. The bill was approved with the conditions of legalizing trade unions in factories, assuring worker safety at work, establishing mandatory group insurance, and prohibiting children from working in dangerous environments.	To carry out the civil works, labor will be required to be hired. Therefore, these laws will be triggered to safeguard the interest of the labor, host community, project authorities, Contractors, and other project stakeholders. The project will ensure that the stipulations of the law are duly followed when it comes to labor-related activities
28.	The Building Construction Act 1952 (with subsequent amendments)	An Act to provide for the prevention of haphazard construction of building and excavation of tanks which are likely to interfere with the planning of certain areas in Bangladesh	Applicable as the project involves the development of infrastructure

SI	Policy/Acts/Rules	Key provisions and purpose	Applicability to the Project
29.	GoB 8th Five Year Plan, 2021-25	Preparatory process of the 8th Five Year Plan is marked by the infestation of major global catastrophe 'COVID-19', which has caused consequential economic conundrum across the world. The Eighth Five Year Plan is unique compared to its preceding two plans as it blends the COVID-19 recovery strategies in the macroeconomic framework as well as developing sectoral strategies in the plan	Applicable as the project involves the development of infrastructure
30.	National Water Management Plan, 2001 (Approved in 2004)	The plan provides a framework within which all concerned with the development, management and use of water resources water services in Bangladesh can plan and implement their own activities in a coordinated and integrated manner. The planned activity programs have been presented in the eight sub-sectoral clusters: i) Institutional Development, ii) Enabling Environment, iii) Main River, iv) Towns and Rural Areas, v) Major Cities; vi) Disaster Management; vii) Agriculture and Water Management, and viii) Environment and Aquatic Resources. Each cluster comprises of a number of individual programs.	As the project proponent passes several waterbodies, this policy is applicable.
31.	Solid Waste Management Regulations 2021	The Solid Waste Management Regulations 2021 were published in Bangladesh on December 23, 2021, under the Bangladesh Environmental Protection Act, 1995. The Regulations define the responsibilities of businesses involved in solid waste management and impose collection, recycling, and disposal obligations according to Extended Producer Responsibility (EPR) on manufacturers of non-biodegradable products such as glass, plastic, and bottles. The Regulations also include provisions for the treatment of solid waste such as composting and energy recover	This project will produce a certain number of solid wastes. So, this policy is applicable

B. International Conventions, Treaties and Protocols (ICTPs)

40. Bangladesh is a party to a large number of international conventions; treaties and protocols (ICTPs) related to the Project and are committed to ensuring that these protocols are complied with during all development works. The applicable ICTPs are enumerated in Table II-2.

Table II-2: International Conventions, Treaties and Protocols Signed by Bangladesh

Conventions	Years	Ratified/Accessed (AC)/Accepted (AT)/ Adaptation (AD)	Relevance
International Plant Protection Convention (Rome,) & Plant Protection Agreement for SE Asia and Pacific (1999 Revision)	1951 1999	01.09.1978 04.12.1974 (AC) (Entry into Force)	Ensuring that the Project work or construction materials do not introduce plant pests
Convention on Wetlands of International Importance ("Ramsar Convention":1971)		20.04.1992 (ratified)	Protection of significant wetland and prevention of draining or filling during construction

Conventions	Years	Ratified/Accessed (AC)/Accepted (AT)/ Adaptation (AD)	Relevance
Convention Concerning the Protection of the World Cultural and natural Heritage (Paris, 1972)		03.08.1983 (AT) 03.11.1983 (ratified)	Prevention of damage or destruction of culturally and/or historically significant sites, monuments, etc.
Convention on Biological Diversity, (Rio de Janeiro, 1992.)	1992	05.06.1992	Protection of biodiversity during construction and operation.
Convention on Persistent Organic Pollutants, Stockholm.	2001	In process	Restrict use of different chemicals containing POPs.
United Nations Framework Convention on Climate Change, (New York, 1992.)	1992	15.04.94	Reduction of emission of greenhouse gases.
Convention on Biological Diversity, (Rio De Janeiro, 1992.)	1992	03.05.94	Conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.
Kyoto protocol to the United Nations Framework Convention on Climate Change		21.8.2001 (AC) 11.12.1997 (AD)	Reduction of emission of greenhouse gases.
International Convention for Protection of Birds, Paris	1950	Signed	Protection of the birds in their wild state.
Convention Concerning the Prevention and Control of Occupational Hazards caused by Carcinogenic Substances and Agents, Geneva.	1974	Signed	To protect workers against hazards arising from occupational exposure to carcinogenic substances and agents.
Convention Concerning the Protection of Workers Against Occupational Hazards in the Working Environment due to Air Pollution, Noise and Vibration, Geneva	1977	Signed	Protection of workers' health against occupational hazards in the working environment due to air pollution, noise and vibration.
Convention on the Conservation of Migratory Species of Wild Animals, Bonn.	1979	Signed	Conservation and sustainable use of migratory animals and their habitats
Convention Concerning Occupational Safety and Health and the Working Environment, Geneva.	1981	Signed	Ensuring occupational health and safety of workers in all branches of economic activity.
Vienna Convention for the Protection of the Ozone Layer, Vienna	1985	02.08.90 (AC) 31.10.90 (entry into force)	Preventing human activities that may have adverse effects on ozone layer.
Convention Concerning Occupational Health Services, Geneva.	1985		Convention Concerning Occupational Health Services, Geneva.
Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal.	1987	31.10.90 (entry into force)	Reduction of the abundance of the substances that deplete the ozone layer in the atmosphere, and thereby protect the earth's fragile ozone Layer.
Convention Concerning Safety in the Use of Chemicals at Work, Geneva.	1990	Signed	Regulating the management of chemicals in the workplaces I order to protect workers from the harmful effects of these substances.
London Amendment to the Montreal Protocol on Substances		18.03.94 (AC) 16.06.94 (entry into force)	To strengthen the control procedure and extend the

Conventions	Years	Ratified/Accessed (AC)/Accepted (AT)/ Adaptation (AD)	Relevance
that Deplete the Ozone Layer, London.			coverage of Montreal Protocol to new substances.
Preparedness, Response and Cooperation (London, 1990.)30.11.90United Nations Framework Convention on Climate Change, New York	09.06.92	15.04.94	Achieving stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.
Convention on Biological Diversity, Rio De Janeiro	05.06.92	03.05.94	Conservation of biological diversity (or biodiversity) and sustainable use of its components.
International Convention to Combat Desertification, Paris.	14.10.94	26.01.1996 (Ratification) 26.12.1996 (entry into force)	Combating desertification and mitigating the effects of drought.
Agenda 21, UNCED, Rio de Janeiro	1992	Signed	Ensuring sustainable development.
Montreal Amendment of the Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal		27.7.2001 (Accepted) 26.10.2001 (Entry into force)	Controls in the trade of ozone depleting substances and the use of licensing procedures to control the import and export of new, recycled and reclaimed ozone depleting substances.

C. Asian Infrastructure Investment Bank (AIIB) Environment and Social Framework and Standards

41. The AIIB Environmental and Social Framework (ESF), 2021 provides an overview of the AIIB concerning (a) environmental and social sustainability; and (b) its role in meeting the challenge of sustainable development in Asia. The pursue of complete objectives of development is framed within the ESF in terms of both local impacts, and global challenges, especially in climate change. The ESF provides general specifications, standards and objectives, that clients should adhere to during project preparation and implementation. Thus, the ESF attaches importance to country regulatory systems as sources of legally binding procedures and standards.

42. The Environmental and Social Policy (ESP) in the ESF comprises essential environmental and social requirements for each project and is accompanied by: (a) three associated mandatory Environmental and Social Standards (ESSs) setting out requirements applicable to clients on, respectively, Environmental and Social Assessment and Management, Land Acquisition and Involuntary Resettlement and Indigenous Peoples; (b) an Environmental and Social Exclusion List (ESEL); and (c) a Glossary of certain terms used in the ESP and ESSs.

43. The three ESSs mentioned in the ESP are, ESS 1: implementation of environmental and social assessment and management, ESS 2: prevent/minimize involuntary resettlement and ESS 3: protection of vulnerable/indigenous people. These standards require clients to implement structured process of impact assessment, planning, and mitigation to address the adverse effects of projects throughout the project cycle. Together, the ESP and the ESSs comprise an environmental and social management approach designed to: (i) ensure environmental and social screening and categorization, (ii) analyze future project environmental and social threats, and impacts; (iii) identify measures to prevent, reduce, mitigate, cover or make up for project environmental and social impacts; (iv) provide

a process to consult the public on environmental and social risks and impacts of projects and to disclose information.

44. The AIIB classifies all its projects into four categories. The project is categorized as Category A if it is likely to have significant adverse environmental and social impacts that are irreversible, cumulative, diverse or unprecedented and requires the client to conduct an Environmental and Social Impact Assessment (ESIA) with Environmental and Social Management Plan (ESMP). A project is categorized as Category B when: it has a limited potentially adverse environmental and social impacts; the impacts are not unprecedented; few if any of them are irreversible or cumulative; they are site-specific; and can be successfully managed using good practice in an operational setting and requires clients to conduct an initial review of the environmental and social implications of the Project. A Project is categorized C when it is likely to have minimal or no adverse environmental and social impacts and the client is required to prepare a review of the environmental and social aspects of the Project. A Project is categorized FI if the financing structure involves the provision of funds to a financial intermediary (FI) for the Project, whereby the Bank delegates to the FI the decision-making on the use of the Bank funds, including the selection, appraisal, approval and monitoring of Bank-financed subprojects. The Bank requires the FI to develop and apply an appropriate ESMS that is proportional to the environmental and social risks associated with the Bank-supported portfolio, is consistent with this ESP, excludes from Bank support activities covered in the ESEL and incorporates applicable provisions of the ESSs.

1. Key Elements of Environmental and Social Framework

45. The objective of this overarching policy is to facilitate achievement of these development outcomes, through a system that integrates sound environmental and social management into Projects. The overarching policy comprises Environmental and Social Policy (ESP), and Environmental and Social Standards (ESSs) and Environmental and Social Exclusion List. The ESP sets out mandatory requirements for the Bank and its Clients relating to identification, assessment and management of environmental and social risks and impacts associated with Projects supported by the Bank.

Environmental and Social Standards

46. The environmental and social standards (ESSs) set out more detailed mandatory environmental and social requirements, as described below.

47. **Environmental and Social Standard 1 (ESS 1)**. The ESS 1 aims to ensure the environmental and social soundness and sustainability of Projects and to support the integration of environmental and social considerations into the Project decision-making process and implementation. ESS 1 is applicable if the Project is likely to have adverse environmental risks and impacts or social risks and impacts (or both). The scope of the environmental and social assessment and management measures are proportional to the risks and impacts of the Project. ESS 1 provides for both quality environmental and social assessment and management of risks and impacts through effective mitigation and monitoring measures during the course of Project implementation. The ESS 1 defines the detailed requirements of the environmental and social assessment to be carried out for any project to be financed by the Bank.

48. **Environmental and Social Standard 2 (ESS 2).** The ESS 2 is applicable if the Project's screening process reveals that the Project would involve Involuntary Resettlement (including Involuntary Resettlement of the recent past or foreseeable future that is directly linked to the Project).

Involuntary Resettlement covers physical displacement (relocation, loss of residential land or loss of shelter) and economic displacement (loss of land or access to land and natural resources; loss of assets or access to assets, income sources or means of livelihood) as a result of: (a) involuntary acquisition of land; or (b) involuntary restrictions on land use or on access to legally designated parks and protected areas. It covers such displacement whether such losses and involuntary restrictions are full or partial, permanent or temporary. The ESS 2 defined detailed requirements of resettlement planning of the projects involving involuntary resettlement.

49. **Environmental and Social Standard 3 (ESS 3).** The ESS 3 is applicable if Indigenous Peoples are present in, or have a collective attachment to, the proposed area of the Project, and are likely to be affected by the Project. The term Indigenous Peoples is used in a generic sense to refer to a distinct, vulnerable, social and cultural group possessing the following characteristics in varying degrees: (a) self-identification as members of a distinct indigenous cultural group and recognition of this identity by others; (b) collective attachment to geographically distinct habitats or ancestral territories in the Project area and to the natural resources in these habitats and territories; (c) customary cultural, economic, social or political institutions that are separate from those of the dominant society and culture; and (d) a distinct language, often different from the official language of the country or region. In considering these characteristics, national legislation, customary law and any international conventions to which the country is a party may be considered. A group that has lost collective attachment to geographically distinct habitats or ancestral territories in the Project area because of forced severance remains eligible for coverage, as an Indigenous People, under ESS 3. The ESS 3 defines the detailed requirements of People planning, in case such groups are present in the project area and are likely to be affected by the project.

50. AIIB requires the client to establish, in accordance with the ESP and applicable ESSs, a suitable grievance mechanism to receive and facilitate resolution of the concerns or complaints of people who believe they have been adversely affected by the Project's environmental or social impacts, and to inform Project-affected people of its availability. People who believe they have been or are likely to be adversely affected by a failure of the Bank to implement the ESP may also submit complaints to the Bank's oversight mechanism in accordance with the policies and procedures to be established by the Bank for such mechanism.

51. ESF 2021 has also provisions for identify measures to avoid, minimize, or mitigate potentially adverse impacts on and risks to physical, biological, socioeconomic and cultural resources, safety of both workers and affected community and natural resources during the design, construction, operation, and decommissioning of the project.

2. Applicability of AIIB ESS

52. Improvement of the Hatirjheel-Rampura-Bonoshree Ideal School and College Sheikherjaiga-Amulia-Demra Highway into 4-lanes {including link to Chattogram Road intersection and access to Tarabo) through PPP project triggers the local environmental and social laws and regulations and also the ESP and ESS of AIIB. Under this project, ESS 1: Environmental and Social Assessment and Management and ESS 2: Involuntary Resettlement are applicable. The EIA (this study) addresses ESS1 and RPF addresses ESS 2. Standards on Indigenous Peoples (ESS 3) is not triggered by the proposed project.

53. The Bank requires its clients to manage the environmental and social risks and impacts associated with its project in a manner designed to meet the ESP and the applicable ESSs. The present

EIA has been developed in compliance with the ESS 1. The applicability of ESP and ESSs for the proposed project is presented in Table II-3.

Table II-3: Applicability of AIIB ESS

Environmental and Social Standards		Applicability	Triggering Status
ESS 1	Environmental and Social Assessment and Management	ESS 1 is applicable if the Project is likely to have adverse environmental risks and impacts or social risks and impacts (or both)	Yes, since the proposed project is likely to have negative environmental and social impacts. The present EIA has been conducted in compliance with the ESS 1.
ESS 2	Involuntary Resettlement	ESS 2 is applicable if the project is likely to cause involuntary resettlement impacts.	Yes. The project involves economic displacement due to the siting of the project. Given such impacts, though low intensity in nature, ESS 2 is triggered.
ESS 3	Indigenous Peoples	ESS 3 is applicable if Indigenous People are present in the project area and they	No, since no Indigenous people, as defined in the ESP.

3. Categorization by AIIB

54. The AIIB Environmental and Social Framework determines the project category by the type of the project's component presenting the highest environmental or social risk, including direct, indirect, cumulative and induced impacts, as relevant, in the project area. The Environmental and Social Standards mentioned in the ESP covers environmental and social assessment and management, involuntary resettlement and vulnerable/indigenous people. These standards require clients to implement structured process of impact assessment, planning, and mitigation to address the adverse effects of projects throughout the project cycle. Together, the ESP and the ESSs comprise an environmental and social management which require that: (i) environmental and social screening and categorization is ensured early, (ii) future project environmental and social threats and impacts are analyzed; (iii) measures are identified to prevent, reduce, mitigate, cover or make up for project environmental and social impacts; (iv) a process to consult the public on environmental and social risks and impacts of projects and to disclose information is provided. The ESF apply to all AIIB-financed projects, including private sector operations, and to all project components.

55. Due to the nature and impact of this project and applying the ESF of AIIB the project has been classified as "Category A" project. Category A refers to proposed project likely to have significant adverse environmental and social impacts that are irreversible, cumulative, diverse or unprecedented and requires the client to conduct an Environmental and Social Impact Assessment (ESIA) with Environmental and Social Management Plan (ESMP). For this project, AIIB has advised to carry out separate study for environment and social and to prepare standalone EIA and SIA documents.

56. The categorization of this project as per the AIIB's ESF is presented in the below table.

Table II-4: Proposed Project Categorization as per AIIB's ESF

SI	Item	Category	Remarks
1.	**Environmental Categorization**		
1.1	– Environmental issues and impacts of the Project are anticipated during the construction and operation of access control road. – The project road already exists and is going for an upgrade (with elevated and at grade sections). This will help in reducing traffic congestion and smooth traffic flow between Rampura Bridge and Demra. Better road condition and less congestion may result into lesser air pollution due to traffic; however, traffic density will increase after road upgrade. No ecological sensitive location or protected area falls within the project corridor and in the surrounding areas.	Category A	Irreversible impacts due to the Project include - ✓ Increase noise and vibration during the road, bridge and culvert construction and operation ✓ Change in air quality due to proposed road construction ✓ Occupational health and safety; ✓ Increase in traffic density ✓ Community health and safety; ✓ Associated development in the area. ✓ Require preparation of EIA Report
2.	**Involuntary Resettlement Categorization**		
2.1	Social impacts and resettlement due to Project	Category A	It is envisaged that the Project will be categorized as A for involuntary resettlement (IR) given its significant resettlement impacts.
3.	**Indigenous People Categorization**		
3.1	Presence	Category C	No foreseen adverse impact as no indigenous community is present within or around the project area.
3.2	Impact		

D. Project Categorization by GoB

62. Under the ECR 1997, a classification system was established for development projects and industries on basis of the location, the size and the severity of potential pollution. There are four categories of projects: green, orange A, orange B and Red with respectively no, minor, medium and severe environmental impacts. According to the guidelines illustrated in the ECR, this project falls under the "Red" category of projects.

57. **Red Category:** According to EIA Guidelines of DoE "Item 67: Construction/reconstruction/ expansion of road (regional, national & international)." projects fall under "Red" category; Red category project needs to conduct IEE and EIA and submit the report to DoE for ECC."

58. Therefore, for this project, it needs to prepare an IEE and EIA in due course following prescribed format and be submitted to the DoE for getting the ECC of the project. The EIA should include the prediction, evaluation and mitigation of environmental impacts and an EMP.

59. Environmental Clearance Certificate has already been obtained by the authority from the DoE (see Appendix 1). So, this EIA report is prepared mainly focusing on complying the AIIB requirements.

E. Equator Principle Financial Institution's (EPFI) Guidelines

1. Principle 1: Review and Categorization

60. When a Project is proposed for financing, the EPFI will, as part of its internal environmental and social review and due diligence, categorize the Project based on the magnitude of potential

environmental and social risks and impacts, including those related to Human Rights, climate change, and biodiversity. Such categorization is based on the International Finance Corporation's (IFC) environmental and social categorization process. The categories are:

61. **Category A** – Projects with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented;

62. **Category B** – Projects with potential limited adverse environmental and social risks and/or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures; and

63. **Category C** – Projects with minimal or no adverse environmental and social risks and/or impacts.

64. The EPFI's environmental and social due diligence is commensurate with the nature, scale and stage of the Project, and with the categorized level of environmental and social risks and impacts. This project falls under "Category A" as per EPFI's guideline.

2. Principle 2: Environmental and Social Assessment

65. The EPFI will require the client to conduct an appropriate Assessment process to address, to the EPFI's satisfaction, the relevant environmental and social risks and scale of impacts of the proposed Project. The Assessment Documentation should propose measures to minimise, mitigate, and where residual impacts remain, to compensate/offset/remedy for risks and impacts to Workers, Affected Communities, and the environment, in a manner relevant and appropriate to the nature and scale of the proposed Project.

66. The Assessment Documentation will be an adequate, accurate and objective evaluation and presentation of the environmental and social risks and impacts, whether prepared by the client, consultants or external experts. For Category A and, as appropriate, Category B Projects, the Assessment Documentation includes an Environmental and Social Impact Assessment (ESIA). One or more specialized studies may also need to be undertaken. For other Category B and potentially C Projects, a limited or focused environmental or social assessment may be appropriate, applying applicable risk management standards relevant to the risks or impacts identified during the categorization process.

67. The client is expected to include assessments of potential adverse Human Rights impacts and climate change risks as part of the ESIA or other Assessment, with these included in the Assessment Documentation. The client should refer to the UNGPs when assessing Human Rights risks and impacts, and the Climate Change Risk Assessment should be aligned with Climate Physical Risk and Climate Transition Risk categories of the Task Force on Climate-related Financial Disclosures (TCFD).

68. A Climate Change Risk Assessment is required:

- For all Category A and, as appropriate, Category B Projects, and will include consideration of relevant physical risks as defined by the TCFD.
- For all Projects, in all locations, when combined Scope 1 and Scope 2 Emissions are expected to be more than 100,000 tonnes of CO_2 equivalent annually. Consideration must be given to relevant Climate Transition Risks (as defined by the TCFD) and an alternatives analysis completed which evaluates lower Greenhouse Gas (GHG) intensive alternatives.

69. The depth and nature of the Climate Change Risk Assessment will depend on the type of Project as well as the nature of risks, including their materiality and severity.

3. Principle 3: Applicable Environmental and Social Standards

70. The Assessment process should, in the first instance, address compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues.

71. EPFIs operate in diverse markets: some with robust environmental and social governance, legislation systems and institutional capacity designed to protect their people and the environment; and some with evolving technical and institutional capacity to manage environmental and social issues.

72. The EPFI's due diligence will include, for all Category A and Category B Projects globally, review and confirmation by the EPFI of how the Project and transaction meet each of the principles.

73. The EPFI will, with supporting advice from the Independent Environmental and Social Consultant where applicable, evaluate the Project's compliance with the applicable standards as follows:

1. For Projects located in Non-Designated Countries, compliance with the applicable IFC Performance Standards on Environmental and Social Standard (ESS) and the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines) (Exhibit III).
2. For Projects located in Designated Countries, compliance with relevant host country laws, regulations and permits that pertain to environmental and social issues.

74. The review of the Assessment process will establish, to the EPFI's satisfaction, the Project's overall compliance with, or justified deviation from, the applicable standards. The applicable standards (as described above) represent the minimum standards required by the EPFI. In addition, for Projects located in Designated Countries, the EPFI will evaluate the specific risks of the Project to determine whether one or more of the IFC Performance Standards could be used as guidance to address those risks, in addition to host country laws.

75. The EPFI may, at its sole discretion, undertake additional due diligence against additional standards relevant to specific risks of the Project and apply additional requirements.

4. Principle 4: Environmental and Social Management System and Equator Principles Action Plan

76. For all Category A and Category B Projects the EPFI will require the client to develop and / or maintain an Environmental and Social Management System (ESMS).

77. Further, an Environmental and Social Management Plan (ESMP) will be prepared by the client to address issues raised in the Assessment process and incorporate actions required to comply with the applicable standards. Where the applicable standards are not met to the EPFI's satisfaction, the client and the EPFI will agree to an Equator Principles Action Plan (EPAP). The EPAP is intended to outline gaps and commitments to meet EPFI requirements in line with the applicable standards.

5. Principle 5: Stakeholder Engagement

78. For all Category A and Category B Projects the EPFI will require the client to demonstrate effective Stakeholder Engagement, as an ongoing process in a structured and culturally appropriate manner, with Affected Communities, Workers and, where relevant, Other Stakeholders.

79. For Projects with potentially significant adverse impacts on Affected Communities, the client will conduct an Informed Consultation and Participation process. The client will tailor its consultation process to the risks and impacts of the Project; the Project's phase of development; the language preferences of the Affected Communities; their decision-making processes; and the needs of disadvantaged and vulnerable groups. This process should be free from external manipulation, interference, coercion and intimidation.

6. Principle 6: Grievance Mechanism

80. For all Category A and, as appropriate, Category B Projects, the EPFI will require the client, as part of the ESMS, to establish effective grievance mechanisms which are designed for use by Affected Communities and Workers, as appropriate, to receive and facilitate resolution of concerns and grievances about the Project's environmental and social performance.

81. Grievance mechanisms are required to be scaled to the risks and impacts of the Project, and will seek to resolve concerns promptly, using an understandable and transparent consultative process that is culturally appropriate, readily accessible, at no cost, and without retribution to the party that originated the issue or concern. Grievance mechanisms should not impede access to judicial or administrative remedies. The client will inform Affected Communities and Workers about the grievance mechanisms in the course of the Stakeholder Engagement process.

7. Principle 7: Independent Review

82. For all Category A and, as appropriate, Category B Projects, an Independent Environmental and Social Consultant, will carry out an Independent Review of the Assessment process including the ESMPs, the ESMS, and the Stakeholder Engagement process documentation in order to assist the EPFI's due diligence and determination of Equator Principles compliance. The Independent Environmental and Social Consultant will also propose or opine on a suitable EPAP capable of bringing the Project into compliance with the Equator Principles, or indicate where there is a justified deviation from the applicable standards. The Independent Environmental and Social Consultant must be able to demonstrate expertise in evaluating the types of environmental and social risks and impacts relevant to the Project.

83. For Category B projects, any due diligence performed by a multilateral or bilateral financial institution or an OECD Export Credit Agency may be taken into account to determine whether an Independent Review is required.

8. Principle 8: Covenants

84. An important strength of the Equator Principles is the incorporation of covenants linked to compliance.

85. For all Projects, where a client is not in compliance with its environmental and social covenants, the EPFI will work with the client on remedial actions to bring the Project back into compliance. If the client fails to re-establish compliance within an agreed grace period, the EPFI reserves the right to exercise remedies, including calling an event of default, as considered appropriate.

9. Principle 9: Independent Monitoring and Reporting

86. For all Category A and, as appropriate, Category B Projects10, in order to assess Project compliance with the Equator Principles after Financial Close and over the life of the loan, the EPFI will require independent monitoring and reporting. Monitoring and reporting should be provided by an Independent Environmental and Social Consultant; alternatively, the EPFI will require that the client retain qualified and experienced external experts to verify its monitoring information, which will be shared with the EPFI in accordance with the frequency required in Principle 8b.

87. In line with the above, in the specific case of monitoring of Project-Related Corporate Loans to national, regional or local governments, governmental ministries and agencies, the EPFI may decide between requiring an Independent Environmental and Social Consultant or relying on internal monitoring by the EPFI.

88. Additionally, any monitoring performed by a multilateral or bilateral financial institution or an OECD Export Credit Agency may be taken into account.

10. Principle 10: Reporting and Transparency

a) Client Reporting Requirements

89. The following client reporting requirements are in addition to the disclosure requirements in Principle 5.

90. For all Category A and, as appropriate, Category B Projects –

- The client will ensure that, at a minimum, a summary of the ESIA is accessible and available online and that it includes a summary of Human Rights and climate change risks and impacts when relevant.
- The client will report publicly, on an annual basis, GHG emission levels (combined Scope 1 and Scope 2 Emissions, and, if appropriate, the GHG efficiency ratio) during the operational phase for Projects emitting over 100,000 tonnes of CO_2 equivalent annually.

91. The EPFI will encourage the client to share commercially non-sensitive Project-specific biodiversity data with the Global Biodiversity Information Facility (GBIF) and relevant national and global data repositories, using formats and conditions to enable such data to be accessed and re-used in future decisions and research applications.

b) EPFI Reporting Requirements

92. The EPFI will, at least annually, report publicly on transactions that have reached Financial Close and on its Equator Principles implementation processes and experience. The EPFI will report according to the minimum reporting requirements, taking into account appropriate confidentiality considerations.

F. Gap Analysis Between AIIB's Requirements and National Laws

93. As part of the E&S capacity assessment of IAs, a gap analysis between AIIB's ESSs and GoB Regulations was performed. The gap analysis revealed that Bangladesh's ES risk assessment and management system for development projects is open-ended, but, like other countries' EIA systems,

does not cover all of the AIIB ESF's ES Standards. The ECA/ECR does not even define the scope of the EIA study (or the IEE), leaving that to the EIA preparation to determine through initial assessment/screening. The scope of the EIA study would thus be determined by the expertise of the EIA team. There is no guarantee that each ESS Standard (1-3) is taken into account in the EIA study and the development of the EMP. Despite the fact that the EIA is heavily weighted toward environmental issues, more and more social issues are being incorporated into the assessment. Furthermore, under normal circumstances, the practice does not include labor management issues. Another critical gap is the absence of provisions requiring the development of project-specific ES management plans. In the case of non-titled entities, the eminent domain land acquisition system, for example, does not require the preparation of a RAP. In addition, the projects are not required to develop their own Labor Management Procedures/Plans. Because of the gaps, this EIA will adhere to the most stringent standards and requirements. Table II-5 below provides an overview of the gaps between GoB laws and AIIB's ESSs, as well as steps to close those gaps.

Table II-5: Gaps Between GoB Laws and AIIB ESSs

AIIB's ESF Standard	Gaps	Gap Minimization
ESS1: Environmental and Social Assessment and Management	(i) EIA study screening and scoping do not guarantee coverage of all ESS standards in the assessment. (ii) EIA study does not advocate to include both the environment and social impacts at same scale but the ESF does. (iii) The stakeholder engagement during the conduct of the EIA is limited and the EIA report is not disclosed. (iv) The EIA system in Bangladesh does not require analysis of alternatives.	EIA has suggested to follow the ESS1 requirements, given in the relevant sections of Environmental Management Procedures.
ESS2: Involuntary Resettlement	Bangladesh: ARIPA (i) does not require the preparation of RAP in case of titled and non-titled entities. (ii) does not provide compensation or assistance to those who do not have formal legal claim to the land; (iii) does not provide transitional allowances for restoration of livelihoods for informal settlers; (iv) relies on cash compensation; (v) no provision to give special attention to the vulnerable groups (vi) valuation of lost asset is not based on "replacement cost' standard	A RAP has been prepared and being updated which will be followed in the project.
ESS3: Indigenous People	No equivalent requirements on: (i) coverage of IP impacts in the EIA; (ii) special treatment or differentiated approach to IPs and vulnerable groups; (iii) conduct of FPIC; (iv) development of IP Plan.	No, since no Indigenous people, as defined in the ESP.

III. DESCRIPTION OF THE PROJECT

A. General

94. The Project is a reconstruction project of existing roads and located in the southeast area of Dhaka City. The Project starts from Chattogram Interchange connecting Chattogram National Highway N1, then runs along R1 10 Highway and extends northwestward as well as is straightened in Demra District by avoiding two 90 degree turns, with the toll plaza provided here, then, runs northwestward along R202 Highway, an interchange is provided at Meradia to facilitate the residents in Meradia District; It reaches the end point by running along the Rampura River. Its end point is connected to Rampura Interchange provided on the urban trunk roads---DIT Roads. It is 12.491 km in total length. The main control points along the route are NI Highway, N2 Highway, Demra District, Meradia District, DIT Roads and existing bridges. The project location map is given below Figure III-1.

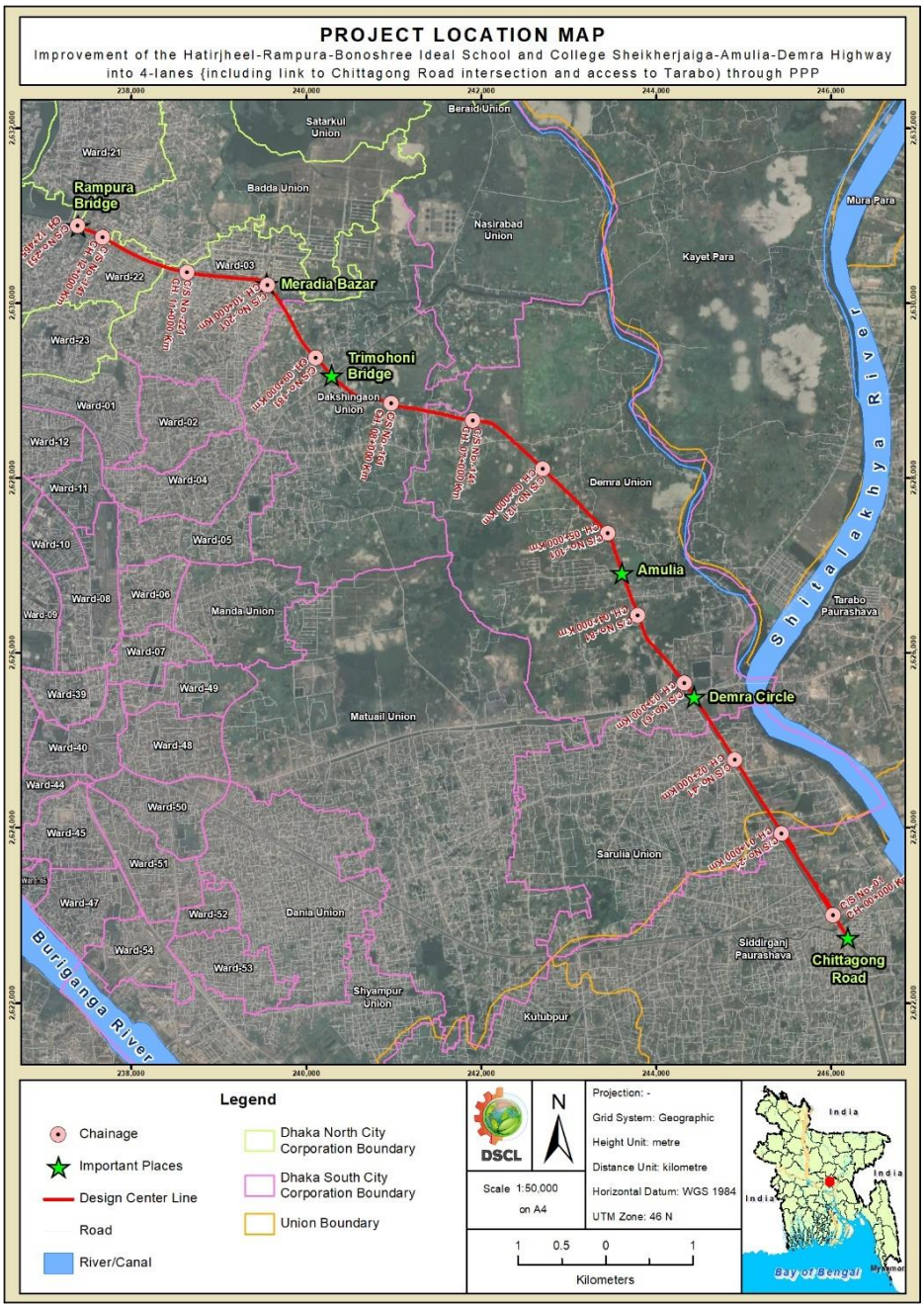


Figure III.1: Project Location Map

B. Need for the Project

95. The Project's starting point is linked to the National Highway N1 Expansion Project. The project connects Bangladesh's capital Dhaka with Chattogram, Sylhet, Narayanganj, and other east areas, which will not only promote social and economic development of Dhaka City but also help the development of the entire Bangladesh. After completion, it will significantly increase the traffic capacity from Dhaka to Chattogram, thus constituting the backbone highway network from Dhaka to Chattogram. The citizens of the surrounding districts will undoubtedly benefit from improvements to the traffic service system and will be encouraged to grow economically.

- ☐ Enhance the city's integrated transportation and traffic network and encourage urban sustainability. Dhaka is not only the capital but also an important business hub for Bangladesh because of its advantageous position, convenient traffic, and distinctive physical location. Dhaka City will play a vital role in Bangladesh as the integrated domestic transportation junction due to the country's rapid economic development. By concentrating on the current traffic conditions and development requirements, it will be possible to achieve a win-win outcome for urban development and transportation development, exterior transportation and urban transportation, facility construction and function promotion, and lead healthy development of transportation in Dhaka City. The Project's construction will advance integrated highway transportation construction and urban sustainable development while enhancing Dhaka City's comprehensive traffic and transportation network.
- ☐ Increase the transport channel's capacity for traffic while reducing gridlock in the city core. National Highways N1 (Dhaka-Chattogram), N2 (Dhaka-Bhutan-Sylhet), N3 (Dhaka-Joydebpur-Mymensingh), N4 (Joydebpur-Tangail), N8 (Dhaka-Mawa-Barishal), N301, and N105 currently carry the majority of traffic in Bangladesh. Due to the fact that these major highways pass through Dhaka City, the capital has experienced severe traffic congestion, particularly in the southeast region. Through the PPP proposed for the Project, the Hatirjheel-Bonoshree Ideal School and College-Sheikherjaiga-Amulia-Demra Highway will be upgraded to four lanes, increasing its traffic capacity. At the same time, some transit traffic won't have to enter Dhaka's downtown any longer, reducing congestion there and enhancing the efficiency of highway transport.
- ☐ Encourage reciprocal economic growth in the Dhaka, Chattogram, and Sylhet regions. Dhaka District is situated geologically between Sylhet District and Chattogram District, and all three districts are connected by Bangladesh's national highways N1 and N2. The Project is a crucial strategic component for the main intercity routes that connect the city center and lead to Bangladesh's eastern region (including Chattogram and Sylhet which are the main trade portals of the country). After the project is finished, it will link Dhaka City's trunk traffic lines with national highways to create a more complete national highway network, strengthening the connection between all the areas and fostering reciprocal economic growth in the Dhaka-Chattogram-Sylhet area.
- ☐ Encourage the growth of the regional tourism industry through Project construction. Both Dhaka and Chattogram provide a variety of tourist attractions, including as the remains of the Shrine of Bayazid Bostami, and Patenga Beach nearby in Chattogram, among others.

C. Scope of the Project

96. The Project is an upgrading and reconstruction project for the existing roads, starting at a proposed interchange at Chattogram Road (National Highway N1) and ending at another interchange at Hatirjheel near Rampura Bridge Road. The Project Highway is 12.491 km in length, and is expected to establish a strong connectivity among the capital city Dhaka to Chattogram, Sylhet, Narayanganj and other eastern districts of Bangladesh. Main work under the project is summarized in the following table.

Table III-1: Main Quantities of the Project

SN	Indicator Name		Unit	Quantity		
				Toll Road	Service Road	Total
I.	**Basic Indexes**					
1	Road Classification			Expressway	Service Road	
2	Design Speed		Km/h	80	80	--
3	Route Length		km	12.491	11,487	--
II.	**Subgrade and Pavement**					
5	Width of Subgrade		m	18.6/32.2	Various	--
6	Driveway Width		m	4×3.65	2×3.65/2×5.5	--
7	Earthwork Quantity of Subgrade		1000m^3	441.713		441.713
8	Average Earthwork per Kilometer		1000m^3	35.362		35.362
9	Drainage Protection (Masonry)		1000m^3	31.95		31.95
10	Pavement	Sidewalk Paving	1000m^2	-	26.587	26.587
		Asphalt Concreate		423.8		423.8
11	Poor Geological Treatment		m	5440	500	5940
III.	**Bridge and Culvert (excluding the interchanges)**					
12	Large Bridge		m/Nos.	8155.5/2		8155.5/2
13	Minor Bridge		M/Nos.	/	68/2	The Existing Bridge is utilized
14	Culvert		Nos.	6	2	8
15	Proportion of Bridge to the route		%	65.29		65.29
IV	**Road Intersection**					
16	Interchange		Nos.	3		3
17	Grade Separation		Nos.	1		1
18	At-grade Intersection		Nos.		30	30
19	Underpass		Nos.	1		1
V	**Traffic Engineering and Others**					
20	Traffic Safety Facilities		km	12.491	11.487	12.491
21	Toll Plaza		Nos.	1		1
21	Greening Landscape		Km	12.491	11.487	12.491

97. The four-lane divided carriageway Project Highway is fully access-controlled and comprises the following project elements:

1. Toll Road (Elevated)

98. Comprising a four-lane divided access-controlled elevated tolled highway for part of the alignment having width of 8.6 metre (7.6 metre main carriageway and 1.0 metre emergency lane) in each direction.

2. Toll Road (At-Grade)

99. Comprising a four-lane divided access-controlled at-grade tolled highway for part of the alignment having width of 9.7m (7.3m main carriageway and 2.4m emergency lane) in each direction.

3. Service Roads

100. Comprising two lanes (minimum 4.8m width pavement plus 1.0m paved shoulder) on both sides of the at-grade section of the Toll Road, and on one or both sides of the elevated section. If the Service Roads are provided on one side of the elevated section, the Service Roads width shall be comprised of minimum 7.3m pavement plus l.0m paved shoulder on both sides of the Service Roads.

4. Cross-Roads

101. The Existing Lanes corridor has numerous intersections with the local roads and connects to two major national highways N1 (Dhaka-Chattogram) and N2 (Dhaka-Sylhet) at its east end. There are some roads to be intersected with the Existing Lanes.

5. Structures

102. Two major bridges (each approximately 36m in length) with very high elevation to provide both the hydraulic opening and also to serve as an underpass for local road crossing. There are also two box culverts. The bridges and culverts shall be kept as they are in order to serve the Service Roads. In addition, there are three interchanges, one each at Rampura, Meradia and at the intersection with N1 Chattogram Road; and

6. Toll Plaza

103. There shall be a toll plaza provided on the at-grade section of the Project Highway. Traffic on the Service Roads shall pass through this toll plaza in order to ensure that Service Road traffic is captured and counted for record purposes. This traffic shall not be tolled at the toll plaza and shall be allowed to pass through freely.

D. Design Aspects

104. Apart from the elevated toll road from Ch. 11 + 500 to Ch. 12 + 450, where there is an existing four lane divided carriage way that does not form part of the Project, a two-lane service road (one-side or both sides, as per available ROW) must be included as an integral part of the Project Highway geometric design. The alignment of the service roads shall, whenever practical and subject to any necessary adjustment, utilize the Existing Lanes.

1. Alignment

105. The Project is to reconstruct an existing road located in the southeast area of Dhaka City. The Project starts from Chattogram Interchange at the link between Chattogram Road and national highway N1, and the starting chainage is K1+154.113; and then, runs along R110 Highway and extends northwestward; in Demra District, reconstructing 90 degree turns of existing road and building a new

subgrade, with a toll plaza provided here, then, runs northwestward along R202 Highway, with an interchange provided at Meradia to facilitate the residents in Meradia District to make use of the highway; Along the Rampura River until the ending point of the Project; the Rampura interchange is set between ending point and urban trunk road DIT Road; with the chainage of K13 + 645.125 at ending point. The total length of alignment is 12.491km.

106. The direction of Service roads is the same to that of the toll road. From the starting point to Meradia interchange, except the separation between SK9 + 148.5 and SK10 + 026 for existing bridges, the service road alignment is consistent with that of the toll road. After passing Meradia Interchange, the service road reaches the current newly paved sections along the existing highway, which is the ending point of the Project. The starting and ending chainage is SK1 + 154.113 ~ SK12 + 640.848, with a total length of 11.487km. SK + 525.500 ~ SK8 + 602 shares the alignment with the toll road, with consistent plan and profile.

107. The operation section in priority includes toll road K4 + 525.5 ~ K13 + 645.125 and service road SK4 + 150 ~ SK12 + 640.848 to ensure the operation of the route between N2 National Highway and Dit Road in advance.

Figure III.2: Schematic Diagram of the Route

108. The whole line is divided into four kinds of Cross-sections: Service Roads both sides of elevated Toll Road, Service Roads on one side of elevated Toll Road, Service Roads both sides of at-grade Toll Road, Service Roads left/right side of elevated Toll Road.

Table III-2: List of Project Subsections

SI	Cross Section Type	From Chainage	To Change	Remarks
1.	Service Roads both sides of elevated Toll Road	K1+154.113	K4+525.5	Toll road K is along the existing road
2.	Service Roads both sides of Toll Plaza	K4+525.5	K4+900	Newly built subgrade
3.	Service Roads both sides of at grade Toll Road	K4+900	K8+602	Toll road is along the existing road
4.	Service Roads both sides of elevated Toll Road	K8+602	K9+350	Separated with existing bridge, toll road located on the left side of existing road
5.	Service Roads both sides of elevated Toll Road	K9+350	K9+750	Toll road K is along the existing road

SI	Cross Section Type	From Chainage	To Change	Remarks
6.	Service Roads both sides of elevated Toll Road	K9+750	K10+230	Separated with existing bridge, toll road in the left side of existing road
7.	Service Roads both sides of elevated Toll Road	K10+230	K10+930	Toll road K is along the existing road
8.	Service Roads both sides of elevated Toll Road	K10+930	K11+230	Viaduct is separated from the service road, and the viaduct is located on the right side of the existing road
9.	Service Roads both sides of elevated Toll Road	K11+230	K11+330	Toll road is on the right side of the existing highway
10.	Service Roads both sides of elevated Toll Road	K11+330	K13+614.125	Viaduct is separated from the service road, and the viaduct is located on the right side of the existing road

2. Road Intersection

a) Interchange

109. The location of interchange is set according to the distribution of urban and trunkline highway along the alignment and traffic demand. Considering traffic volume, terrain, environment, land use, and ROW range to make choice of the reasonable type of interchange. In the proposal scheme for the Project, three interchanges are set as shown in Table III-3.

Table III-3: List of Interchanges

SI	Name of Interchange	Intersection Chainage	Name of Crossing Roads	Class of Road and Type of Pavement
1.	Chattogram Interchange	K1+154.113	National Highway N1	National highway, two-way 4-lane asphalt concrete road
2.	Meradia Interchange	K11+000	Service Road S	service road, two-way two-lane asphalt concrete road
3.	Rampura Interchange	K13+645.125	DIT Road	Urban trunk road, two-way 4-lane asphalt concrete road

(a)

(b)

(c)

Figure III.3: (a) Plan of K1+ 154.113 Chattogram interchange (b) Plan of K11 + 000 Meradia interchange & (c) Plan of Rampura interchange at K13 + 645.125

b) Grade Separation

110. The existing road near K7 + 780 is two T-shaped intersections originally. One of intersected roads is R202 highway with pavement width of 5.4m, as shown in Figure III-3; The other is a village road with width of 3.15m, as shown in Figure III-4. Because the toll road cuts off the traffic, a grade separation structure shall be set to ensure the vehicle traffic on Road R202, and two roundabouts are set at the ends of bridge respectively to realize the connection between R202 and the service roads on two sides.

Figure III.4: Plan of Grade Separation

c) At-Grade Intersection

111. In combination with following factors of Service Roads, such as traffic volume prediction, design speed, cross-section of road width and the current situation of intersections of existing road, the proposed service road is divided into two sections for the at-grade intersection arrangement.

(1) General Sections

112. The design of the intersection with widened comers and paving is adopted to realize the traffic transfer between the local roads and the service roads when the traffic volume of crossed road sections is less.

(2) Sections with High Traffic Volume

113. When the traffic volume is higher, the intersections are denser and the pedestrians are more numerous, the design of the intersection with widened comers and paving is adopted; at the same time, the traffic island is set for traffic channelization, and the traffic management facilities are combined to channel the pedestrians so as to reduce the intertwined conflict between pedestrians and vehicles. If three-way intersection is exceeded, a roundabout shall be set.

Figure III.5: Roundabout Plan at K4 + 150

3. Toll Plaza

114. The proposed toll plaza is set in Demra, with the central chainage of K4+750, which is located within the scope of newly-constructed subgrade section (at-grade Toll Road K4+150 ~ K5 + 000), with distribution of more fish ponds. In combination with ROW, the range of toll plaza square is K4+600 ~ K4+900, and the toll road in toll plaza is adopted with 4-in and 4 out. The service roads are at the both sides of the toll road. Traffic on the Service Roads shall pass through this toll plaza in order to ensure that Service Road traffic is captured and counted for record purposes, and this traffic shall not be tolled at the toll plaza and shall be allowed to pass through freely. The toll plaza square is 200m in length and 57.8m in width. The length of transition section for square is 50m, with transition rate of 1:2.

115. The overweight control stations are set (one for each direction) with weigh scales constructed in the toll plaza areas for controlling any overweight vehicle(s) on the Project Highway and ensuring that the weight of vehicles using the Toll Road does not exceed prevailing axel load control policies and regulations.

116. The fish pond on the left side of route is utilized to arrange field floor, the toll management office, maintenance unit and traffic control center are set.

Figure III.6: Plan of Demra Toll Plaza

117. At toll plazas, common concrete pavements (JPCP) that are provided with contraction joints and dowel bars will be adopted. Dowel bars will be arranged at the transverse joints, and tie bars at the longitudinal joints.

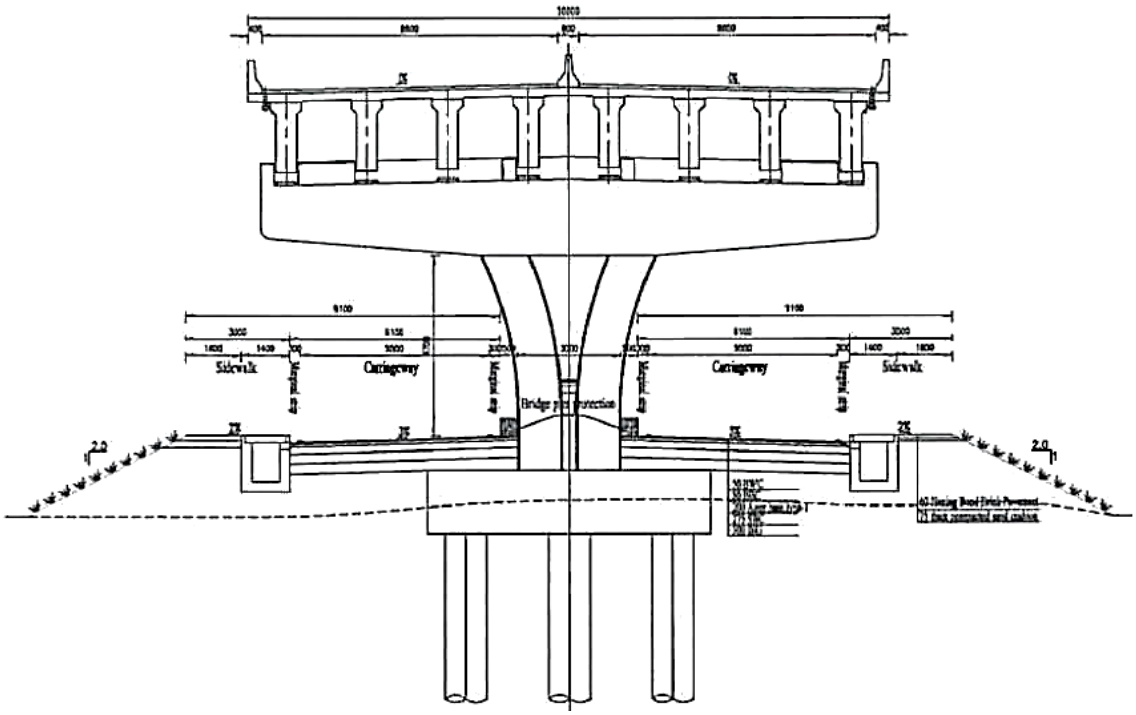


Figure III.7: Schematic Diagram of Service Roads both sides of Elevated Toll Road

118. According to the scope of given ROW in the basis for bidding proposal, the minimum curve radius of this section of viaduct is 250m and the minimum curve radius of service road is 120m.

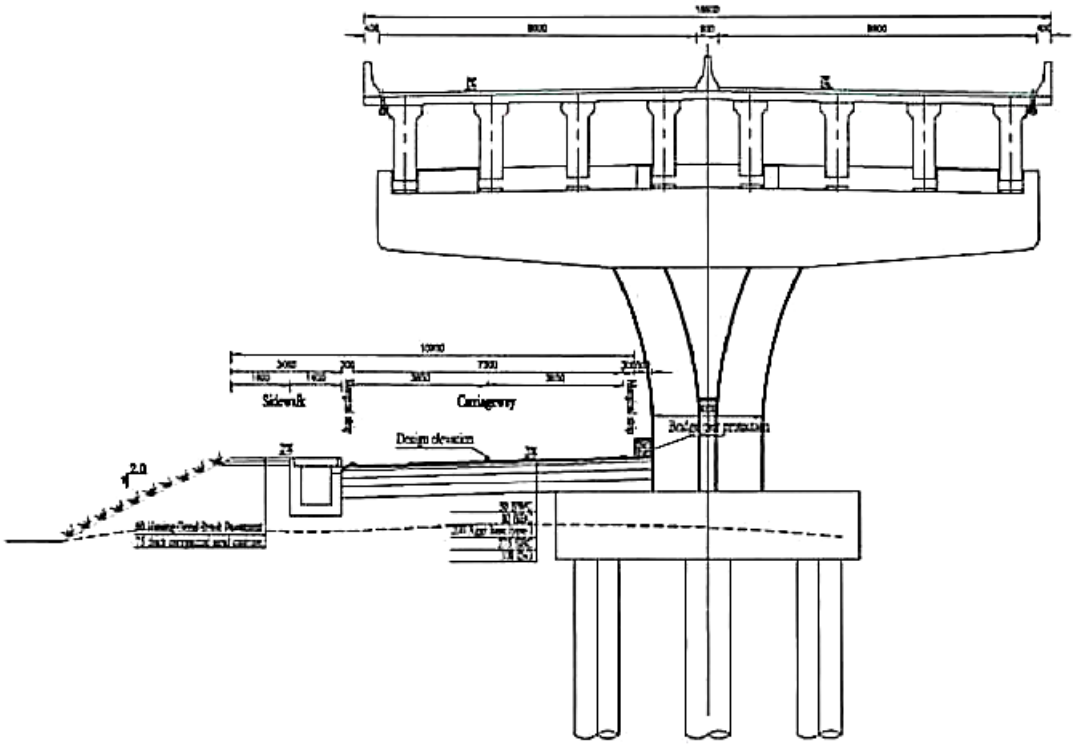


Figure III.8: Schematic Diagram of Service Roads on one side of Elevated Toll Road

4. Green Landscape Design

a) Greening Landscape Design of Median Strip

119. According to the section characteristics of the Project, the central median strip is divided into two sections: the median strip under the bridge and the median strip of the existing road. Two green schemes are designed to enhance the contrast of plant colors under the premise of ensuring the survival rate of seedlings, which has also shaped a richer change in plant morphology and texture to form a rhythmic plant landscape sequence.

120. Median strip under the bridge: In this scheme, *Schefflera actinophylla* and *Schefflera heptaphylla*, shade tolerant plants, are selected, of which *Schefflera actinophylla* is planted in two rows in a determinant manner, with a plant spacing of3m, and the ground is covered with *Schefflera heptaphylla*.

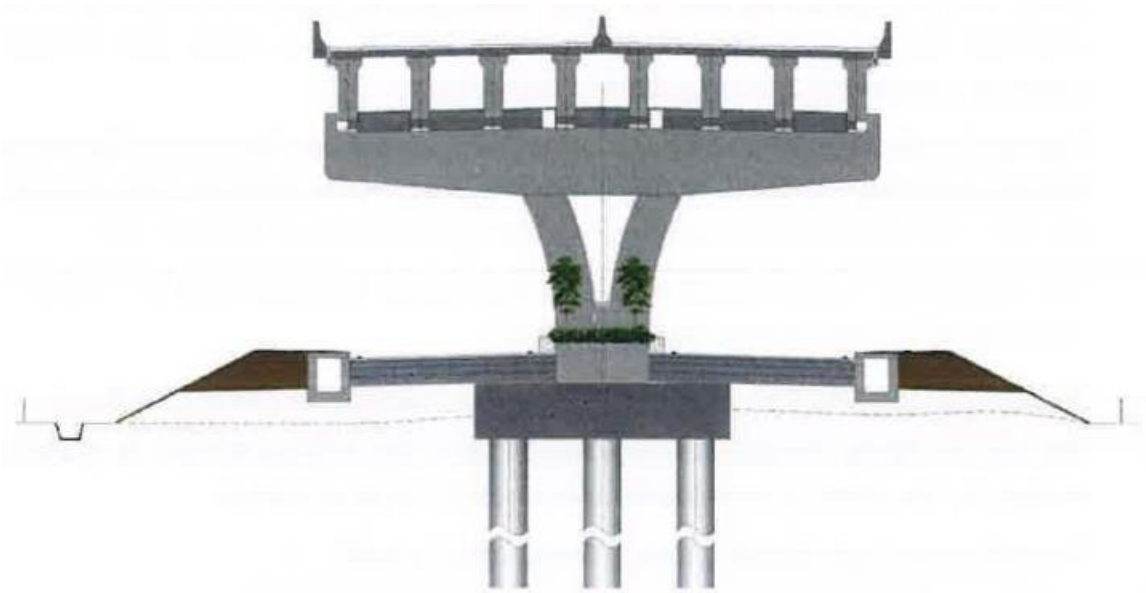


Figure III.9: Cross Section of Greening Landscape

b) Green Landscape Design in Interchange Area

121. The Project has three interchanges, namely, Chattogram interchange, Meradia interchange and Rampura interchange.

122. The form of interchange greening is mainly based on natural forms, emphasizing the natural scenery of the region, highlighting the layering and stereoscopic effects of greening, and fully integrating the interchange landscape into the surrounding natural environment. Plant materials vary from place to place, and on the basis of ensuring survival, the seasonal phase changes and characteristics of plant landscapes are pursued to form regular interchange sequences.

123. Because the space of Rampura interchange and Meradia interchange that can be greened is insufficient due to the close distance between the ramp and the viaduct and it is not within the sight distance, no seedlings are planted here based on the principle of appropriate land and economical savings in the design.

c) Greening Landscape of the Housing Area

124. There is a toll plaza in the Project.

125. The green landscape design of housing building area combines the layout of buildings and activity sites and creates the plant landscape space with regional characteristics under the premise of considering the use of functions, so as to create a sound building peripheral environment. Plants selected include *Polyalthia longifolia*, *Terminalia catappa*, *Acacia auriculiformis*, *Ceiba speciosa St.Hih.*, *Hibiscus rosasinensis linn.*, *Bougainvillea glabra choisy*, etc.

d) Roundabout Green Landscape Design

126. At the roundabout, *Terminalia catappa* and *Ceiba speciosa St.Hih*. are used as the backbone trees in the design. The lower layer is matched with low shrubs such as *Hibiscus rosa-sinensis linn*. and *Bougainvillea glabra choisy* and the bottom layer is covered with *Schefflera heptaphylla* to create a road node landscape with flowers all year round and well-arranged.

E. Existing Traffic Status

127. To understand the present traffic status of the project area a traffic volume survey was carried out from March to April 2022, including section and turning traffic volume observations, and points were arranged along the main crossed roads. The selection of traffic survey locations mainly considers locations with concentrated and representative traffic volumes for convenient counts and control. Based on the above analysis, the layout of the traffic survey points is shown in the following table, and the specific location is shown in the distribution map of the traffic survey points.

Table III-4: List of Traffic Survey Points

Survey Point	Survey Site	Road Name	Survey Content	Survey Time
1	Footbridge	N1	Section traffic volume observation	3.11 08:00-18:00 3.30 00:00-24:00
2	Trimohoni Bridge	Bonoshree – Staff Quarter – Demra Rd	Section traffic volume observation	3.16 15:00-18:00 4.3 00:00-24:00
3	Pizza Hut Bonoshree	Bonoshree Main Rd	Section traffic volume observation	3.16 08:00-11:00
4	Rampura foot Over	DIT Rd	Section traffic volume observation	3.30 00:00-24:00
5	Steel Palace	R110 and R201	Turning traffic volume observation	3.14 15:00-18:00
6	Haji Hossain Plaza	Shekher Jayga – Staff Quarter Rd and R110	Turning traffic volume observation	3.14 08:00-11:00
7	Hatir Jheel U-Turn Loop	Bonoshree Main Road	Turning traffic volume observation	3.21 08:00-11:00

128. According to the difficulty of field operations, the traffic volume is observed with the video recording, with each vehicle being observed and counted, and traffic volumes in both directions being counted separately.

1. Section Traffic Volume Observation

(1) Point 1

129. Two section traffic volume observations were made at Point 1 on March 11, 2022 (Friday, a day-off) and March 30, 2022 (Wednesday, a weekday), and the results are shown in the table below.

Table III-5: Observation Results of Traffic Volume at Point 1 (3.11, veh)

Time	1	2	3	4	5	6	7	8	9	10	11	12	13	Total	
														1-8	1-13
8-9	3	358	257	374	220	260	236	514	178	338	13	302	0	2222	3053
9-10	8	373	246	404	230	342	263	508	225	391	18	405	0	2374	3413
10-11	4	480	238	441	164	293	245	515	272	444	14	477	0	2380	3587
11-12	6	479	229	441	118	323	221	475	294	532	5	527	0	2292	3650
12-13	5	454	267	409	102	306	221	451	303	525	8	448	0	2215	3499
13-14	4	364	204	367	91	231	164	367	336	388	8	253	0	1792	2777
14-15	9	290	178	442	72	277	180	397	322	399	0	247	0	1845	2813
15-16	2	330	153	484	108	285	211	500	304	480	10	391	0	2073	3258
16-17	4	342	155	440	112	238	173	452	345	536	7	486	0	1916	3290
17-18	2	307	114	394	234	290	157	540	353	577	6	701	0	2038	3675

Table III-6: Observation Results of Traffic Volume at Point 1 (3.30, veh)

Time	1	2	3	4	5	6	7	8	9	10	11	12	13	Total	
														1-8	1-13
0-1	1642			275			409		248					2326	2574
1-2	1562			138			288		150					1988	2138
2-3	1516			114			248		128					1878	2006
3-4	1730			188			163		88					2081	2169
4-5	1346			398			187		118					1931	2049
5-6	14	621	474	614	61	34	80	164	143	60	0	90	0	2062	2355
6-7	5	822	276	387	44	143	153	256	203	175	2	225	0	2086	2691
7-8	7	443	279	519	113	218	198	368	267	345	5	254	0	2145	3016
8-9	11	386	324	539	117	319	190	456	315	520	7	322	0	2342	3506

Time	1	2	3	4	5	6	7	8	9	10	11	12	13	Total	
														1-8	1-13
9-10	3	405	338	417	86	213	214	461	253	593	2	436	0	2137	3421
10-11	3	460	364	439	83	218	228	464	263	581	2	462	0	2259	3567
11-12	3	572	416	483	78	225	255	468	282	559	2	514	0	2500	3857
12-13	3	530	442	447	83	216	234	465	306	546	3	500	0	2420	3775
13-14	4	509	455	429	85	211	223	462	319	540	3	492	0	2378	3732
14-15	5	504	423	433	119	218	164	570	286	509	6	445	0	2436	3682
15-16	5	527	428	436	115	222	170	580	289	519	5	470	0	2483	3766
16-17	6	575	439	441	105	230	181	597	296	540	2	522	0	2574	3934
17-18	4	551	419	417	89	233	178	514	284	573	8	518	0	2405	3788
18-19	1171			669			862		1107					2702	3809
19-20	1112			523			789		1128					2424	3552
20-21	1102			403			579		918					2084	3002
21-22	1350			358			556		714					2264	2978
22-23	1636			289			603		542					2528	3070
23-0	1692			283			541		371					2516	2887

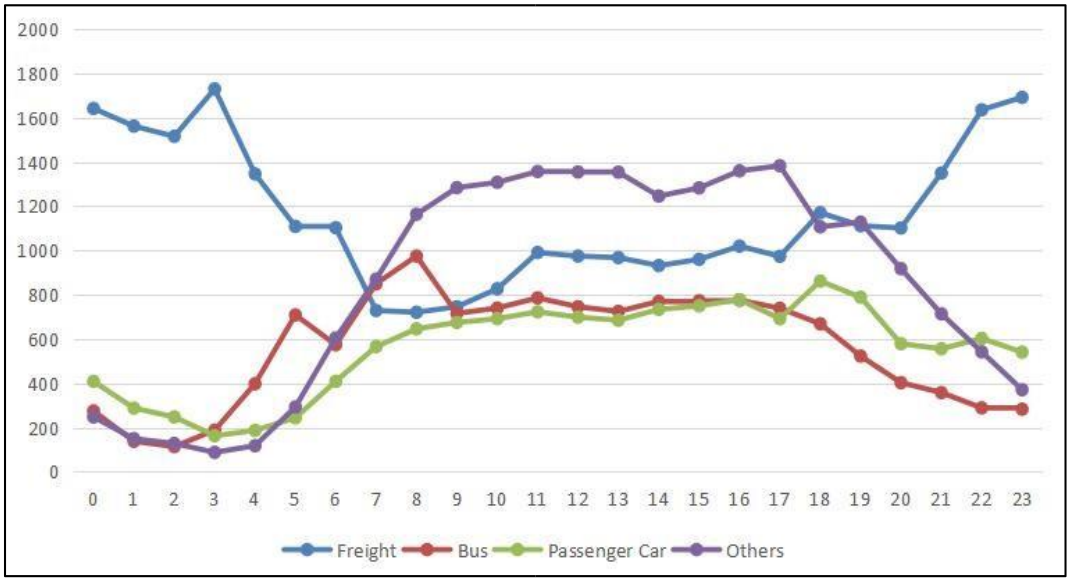


Figure III.10: Traffic Volume Broken Line at Point 1 by hour

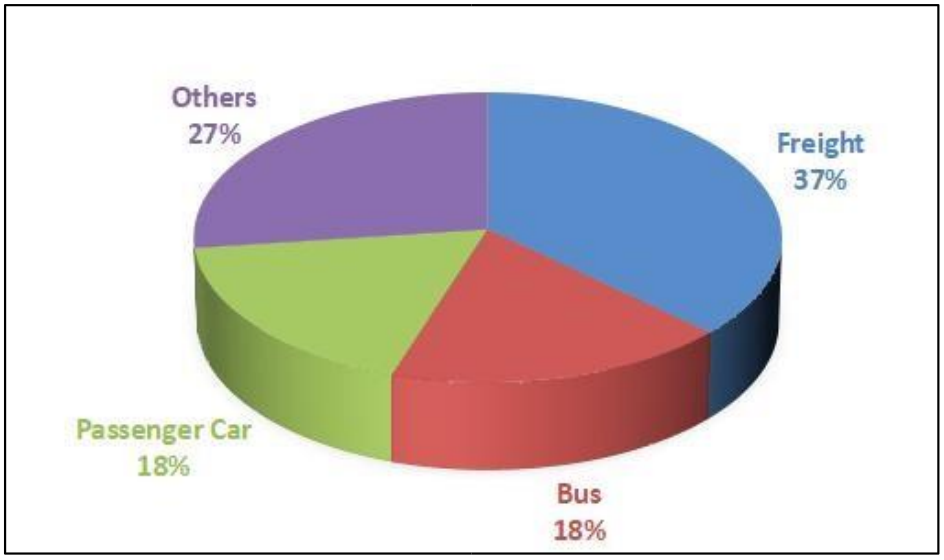


Figure III.11: Vehicle Type Proportion at Point 1

(2) Point 2

130. Two section traffic volume observations were made at Point 2 on March 16, 2022 (Wednesday, a weekday) and April 3, 2022 (Sunday, a day-off), and the results are shown in the table below.

Table III-7: Observation Results of Traffic Volume at Point 2 (3.16, veh)

Time	1	2	3	4	5	6	7	8	9	10	11	12	13	Total	
														1-8	1-13
15-16	1	93	265	4	78	144	112	273	163	299	4	3	0	970	1439
16-17	3	69	235	5	76	95	127	262	167	295	4	4	0	872	1342
17-18	0	70	237	8	71	136	122	254	148	365	5	6	0	898	1422

Table III-8: Observation Results of Traffic Volume at Point 2 (4.3, veh)

Time	1	2	3	4	5	6	7	8	9	10	11	12	13	Total	
														1-8	1-13
0-1	669			7			38		23					714	737
1-2	686			5			19		16					710	726
2-3	433			4			12		12					449	461
3-4	408			8			27		14					443	457
4-5	388			26			69		41					483	524
5-6	232			61			139		26					432	458
6-7	252			60			180		60					492	552
7-8	243			70			331		119					644	763
8-9	233			88			342		333					663	996
9-10	266			93			331		299					690	989
10-11	332			100			307		228					739	967
11-12	356			116			313		216					785	1001
12-13	367			123			316		211					806	1017
13-14	375			109			332		208					816	1024
14-15	367			101			368		235					836	1071
15-16	350			87			438		288					875	1163

Time	1	2	3	4	5	6	7	8	9	10	11	12	13	Total	
														1-8	1-13
16-17	320			84			414		301					818	1119
17-18	305			82			401		307					788	1095
18-19	387			143			257		234					787	1021
19-20	295			91			179		236					565	801
20-21	310			81			158		221					549	770
21-22	491			64			93		238					648	886
22-23	578			57			66		219					701	920
23-0	597			27			62		64					686	750

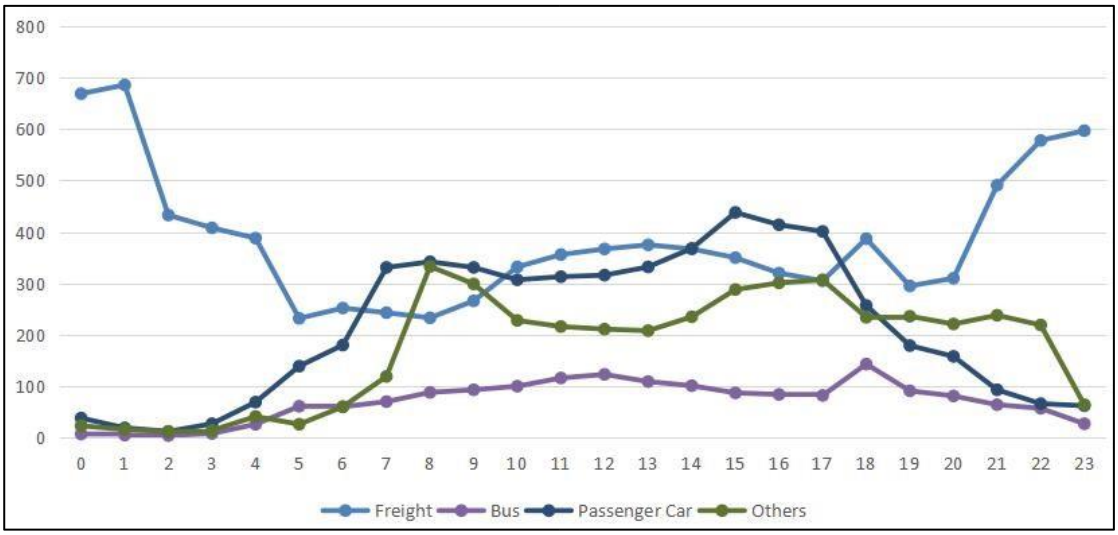


Figure III.12: Traffic Volume Broken Line at Point 2 by hour

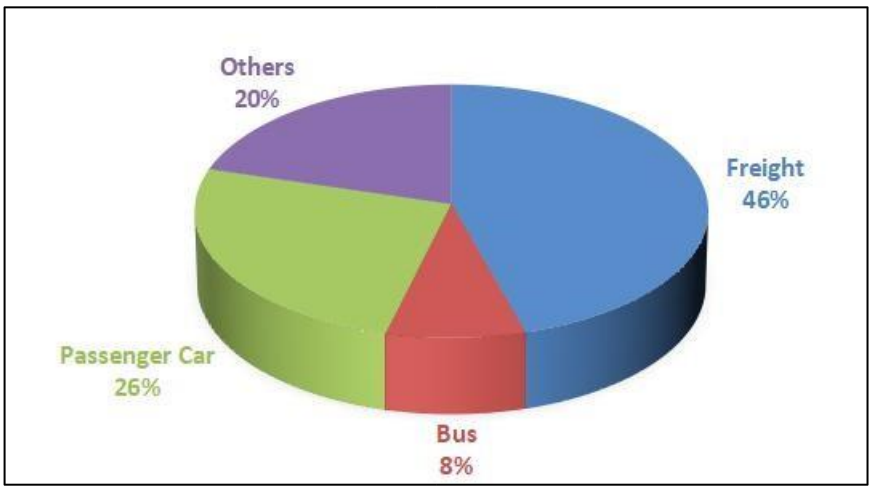


Figure III.13: Vehicle Type Proportion at Point 2

(3) Point 3

131. A section traffic volume observation was made at Point 3 on March 16, 2022 (Wednesday, a weekday), and the results are shown in the table below.

Table III-9: Observation Results of Traffic Volume at Point 3 (3.16, veh)

Time	1	2	3	4	5	6	7	8	9	10	11	12	13	Total	
														1-8	1-13
8-9	2	54	272	33	146	351	436	1014	347	1128	191	606	0	2308	4580
9-10	2	82	311	30	146	201	338	854	337	1214	161	732	0	1964	4408
10-11	2	105	259	86	70	168	265	806	410	1140	102	500	0	1761	3913

(4) Point 4

132. A section traffic volume observation was made at Point 4 on Wednesday, March 30, 2022 (Wednesday, a weekday), and the results are shown in the table below.

Table III-10: Observation Results of Traffic Volume at Point 4 (3.30, veh)

Time	1	2	3	4	5	6	7	8	9	10	11	12	13	Total	
														1-8	1-13
0-1	260			368										628	628
1-2	223			216										439	439
2-3	220			112										332	332
3-4	203			96										299	299
4-5	211			179										390	390
5-6	10	124	120	50	50	56	128	228	492	194	2	304	0	766	1758
6-7	6	62	95	207	77	70	405	312	391	501	10	547	0	1234	2683
7-8	5	72	90	239	111	149	549	791	451	904	9	878	0	2006	4248
8-9	15	137	86	228	139	144	519	925	395	956	127	1004	0	2193	4675
9-10	13	80	88	182	128	93	543	1077	443	1292	131	1028	0	2204	5098
10-11	3	92	82	215	141	70	475	1157	547	1201	146	1112	0	2235	5241
11-12	1	98	97	202	127	73	469	1019	571	1259	157	1189	0	2086	5262
12-13	1	101	105	196	121	74	466	951	584	1287	162	1229	0	2015	5277
13-14	3	73	119	227	98	53	385	908	564	1155	156	1177	0	1866	4918
14-15	2	100	148	207	97	59	387	938	572	1166	152	1153	0	1938	4981
15-16	2	156	207	168	97	72	393	997	588	1186	146	1105	0	2092	5117
16-17	3	123	165	170	116	66	440	955	524	1131	147	1115	0	2038	4955
17-18	5	107	144	171	124	63	464	934	492	1105	148	1119	0	2012	4876
18-19	13	71	157	277	69	42	258	839	245	771	126	948	0	1726	3816
19-20	140			1475										1615	1615
20-21	185			1378										1563	1563
21-22	153			1188										1341	1341
22-23	240			858										1098	1098
23-0	223			742										965	965

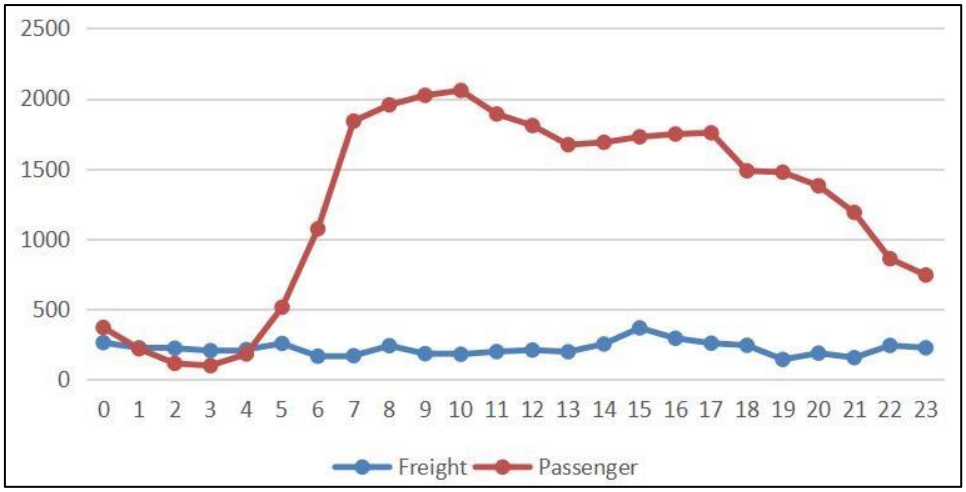


Figure III.14: Traffic Volume Broken Line at Point 4 by hour

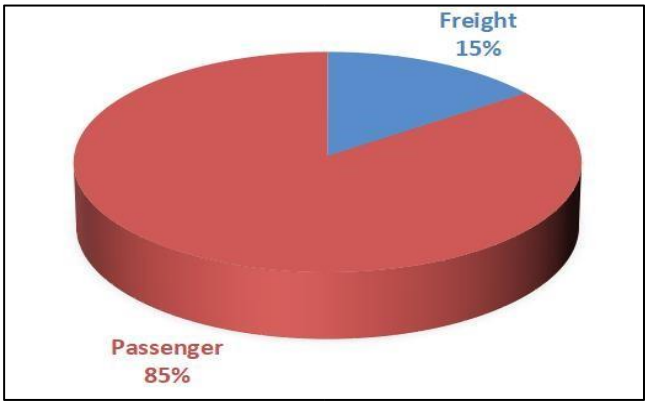


Figure III.15: Vehicle Type Proportion at Point 4

2. Turning Traffic Volume Observation

(1) Point 5

133. A turning traffic volume observation was made at Point 5 on March 14, 2022 (Monday, a weekday), and the results are shown in the table below.

Figure III.16: Turning Traffic Volume at Point 5

Table III-11: Observation Results of Traffic Volume at Point 5 (3.14, veh)

Direction	Time	Go Straight					Turn Right				
		1-3	4-6	7-8	9-13	Total	1-3	4-6	7-8	9-13	Total
1	**15-16**	139	46	88	158	431	147	12	69	91	319
	16-17	124	44	52	126	346	106	13	53	66	238
	17-18	145	39	125	141	450	131	9	116	77	333
2	**15-16**	114	16	105	81	316	33	8	5	45	91
	16-17	126	11	98	87	322	28	0	9	61	98
	17-18	132	5	123	113	373	41	1	6	57	105
3	**15-16**	23	3	9	30	65	81	45	126	63	315
	16-17	47	2	6	15	70	78	31	95	45	249
	17-18	36	5	12	24	77	101	92	137	51	381

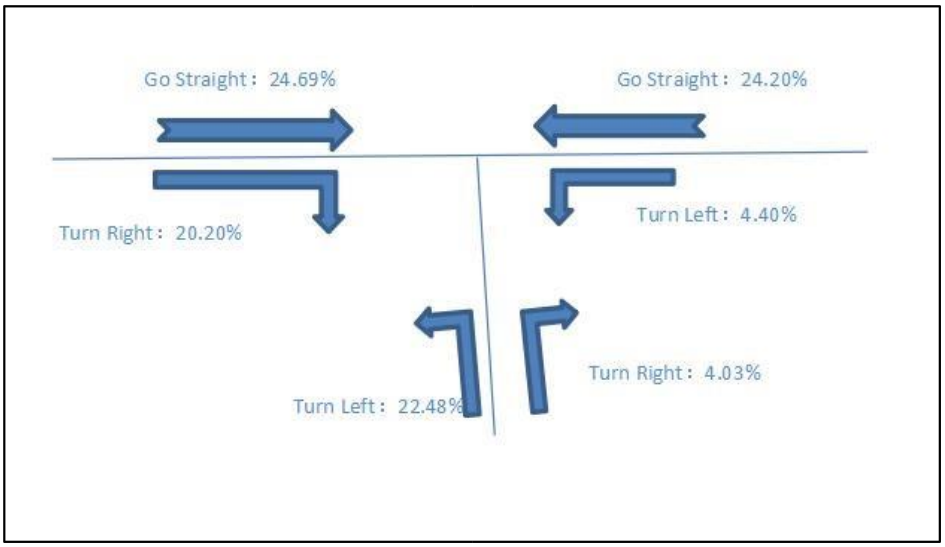


Figure III.17: Proportion of Turning Traffic Volume at Point 5

(2) Point 6

134. A turning traffic volume observation was made at Point 6 on March 14, 2022 (Monday, a weekday), and the results are shown in the table below.

Figure III.18: Turning Traffic Volume at Point 6

Table III-12: Observation Results of Traffic Volume at Point 6 (3.14, veh)

Direction	Time	Go Straight					Turn Right				
		1-3	4-6	7-8	9-13	Total	1-3	4-6	7-8	9-13	Total
1	8-9	86	83	11	38	218	128	28	167	55	378
	9-10	72	52	15	55	194	99	15	157	60	331
	10-11	68	39	11	54	172	130	11	147	78	366
2	8-9	126	35	316	162	639	15	77	14	31	137
	9-10	92	20	251	140	503	17	20	18	71	126
	10-11	99	12	188	108	407	17	31	16	42	106
3	8-9	25	46	20	10	101	94	29	33	6	162
	9-10	36	26	30	10	102	106	20	22	12	160
	10-11	29	23	10	4	66	86	24	25	3	138

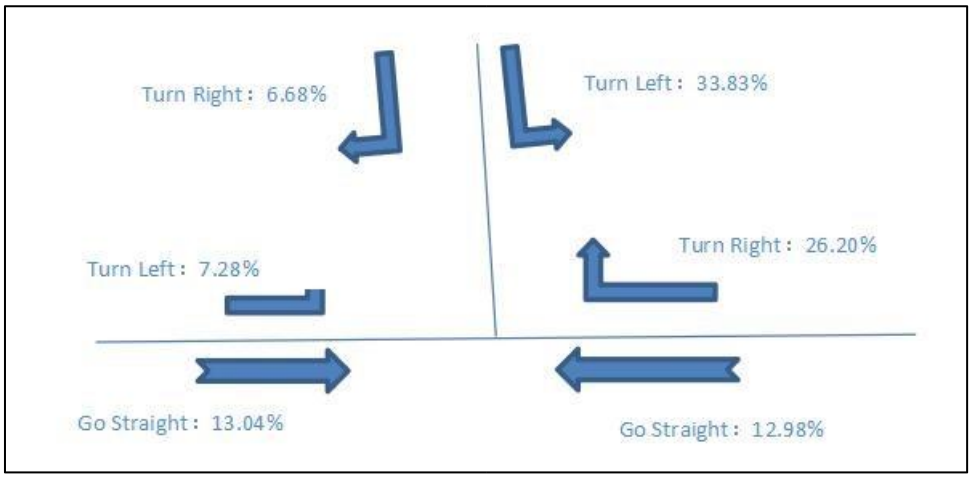


Figure III.19: Proportion of Turning Traffic Volume at Point 6

(3) Point 7

135. A turning traffic volume observation was made at Point 7 on March 21, 2022 (Monday, a weekday), and the results are shown in the table below.

Figure III.20: Turning Traffic Volume at Point 7

Table III-13: Observation Results of Traffic Volume at Point 7 (3.21, veh)

Direction	Time	1	2	3	4	5	6	7	8	Total
		Heavy Truck 3 axes	Medium Truck 2 axes	Light Truck 2 axes	Large bus	Mini bus	Micro bus	Pickup SUV	Car	
1	8-9	3	3	9	24	0	33	54	57	183
	9-10	0	3	6	15	0	6	21	39	90
	10-11	0	21	18	15	0	21	45	75	195
2	8-9	0	93	123	63	9	204	297	837	1626
	9-10	0	39	63	78	3	192	336	771	1482
	10-11	6	96	78	69	0	234	282	555	1320
3	8-9	0	48	60	12	0	111	249	537	1017
	9-10	0	3	39	9	3	66	282	453	855
	10-11	0	48	48	6	0	133	207	288	730
4	8-9	0	45	63	51	9	93	48	300	609
	9-10	0	36	24	69	0	126	54	318	627
	10-11	6	48	30	63	0	101	75	267	590

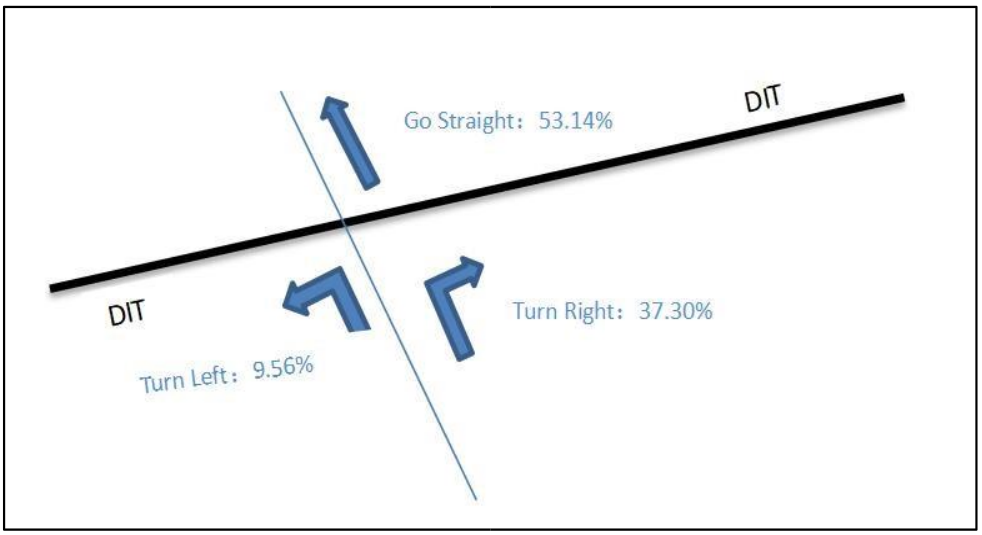


Figure III.21: Proportion of Turning Traffic Volume at Point 7

3. Seasonal Variation of Traffic Volume

136. Due to conditions that do not generally allow for year-round uninterrupted section traffic volume observations, the annual average daily traffic volume (AADT) on existing roads is estimated by collecting temporary traffic volume observations for a few hours to a week and then using seasonal factors obtained from permanent statistics stations with similar characteristics to extend them to the whole year.

137. The following table shows the seasonal variation of traffic volume along the N2 passageway, from which can be seen that the seasonal variation of traffic flow is not obvious when AADT is calculated.

Table III-14: Seasonal Volume Variation and Distribution along the N2 Passageway

Dry Season		Rainy Season	
Month	**Seasonal Volume**	**Month**	**Seasonal Volume**
November	9.65%	May	8.53%
December	9.82%	June	8.60%
January	7.35%	July	8.28%
February	7.24%	August	8.25%
March	8.26%	September	7.71%
April	7.52%	October	8.77%
Total	49.85%	Total	50.15%

Source: Feasibility Study for Rampura – Amulia – Demra Road PPP Project, Dhaka, Bangladesh

4. Traffic Hotspots

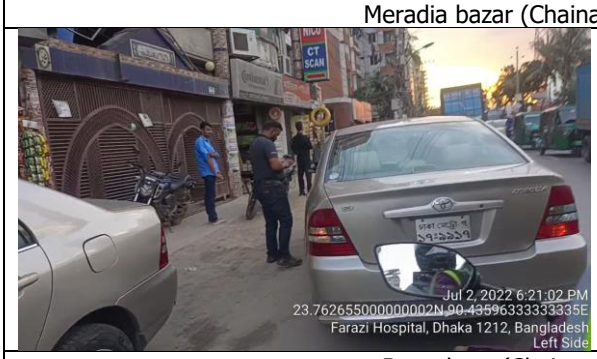
138. Some of the spots along the project road have been noted during the reconnaissance survey as possible spots for road safety concerns. These are mainly busy segments or locations with sensitive receptors close to the highway, such as a market or a school (refer to Figure III-22). Figure III-22 displays the Chainage where traffic congestion was noticed during the field assessments.

Chattogram Road (0+000 to 0+250)

Sarulia Bazar (Chainage 2+300 to 2+450)

Demra Circle (Chainage 2+900 to 3+350)

Meradia bazar (Chainage 10+300 to 10+500)



Bonoshree (Chainage 11+000 to 12+680)

Rampura Bridge Bus Stop (Chainage 12 +465)

Figure III.22: Traffic Hotspots along the Project Road

139. Since these places are heavily built-up or are important transport junctions they are congested. The unauthorized parking as well as the markets also contribute to the congestion. The built-up areas along the project alignment identified during the survey are presented below.

Chattogram Road, Narayanganj
(C/S -01 Chainage 00+000km)

Demra-Ranimohol-Chattogram Road (Beside C/S -17 to -18 Chainage 00+800km to 00+850km)

Sarulia Road, Dhaka (Beside C/S -41 to -42 Chainage 02+000km to 02+050km)

Wasa Road, Sarulia Bazar, Demra (Beside C/S -46 to -47 Chainage 02+250km to 02+300km)

Wasa Road, Sarulia Bazar, Demra (C/S -50 Chainage 02+450km)

Shekher Jayga-Staff Quarter Road (C/S -70 Chainage 03+450km)

Demra Main Road (C/S -74 Chainage 03+650km)

Shekher Jayga, Staff Quarter Road, Dhaka (C/S -78 Chainage 03+850km)

Shekher Jayga-Staff Quarter Road, Dhaka (Beside C/S -82 to -83 Chainage 04+050km to 04+100km)

Shekher Jayga, Staff Quarter Road, Dhaka (C/S -100 Chainage 04+950km)

Shekher Jayga, Staff Quarter Road, Dhaka (Beside C/S -104 to -105 Chainage 05+150km to 05+200km)

Amulia Baitunnur Jame Masjid (Beside C/S -105 to -106 Chainage 05+200km to 05+250km)

Shekher Jayga, Staff Quarter Road, Dhaka (C/S -109 Chainage 05+400km)

Bandhan City Road, Dhaka (C/S -144 Chainage 07+150km)

Bonoshree-Staff Quarter Road, Dhaka (C/S -153 to -154 Chainage 07+600km to 07+650km)

Demra Staff Quarter Road, Dhaka (Beside C/S -182 to -183 Chainage 09+050km to 09+100km)

Meradia Bazar Road (Beside C/S -187 to -188 Chainage 09+300km to 09+350km)

Beside Bonoshree Main Road (Beside C/S -187 to -188 Chainage 09+300km to 09+350km)

Beside Bonoshree Main Road (Beside C/S -195 to -196 Chainage 09+700km to 09+750km)

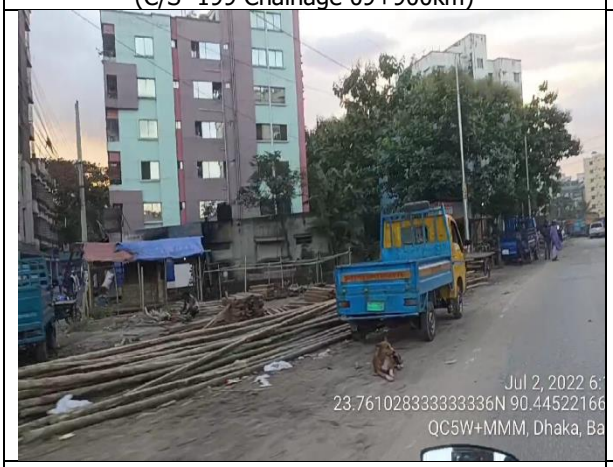
Alif Stand Meradia, Dhaka
(C/S -196 Chainage 09+750km)

Alif Stand Meradia, Dhaka
(C/S -198 Chainage 09+850)

Alif Stand Meradia, Dhaka (Beside C/S -198 to -199 Chainage 09+850km to 09+900km)

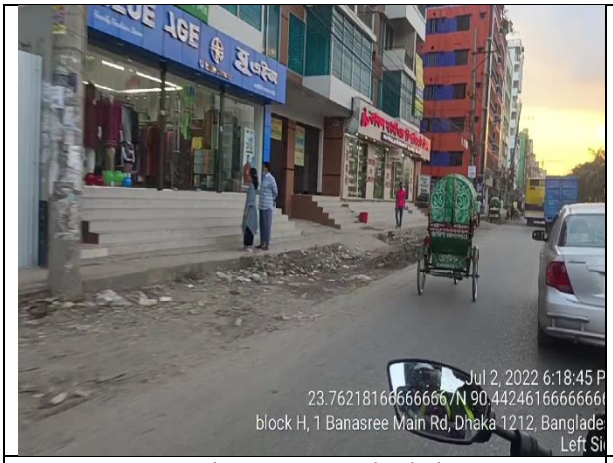
Bonoshree Main Road
(C/S -199 Chainage 09+900km)

Meradia Bazar Road (C/S -201 Chainage 10+000km)



Beside Meradia Bamboo Market
(C/S -202 Chainage 10+050km)

Beside Rampura Police Box Main Road, Dhaka
(C/S -203 Chainage 10+100km)



Bonoshree Main Road, Dhaka
(C/S -209 Chainage 10+400km)

Beside Ideal School and College, Bonoshree
(C/S -229 Chainage 11+400km)

Bir Uttam Rafiqul Avenue (C/S -251 Chainage 12+465km)

Figure III.23: Built up Areas along the Project Road

IV. BASELINE ENVIRONMENTAL AND SOCIAL DATA

A. General

140. In order the identify and mitigate the possible impacts from any project activities, it is first to be ensured, that the environmental and social baseline data are collected properly. This will help us detecting any kind of change or alteration in surrounding natural environment due to the project activities and help mitigate them eventually. The main environmental components of survey were:

1. physical environment
2. biological environment and
3. socio-economic environment

141. The sub-components include, environmental quality test of ambient air quality, noise level measurement, vibration level detection, surface water quality identification, groundwater quality identification, riverbed sediment analysis of the project areas. On the other hand, meteorological data like temperature, rainfall, wind speed and humidity during the period of 1987 to 2021 has been collected from secondary source. Moreover, satellite images of project areas, statistical databased documents collected and reviewed the relevant previous projects/ studies and documents.

142. In addition, the field investigation of different components and information of public consultations data have been collected, analyzed and used in the report. Environmental safeguard is identified which includes assessment of impacts and mitigation.

B. Physical Environment

143. Physical environment of the project area has been described that relates to the area-specific conditions pertaining to climate, meteorology, topography, physiographic features, geology, soil, air quality, noise and vibration quality and seismicity, water resources and hydrology, seismicity and flooding and most importantly environmental sensitive locations which is identified as environmental hotspots.

1. Climate

144. In order to investigate the climatic condition of the study area different meteorological parameters have been collected from multiple secondary sources. The proposed project area falls under tropical climate. Basically, this region has a distinct monsoonal season which influences all other climatic parameters. This project area includes Rampura, Amulia, Demra which falls under the Dhaka weather station. Climatic zone map is given in the Figure IV-1 where the project location is within the south-central zone. The detailed description of the temperature, rainfall, humidity and wind speed with directions is given below.

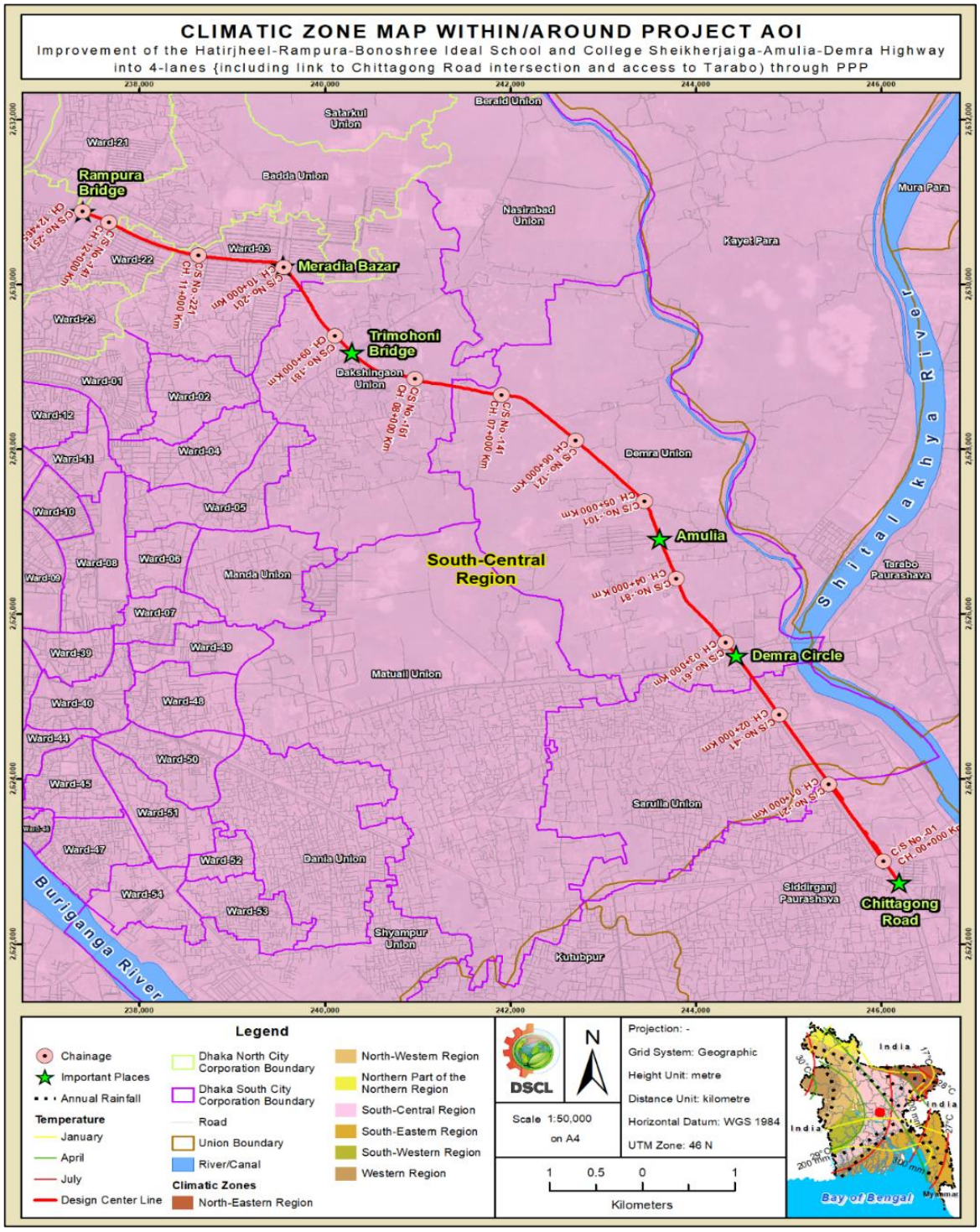
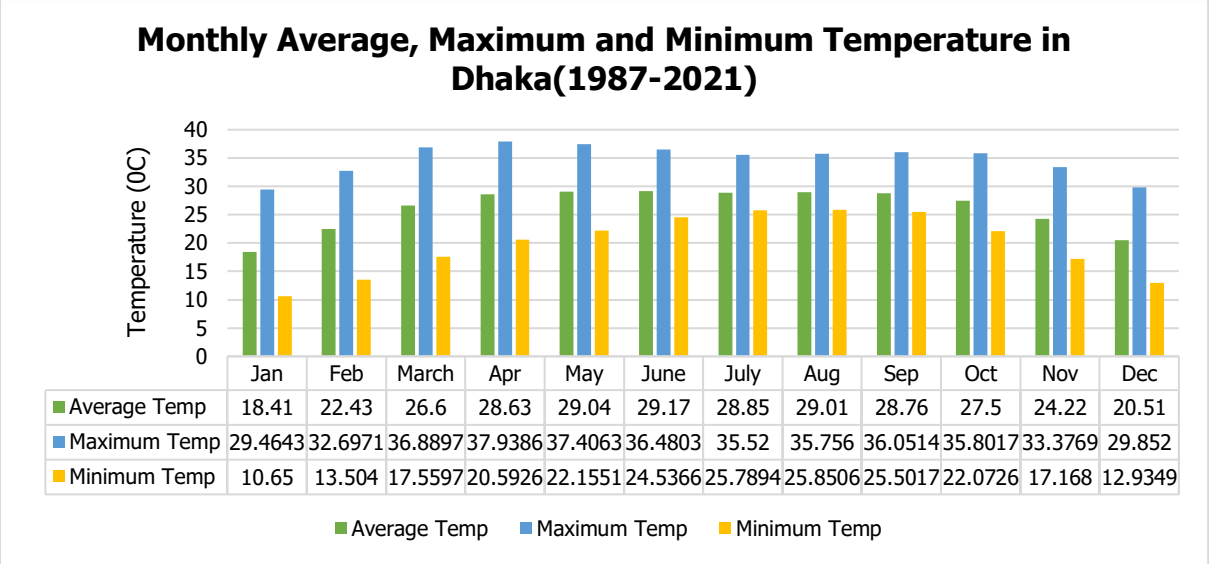


Figure IV.1: Climatic Zone Map of the Project Area

a) Temperature

145. Long-term average monthly temperature data (1987-2021) has been collected from Dhaka weather station of Bangladesh Meteorological Department. The highest average recorded temperature in this weather station was 29.17°C in June. The lowest average recorded temperature was found in the month of January which was 18.41°C. Both of the average monthly temperature graphs show that this area faces high temperature from April to September and lowest temperature during winter remains from December to February in the year (Figure IV-2).

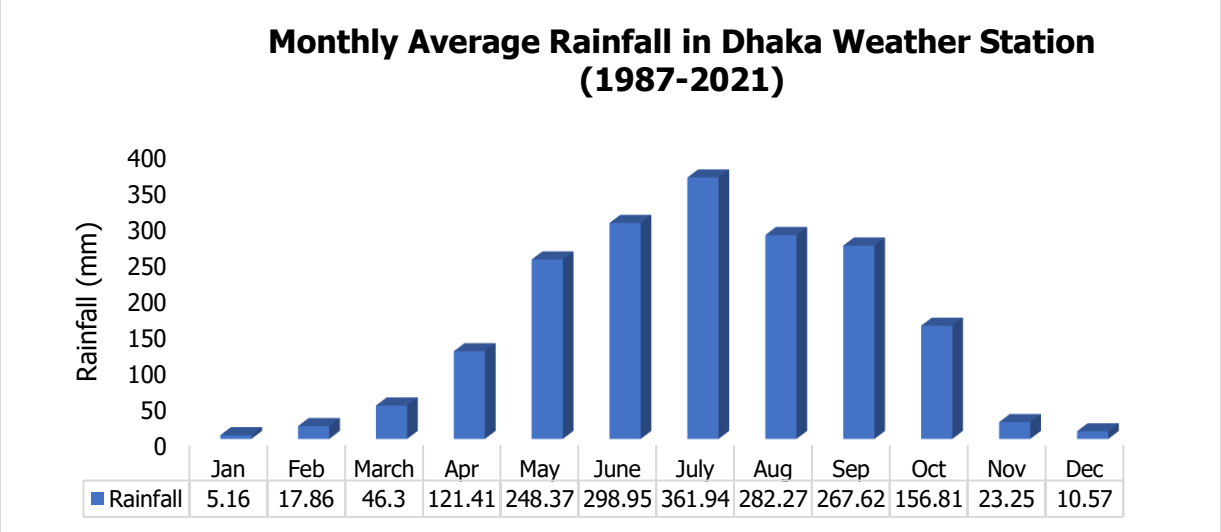


	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Average Temp	18.41	22.43	26.6	28.63	29.04	29.17	28.85	29.01	28.76	27.5	24.22	20.51
Maximum Temp	29.4643	32.6971	36.8897	37.9386	37.4063	36.4803	35.52	35.756	36.0514	35.8017	33.3769	29.852
Minimum Temp	10.65	13.504	17.5597	20.5926	22.1551	24.5366	25.7894	25.8506	25.5017	22.0726	17.168	12.9349

Figure IV.2: Monthly Average, Maximum and Minimum Temperature of Dhaka

b) Rainfall

146. In Dhaka rainfall is not abundant, being above 350 mm. The range of temperature is, as can be expected, much less than to the west, but somewhat more than in South-western zone. This is a transitory zone among the North-eastern, South-western and western zones. The rainfall data collected from the above stated station represents that maximum rainfall occurs during May to September which is 248.37mm to 267.62mm and the lowest rainfall occurs in November to March during winter season. Statistical data of 1987 to 2021 shows that Dhaka experience more than 300 mm rainfall during monsoon. In the month of December and January of winter season around 10 mm rainfall occurred in the region of Dhaka weather station (Figure IV-3).



	Jan	Feb	March	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
Rainfall	5.16	17.86	46.3	121.41	248.37	298.95	361.94	282.27	267.62	156.81	23.25	10.57

Figure IV.3: Average Monthly Rainfall of Dhaka

c) Wind Speed

147. The statistical wind speed data (Figure IV-4) shows that average wind speed maximum value was 3.73 knots in April. The minimum wind speed value was 2.43 knots in the month of December in

the area of Dhaka weather station. In the project areas the predominant wind flows from the northwest but with a high frequency of calm situations (Figure IV-5).

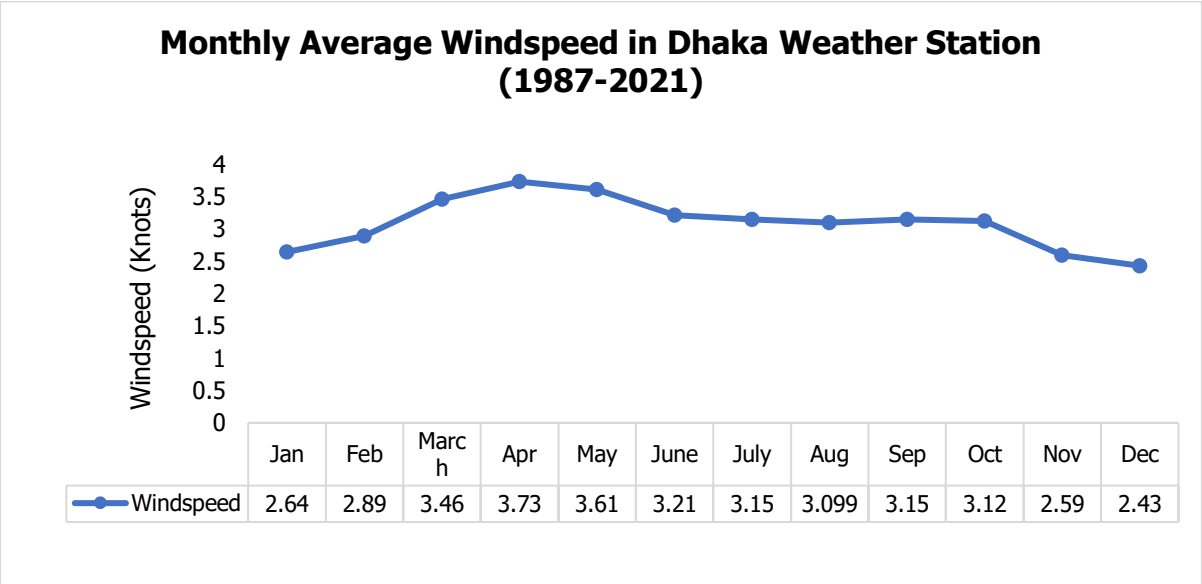


Figure IV.4: Average Monthly Wind Speed of Dhaka

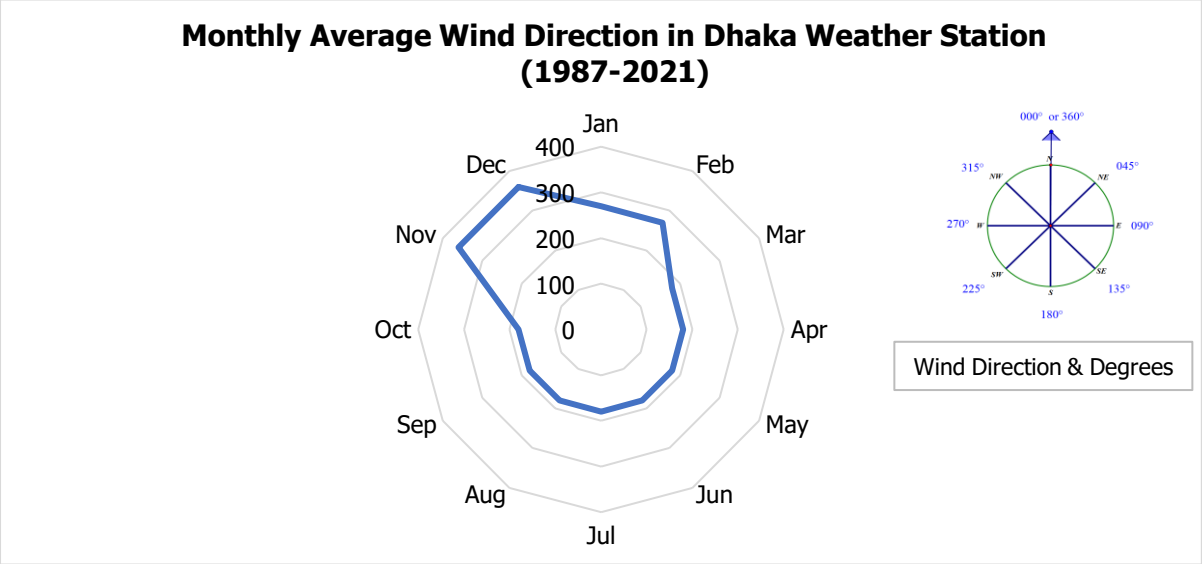


Figure IV.5: Wind Rose Diagram for Dhaka

d) Humidity

148. Humidity remains high in summer and comparatively low in winter season. The statistical data of humidity from 1987 to 2021 indicates that humidity in the Dhaka Station area maximized in June to September in the year which is ranges from 80% to 82%. On the other hand, humidity falls around 60%-65% in February, March and April during the winter season in the considered station area (Figure IV-6).

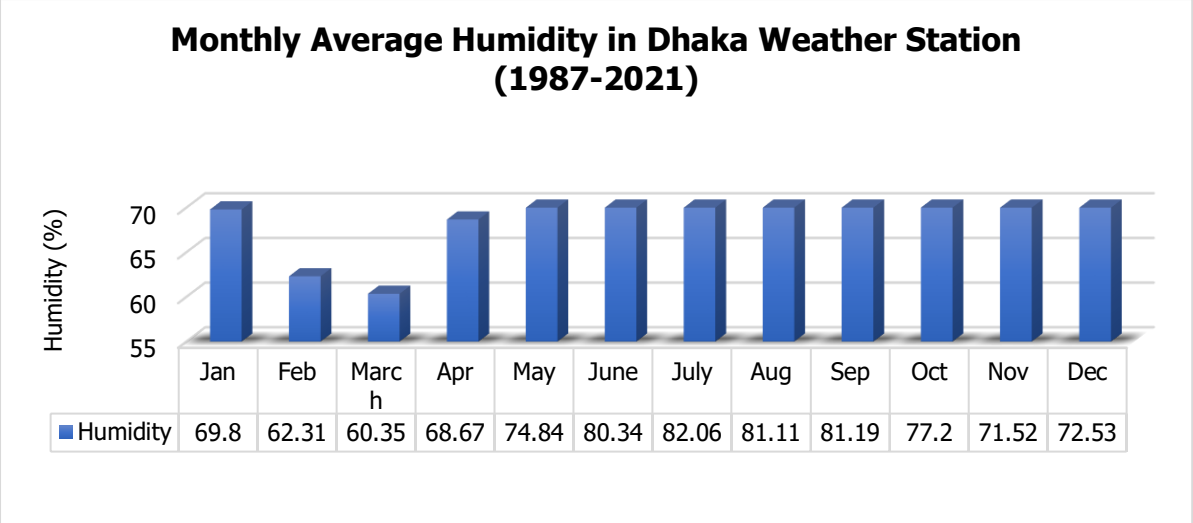


Figure IV.6: Average Monthly Relative Humidity of Dhaka

2. Topography

149. Although Bangladesh is a small country, it has considerable topographic diversity. It has three distinctive features: (i) a broad alluvial plain subject to frequent flooding, (ii) a slightly elevated relatively older plain, and (iii) a small hill region drained by flashy rivers. The project area is mostly flat. The elevation ranges mostly between 3 to 10 m PWD. However, there are some small patches of land having elevation as high as 5m PWD is presented through the Figure IV-7.

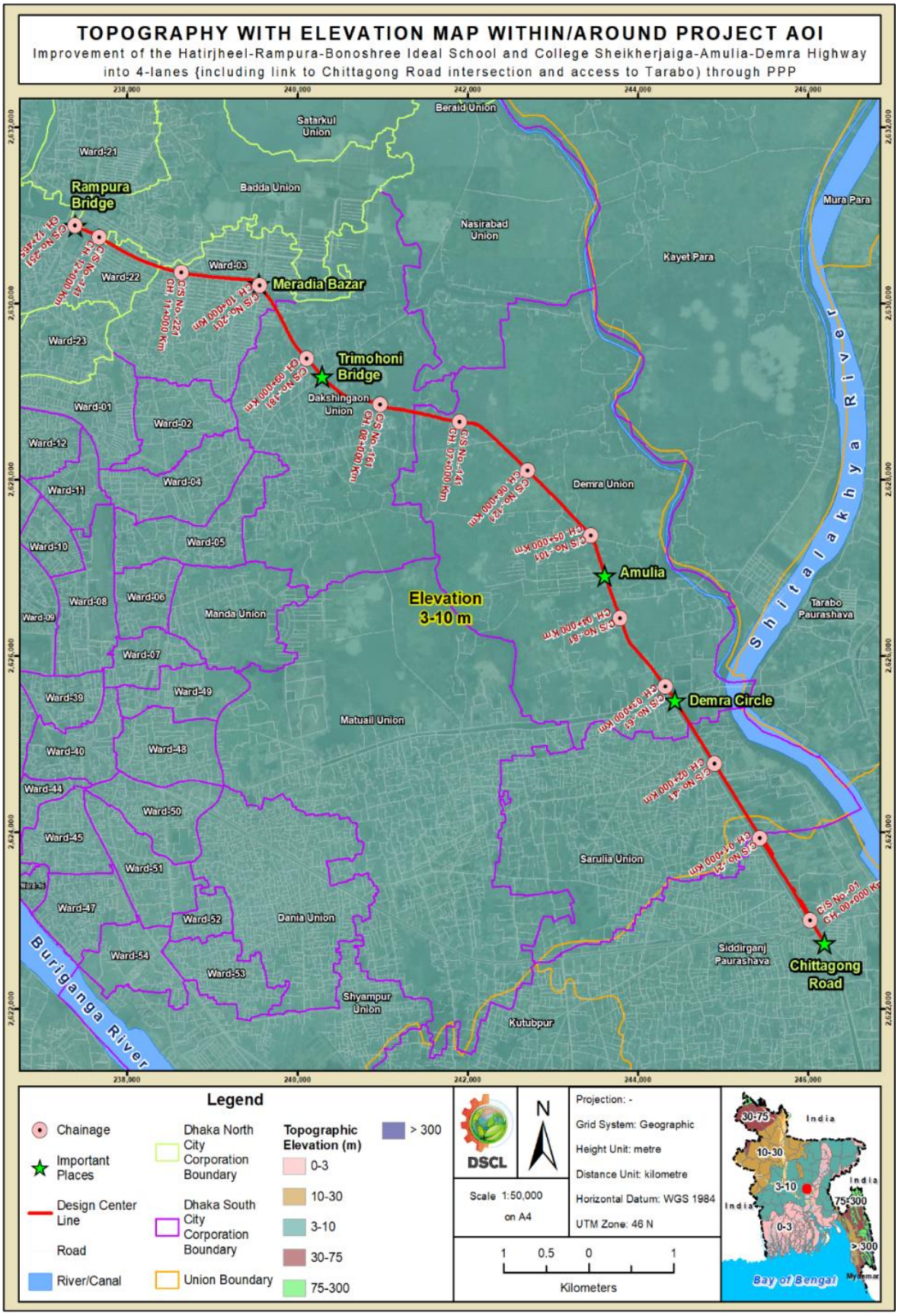
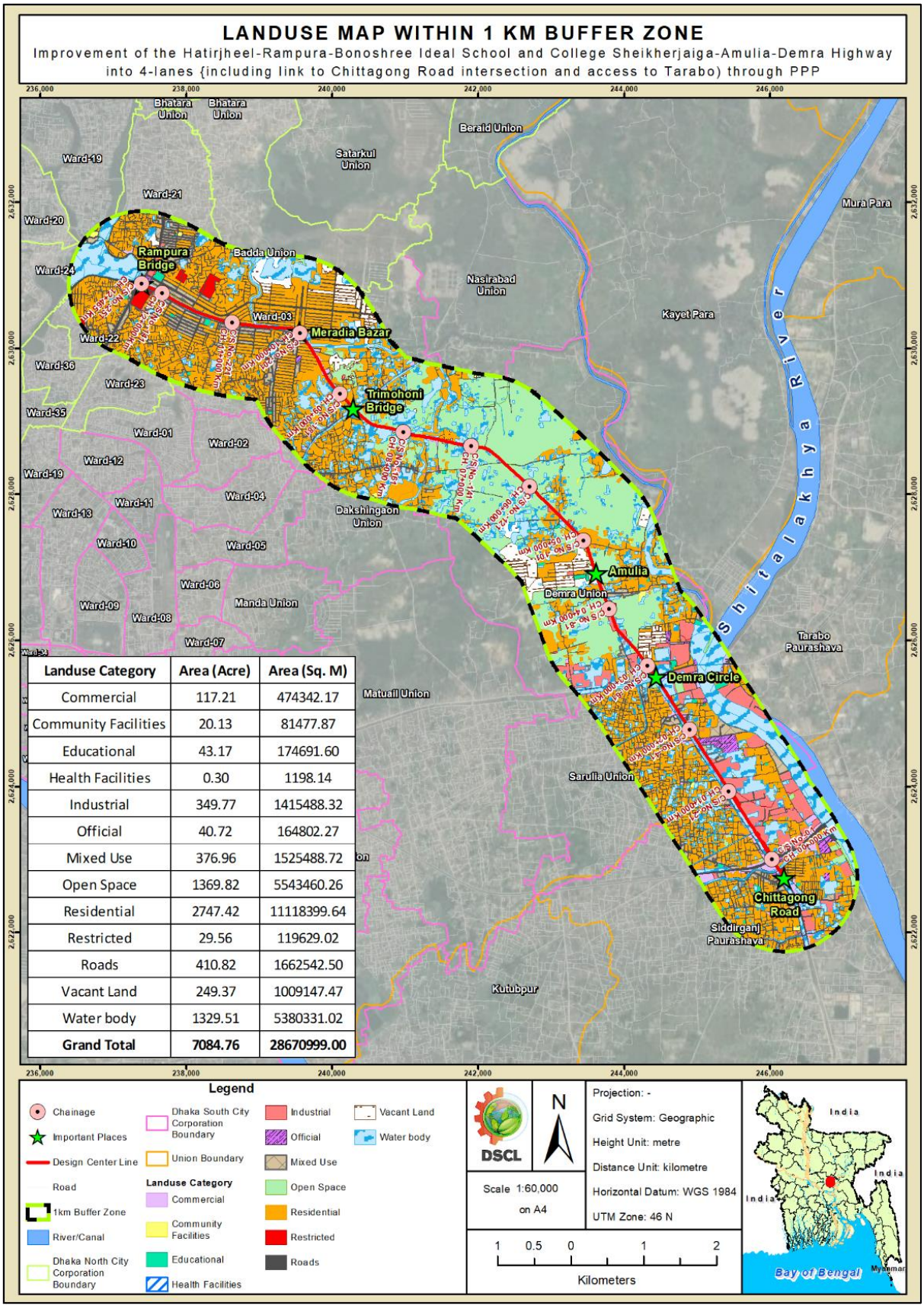


Figure IV.7: Topographic Map with Elevation of the Project Area

3. Land use

150. Land-use changes along the alignment are anticipated. These shall bring about a change in the characteristics of the adjacent lands. The construction activity will temporarily change the land use for use of construction site, access road, and construction camp. Due to these interventions and seasonal wetland areas around these areas may get affected adversely. Land use category generally includes commercial, community facilities, educational, health facilities, industrial, official, open space, residential, restricted, roads, vacant roads, water body etc. The total area adjacent to the project is 7084.76 acres or 28670999.00 m^2 land which includes all of those categories stated above. Among these categories, mostly open space (1369.82 acre) is more affected that is within these land use. Within this 1 km buffer zone of the land use map there are some important places identified as important locations in the alignment. The land use map is given below:



Landuse Category	Area (Acre)	Area (Sq. M)
Commercial	117.21	474342.17
Community Facilities	20.13	81477.87
Educational	43.17	174691.60
Health Facilities	0.30	1198.14
Industrial	349.77	1415488.32
Official	40.72	164802.27
Mixed Use	376.96	1525488.72
Open Space	1369.82	5543460.26
Residential	2747.42	11118399.64
Restricted	29.56	119629.02
Roads	410.82	1662542.50
Vacant Land	249.37	1009147.47
Water body	1329.51	5380331.02
Grand Total	**7084.76**	**28670999.00**

Figure IV.8: Land use map within 1 km buffer zone

4. Physiographic Features

151. Physiography is the description of the physical nature (form, substance, arrangement, changes) of objects, especially of natural features. Physiographic region/unit refers to a region of which all parts are similar in terms of physical characteristics, and which have consequently had a uniform geomorphic history, and whose pattern of topographical features or landforms differs significantly from that of adjacent regions. The project area is being covered by the following physiographic regions (Figure IV-9).

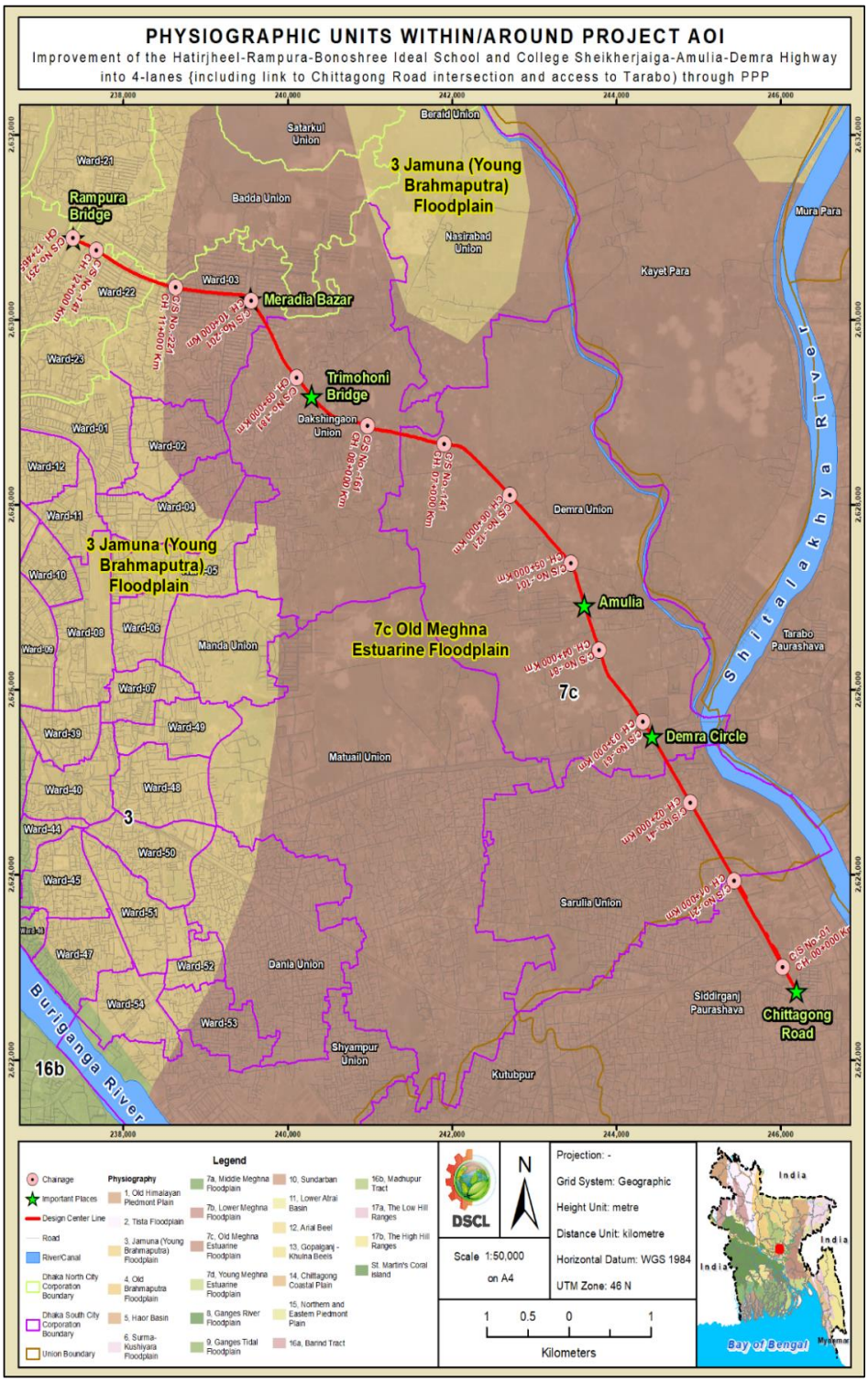


Figure IV.9: Physiographic Unit Map of the Project Area

(i) **Jamuna (Young Brahmaputra) Floodplain-** A dual name is used for the mighty Brahmaputra, because the Jamuna channel is comparatively new, and this course must be clearly distinguished from that of the older Brahmaputra. Before 1787, the Brahmaputra's course swung east to follow the course of the present Old Brahmaputra. In that year, apparently, a severe flood had the effect of turning the course southwards along the Jenai and Konai rivers to form the broad, braided Jamuna channel.

(ii) **Old Meghna Estuarine Floodplain-** Old Meghna Estuarine Floodplain (7,740 sq km) this region occupies a large area, mainly low-lying land between the south of the Surma-Kushiyara floodplain and the northern edge of the young Meghna estuarine floodplain. Silt loam soils predominate on highlands and silty clay to clay on lowlands.

Table IV-1: List of Physiographic Units along the Project Road

No.	Soil Tract	Physiography Units	Chainage Distribution (km)
1.	Brahmaputra Alluvium	Old Meghna Estuarine Floodplain	CH 0+000 to CH 11+000
		Jamuna floodplain	CH 11+000 to CH 12+500

5. Geology

152. The Project surrounding areas in the western zone are within the Meghna flood plain which formed by alluvial deposit of silt, sand and clay. Geology of the project area comprises with deltaic deposit and tidal deltaic deposit with clay, silt and sand.

153. A part of the project area, Dhaka division consists of Holocene alluvial deposits flood plain and predominantly consisting of fine sand, silts, and clay. It is on deep Cainozoic deposits that overlie Precambrian basement rock. The Precambrian rocks form the basement of all geological formations of Bengal Basin and shield areas. The materials deposited are a mixture of sediments transported by the old Brahmaputra and by the Jamuna (Brahmaputra) River. The majority area of Dhaka division is under the Faridpur Trough.

154. Bar deposit of older flood plain mainly consists of alteration of very fine sand, medium sand, sandy silt and clayey silt deposit along the river channel. Medium sand is light gray in color, sub rounded to rounded having mica which percentages are about 5%. Very fine-to-fine sands are grey in color with presence of mica (1% to 5%). Clayey silts are greyish brown colored, slightly oxidized; rootlets are found in this bed. The geological map of the surrounding area is presented below in Figure IV-10.

Figure IV.10: Geologic Zones within and around the Project Area

6. Soil Quality

155. Dhaka division falls around six different soil formation zones. The general soil types of the Dhaka division predominantly include the following:

(i) **Deep Red Brown Terrace Soils:** Occur extensively in the north-eastern Barind Tract, on the Madhupur Tract and on the Akhaura Terrace. These soils are well to moderately well drained, reddish brown to yellow-brown, strongly to extremely acidic, friable clay soils over deeply weathered, red-mottled, Madhupur Clay. They are mainly Ferric Alisols.

(ii) **Non-Calcareous Dark Grey & Grey Floodplain Soils:** They have a cambic B-horizon, non-calcareous dark grey topsoil, and subsoil. They occur extensively on the Old Brahmaputra and old Meghna estuarine floodplain.

156. Soil types along the project area with chainage distribution is presented below table. The soil quality map of the project location around the north-eastern zone is given below in Figure IV-10.

Table IV-2: List of Geologic Units along the Project Road

No.	Soil Types	Chainage Distribution (km)
1.	Non-Calcareous Dark Grey & Grey Floodplain Soils	CH 0+000 to CH 5+000 and CH 9+000 to CH 12+500
	Deep Red Brown Terrace Soils	CH 5+000 to CH 9+000

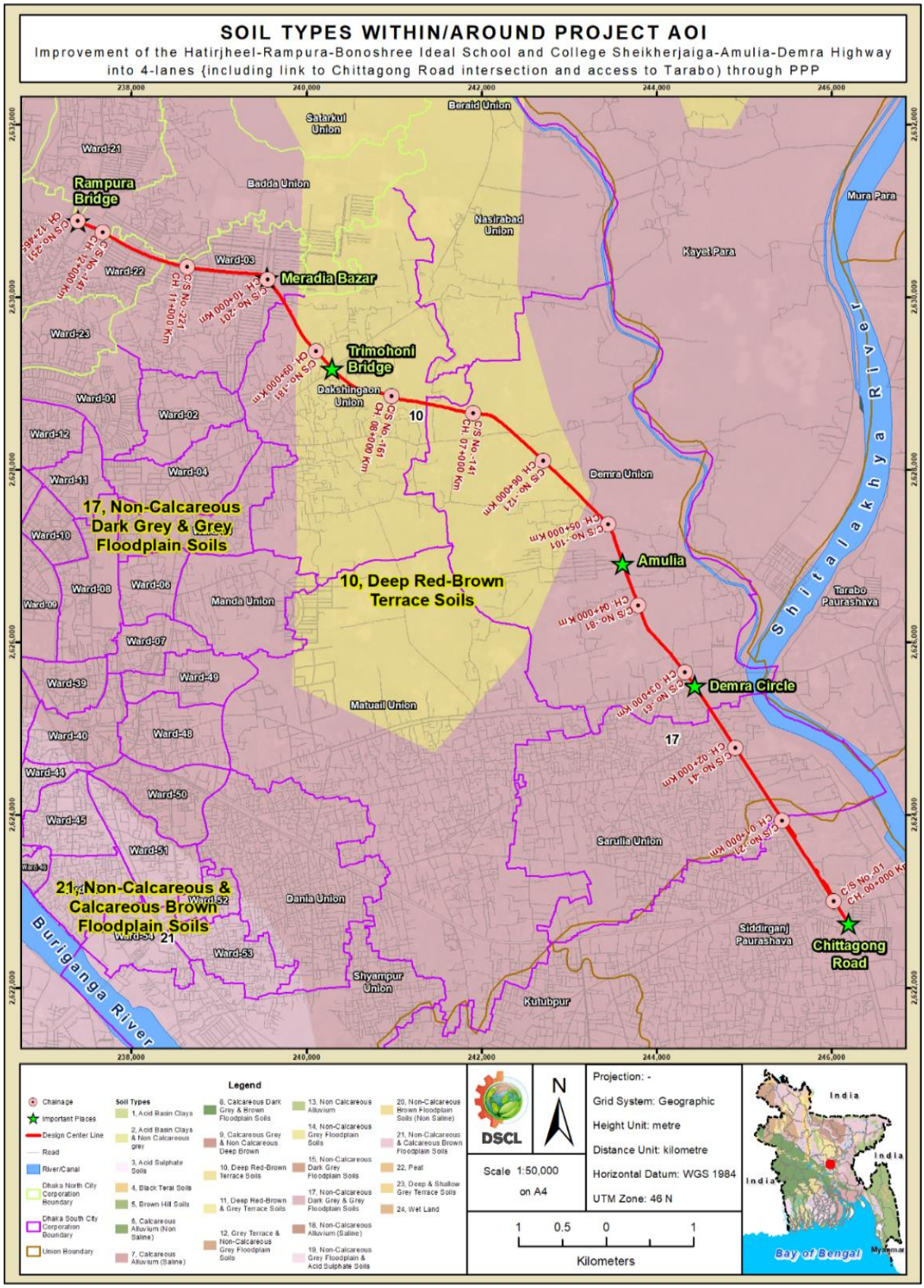


Figure IV.11: Soil Types around or within the Project AOI

157. To understand the baseline soil quality status five (05) soil samples were collected from the project influenced locations on 23 June and 24 June of 2022. The laboratory test results are given in Annex 2. Test Result of soil sampling analysis of project influenced area is given at Table IV-2.

Yamagata Dhaka Friendship Hospital

RAD_SQ_01

Beside Bonoshree Main Road

RAD_SQ_02

Nagdarpar, Khilgaon

RAD_SQ_03

Demra Ideal College

RAD_SQ_04

Beside Sugondha Hospital, Shimrail, Chattogram Road

RAD_SQ_05

Figure IV.12: Soil Sampling Collection at Project Influenced Areas

158. The soil quality and ground water sampling location map are is presented below.

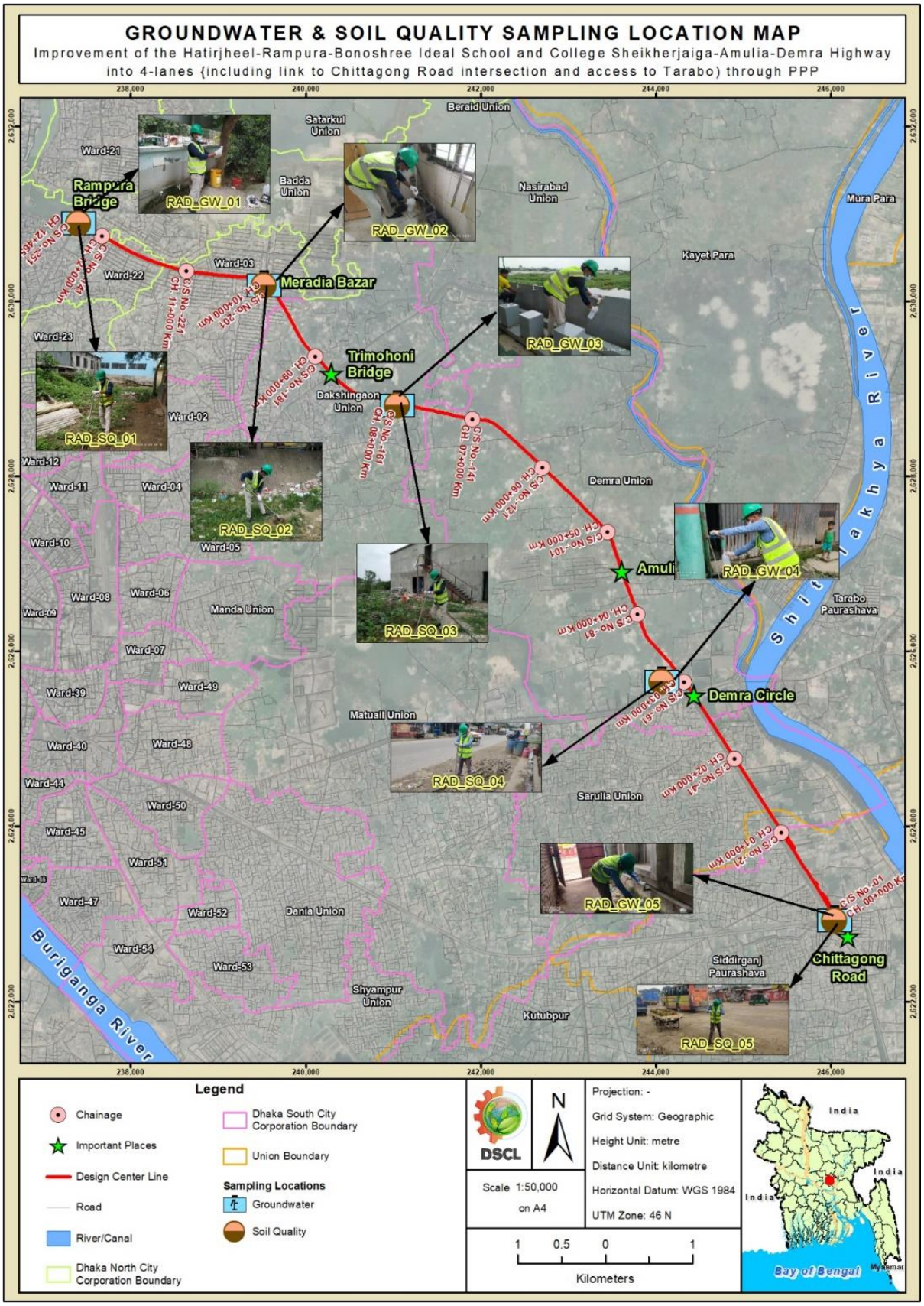


Figure IV.13: Sample location Map of Groundwater and Soil Quality Collection

Table IV-3: Test Result of Soil Quality Analysis

Parameters	Unit	Soil Quality Result					Dutch Standards for Soil*	Method of Analysis
		RAD_SQ_01	RAD_SQ_02	RAD_SQ_03	RAD_SQ_04	RAD_SQ_05		
		23.761625° N 90.444196° E	23.767511° N 90.423707° E	23.749547° N 90.459555° E	23. 72161° N 90. 48959° E	23.698837° N 90.508504° E		
pH	-	9	8.2	8.6	8.9	9.0	NYS	USEPA 9045 D
Texture	-	Loamy Sand	Loamy Sand	Sandy Loam	Silt Loam	Silt Loam	NYS	Jar Test Method
Electrical Conductivity (EC)	µS/cm	248	147.9	176	320	326	10	Conductivity Meter
Iron (Fe)	mg/kg	14163	11431	21487	18581	19110	10	Acid Digestion with ICP Analysis
Lead (Pb)	mg/kg	6	5	13	21	24	5	Acid Digestion with ICP Analysis
Manganese (Mn)	mg/kg	203	162	596	210	1136	10	Acid Digestion with ICP Analysis
Zinc (Zn)	mg/kg	82	88	70	73	81	10	Acid Digestion with ICP Analysis
Copper (Cu)	mg/kg	<10	30	15	22	26	10	Acid Digestion with ICP Analysis
Cadmium (Cd)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	Acid Digestion with ICP Analysis
Chromium (Cr)	mg/kg	14	23	23	21	18	5	Acid Digestion with ICP Analysis
Arsenic (As)	mg/kg	<5	<5	<5	<5	<5	5	Acid Digestion with ICP Analysis
Mercury (Hg)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	Acid Digestion with ICP Analysis
Total Organic Matter	%	0.82	NYS	1.7	1.5	1.5	NYS	Ignition Method

Source: UL laboratory Test, July 2022

*Dutch Standards for Soil, 2004; NYS-Not Yet Standardized

159. There is no Bangladesh regulation/standard for soil. In the absence of local country standards, the environmental consultant's practice is to use globally recognized 'Dutch Ministry of Public Housing, Land-use and Environmental Guidelines - Soil and Groundwater Standards' to assess soil quality and determine the need for remedial action. Parameters analyzed in soil were well below the threshold limits for Intervention as per the Dutch Standards. Most of the parameters have exceeded the standard except Cd, Hg and Pb. Among the parameters only pH, Texture and Organic Matter have not yet standardized. Further degradation in soil quality can be minimized through implementation of mitigation measures suggested in the EMP.

7. Ambient Air Quality

160. In Dhaka, air pollution is mainly caused by dust from construction, motor vehicles and traffic, and smoke from brick kilns. Besides, several mega projects are ongoing e.g.; Dhaka Elevated Expressway PPP project, Bus Rapid Transit, Mass Rapid Transit etc. These also contribute to the existing pollution. Ambient air quality data at the project site was measured to verify the current quality of air. The aim was to collect the baseline air quality data and to compare the data with the air quality data during project activities to check if there is any high air pollution level due to the construction activities and to design adequate mitigation measures, as applicable. The main air pollutants in Bangladesh are nitrogen oxides (NO_X), Sulphur dioxide (SO_2), PM_{10}, $PM_{2.5}$ and O_3, carbon monoxide (CO) and carbon dioxide (CO_2). Most of the PM pollutants (greater than 80%) come from diesel-run vehicles. The air quality testing was performed at and around the project location from 23 to 30 June 2022 at eight (08) locations (Figure IV-15). The laboratory test result is given in Annex 2. Results of the air quality monitored at the project location have been showed in Table IV-3. The air quality testing pictures are given below in Figure IV-14.

Meradia Bazar, Rampura, Dhaka	Aichi Medical College, Mendipur, Amulia, Dhaka
	
RAD_AAQ_01	**RAD_AAQ_02**
Bonoshree Central Jame Mosque, Bonoshree, Dhaka	**Beside Rampura Bridge Police Box, Rampura, Dhaka**
	
RAD_AAQ_03	**RAD_AAQ_04**

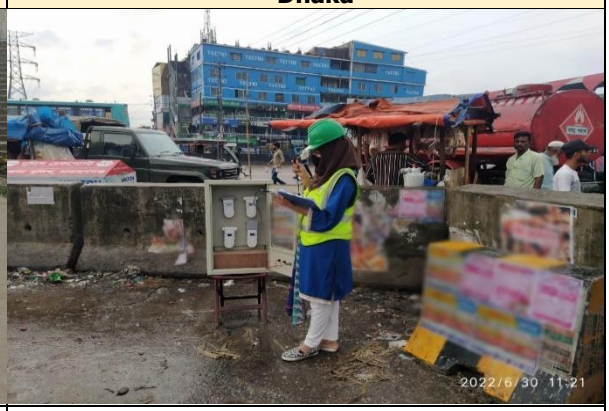
Nagdarpar Bridge, Bonosree, Dhaka	Mostam Haji Mor, Rampura, Dhaka
	
RAD_AAQ_05	RAD_AAQ_06
Staff Quarter Jame Mosque, Demra, Dhaka	**Near Sugandha Hospital, Chattogram Road, Dhaka**
	
RAD_AAQ_07	RAD_AAQ_08

Figure IV.14: Air Quality Monitoring in the Project Site

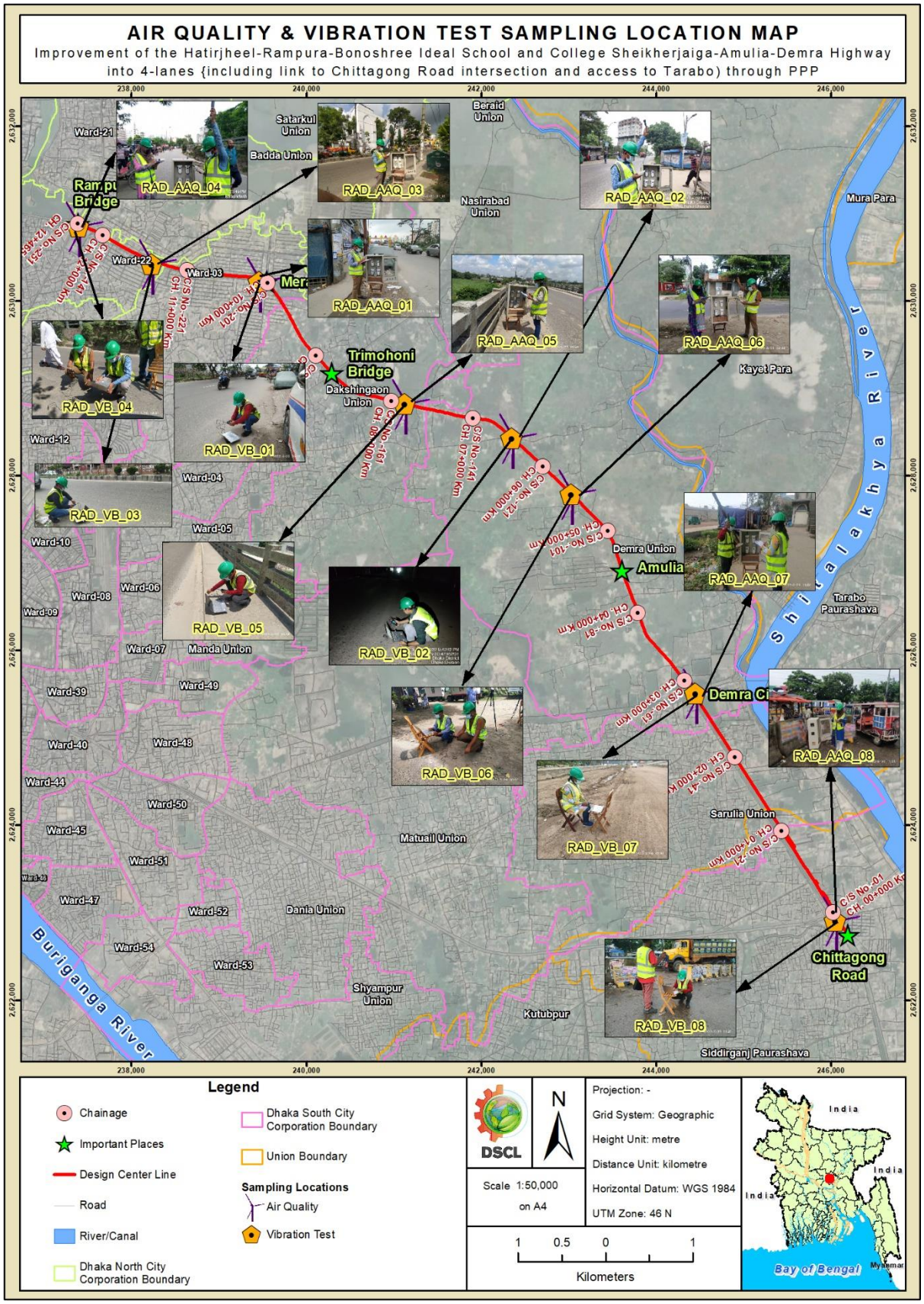


Figure IV.15: Sample location Map of Ambient Air Quality and Vibration Level Measurement

Table IV-4: Test Results of Ambient Air Quality Monitoring

Parameter	Unit	Concentration Present								Bangladesh Standard	IFC Standards	Duration (hours)	Method of Analysis
		RAD_AAQ_01	RAD_AAQ_02	RAD_AAQ_03	RAD_AAQ_04	RAD_AAQ_05	RAD_AAQ_06	RAD_AAQ_07	RAD_AAQ_08				
		Meradia Bazar, Rampura, Dhaka	Aichi Medical College, Mendipur, Amulia, Dhaka	Bonoshree Central Jame Mosque, Bonoshree, Dhaka	Beside Rampura Bridge Police Box, Rampura, Dhaka	Nagdarpar Bridge, Bonoshree, Dhaka	Mostam Haji Mor, Rampura, Dhaka	Staff Quarter Jame Mosque, Demra, Dhaka	Near Sugandha Hospital, Chattogram Road, Dhaka				
		23.762032°N 90.443609°E	23.739986°N 90.479863°E	23.763663°N 90.431573°E	23.767401°N 90.423261°E	23.749650°N 90.460163°E	23.746545°N 90.472206°E	23.720360°N 90.491715°E	23.697662°N 90.509537°E				
$PM_{2.5}$	µg/m^3	73.17	68.21	74.82	89.5	78.82	86.3	95.81	74.24	65	75	24	AEROQUAL Series 500Perticulate matter monitor
PM_{10}	µg/m^3	156.72	153.71	154.88	174.8	159.08	179.8	193.19	158.25	150	150	24	
SO_2	µg/m^3	152	167.7	167.7	218.6	390	206.3	126.66	190.10	365	125	24	AEROQUAL Series SOx monitor
NO_X	µg/m^3	18.3	27.4	24.3	30.9	38	33.7	25.3	29.98	100	40	Annually	AEROQUAL Series NOx monitor
O_3	µg/m^3	0	0	0	0	0	0	0	0	NYS	160	8	AEROQUAL Series 500 O3 monitor
CO	ppm	1	1	2	1	2	7	10	15.33	9	NYS	8	Lutron AQ 9901
CO_2	ppm	452	343	413	700	456	413	329	446	NYS	NYS	8	
Weather Condition		Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	--			

Note: * The Bangladesh National Ambient Air Quality Standards have been taken from the Environment Conservation Rules, 1997 which was amended on 19 July 2005 vide S.R.O. No. 220-Law/2005.
** IFC Standard for Air Emissions and Ambient Air Quality, April 2007.

Table IV-5: Description of the Surrounding Environment of the Sample Collection Area

Sample Location and ID	Sample Site Description
Meradia Bazar, Rampura, Dhaka (RAD_AAQ_01)	➢ High amount of vehicle was moving. ➢ High amount of dust particles was present in the project area. ➢ The weather was mostly sunny. ➢ People movement was high. ➢ This location was beside C/S No. -206 CH. 10+250 km. ➢ The location is 43m away from the road centreline. ➢ Nearest sensitive location, Famous Specialized Hospital is 23m away from the location. ➢ Closest water body, Rampura Khal is in 25m away from the location.
Aichi Medical College, Mendipur, Amulia, Dhaka (RAD_AAQ_02)	➢ Moderate amount of dust particles was present in the project area. ➢ The weather was sunny. ➢ People movement was moderate. ➢ High amount of vehicle was moving. ➢ This location was beside C/S No. -113 CH. 05+600 km. ➢ 8m away from Mendipur Aman Market. ➢ The location is 3m away from the road centreline ➢ The closest water body is in 34m south from the location
Bonoshree Central Jame Mosque, Bonoshree, Dhaka (RAD_AAQ_03)	➢ Moderate amount of dust particles was present in the project area. ➢ The weather was sunny. ➢ People movement was high. ➢ High amount of vehicle was moving. ➢ This location was in between C/S No. -232 to -231. ➢ 70m far from the nearest sensitive location, Ideal School & College. ➢ The location is 37m away from the road centreline. ➢ Closest water body, Rampura khal is in 27m far from the location
Beside Rampura Bridge Police Box, Rampura, Dhaka (RAD_AAQ_04)	➢ High amount of vehicle was moving. ➢ High amount of dust particles was present in the project area. ➢ The weather was mostly sunny. ➢ People movement was high. ➢ This location was beside C/S No. -251 CH. 12+450 km. ➢ The location is in 22 m away from the centerline. ➢ The closest water body, Rampura Khal is in 45m away from the location ➢ The closest sensitive location, Rampura Water pump is in 20 m away from the location.
Nagdarpar Bridge, Bonoshree, Dhaka (RAD_AAQ_05)	➢ Traffic volume is high. ➢ The movement of people is very low. ➢ The weather was sunny. ➢ Visual dust particle is high. ➢ The location is situated 12m far from the road centreline. ➢ This location was beside C/S No. -161 CH. 07+950 km. ➢ Closest water body, Nagdarpar pond is 77m from the location.
Mostam Haji Mor, Rampura, Dhaka (RAD_AAQ_06)	➢ Dust particle high. ➢ Vehicular movement is also high. ➢ Moderate people movement. ➢ The location is 7.02 m far from the centre line. ➢ This location was in between C/S No. -134 CH. 06+650 km. ➢ Sensitive location- Iram Chattar Bazar is 44 m far from the location.

Sample Location and ID	Sample Site Description
	➢ Closest Water body- Mostam Haji Pond is 178 m far from the location
Staff Quarter Jame Mosque, Demra, Dhaka (RAD_AAQ_07)	➢ Heavy traffic movement. ➢ Visible dust particle high. ➢ People movement high. ➢ The weather was cloudy and rainy. ➢ This location was beside C/S No. -62 CH. 03+050 km. ➢ The location is 113m far from the centre line of the road. ➢ Closest water body is in 78m far from the location. ➢ Nearest sensitive location-Staff quarter jam-e-masjid is 17m far from the location.
Near Sugandha Hospital, Chattogram Road, Dhaka (RAD_AAQ_08)	➢ Heavy traffic volume. ➢ People movement was very high. ➢ The weather was mostly rainy. ➢ Visible dust particle high. ➢ This location was in beside C/S No. -01 CH 00+000 km. ➢ The location is 6.30m far from the road centre line. ➢ Closest water body, Chattogram Road Lake is in 103m from the location.

161. The result shows that time weighted average value of the ambient air quality monitored inside the project location are not within the limit for all the locations. According to Bangladesh Standard, the value of $PM_{2.5}$ and PM_{10} exceeds for all the locations, values of SO_2 and NO_2 are within the limit for all the locations, CO is within the limit for other locations except Staff Quarter Jame Mosque, Demra, Dhaka and Near Sugandha Hospital, Chattogram Road, Dhaka. According to IFC standard, values of $PM_{2.5}$ and PM_{10} are within the limits except for the locations of Nagdarpar Bridge, Bonoshree, Dhaka, Mostam Haji Mor, Rampura, Dhaka and Staff Quarter Jame Mosque, Demra, Dhaka. SO_2 exceeds for all the locations, values of NO_2 are within the limit for all the locations. The quality of air quality degradation is because of the huge vehicle movement along the project location alignment. There were different types of interruptions during the monitoring period which is described in Table IV-5.

8. Noise and Vibration Level

a) Noise Level Measurement

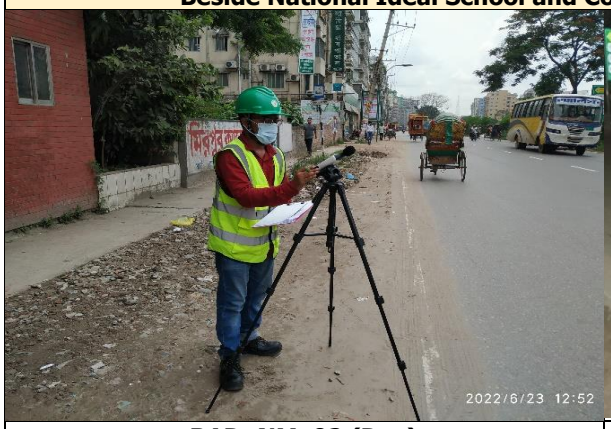
162. The residents of Dhaka City are exposed to high levels of noise pollution in addition to the rising levels of air and water pollution. People continually deal with the annoyance and potentially severe health impacts of exposure to excessive noise because the noise levels in the city are significantly over that that have been determined to be acceptable for health and hearing. Noise Level Measurement was analyzed at project influenced area on 23 to 30 June 2022 at 16 locations. Noise level data were taken during daytime are summarized in Table IV-6.

Meradia Bazar, Rampura, Dhaka

RAD_NM_01 (Day)

RAD_NM_01 (Night)

Beside National Ideal School and College, Bonoshree, Rampura, Dhaka



RAD_NM_02 (Day)

RAD_NM_02 (Night)

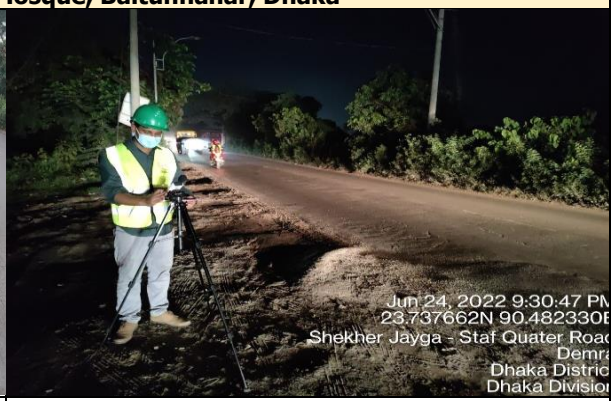
Aichi Medical College, Mendipur, Amulia, Dhaka

RAD_NM_03 (Day)

RAD_NM_03 (Night)

Amulia Baitunnahar Jame Mosque, Baitunnahar, Dhaka

RAD_NM_04 (Day)



RAD_NM_04 (Night)

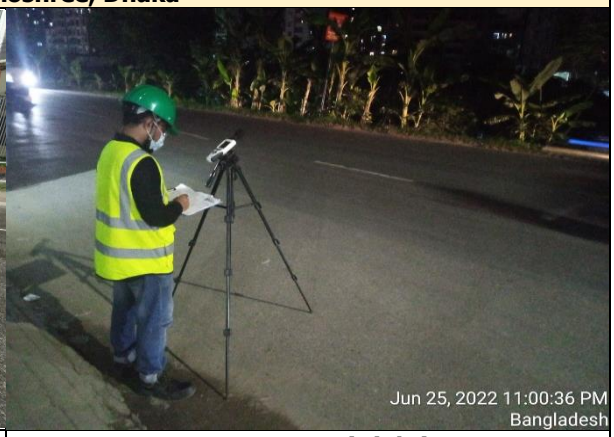
Bonoshree Central Jame Mosque, Bonoshree, Dhaka

RAD_NM_05 (Day)

RAD_NM_05 (Night)

Academia Bonoshree, Dhaka

RAD_NM_06 (Day)



RAD_NM_06 (Night)

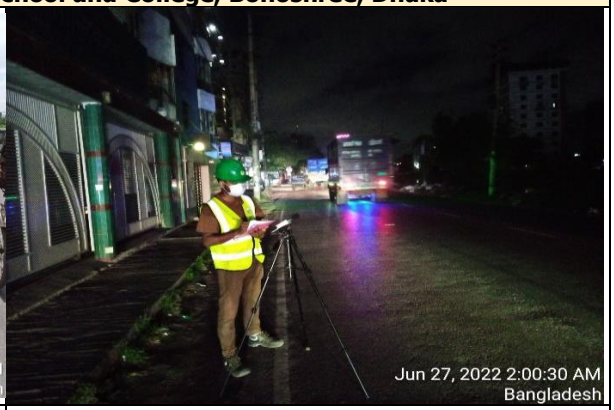
Beside Rampura Bridge Police Box

RAD_NM_07 (Day)

RAD_NM_07 (Night)

Bonoshree Adarsha Bidda Niketon School and College, Bonoshree, Dhaka

RAD_NM_08 (Day)



RAD_NM_08 (Night)

Nandipara Bus Stop, Rampura, Dhaka	
	
RAD_NM_09 (Day)	RAD_NM_09 (night)
Sarulia Bazar Jame Mosque, Sarulia, Dhaka	
	
RAD_NM_10 (Day)	RAD_NM_10 (Night)
Mostam Haji Mor, Rampura, Dhaka	
	
RAD_NM_11 (Day)	RAD_NM_11 (Night)
Demra Fire Station, Demra, Dhaka	
	

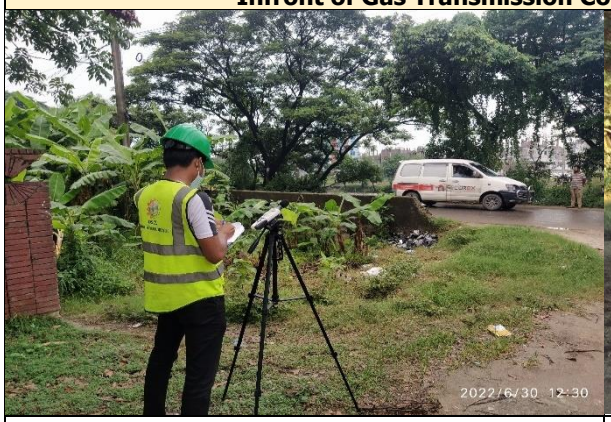
RAD_NM_12 (Day)	RAD_NM_12 (Night)
Staff Quarter Jame Mosque, Demra, Dhaka	
	
RAD_NM_13 (Day)	RAD_NM_13 (Night)
Sarulia DPDC, Sarulia, Dhaka	
	
RAD_NM_14 (Day)	RAD_NM_14 (Night)
Infront of Gas Transmission Company Limited, Demra, Dhaka	
	
RAD_NM_15 (Day)	RAD_NM_15 (Night)
Near Sugandha Hospital, Chattogram Road, Dhaka	
	
RAD_NM_16 (Day)	RAD_NM_16 (Night)

Figure IV.16: Noise Level Monitoring at Different Project Influenced Locations

163. The sample collection location map is presented below Figure IV-17.

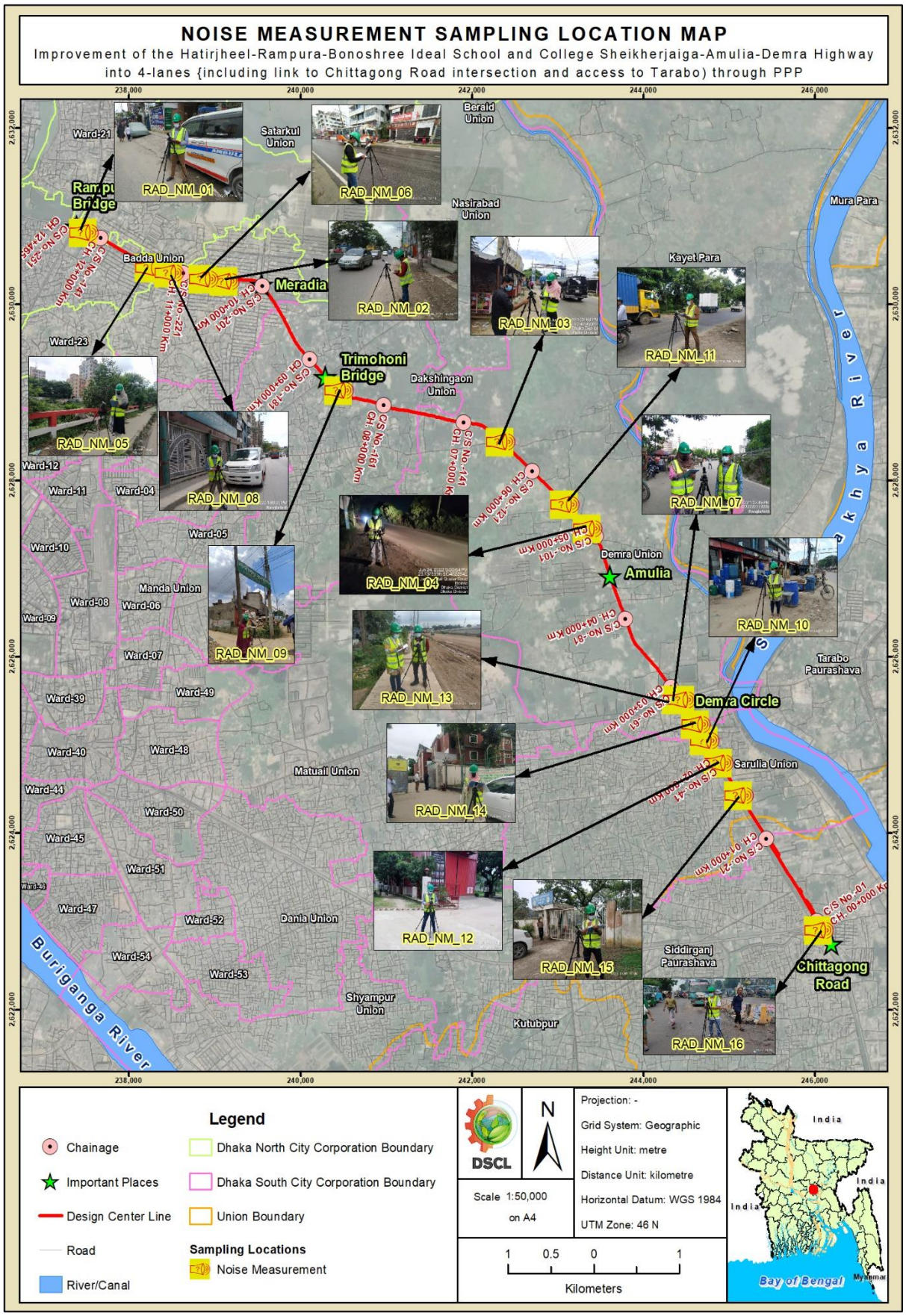


Figure IV.17: Sample location Map of Noise Level Measurement

Table IV-6: Results of Noise Level Measurements

Location	Sample ID	GPS Location	Land Use Category	Time		Noise Level (dBA) (LAeq)		Bangladesh Standard (dB A) **	
				Day	Night	Day	Night	Day	Night
Meradia Bazar, Rampura, Dhaka	RAD_NM_01	23.762089^0 N 90.443466^0 E	Mixed	09:27am to 11:27am	8:00pm to 10:00pm	77.63	83.92	60	50
Beside National Ideal School and College, Bonoshree, Rampura, Dhaka	RAD_NM_02	23.762317^0 N 90.440339^0 E		12:50pm to 02:50pm	09:05pm to 11:05pm	77.5	94.15		
Aichi Medical College, Mendipur, Amulia, Dhaka	RAD_NM_03	23.739983^0 N 90.472190^0 E		08:53am to 10:53am	08:42pm to 10:42pm	57.19	77.63		
Amulia Baitunnahar Jame Mosque, Baitunnahar, Dhaka	RAD_NM_04	23.73769^0 N 90.48232^0 E		09:05am to 11:05am	09:00pm to 11:00pm	63.47	75.11		
Bonoshree Central Jame Mosque, Bonoshree, Dhaka	RAD_NM-05	23.763592^0 N 90.431749^0 E		08:34am to 10:34am	08:00pm to 10:00pm	69.15	63.91		
Academia Bonoshree, Dhaka	RAD_NM-06	23.762523^0 N 90.437947^0 E		11:45am to 01:45pm	09:20pm to 11:20pm	63.88	63.73		
Beside Rampura Bridge Police Box	RAD_NM_07*	23.767437°N 90.423241°E		10:24am to 10:24pm	10:24pm to 10:24pm	68.82	67.60		
Bonoshree Adarsha Bidda Niketon School and College, Bonoshree, Dhaka.	RAD_NM_08*	23.76306° N 90.43398° E		11:30am to 11:30pm	11:30pm to 11:301m	75.92	78.72		
Nandipara Bus Stop, Rampura, Dhaka	RAD_NM_09	23.751376°N 90.453586°E		11:08am to 01:08pm	07:30pm to 09:30pm	71.10	71.68		
Sarulia Bazar Jame Mosque, Sarulia, Dhaka	RAD_NM_10	23.716238°N 90.496155°E		11:34am to 01:34pm	08:45pm to 10:45pm	67.79	66.90		
Mostam Haji Mor, Rampura, Dhaka	RAD_NM_11*	23.746594°N 90.472167°E		10:00am to 10:00pm	10:00pm to 10:00am	70.20	68.33		
Demra Fire Station, Demra, Dhaka	RAD_NM-12*	23.71393° N 90.49777° E		10:39am to 10:39pm	10:39pm to 10:39am	67.79	68.33		
Staff Quarter Jame Mosque, Demra, Dhaka	RAD_NM_13	23.720129^{O}N 90.491336^{O}E		11:20am to 01:20pm	08:00pm to 10:00pm	66.48	63.70		
Sarulia DPDC, Sarulia, Dhaka.	RAD_NM_14	23.717709°N 90.495160°E		11:30am to 01:30pm	08:05pm to 10:05pm	67.15	61.46		

Location	Sample ID	GPS Location	Land Use Category	Time		Noise Level (dBA) (LAeq)		Bangladesh Standard (dB A) **	
				Day	Night	Day	Night	Day	Night
Infront of Gas Transmission Company Limited, Demra, Dhaka	RAD_NM_15*	23.710745°N 90.500286°E		12:00pm to 12:00pm (24hours)	04:00am to 06:00am	74.29	77.73		
Near Sugandha Hospital, Chattogram Road, Dhaka	RAD_NM_16*	23.697620°N 90.509541°E		10:30am to 10:30am (24Hours)	11:45pm to 01:45am	81.66	80.24		

IFC Standards**		
Residential; Institutional; Educational	Day Time	55 dB
	Night Time	45 dB
Industrial; Commercial	Day Time	70 dB
	Night Time	70 dB

Notes
- The land use category is based on the classification provided in the Noise Pollution Control Rules (2006).
- The sound level standard for the mixed area is 60 and 50 dBA during the daytime and night time respectively.
- Noise Level is the average noise recorded throughout the monitoring period.

*24 hours value is calculated for 12 hours day time and 12 hours night time.
** IFC Standards for Noise Level Guideline, April 2007.

Table IV-7: Description of the Surrounding Environment of the Sample Collection Area

Sample Location and ID	Sample Site Description
Meradia Bazar, Rampura, Dhaka **(RAD_NM_01)**	➢ It was both residential and commercial area. ➢ High volume of traffic because it's situated beside the road. ➢ High people movement. ➢ Noise from vehicle and people is high. ➢ Heavy vehicle movement during night time.
Beside National Ideal School and College, Bonoshree, Rampura, Dhaka. **(RAD_NM_02)**	➢ It was both residential and commercial area. ➢ High volume of traffic. ➢ Very Low people movement. ➢ Four-wheeler specially trucks and buses movement are high.
Aichi Medical College, Mendipur, Amulia, Dhaka. **(RAD_NM_03)**	➢ It was a commercial area. ➢ High volume of traffic. ➢ Moderate people movement. ➢ Some small shops are present. ➢ Heavy vehicle movement during night time has been noticed.
Amulia Baitunnahar Jame Mosque, Baitunnahar, Dhaka. **(RAD_NM_04)**	➢ It was both residential and commercial area. ➢ High amount volume of traffic. ➢ High amount of people movement. ➢ Busy road. ➢ Heavy vehicle movement during night time.
Bonoshree Central Jame Mosque Bonoshree Central Jame Mosque, Bonoshree, Dhaka. **(RAD_NM_05)**	➢ High volume of traffic. ➢ High people movement. ➢ Many grocery shops are present. ➢ Comparatively less busy area.
Academia Bonoshree, Dhaka **(RAD_NM_06)**	➢ It was both commercial and residential areas. ➢ Traffic volume was moderate. ➢ Moderate amount of people movement. ➢ No construction work is going on.
Beside Rampura Bridge Police Box **(RAD_NM_07)**	➢ It was a commercial area. ➢ Traffic volume was high in the project area. ➢ High people movement was noticed. ➢ Busy road. ➢ Cars and motor vehicle movement was high.

Sample Location and ID	Sample Site Description
Bonoshree Adarsha Bidda Niketon School and College, Bonoshree, Dhaka. **(RAD_NM_08)**	➢ It situated in both commercial and residential area. ➢ High people movement ➢ High volume of traffic because of beside the road. ➢ Busy road. ➢ School was open and noise from the institution was high.
Nandipara Bus Stop,Rampura, Dhaka. **(RAD_NM_09)**	➢ It was situated in both commercial and residential area. ➢ Moderate people movement was noticed. ➢ Moderate vehicle movement is present. ➢ Beside Bazar area. ➢ Mini buses and large buses movement was high.
Sarulia Bazar Jame Mosque, Sarulia, Dhaka. **(RAD_NM_10)**	➢ It was situated in both commercial and residential area. ➢ High volume of traffic. ➢ High people movement. ➢ Welding machine sound high. ➢ Very crowdy place. ➢ Weather was sunny.
Mostam Haji Mor, Rampura, Dhaka **(RAD_NM_11)**	➢ It was situated in both commercial and residential area. ➢ High volume of people movement ➢ High volume of traffic because of beside the road. ➢ Some shops are present.
Demra Fire Station, Demra, Dhaka. **(RAD_NM_12)**	➢ It was situated in both commercial and residential area. ➢ High people movement ➢ High volume of traffic because of beside the road. ➢ Commercial buildings are seen.
Staff Quarter Jame Mosque, Demra, Dhaka. **(RAD_NM_13)**	➢ It was situated in both commercial and residential area. ➢ Moderate amount of people movement. ➢ High volume of traffic movement. ➢ Bazar area.
Sarulia DPDC, Sarulia, Dhaka. **(RAD_NM_14)**	➢ It was both industrial and commercial area. ➢ High amount of vehicle movement. ➢ Moderate people movement. ➢ Situated beside a canal and in open place.
Infront of Gas Transmission Company Limited, Demra, Dhaka. **(RAD_NM_15)**	➢ It was both industrial and commercial area. ➢ Low amount of people movement is visible. ➢ Moderate amount of vehicle movement. ➢ Dust particle is moderate.
Near Sugandha Hospital, Chattogram Road, Dhaka. **(RAD_NM_16)**	➢ It was both residential and commercial area. ➢ High amount of traffic movement. ➢ High volume of people. ➢ Beside a local Bazar.

164. The result shows that time weighted average value of the sound monitored inside the project location area exceeds the standard set for all the locations except Aichi Medical College for the day time for Bangladesh Standard. According to IFC standard, the average value exceeds the limit except Aichi Medical College, Amulia; Baitunnahar Jame Mosque, Baitunnahar, Dhaka; Academia Bonoshree, Dhaka; Beside Rampura Bridge Police Box for daytime and Bonoshree Central Jame Mosque, Bonoshree, Dhaka; Academia Bonoshree, Dhaka; Beside Rampura Bridge Police Box; Sarulia Bazar Jame Mosque, Sarulia, Dhaka; Demra Fire Station, Demra, Dhaka; Staff Quarter Jame Mosque, Demra, Dhaka; Sarulia DPDC, Sarulia, Dhaka for both the time and for Mostam Haji Mor, Rampura, Dhaka nighttime only. Noise level is not within the limit may be due to the higher amount of traffic and people movement both at day at night. There were different types of interruptions during the monitoring period which is described in Table IV-7.

b) Vibration Level Measurement

165. Vibration Level Measurement was analysed at project influenced locations on 23 to 30 June 2022 at 08 locations (Figure IV-18). Noise level data were taken during daytime are summarized in

Table IV-8. The sampling location map for vibration level measurement is shown above in Figure IV-18.

Meradia Bazar	
	
RAD_VB_01 (Day)	**RAD_VB_01 (Night)**
Mostam Haji mor	
	
RAD_VB_02 (Day)	**RAD_VB_02 (Night)**
Bonoshree Central Jame Mosque	
	
RAD_VB_03 (Day)	**RAD_VB_03 (Night)**
Bonoshree Bus Stop	
	
RAD_VB_04 (Day)	**RAD_VB_04 (Night)**

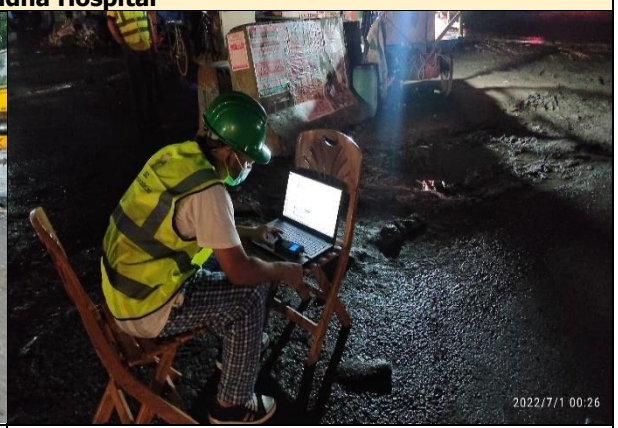
Nagdarpar Bridge	
	
RAD_VB_05 (Day)	**RAD_VB_05 (Night)**
Aichi Medical College and Hospital	
	
RAD_VB_06 (Day)	**RAD_VB_06 (Night)**
Staff Quarter Jame Mosque	
	
RAD_VB_07 (Day)	**RAD_VB_07 (Night)**
Near Sugandha Hospital	
	
RAD_VB_08 (Day)	**RAD_VB_08 (Night)**

Figure IV.18: Vibration Level Monitoring at Different Project Influenced Locations

Table IV-8: Results of Vibration Level Measurements

Location	Sample ID	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
Meradia Bazar	**RAD_VB_01 (Day)**	37.71	0	1.160	0.475	18	0	0.727	0.261	2.462	0	0.127	0.030
	RAD_VB_01 (Night)	3.89	0	0.603	0.435	13	0	0.839	0.356	2.401	0	0.070	0.016
Aichi Medical College	**RAD_VB_02 (Day)**	2.99	0	0.518	0.812	2.93	0.31	0.455	0.692	2.005	0.005	0.204	0.202
	RAD_VB_02 (Night)	15.07	0.31	3.108	3.392	3.63	0.33	0.700	1.518	3.055	0.005	0.654	0.593
Bonoshree Central Jame Mosque	**RAD_VB_03 (Day)**	6.53	0.31	0.617	0.921	5.91	0.31	0.399	0.543	0.989	0.005	0.079	0.022
	RAD_VB_03 (Night)	5.05	0.31	0.681	0.886	2.83	0.31	0.474	0.837	0.661	0.005	0.066	0.041
Bonoshree Bus Stop	**RAD_VB_04 (Day)**	30.01	0.31	1.974	1.429	6.71	0.31	0.748	0.883	3.675	0.005	0.397	0.154
	RAD_VB_04 (Night)	72.55	0.31	3.160	1.523	341.9	0.31	10.699	2.156	3.897	0.005	0.445	0.233
Nagdarpar Bridge	**RAD_VB_05 (Day)**	2.41	0.31	0.412	0.740	1.87	0.31	0.335	0.660	0.965	0.005	0.084	0.041
	RAD_VB_05 (Night)	3.51	0.31	0.613	0.961	2.97	0.31	0.320	0.626	0.941	0.005	0.082	0.053
Mostam haji mor	**RAD_VB_06 (Day)**	7.25	0.31	0.675	0.932	2.55	0.31	0.390	0.716	2.376	0.005	0.397	0.154
	RAD_VB_06 (Night)	30.01	0.31	1.974	1.429	6.71	0.31	0.748	0.883	3.675	0.005	0.008	0.003
Staff Quarter Jame Mosque	**RAD_VB_07 (Day)**	9.21	0.31	0.733	0.808	1.91	0.31	0.354	0.634	0.486	0.005	0.036	0.028
	RAD_VB_07 (Night)	2.93	0.31	0.434	0.755	2.25	0.31	0.417	0.793	0.215	0.005	0.018	0.012

Location	Sample ID	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
Near Sugandha Hospital	**RAD_VB_08 (Day)**	7.27	0.31	0.997	1.398	2.09	0.31	0.376	0.611	2.51	0.005	0.133	0.085
	RAD_VB_08 (Night)	1.01	0.31	0.232	0.513	4.87	0.31	0.718	0.956	2.588	0.005	0.208	0.046

166. **Velocity:** The result shows that the maximum velocity was in Bonoshree Bus Stop (72.55 mm/s), and the minimum velocity was 0.05 mm/s in Mostam Maji Mor. The standard deviation of velocity maxed in Bonoshree Bus Stop, which is 3.160 mm/s and was minimum in Meradia Bazar, and the value was 0.435 mm/s.

167. **Acceleration:** Maximum acceleration found in the Bonoshree Bus Stop was 341.9 m/s^2. Minimum acceleration was mostly 0 m/s^2 in Meradia Bazar and Mostam Haji Mor (Day Time). The maximum standard deviation of acceleration was in Bonoshree Bus stop which is 10.699 m/s^2, and was minimum in Nagdarpar Bridge, which was 0.320 m/s^2.

168. **Displacement:** Maximum displacement found in Bonoshree Bus Stop, was 3.897 mm. Minimum displacement was 0 mm for Meradia Bazar and Mostam Haji Mor (Day Time). Standard Deviation for Displacement maximum in Aichi Medical College which is 0.654 mm and was minimum in Mostam Haji Mor with a value of 0.008 mm.

9. Water Resources and Hydrology

169. There is industrial area situated around the alignment of the project area. These are contributing to the pollution of the adjacent waterbodies. Shitalakshya river which was identified as ECA is also being polluted from these wastes but the project alignment is at a good distant and details are presented in Table VI-6. People throw waste to the water bodies are also one of the main reasons of water pollution in the project surrounding area. The details of this criteria are given below along with a hydrological map of the project area.

Beside Demra-Narayanganj Road
(C/S -17 Chainage 00+800km)

Beside Demra-Ranimahal-Chattogram Road Left side
(C/S -22 Chainage 01+050km)

Beside Sarulia, Chattogram Road
(C/S -34 Chainage 01+650km)

Near Ranimahal Cinema Hall, Sarulia
(C/S -43 Chainage 02+100km)

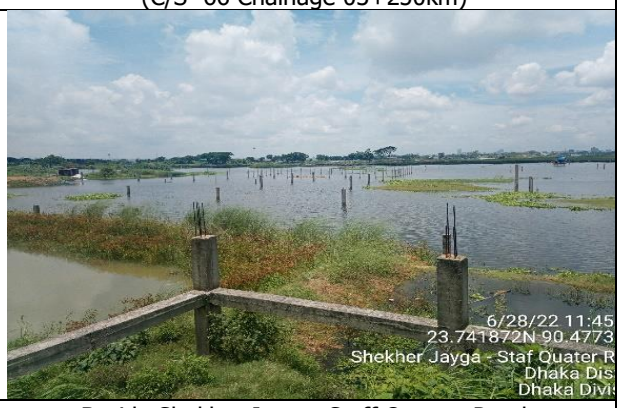
Police Fari Pond (CH. 02+250 – CH. 02+200)

Sarulia Pond (CH. 02+450 – CH. 02+400)

Beside Sarulia Road
(C/S -72 Chainage 03+0550 km)

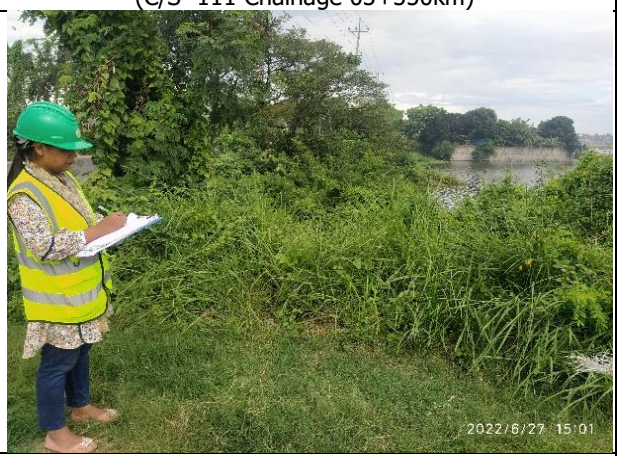
Beside Demra Main Road
(C/S -66 Chainage 03+250km)

Beside Mendipur Road
(C/S -112 Chainage 05+550km)



Beside Shekher Jayga- Staff Quater Road
(C/S -111 Chainage 05+550km)

Beside Shekher Jayga- Staff Quater Road
(C/S -111 Chainage 05+550km)



Mostomajhi Pond
(CH. 06+500 – CH. 06+450)

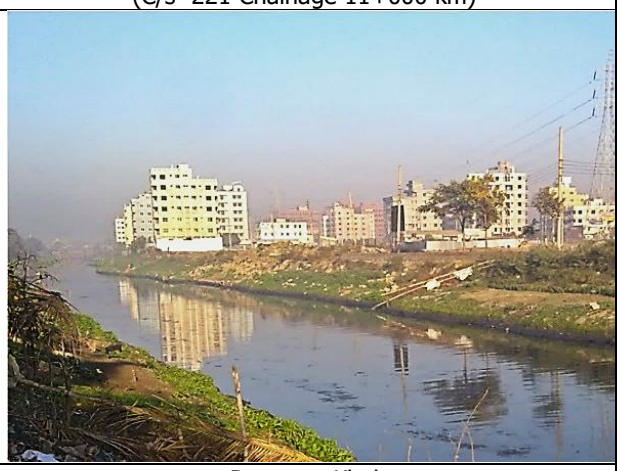
	
Bonoshree Staff Quarter, Demra Road, Right Side (Beside C/S -163 to -162 Chainage 08+100km to 08+050km)	Nagdarpar Pond (CH. 08+100 – CH. 08+050)
	
Alif Stand Meradia Right Side (Beside C/S -200 to -201 Chainage 09+950km to 10+000km)	Bonoshree Main Road right side (C/s -221 Chainage 11+000 km)
	
Near Bonosree Main Road, Rampura (C/S -146 Chainage 12+250km)	Rampura Khal (CH. 12+100 – CH. 12+050)

Figure IV.19: Waterbodies along the Project Alignment

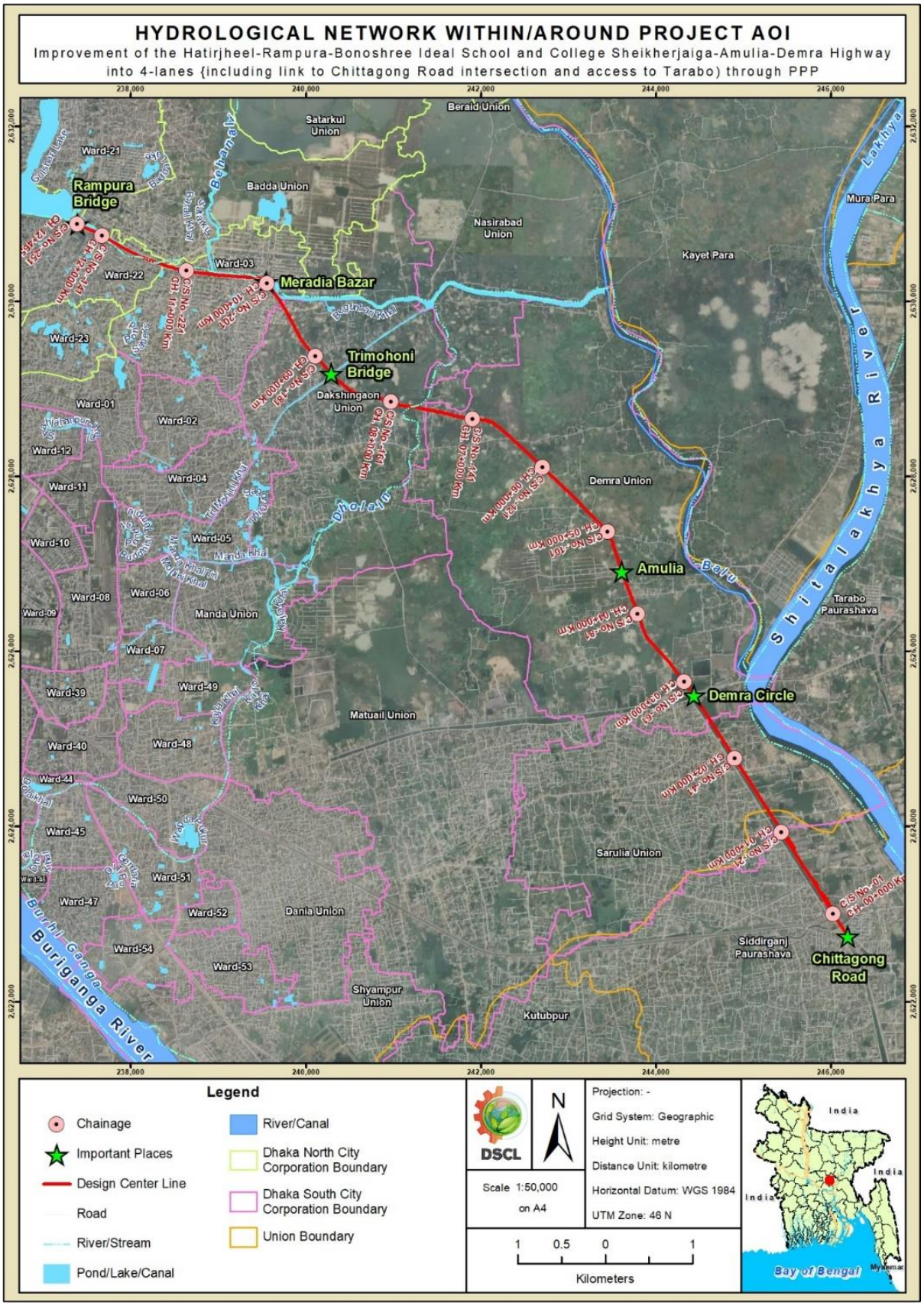


Figure IV.20: Hydrological Map of the Project Area

a) Surface Water Quality

170. Surface water samples were collected from five (05) project influenced locations on 23 and 24 June 2022. The laboratory test results are given in Annex 2. Test Result of surface water sampling analysis of project influenced area is given at Table IV-9.

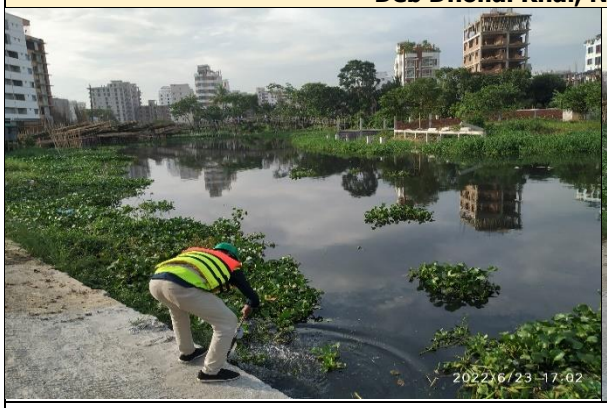
Rampura Khal, Rampura, Dhaka

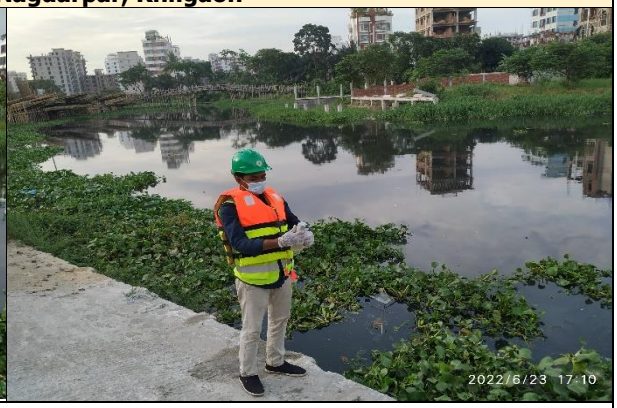
RAD_SW_01

Meradia Bazar, Rampura, Dhaka

RAD_SW_02

Deb Dhoilai Khal, Nagdarpar, Khilgaon





RAD_SW_03

Demra khal, Demra, Dhaka

RAD_SW_04

Shitalakshya river, Siddhirganj, Dhaka

RAD_SW_05

Figure IV.21: Surface Water Sampling from Project Influenced Location

171. The sampling location map of surface water and riverbed sediment quality is given below.

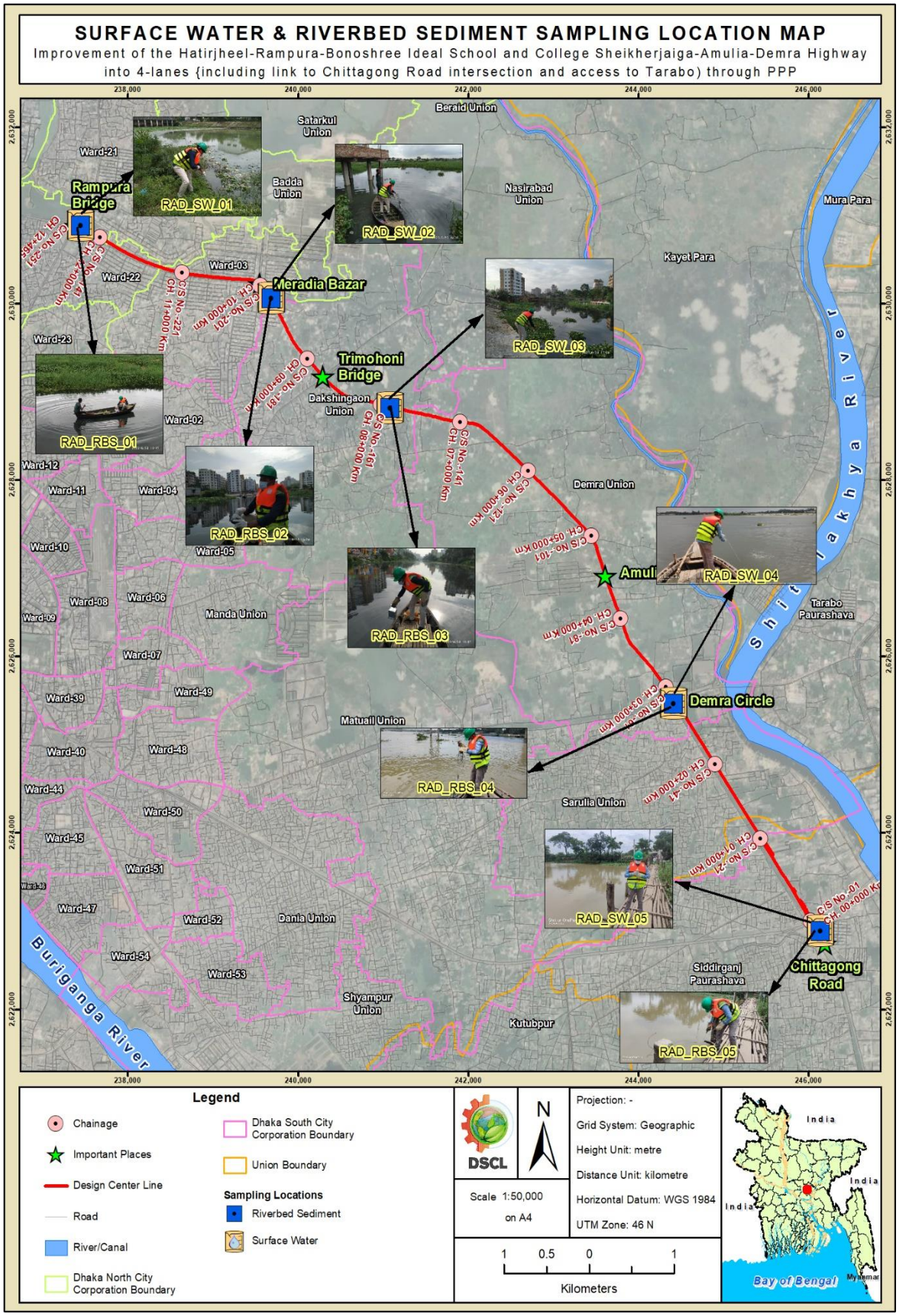


Figure IV.22: Sample Location Map of Surface Water and Riverbed Sediment Quality

Table IV-9: Test Results of Surface Water Quality

Parameters	Unit	Concentration Present					Standards for Inland Surface Water**	EU Standard	Analysis Method
		Rampura Khal, Rampura, Dhaka	Meradia Bazar, Rampura, Dhaka	Deb Dholai Khal, Nagdarpar, Khilgaon	Demra khal, Demra, Dhaka	Shitalakshya river, Siddhirganj, Dhaka			
		RAD_SW_01	RAD_SW_02	RAD_SW_03	RAD_SW_04	RAD_SW_05			
		23.767511^0 N 90.423707^0 E	23. 76063^0 N 90. 44588^0 E	23.749825^0 N 90.460082^0 E	23. 71991^0 N 90. 49303^0 E	23.722250°N 90.499085°E			
Temperature*	°C	30.3	29.5	27.9	29.9	30.6	20-30	NYS	Multimeter
Turbidity	NTU	29.6	75.5	8.5	<5	45	5	NYS	Nephelometric
pH*	-	10.89	9.89	10.74	12.05	10.05	6.5-8.5	6.5-8.5	Multimeter
Electric Conductivity (EC)*	µS/cm	746	549	649	268	307	NYS	500	Multimeter
Total Dissolved Solids (TDS)*	mg/L	479	479	542	178	214	NYS	NYS	Multimeter
Total Suspended Solids (TSS)	mg/L	43	140	25	20	81	5	25	APHA/SM 2540D
Dissolved Oxygen (DO)*	mg/L	6.9	6.5	7.4	9.4	1.4	5 or more	≥7	DO Meter
Salinity	mg/L	363	465	401	136	163	NYS	NYS	Multimeter
Alkalinity	mg/L	272	262	175	146	68	5	>200	APHA/SM 2320B
Arsenic (As)	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	0.01-1	Acid Digestion with ICP Analysis
Chemical Oxygen Demand (COD)	mg/L	76	205	73	42	46	5	<7	APHA/SM 5220D
Biochemical Oxygen Demand (BOD_5)	mg/L	20	70	25	15	18	2	3-<7	5 days Incubation
Total Coliform (TC)	CFU/100mL	18200	22000	2500	140000	188	NYS	50-50000	Membrane Filtration
Fecal Coliform (FC)	CFU/100mL	10900	16000	900	72000	140	NYS	20-20000	Membrane Filtration
Copper (Cu)	mg/kg	<0.25	<0.25	0.8	0.27	<0.25	0.25	0.02-0.05	Acid Digestion with ICP Analysis
Fluoride (F)	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.7-1	Photometric Method

Parameters	Unit	Concentration Present					Standards for Inland Surface Water**	EU Standard	Analysis Method
		Rampura Khal, Rampura, Dhaka	Meradia Bazar, Rampura, Dhaka	Deb Dholai Khal, Nagdarpar, Khilgaon	Demra khal, Demra, Dhaka	Shitalakshya river, Siddhirganj, Dhaka			
		RAD_SW_01	RAD_SW_02	RAD_SW_03	RAD_SW_04	RAD_SW_05			
		23.767511^0 N 90.423707^0 E	23. 76063^0 N 90. 44588^0 E	23.749825^0 N 90.460082^0 E	23. 71991^0 N 90. 49303^0 E	23.722250°N 90.499085°E			
Cadmium (Cd)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.001-0.005	Acid Digestion with ICP Analysis
Iron (Fe)	mg/L	0.5	1.7	<0.5	<0.5	4.58	0.5	<1	Acid Digestion with ICP Analysis
Lead (Pb)	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	<50	Acid Digestion with ICP Analysis
Zinc (Zn)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	0.5-5	Acid Digestion with ICP Analysis
Sulphate (SO_4)	mg/L	16	20	21	22	21	10	150-250	Photometric Method
Magnesium (Mg)	mg/kg	12	11	<10	<10	<10	10	50	Acid Digestion with ICP Analysis

* On-Site Test Result
**Standards for Inland Surface Water is followed Environment Conservation Rules (ECR), 1997
NYS = Not Yet Standard

Table IV-10: Description of the Surrounding Environment of the Sample Collection Area

Sample Location and ID	Sample Site Description
Rampura Khal, Rampura, Dhaka **(RAD_SW_01)**	➢ The pond is located beside C/S -209 CH. 10+400km. ➢ Fish is not cultured in the pond. ➢ Water remains in the khal off and on the whole year. ➢ Water is mostly polluted. ➢ There is a large dustbin beside the khal. ➢ Drainage wastes were noticed.
Meradia Bazar, Rampura, Dhaka **(RAD_SW_02)**	➢ The pond is beside C/S -205 CH. 10+200km. ➢ Fish is cultured in the pond. ➢ Water is constant in the pond all-round the year. ➢ Household water drains in the pond. ➢ Rain water and domestic sewage water drains in the pond.
Deb Dhoilai Khal, Nagdarpar, Bonoshree, Dhaka **(RAD_SW_03)**	➢ The Sample was collected from deb dholai khal near Nagdarpar Bridge. ➢ The khal is located between C/S -161 CH. 08+000km and C/S -160 CH. 07+950km. ➢ No drainage is attached. ➢ Situated beside household. ➢ Fish is not cultured here.
Demra khal, Demra, Dhaka **(RAD_SW_04)**	➢ The Sample was collected from Demra khal within the alignment. ➢ The water body is located beside C/S -60 CH. 02+950 km. ➢ Sand collection is going on. ➢ Water color is turning into black as the water is polluted. ➢ Sheola is seen in the water body.
Shitalakshya river, Siddhirganj, Dhaka **(RAD_SW_05)**	➢ The Sample was collected from Shitalakshya River. ➢ The water body is located beside C/S -63 CH. 03+100km. ➢ The distance of the water body from the alignment is approximately 0.67km. ➢ The sample was collected during upstream. ➢ Commercial area was seen beside the river.

172. The result shows that the value of the surface water monitored in the specific locations exceeds most of the locations except Turbidity for Demra khal, Demra, Dhaka; Dissolved Oxygen (DO) for Rampura Khal, Rampura, Dhaka; Meradia Bazar, Rampura, Dhaka; Deb Dholai Khal, Nagdarpar, Khilgaon and Demra khal, Demra, Dhaka; Arsenic (As), Fluoride (F), Cadmium (Cd), Lead (Pb) and Zinc (Zn) for all locations; Copper (Cu) for Rampura Khal, Rampura, Dhaka; Meradia Bazar, Rampura, Dhaka and Shitalakshya river, Siddhirganj, Dhaka; Iron(Fe) for Rampura Khal, Rampura, Dhaka; Deb Dholai Khal, Nagdarpar, Khilgaon and Demra khal, Demra, Dhaka; Magnesium (Mg) for Deb Dholai Khal, Nagdarpar, Khilgaon; Demra khal, Demra, Dhaka and Shitalakshya river, Siddhirganj, Dhaka according to national standards (ECR 1997) for Inland Surface Water. According to EU standard, values for different parameters exceeds in all the locations except Electric Conductivity (EC) for Demra khal, Demra, Dhaka and Shitalakshya river, Siddhirganj, Dhaka; Dissolved Oxygen (DO) for Deb Dholai Khal, Nagdarpar, Khilgaon and Demra khal, Demra, Dhaka; Alkalinity for Rampura Khal, Rampura, Dhaka and Meradia Bazar, Rampura, Dhaka; Arsenic (As), Total Coliform (TC), Fecal Coliform (FC), Fluoride (F), Lead (Pb), Zinc (Zn), Sulphate (SO_4) and Magnesium (Mg) for all the locations; Iron(Fe) for Rampura Khal, Rampura, Dhaka; Deb Dholai Khal, Nagdarpar, Khilgaon and Demra khal, Demra, Dhaka. There were different types of interruptions during the monitoring period which is described in Table IV-10.

b) Groundwater Quality

173. Groundwater samples were collected from the project influenced locations at 23 and 24 June 2022. The laboratory test results are given in Annex 2. Test Result of groundwater sampling analysis of project influenced area is given at Table IV-11. The sampling location map is given above in Figure IV-23.

Yamagata Dhaka Friendship Hospital, Bonoshree, Dhaka

RAD_GW_01

Rampura Bridge Traffic Police Booth, Rampura, Dhaka

RAD_GW_02

Nagdarpar, Bonoshree, Dhaka

RAD_GW_03

Near Demra Ideal College, Demra, Dhaka

RAD_GW_04

Beside Sugandha Hospital, Chattogram Road, Dhaka

RAD_GW_05

Figure IV.23: Groundwater Sampling from Project Influenced Locations

Table IV-11: Test Results of Groundwater Quality

Parameters	Unit	Concentration Present					Standards for Inland Surface Water**	WHO standards***	AnalysisMethod
		Yamagata Dhaka Friendship Hospital, Bonoshree, Dhaka	Rampura Bridge Traffic Police Booth, Rampura, Dhaka	Nagdarpar, Bonoshree, Dhaka	Near Demra Ideal College, Demra, Dhaka	Beside Sugandha Hospital, Chattogram Road, Dhaka			
		RAD_GW_01	RAD_GW_02	RAD_GW_03	RAD_GW_04	RAD_GW_05			
		23.761610^0 N 90.444341^0 E	23.767484^0 N 90.423122^0 E	23.749514^0 N 90.459496^0 E	23. 72161^0 N 90. 48959^0 E	23.69726°N 90.50942°E			
Temperature*	°C	27.89	29.7	27.4	29.6	29.1	20-30	25	Multimeter
Turbidity	NTU	<5	<5	<5	<5	<5	5	5	Nephelometric
pH*	-	10.01	10.07	8.18	11.96	10.8	6.5-8.5	8	Multimeter
Electric Conductivity (EC)*	µS/cm	407	372	232	223	332	NYS	400	Multimeter
Total Dissolved Solids (TDS)*	mg/L	270	258	358	161	233	NYS	1500	Multimeter
Total Suspended Solids (TSS)	mg/L	14	10	16	11	8	5	NYS	APHA/SM 2540D
Dissolved Oxygen (DO)*	mg/L	6.3	5.9	6.2	5.3	8.2	5 or more	NYS	DO Meter
Salinity	mg/L	207	200	187	127	185	NYS	600	Multimeter
Alkalinity	mg/L	165	184	155	146	165	5	NYS	APHA/SM 2320B
Arsenic (As)	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	0.01	Acid Digestion with ICP Analysis
Chemical Oxygen Demand (COD)	mg/L	26	45	16	20	28	5	NYS	APHA/SM 5220D
Biochemical Oxygen Demand (BOD_5)	mg/L	10	15	5	6	13	2	NYS	5 days Incubation
Total Coliform (TC)	CFU/100mL	65	3	0	5	700	NYS	NYS	USEPA 9132
Fecal Coliform (FC)	CFU/100mL	45	0	0	2	520	NYS	100–100,000	Membrane Filtration
Copper (Cu)	mg/kg	<0.25	<0.25	<0.25	<0.25	<0.25	0.25	2	Acid Digestion with ICP Analysis
Fluoride (F)	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	1.5	Photometric Method

Parameters	Unit	Concentration Present					Standards for Inland Surface Water**	WHO standards***	AnalysisMethod
		Yamagata Dhaka Friendship Hospital, Bonoshree, Dhaka	Rampura Bridge Traffic Police Booth, Rampura, Dhaka	Nagdarpar, Bonoshree, Dhaka	Near Demra Ideal College, Demra, Dhaka	Beside Sugandha Hospital, Chattogram Road, Dhaka			
		RAD_GW_01	RAD_GW_02	RAD_GW_03	RAD_GW_04	RAD_GW_05			
		23.761610^0 N 90.444341^0 E	23.767484^0 N 90.423122^0 E	23.749514^0 N 90.459496^0 E	23. 72161^0 N 90. 48959^0 E	23.69726°N 90.50942°E			
Cadmium (Cd)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.003	Acid Digestion with ICP Analysis
Iron (Fe)	mg/L	0.68	<0.5	<0.5	<0.5	0.88	0.5	0.3	Acid Digestion with ICP Analysis
Lead (Pb)	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	0.01	Acid Digestion with ICP Analysis
Zinc (Zn)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	NYS	Acid Digestion with ICP Analysis
Sulphate (SO_4)	mg/L	<10	<10	<10	<10	<10	10	NYS	Photometric Method
Magnesium (Mg)	mg/kg	16	13	14	14	23	10	NYS	Acid Digestion with ICP Analysis

*Onsite Test
**Standards for Potable Water is followed Environment Conservation Rules (ECR)'97

Table IV-12: Description of the Surrounding Environment

Sample Location & ID	Description of Surrounding Environment
Yamagata Dhaka Friendship Hospital, Bonoshree, Dhaka **(RAD_GW_01)**	▪ Tube well was established in 2019/2020. ▪ Distance of the source from the nearest toilet is 20m. ▪ The depth of the tube well is 15m. ▪ Nearest agricultural land is far away from the source. ▪ Water is used for washing purpose.
Rampura Bridge Traffic Police Booth, Rampura, Dhaka **(RAD_GW_02)**	▪ Depth of the ground water source is 20ft. ▪ The source was established on 2012. ▪ Distance of the source from the nearest toilet is 3m. ▪ The water is used for washing purpose. ▪ Agricultural land is not visible nearly.
Nagdarpar, Bonoshree, Dhaka **(RAD_GW_03)**	▪ The depth of the tube well is 18ft. ▪ Distance of the source from septic tank is 20m. ▪ The nearest toilet from the source is 10m. ▪ Nearest agricultural land is about 15m away. ▪ Water is used for cleaning and washing purpose.
Near Demra Ideal College, Demra, Dhaka **(RAD_GW_04)**	▪ The depth of the source is 10m. ▪ Nearest toilet source is 18m. ▪ Distance of the source from septic tank is 25m. ▪ Water is used for washing purpose. ▪ No agricultural land was detected near.
Beside Sugandha Hospital, Chattogram Road, Dhaka **(RAD_GW_05)**	▪ The depth of the source is 25m. ▪ Septic was located in 10m distance. ▪ Owner of the source is hospital authority. ▪ Nearest toilet source is in 10m distance. ▪ Water is used for washing purpose.

174. From the above test results, it is found that, most of the parameters are showing the results that exceeds parameters except Turbidity, Dissolved Oxygen (DO) Arsenic (As), Copper (Cu), Fluoride (F), Cadmium (Cd), Lead (Pb), Zinc (Zn) and Sulphate (SO_4) for all locations; pH for Nagdarpar, Bonoshree, Dhaka; Iron (Fe) for Rampura Bridge Traffic Police Booth, Rampura, Dhaka; Nagdarpar, Bonoshree, Dhaka and Near Demra Ideal College, Demra, Dhaka according to national standards for potable water. According to WHO standard values for drinking water exceeds in most of the locations except Turbidity, Total Dissolved Solids (TDS), Salinity, Fecal Coliform (FC), Copper (Cu), Fluoride (F) for all the locations; Electric Conductivity (EC) for Rampura Bridge Traffic Police Booth, Rampura, Dhaka; Nagdarpar, Bonoshree; near Demra Ideal College, Dhaka and beside Sugandha Hospital, Chattogram Road, Dhaka. These may result in loss of tastes and corrosion of pipes. No health hazard will be resulted from these issues rather than loss of some aesthetic values. The surrounding environment is described in the Table IV-12.

c) Riverbed Sediment Quality

175. Riverbed Sediment samples were collected from five (05) project influenced locations (upstream and downstream considering 1km buffer zone beside the alignment) from different sources from 23 June to 24 June of 2022 and analyzed for the heavy metals. Test result of sediment analysis of project influenced area is given in table IV.12. Laboratory test result are given in Annex 2 of the report. The riverbed sediment collection location map is shown above in the Figure of IV-24.

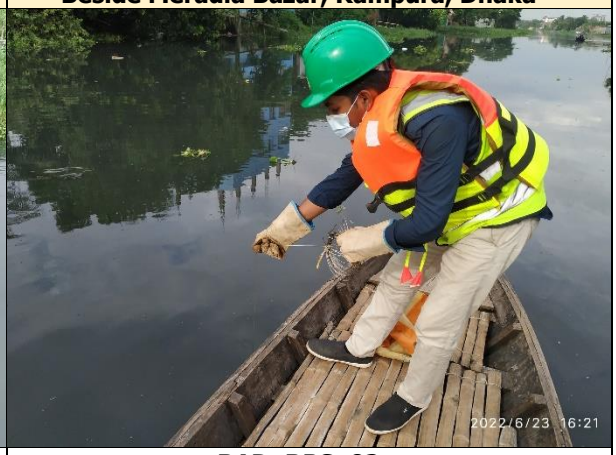
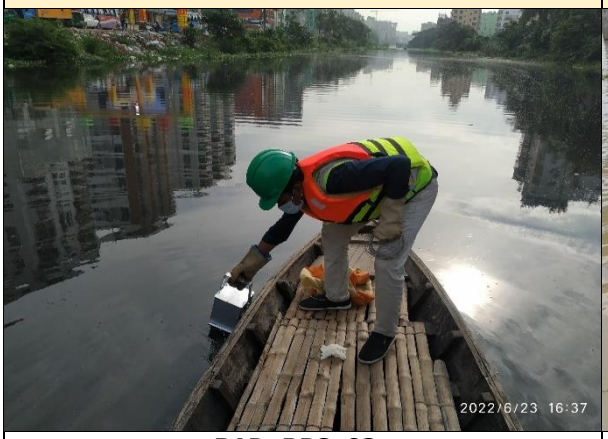
Nagdarpar Khal, Bonoshree, Dhaka	Beside Meradia Bazar, Rampura, Dhaka
	
RAD_RBS_01	**RAD_RBS_02**
Rampura Khal, Rampura, Dhaka	**Shitalakshya River, Shiddhirganj, Dhaka**
	
RAD_RBS_03	**RAD_RBS_04**
Demra Khal, Demra, Dhaka	
	
RAD_RBS_05	

Figure IV.24: Riverbed Sediment Sampling Collection at Project Influenced Areas

Table IV-13: Test Result of Riverbed Sediment Quality Analysis

Parameters	Unit	Nagdarpar Khal, Bonoshree, Dhaka	Beside Meradia Bazar, Rampura, Dhaka	Rampura Khal, Rampura, Dhaka	Shitalakshya River, Siddhirganj, Dhaka	Demra Khal, Demra, Dhaka	OSPAR Standard for Riverbed Materials 2004*	Method of Analysis
		RAD_RBS_01	RAD_RBS_02	RAD_RBS_03	RAD_RBS_04	RAD_RBS_05		
		23.767237°N 90.427830°E	23.760563°N 90.440681°E	23.749900°N 90.460027°E	24.717704°N 90.494618°E	24.71991°N 90.49303°E		
Lead (Pb)	mg/kg	18	16	17	13	11	5	Acid Digestion with ICP Analysis
Iron (Fe)	mg/kg	4619	3935	4320	16347	10982	10	Acid Digestion with ICP Analysis
Copper (Cu)	mg/kg	<10	11	21	13	16	10	Acid Digestion with ICP Analysis
Zinc (Zn)	mg/kg	158	242	148	87	89	8700	Acid Digestion with ICP Analysis
Total Phosphorus (P)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	Photometric method
Sulphate (SO_4)	mg/kg	768	748	770	1559	421	20	Photometric method

176. There is no Bangladesh regulation/standard for sediment. In the absence of local country standards, it is the environment consultant's practice to use globally recognized "OSPAR Standard for Riverbed Materials 2004" to assess sediment quality and to determine the need, if any, for remedial action. Lead (Pb), Iron (Fe), Copper (Cu), Zinc (Zn), Sulphate (SO_4) has been tested to know riverbed quality of the project areas along with Total Phosphorus (P) which is a moderate toxic material. Concentration of Total Phosphorus (P) are found within the limits for all the locations and Copper (Cu) for Nagdarpar Khal, Bonoshree, Dhaka is within the limit as well. Except these values all other parameters exceed the limits for OSPAR Standard for Riverbed Materials 2004.

10. Ecologically Critical Area (ECA)

177. The ecosystem of Shitalakshya and Balu River is considered to be threatened to reach a critical state. Balu River and Shitalakshya River and its foreshore areas were declared as "ecologically critical area" (ECA), according to provisions of the Environment Conservation Act 1995.

Balu River

Shitalakshya River

Figure IV.25: ECA adjacent to the Project Area

178. These include all types of hunting, collection of all types of aquatic species living in the rivers, all activities that could result in the destruction of floral or faunal habitats, all activities that could destroy natural characteristics of water and soil, activities detrimental to fishery, installation of polluting industrial units and discharge of domestic/ industrial liquid waste. As result a number of activities in the Shitalakshya River and its foreshores will be restricted. Till date implementation of the provisions associated with the ECA is pending. A map is attached below showing the distance of these ECAs from the project alignment.

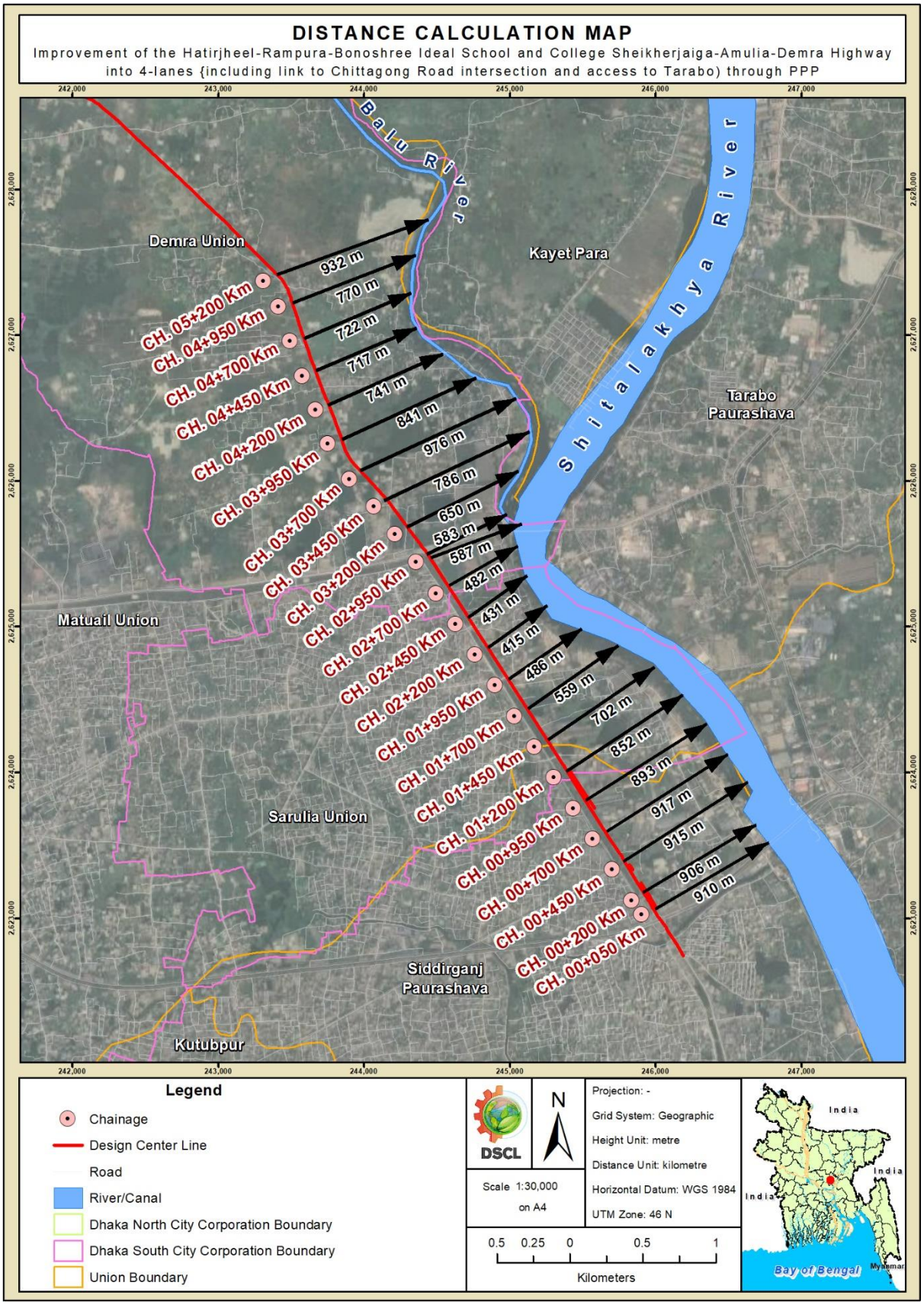


Figure IV.26: Distance Calculation Map

11. Seismicity

179. On the basis of distribution of earthquake epicenters and morphotectonic behavior of different tectonic blocks the Bangladesh National Building Code (BNBC, 2020) which has divided our

country into four (04) seismic zones and the project area falls under Zone-2 which indicates low risk zone. The map of the project seismic zones is given below.

Figure IV.27: Seismic Zone around or within the Project AOI

12. Natural Hazards

180. Natural hazard of the project locations includes earthquake zone and the flooding conditions of that area. The details description is given below.

a) Earthquake

181. Recent earthquakes with low to moderate magnitude very close to Dhaka are certainly indications of its earthquake source and vulnerability. At present earthquake risk of Dhaka city has been one of the most burning topics to discuss about. On the basis of the depth of focus, an earthquake may be termed as shallow focus (0-70 km), intermediate focus (70-300 km), and deep focus (>300 km). An earthquake with a moderate to high intensity can cause an immense and destructive impact on both the property and people of the city. The percentage Dhaka city where different phenomenon can happen for earthquake is shown below as table.

Table IV-14: Respondent's Perception about Earthquake around Dhaka City[1]

Sl. No.	Phenomenon	Contents	Total No.	Percentage (%)
1	Thinking about earthquake vulnerability	High	32	64
		Moderate	12	24
		Less	2	4
		No idea	4	8
2	Probable impacts of earthquake ondifferent points	Property	10	20
		Life	20	40
		Infrastructure	18	36
		Garden and forest	2	4
3	Level of earthquake resistancehouses or offices	High	6	12
		Medium	28	56
		Low	16	32
4	Vulnerable part of Dhaka city	Northern part	7	14
		Southern part	43	86

b) Flood

182. Dhaka is likely to be flood prone area when there occurs heavy rainfall. It is under the types of monsoon/river flood area. Due to the nature of the project area around Rampura-Amulia-Demra it is under the severe flood zone area.

183. Floods are more or less a recurring phenomenon in Bangladesh and often have been within tolerable limits. But occasionally they become devastating. Each year in Bangladesh about 26,000 sq km, 18% of the country is flooded. During severe floods, the affected area may exceed 55% of the total area of the country. In an average year, 844,000 million cubic metre of water flows into the country during the humid period (May to October) through the three main rivers the ganges, the Brahmaputra-Jamuna and the meghna. This volume is 95% of the total annual inflow. By comparison only about 187,000 million cu m of streamflow is generated by rainfall inside the country during the same period. The flood zone map of the project area is given below.

[1]https://www.researchgate.net/publication/282529823_Effects_of_Earthquake_on_Urbanization_in_Dhaka_City

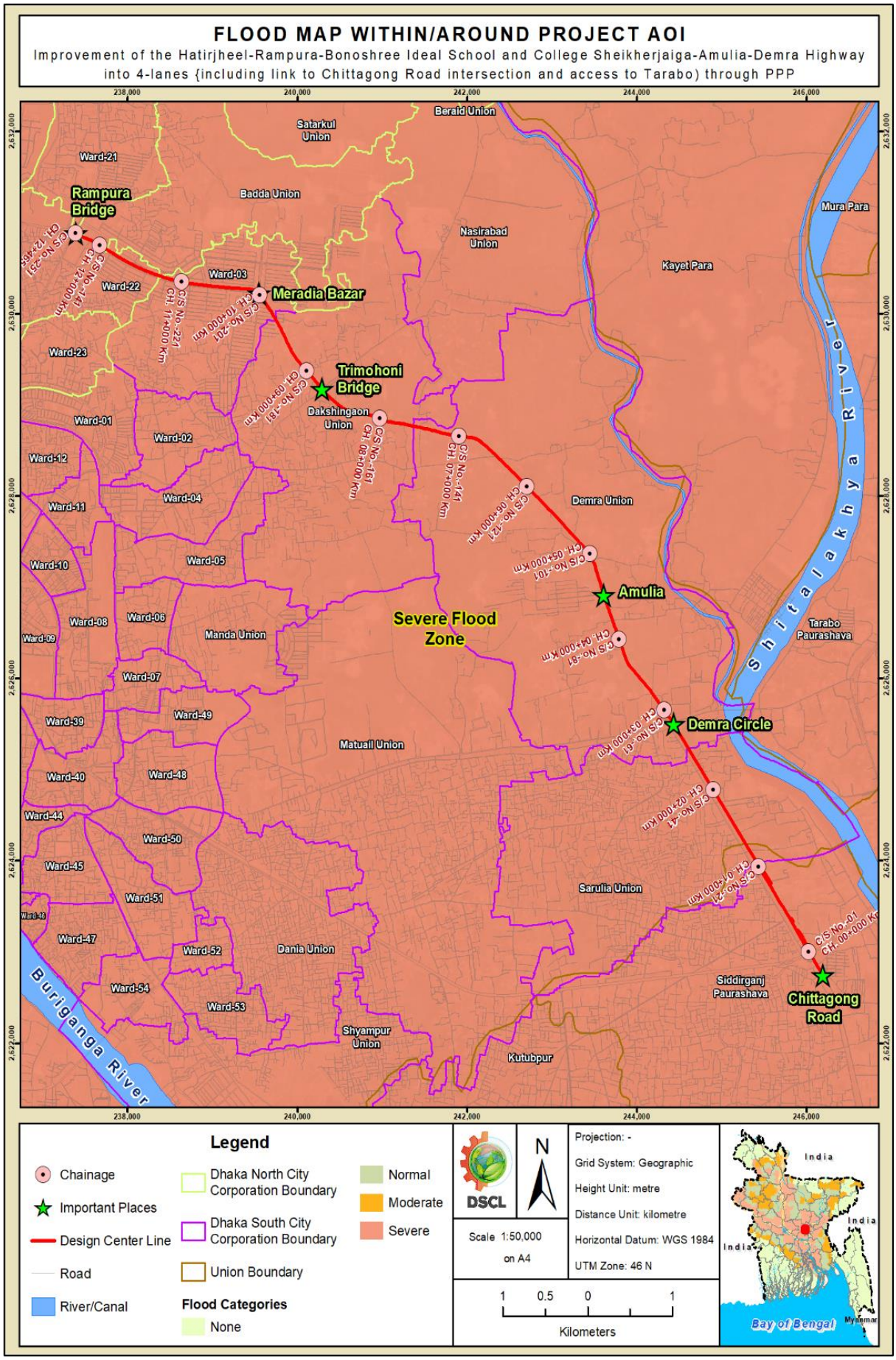


Figure IV.28: Flood zone around or within the Project AOI

13. Important Environmental and Social Features

A number of important environmental and social features have been identified adjacent to the alignment of the project design. The lists are given below. Detail list is presented in Appendix 4.

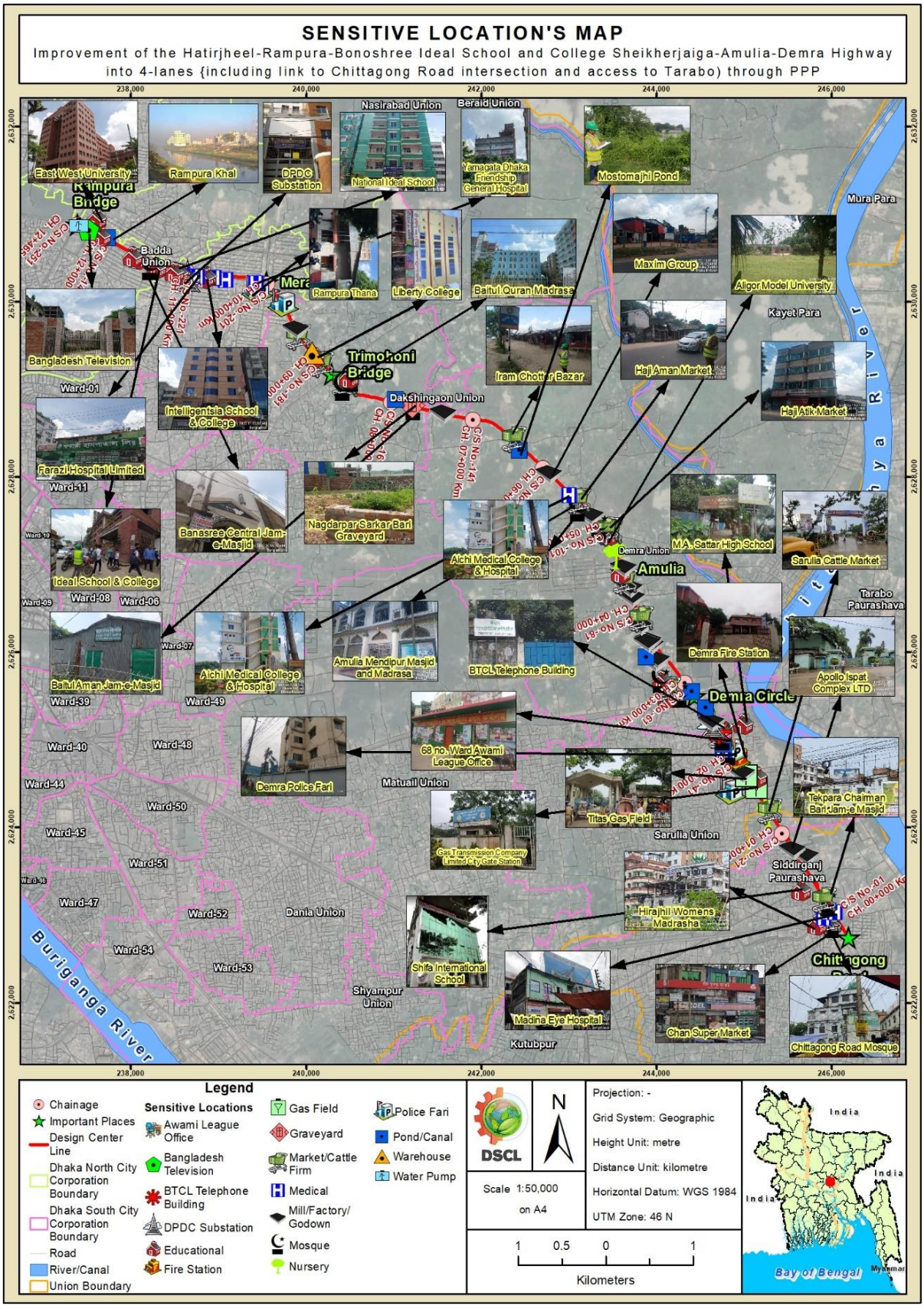


Figure IV.29: Sensitive Locations around or within the Project AOI

C. Biological Environment

1. Bio-Ecological Zone

184. Bangladesh's ecosystems can be divided into two categories: (i) land-based ecosystems and (ii) aquatic ecosystems. Forest and hill ecosystems, agro-ecosystems, and homestead ecosystems are land-based, whereas seasonal and perennial wetlands, rivers, lakes, coastal mangroves, coastal mudflats, chars, and marine are examples of aquatic ecosystems. Each of the ecosystems has many units with distinct characteristics as well. IUCN Bangladesh in 2002 classified the country into twenty-five bio-ecological zones. The project area falls into Brahmaputra-Jamuna Floodplain.

Figure IV.30: Bio-Ecological Zone within/ around Project AOI

185. **Brahmaputra-Jamuna Floodplain**: The Brahmaputra floodplain situated in greater Mymensingh and Dhaka districts comprises the active channel of the Brahmaputra River and the adjoining areas of the young floodplain lands formed since about 1780, when the river shifted to its present course (i.e., the Jamuna River) to the south of Dewanganj in Jamalpur district. The main river course is strongly braided and consists of several interconnecting channels. This floodplain posse a unique variety of plants, medicinal herbs, fruit yielding trees, many jungle shrubs, creepers and climbers, flowering trees etc., many of which yield valuable products. Bushes of reeds and canes are

also found here. The faunal diversity in this zone is also rich. Leopard was frequently sited in this zone. The most common poisonous snake is the Banded kraitin this area, which could easily be identified by its broad black and yellow bands (IUCN, 2002f).

2. Biodiversity of Flora and Fauna

186. The main objectives of the flora and fauna survey are:

- Using various conventional approaches, assess the status of important floral and faunal components of all terrestrial habitats (forest, grassland, fallow land, riverine land, agroecosystem, and homestead plantation) present in the Project AOI (containing the project site);
- Secondary data on the status of floral and faunal components and habitats are being collected and compiled from interested parties such as the Forest Service and others. Provide quantitative information on different floral and faunal components: using statistical analysis and deriving diversity indices;
- Identification and listing of floral and faunal species of conservation significant (rare, endangered and threatened – RET species and endemic species in accordance with International Union of Conservation for Nature - IUCN RED List) if any in the Project AOI;
- Assess the status of floral components (macro and microflora) of perennial aquatic habitats (lake, reservoirs/dams, and rivers) present in the Project AOI adopting standard techniques.
- Since some parts of the location near Demra is wholly and intensively rural, much of the natural ecosystem remains intact. Herbs, shrubs, and trees are among the many types of vegetation. The project is not likely to harm terrestrial flora because its activities have been substantially similar to those in the area over the last few decades. The ecological survey was conducted in two ways; i) Transect walk along the project intervention area ii) Quadrat method on sample basis.

a) Quadrats

187. A total of 4 grids (size: 50 m × 50 m) were selected to study floral composition. A total of 2 days was spent in the field. The observation started early in the morning and ended in the late afternoon each day. For later identification, unidentified vegetation species were collected (seed, flower, or leaf). The micro-level approach mainly involved field-based primary data collection on different project objectives using well-established and accepted ecological methods in different habitats identified within the Project AOI. The field data collection mainly included biodiversity status assessment of different life forms of floral elements such as trees, shrubs, climbers, herbs, and grass (Figure IV-31).

Figure IV.31: Vegetation Survey using Quadrat Method

b) Transect Walk

188. Alongside Transect line and gridding methods, surveyors performed transect walking to identify floral species. These random transect walks were done in-between the quadrat exercises (Figure IV-32).

Figure IV.32: Transect Walk along Project Location

189. Quantitative Plant surveys were conducted in two habitats to enumerate the vegetation occurring within the Project AOI. The proposed area mainly harbors naturalized shrubs, herbs, and grasses. The region is highly diversified in terms of vegetation. Since there is no single satisfactory book of red lists in Bangladesh, we used the categories identified by various papers with references for threatened species listing. Below table presents the detailed information of the quadrat survey conducted in the field. The quadrats include Homestead, roadside, riverine/aquatic vegetation, and agricultural vegetation. From the Survey analysis, Mahagony has been found as the most dominant tree species in the entire project location.

Table IV-15: Detail Quadrat Information for Floral Survey

S/N	Location	Types of Habitats
1	**Beside Iram Chattar Bazar, Mostam majhi Mor** Near C/S No.-134 CH. 06+650 km	Roadside, Homestead
2	**Beside Sarulia Bazar** Near C/S No.-50 CH. 02+450 km	Roadside, Homestead

Homestead Plantation

190. A list of plants found at homesteads of the project area is given in below table and figure.

Table IV-16: Common Plants Found in The Backyards of Homesteads of the Project Area

Bengali/ Local Name	Scientific name	Family	Uses/importance
Aam	*Mangifera indica*	Anacardiaceae	Fruits, timber, fuel, furniture
Lau	*Lagenaria siceraria*	Cucurbits	Vegetable
Bel	*Aegle marmelos*	Rutaceae	Fruits, herbal medicine
Neem	*Azadirachta indica*	Meliaceae	Medicine, Wood
Kathal	*Artocarpus heterophyllus*	Moraceae	Fruit
Khejur	*Phoenix sylvestris*	Palmae	Juice, fruits, fuel, fence, Basket
Narikel	*Cocos nucifera*	Palmae	Fruits, drinks, fuel, fence, handicrafts
Peyara	*Psidium guajava*	Myrtaceae	Fruits, jelly, fuel, tools
Supari	*Areca catechu*	Palmae	Fruits, fuel, pole, window rod
Tetul	*Tamarindus indica*	Leguminosae	Fruits, medicine, timber, fuel
Mishti Kumra	*Cucurbita moschata*	Cucurbitaceae	Vegetable
Kola Gach	*Musa acuminata*	Musaceae	Fruit

Bengali/ Local Name	Scientific name	Family	Uses/importance
Palong	*Spinacia oleracea*	Amaranthaceae	Vegetable
Peyara	*Psidium guajava*	Myrtaceae	Fruit

Banana

Mango

Figure IV.33: Commonly Found Homestead Plants in the Project Area

(Source: Survey Team 2022)

Roadside Plantation

191. *Terminalia arjuna* (Arjun), *Lannea coromandelica* (Jiol), *Tectona Grandis* (Segun) etc., were found as the most common roadside plantation. A list of homestead and roadside plats is presented in below table.

Shrub

Teak

Almond

Bombax

Damiana

Coral Swirl

Shrub

Gmelina

Banana Tree

Lebbeck

Water Hycinths

Banyan Tree

Periwinkle

Tropical milkweed

Royal poinciana

Taro

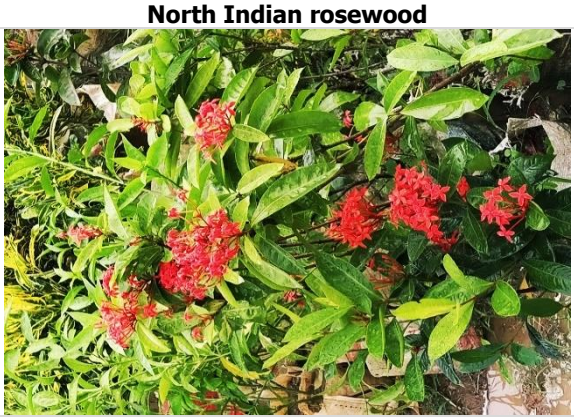
Mimosa Plant

Flea Tree

Poinsettia

North Indian rosewood

Climbing hemp vine

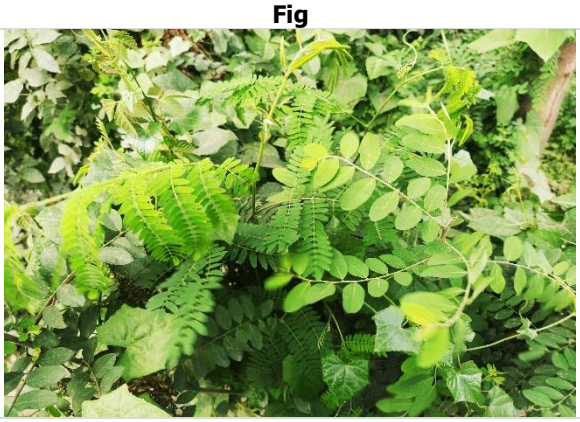


Ixora

Mango

Fig

Golden Trumpet



Mimosa Plant

Thumbai

Figure IV.34: Commonly Found Roadside Plants in the Project Area

(Source: Survey Team 2022)

Table IV-17: List of Roadside and Homestead Plantation Found in the Project Area

Scientific Name	Local Name	English	Types	Use	Indigenous	IUCN Red Book Status	Indigenous/ Exotic
Mangifera indica	Aaam	Mango	Fruit-bearing tree	Food	Indigenous	LC	Endemic
Ziziphus izyphus	Boroi	Jujube / Chinese date	Fruit-bearing tree	Food	Indigenous	LC	Endemic
Syzygium jambos	Amruj	Rose Apple	Fruit-bearing tree	Food	Indigenous	LC	Endemic
Artocarpus heterophyllus	Kathal	Jackfruit	Fruit-bearing tree	Food	Indigenous	LC	Endemic
Albizia lebbeck	Shirish	Flea Tree (Rain tree)	Wood	Timber	Indigenous	LC	Endemic
Ficus benghalensis	Bot Gaach	Banyan	Woody tree	Timber	Indigenous	LC	Endemic
Phoenix dactylifera	Khejur	Date	Fruit-bearing tree	Food	Indigenous	LC	Endemic
Swietenia macrophylla	Mahagony	Spanish Mahagoni	Woody tree	Timber	Exotic	VU	Endemic
Dalbergia sissoo	Sishoo	North Indian rosewood	Fuelwood	Fuelwood	Exotic	LC	Endemic
Azadirachta indica	Neem	Neem	Mdicinal	Medicinal	Indigenous	LC	Endemic
Neolamarckia cadamba	Kadam	Burflower-tree	Medicinal and Fuelwood	Medicinal and Fuelwood	Indigenous	LC	Endemic
Moringa oleifera	Shojona	Drumstick tree	Vegetable	Food	Indigenous	LC	Endemic
Spondias mombin	Amra	Hog Plum	Fruit-bearing tree	Food	Indigenous	LC	Endemic
Cocos nucifera	Narkel	Coconut	Fruit-bearing tree	Food	Indigenous	LC	Endemic
Dillenia indica	Chalta	Elephant Apple	Fruit-bearing tree	Food	Indigenous	LC	Endemic
Albizia lebbeck	Koroi	Lebbeck	Timber	Timber	Indigenous	LC	Endemic
Delonix regia	Krishnachura	Royal poinciana	Flower and Timber	Timber	Indigenous	LC	Endemic
Prunus dulcis	Kathbadam	Almond	Fruit-bearing tree	Food	Indigenous	LC	Endemic
Tectona grandis	Kathgaach	Wood Tree	Wood	Timber	Indigenous	LC	Endemic
Eucalyptus globulus	Eucalyptus	Bluegum	Wood	Timber	Indigenous	LC	Endemic
Mimosa pudica	Lojjaboti	Mimosa plant	Bush		Indigenous	LC	Endemic
Ixora chinensis	Lal Rongon	Ixora	Flower Bearing tree	Flower	Indigenous	LC	Endemic
Wrightia antidysenterica	Shwet Dyuti	Coral Swirl	Flower Bearing tree	Flower	Indigenous	LC	Endemic
Turnera diffusa	Damiana	Damiana	Flower	Medicinal	Indigenous	UC	Endemic
Catharanthus roseus	Nayantara	Periwinkle	Flower Bearing tree	Flower	Indigenous	LC	Endemic
Colocasia esculenta	Kochu Gach	Taro	Vegetable	Food	Indigenous	LC	Endemic

Scientific Name	Local Name	English	Types	Use	Indigenous	IUCN Red Book Status	Indigenous/ Exotic
Eichhornia crassipes	Kochuripana	Water Hyacinths	Aquatic plant		Indigenous	LC	Endemic
Lannea coromandelica	Ziga	Indian Ash Tree	Medicinal	Medicinal	Exotic	LC	Endemic
Lagenaria siceraria	Lau	Bottle gourd	Vegetables	Food	Indigenous	LC	Endemic
Lablab Purpureas	Shim	Bean	Vegetables	Food	Indigenous	LC	Endemic
Musa acuminata	Kola	Banana	Fruit-bearing tree	Food	Indigenous	LC	Endemic
Polyalthia longifolia	Devdharu	Monoon longifolium	Woody tree	Timber	Indigenous	LC	Non-Endemic
Leucas Aspera	Dhulpi	Thumbai	Flower	Flower	Indigenous	VU	Endemic
Litchi chinensis	Lichu	Lychee	Fruit-bearing tree	Food	Indigenous	VU	Endemic
Terminalia arjuna	Arjun	Arjun tree	medicinal	Medicinal	Exotic	VU	Endemic
Averrhoa bilimbi	Bilombo	Cucumber tree	fruit-bearing tree	Food	Exotic		Non-Endemic
Lannea coromandelica	Jiol	Indian ash tree	Woody Tree	Timber	Indigenous	LC	Endemic
Tectona Grandis	Shegun	Teak	Woody tree	Timber	Exotic		Endemic
Streblus asper	Shaora	Toothbrush tree	Shrub	papermaking	Exotic	LC	Endemic
Bombax ceiba	Shimul	Cotton tree	Cotton Tree	Cotton	Exotic	LC	Endemic
Allamanda cathartica	Alkananda	Golden Trumpet	Flower bearing tree		Indigenous	LC	Endemic

*** Abbreviation:** UC = Uncommon, VC = Very Common, C = Common, F = Few, O = Occasional, CR = Critically Endangered, EN = Endangered, Vu = Vulnerable, LC = Least Concern, DD = Data Deficient, M = Migratory, R = Resident, Bh = Bush, Op = Open place, Hh = Human habitation, Cl = Cultivated land, Tt = Tall tree, H = Hole, R = River, P = Pond, C = Canal, Dt = Ditch, We = Water edge.

c) Fauna

192. Faunal studies were undertaken in the Project AOI by opportunistic search methods where habitats of the different faunal species were repeatedly visited twice to confirm their presence and usage. The focus was on the larger animals under threat of frequent urbanization and industrialization in the area. The target faunal species studied are Mammals, Avifauna, Reptiles, and Amphibians. Cows, goats, dogs, cats, mules are found in the study area during the visit. No wild fauna was found in the study area. Cow (*Bos Taurus*), Goat (*Capra aegagrus hircus*), Dogs (*Canis lupus familiaris*) were seen on the road.

Cow

Crow

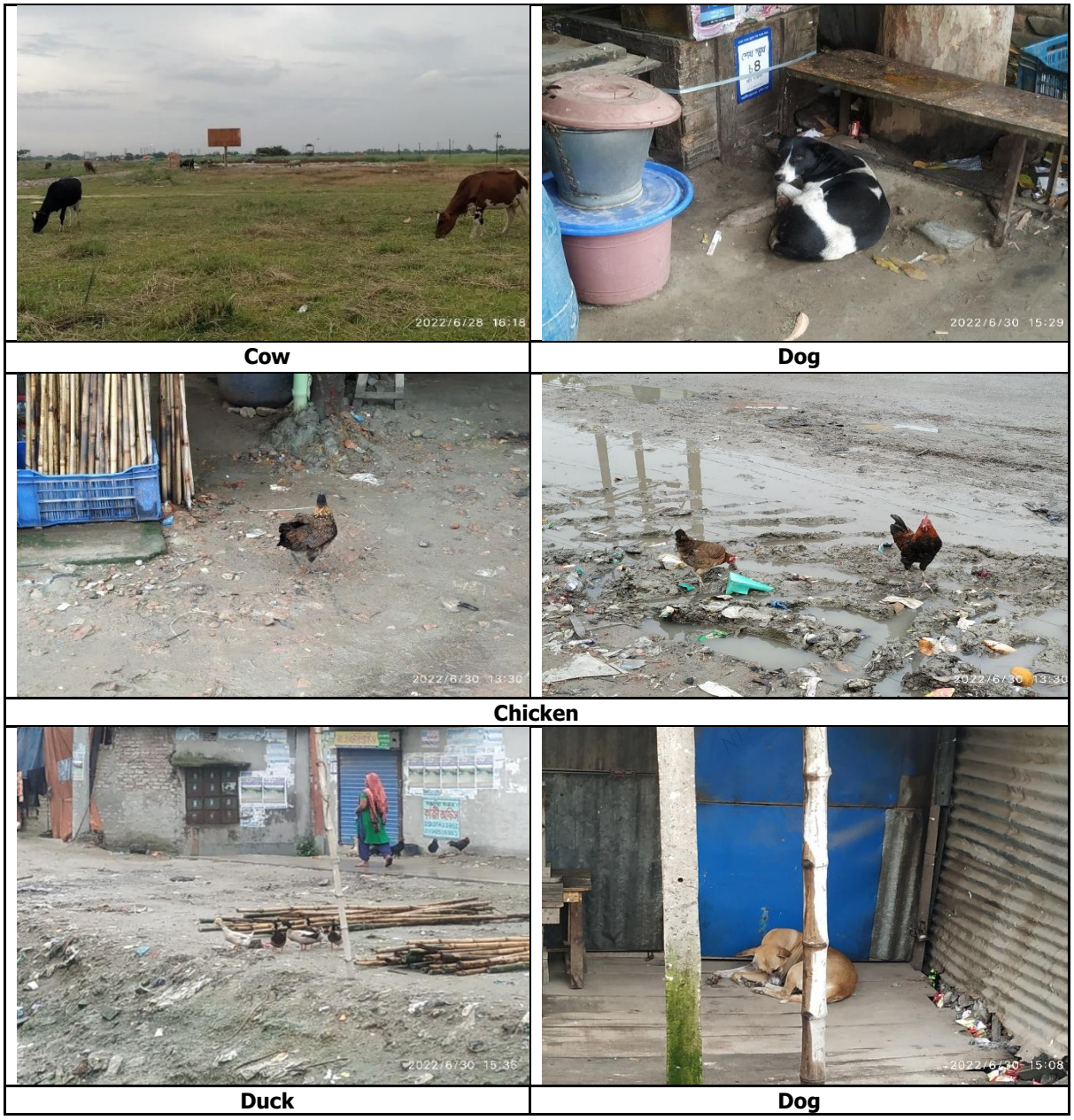


Figure IV.35: Commonly found Fauna in the Project Area

(Source: Survey Team 2022)

Table IV-18: List of Fauna found in the Project AOI and their Local IUCN Status

Scientific Name	Name	IUCN Redbook Status*	Habitat*
Pteropus giganteus	Bat	LC	Tt
Gallus gallus domesticus	Chicken	LC	H
Cygnus	Swans	LC	Tt
Anatidae	Duck	LC	Tt
Bos Taurus	Cow	LC	Hh
Capra aegagrus hircus	Goat	LC	Op
Corvus splendens	Crow	LC	Tt
Canis lupus familiaris	Dog	VU	R

d) Fish Survey

193. The survey was conducted for 02 days in the adjacent fish markets. The two days were spent on reconnaissance surveys and primary survey purposes. During surveys, fishers' interviews were also conducted to understand their perceptions and thoughts of fishing techniques, fish availability, and the correlation of fish caught with the environment. Interviews also covered environmental considerations, e.g., environmental changes over the last 30 years and their correlation with a fish catch or migratory route.

Table IV-19: Location of Fisheries Survey

S/N	Location	GPS
1	Meradia Bazar, Rampura	23.761573°N, 90.444457°E
2	Shimrail Tekpara, Siddhirganj, Narayanganj	23.715648°N, 90.496814°E

194. Different fish species were observed and interviewed with fishers during the field survey during the fish market visit. Some figures are shown in Figure IV-36. A complete list of fisheries found in the project area is listed in Table IV-20.

Figure IV.36: Fisheries Survey within the Project Area

Table IV-20: List of Fisheries Species found in the Project AOI and their Local IUCN Status

Family	Scientific Name	English Name	Local Name	IUCN Red Book Status*	Remarks
Ambassidae	*Parambassis ranga*	Indian glassy fish	Chanda	LC	
Amblycipitidae	*Amblyceps mangois*	Indian Torrent catfish	Shing	LC	
Anguillidae	*Anguilla bengalensis*	Indian longfin eel	Bain	VU	
Anabantidae	*Anabas testudineus*	Climbing perch	Koi	LC	
Bagridae	*Mystus tengara*	Indian catfish	Tengra	LC	
	Sperata aor	long-whiskered catfish	Aair	VU	The status is old but at present these types are being cultured and become very common in and around the project area
	Rita rita	Rita	Ritha	LC	
Channidae	*Channa marulius*	Great snakehead	Gojar	EN	The status is old but at present these types are being cultured and become very common in and around the project area
	Channa striata	Snakehead murrel	Shol	LC	
	Channa punctata	Spotted snakehead	Taki	LC	
Cyprinidae	*Labeo bata*	Bata Labeo	Bata	LC	
	Ctenopharyngodon idella	Grass carp	Grass carp	VU	The status is old but at present these types are being cultured and become very common in and around the project area
	Labeo calbasu	Black Rui	kal Baush	DD	
	Labeo catla	Indian carp	Katol	LC	
	Hypophthalmichths molitrix	Common carp	Silver Carp	DD	
	Puntius chola	Swamp barb	Puti	LC	
	Labeo rohita	Ruhi	Rui	LC	
	Puntius Sarana	Olive barb	Sorputi	LC	
	Cirrhinus cirrhosus	Cauvery white carp	Mirka	LC	
Notopteridae	*Notopterus chitala*	Chital	Humped Feather back	EN	The status is old but at present these types are being cultured and become very common in and around the project area
Siluridae	*Ompok pabo*	Pabda	Pabo Catfish	EN	
Pangasiidae	*Pangasius pangasius*	Pangas	River catfish	EN	
Latidae	*Lates calcarifer*	Barramundi	Coral	EN	

Family	Scientific Name	English Name	Local Name	IUCN Red Book Status*	Remarks
Cichlidae	*Oreochromis niloticus*	Tilapia	Telapia	LC	
Penaeidae	*Fenneropenaeus indicus*	Prawn	Chingri	LC	
Siluridae	*Wallago attu*	Helicopter Catfish	Boyal	**LC**	

*** Abbreviation:** UC = Uncommon, VC = Very Common, C = Common, F = Few, O = Occasional, CR = Critically Endangered, EN = Endangered, Vu = Vulnerable, LC = Least Concern, DD = Data Deficient, M = Migratory, R = Resident, Bh = Bush, Op = Open place, Hh = Human habitation, Cl = Cultivated land, Tt = Tall tree, H = Hole, R = River, P = Pond, C = Canal, Dt = Ditch, We = Water edge.

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<tr><td>Indian carp</td><td>long-whiskered catfish</td></tr>
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<tr><td>Coral</td><td>Tilapia</td></tr>
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<tr><td>Spiny eel</td><td>Indian Torrent catfish</td></tr>
<tr><td> 
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</td></tr>
<tr><td>Climbing perch</td><td>Long-whiskered catfish</td></tr>
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Ruhi	**Silver cup**
	
Bata labeo	**Cauvery white carp**
	
Catla	**Prawn**
	
Cauvery white carp	**Shark Catfish**

Figure IV.37: Different Types of Fishes Observed in the Project AOI

3. Endangered Species & Red Book Species

195. There are no biodiversity receptors of international, national, state, or district importance, including protected areas, key biodiversity areas, forest areas around the identified proposed sites or along the alignments. There is no locally threatened species were found in the project AOI.

D. Socio-Economic Environment

196. It is essential for every development project, whether small or large, to understand the social, human and economic aspects of the primary stakeholders, i.e., people living in and around the project

site. The following tools and techniques were used to collect the relevant data/information on the social and economic aspects of affected people:

- Literature review;
- Group discussion;
- Socio-economic survey, and
- Informal meeting with various professionals.

197. In addition, data obtained from secondary sources were considered along with the primary data/information gathered during the study.

198. Data on population, age/sex composition, household patterns, and sources of drinking water, sanitation facility, and ownership of agricultural land were enumerated based on the primary data collected during the survey.

1. Administrative Structures

199. The study area falls under Dhaka north city corporation, Dhaka south city corporation and Narayanganj Sadar upazila of Dhaka and Narayanganj district respectively. A brief detail of administrative setup of the study area is given below-

200. Dhaka north city corporation is a northern part of Dhaka City under the Dhaka district covering a total of 196.22 sq. km, located in between 23°44' and 23°54' north latitudes and in between 90°20' and 90°28' east longitudes. It is bounded by Tongi town (upazila) on the north, Dhaka South City Corporation on the south, Rupganj upazila on the east and Savar upazila on the west. Rampura thana was formed on 2 August 2009 and this is a very densely populated area.

Table IV-21: Administrative description in project affected areas of Dhaka North City Corporation

City Corporation	Zone	Ward	Location name	Total population	Sex Ratio	Population density (Sq. Km)
Dhaka North City Corporation	03	22	Rampura	224079	113	72753

201. Dhaka South City Corporation is one of the two municipal corporation of Dhaka City under the Dhaka district covering a total of 109.251 sq. km, located in between 23°43'26" and 23.72396° north latitudes and in between 90°24'31" and 90.4085° east longitudes. It is bounded by Dhaka North City Corporation on the north, Siddhirganj upazila on the south, Rupganj upazila on the east and Keraniganj on the west.

Table IV-22: Administrative description in project affected areas of Dhaka South City Corporation

City Corporation	Zone	Ward	Location name	Total population	Sex Ratio	Population density (Sq. Km)
Dhaka South City Corporation	06	70	Demra	226679	116	10129

202. Narayanganj Sadar is a Sub-district of Narayanganj district covering a total of 113.98 sq. km, located in between 23°44' and 23°54' north latitudes and in between 90°20' and 90°28' east longitudes. It is bounded by Dhaka district to the north and west, Munshiganj to the south and Shitalakshya river to the east. The Buriganga river flows through some areas of the western border and the Dhaleswari river flows through the southwestern region. Siddhirganj Union under the Narayanganj Sadar is among the affected areas. .

Table IV-23: Administrative description in project affected areas of Siddhirganj

Upazila	Union	Total Population	Sex Ratio	Population Density (Sq. Km)
Narayanganj Sadar	Siddhirganj	96222	126	8154

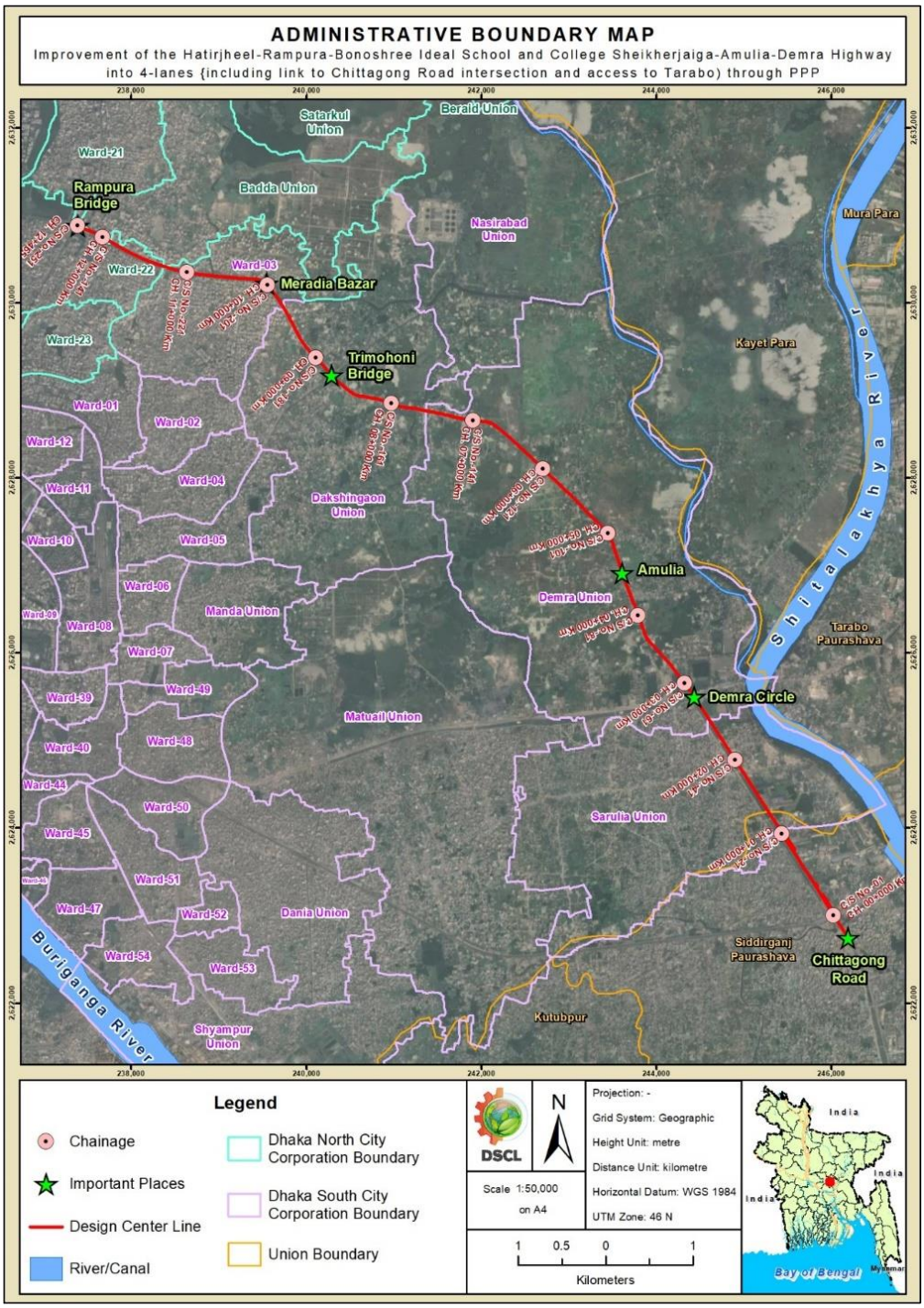


Figure IV.38: Administrative Map of the Project Area

2. Quality of Life Indicator

203. Socio-economic profile of the affected area is analyzed based on religion, HH size, level of education, occupation, per capita income and marital status etc. A socio-economic survey has been carried out and done necessary analysis to find out the status of the affected area during the field visit

in June 2022. Analysis result depict that majority percent HHs have 2 to 4 members. A total of 98.07% of the PAPs are followers of Muslim religion. The education level of the project area is in consequence with the national education level; higher number of pupils enters primary and secondary education and the rate then sharply decreases as it comes to higher education. Unemployment rate is higher in this region as women are mostly housewives and they share the majority of the population as most of the people are married.

a) Distribution of HH Population

204. Distribution of HH population among 1041 affected HH is presented in the Figure IV-39. It indicates that majority of the HHs have 2-4 members. It is interesting that 36% HHs have only 1-2 members. HH size of within 9 to 10 members was absent in the area. Therefore, average HH population in this area is not large.

Figure IV.39: Distribution of HH Population

b) Gender Distribution of Household Heads (HHs)

205. The gender distribution of the project area is represented in a pie diagram in Figure IV-40. It corresponds that among 1041 HHs only 5% of the project affected HHs are headed by female members whereas male headed 95% are headed by males. The project area lacks gender parity and this will be further validated by the picture of gender wise population distribution according to education level of the area.

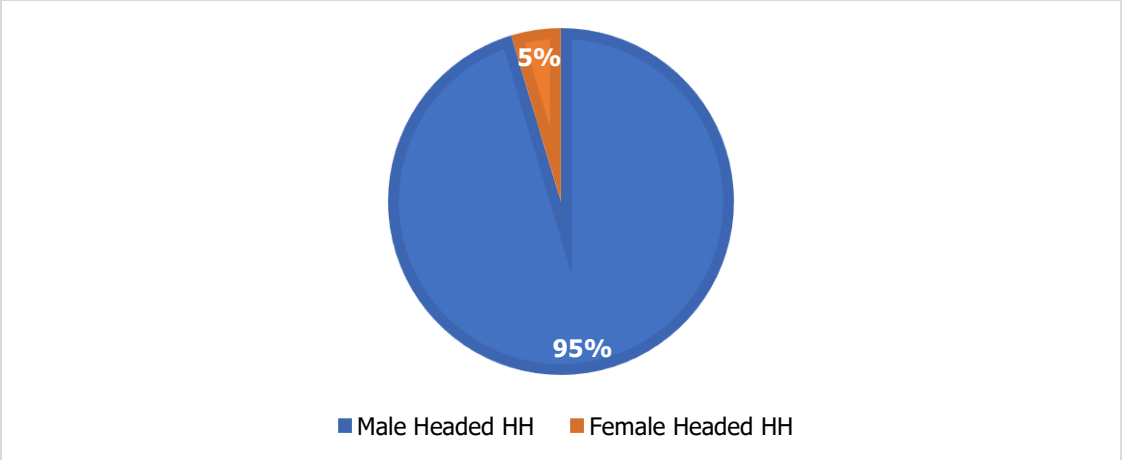


Figure IV.40: HH Gender Distribution of Project Affected People

c) Sex Profile of Affected Population

206. Sex profile of the affected HHs has been illustrated in the Figure IV-40. It represents that among the 2810 affected persons, the percentage of male populations are greater than female in the project area where 54% are male and 46% are female. The overall male-female ratio of the project area is 100:118, which represents that percentage of female population in the project area is less compared to the male population.

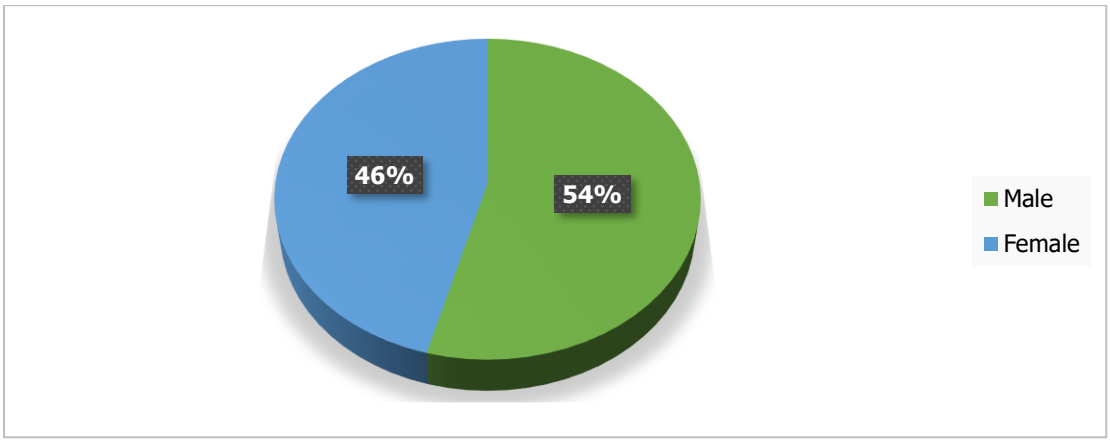


Figure IV.41: Sex Profile of Affected HHs

d) Affected HH Population by Age Structure

207. The Figure IV-42 discloses a very remarkable trend in age-sex distribution of the project-affected area where the total affected population is 2810. The figure shows that the highest population density has been found within the age limit of 35-59. Then, irrespective of gender, the curve sharply decreases to less than even 20% of the population of its preceding level. It represents that the area has low average life expectancy after 60 years of age and therefore may have health or nutrition issues to be addressed.

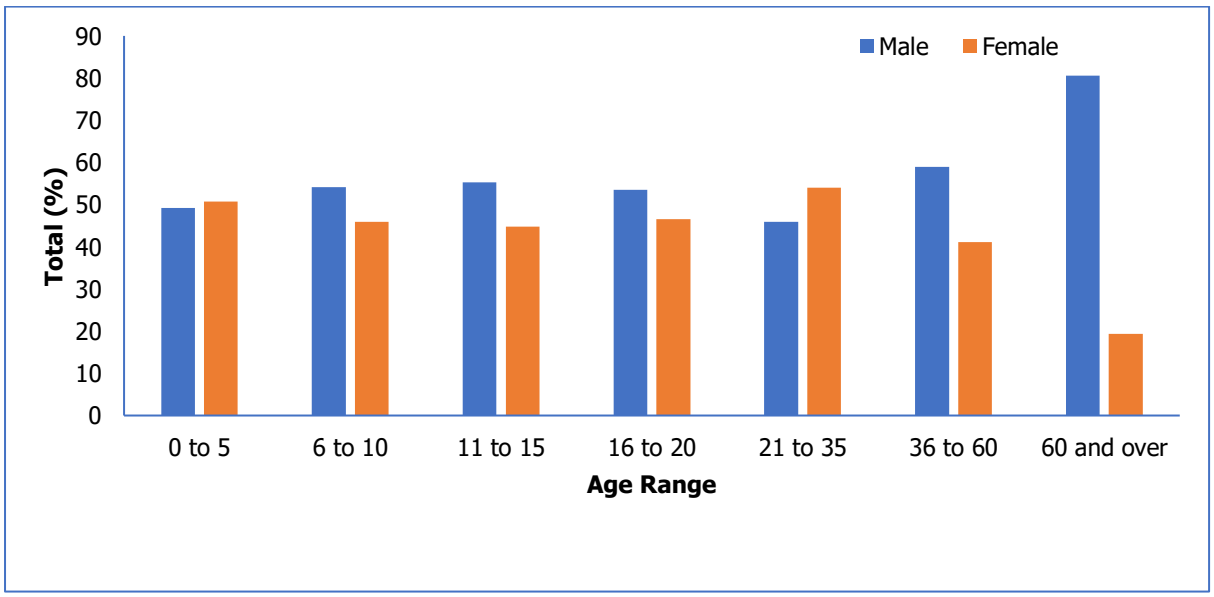


Figure IV.42: Age-sex Distribution of Affected Population

e) Religion of the Affected Population

208. The Figure IV-43 represents that most of the project- affected people are following Muslim religion (95.4%). Rest of the people are following Hindu and Christian religion. No other religious people have been found in the project affected area.

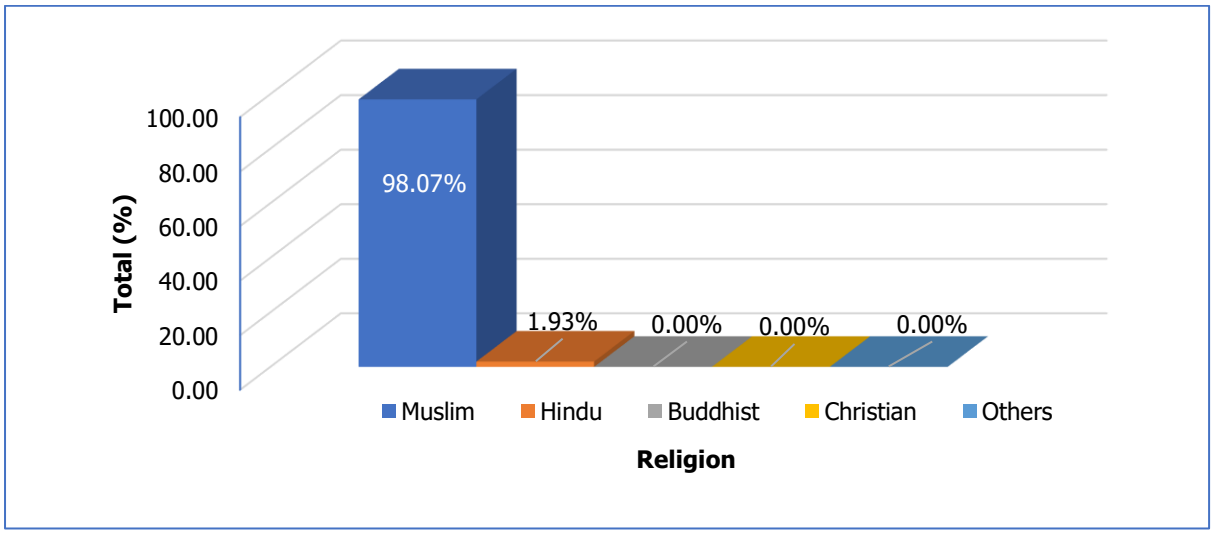


Figure IV.43: Population Distribution by Religion

f) Marital Status

209. The survey was designed, undertaken and collected data analyzed in a way which adequately identify gender differences and gender specific impacts. Presented in Figure IV-44 the distribution of total affected HHs population by marriageable age and their actual marital status; wherefrom is evident that among 2810 affected population, 85.1% of male aged above 21 years is married; compared to 90.1% married female aged 18 years or above. As against 14.3% unmarried male aged above 21 years, unmarried female aged 18 years or above only 7.6%. While only 0.5% male is widower, female widower is 1.9%. Total 7.9% male and 7.4% female are married while there were under legal marriageable age.

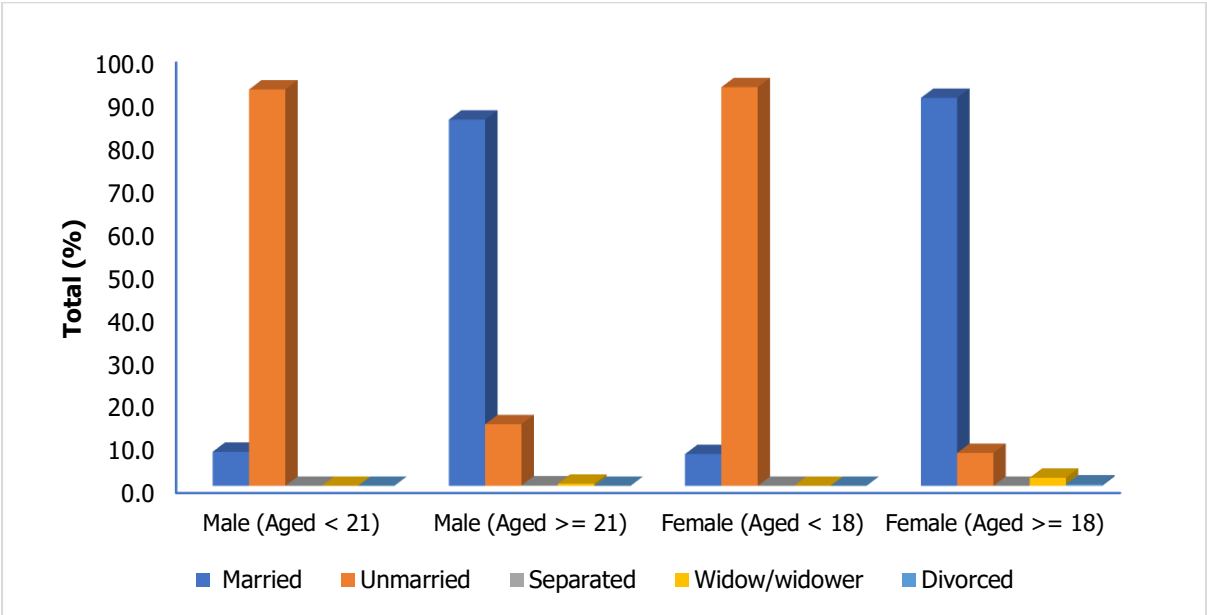


Figure IV.44: Age-marital Status Distribution of Affected Population

g) Education Level of Affected Population

210. The Figure IV-45 represents that picture of education level in the project area is similar to national level. That rate of population with primary and secondary level education is much higher compared to the pupils completing SSC or HSC, dropout rate continues to grow higher as it comes to higher studies. The total population (2810 affected population) drops to have passed at SSC and HSC and decreasing rate continues for advanced studies.

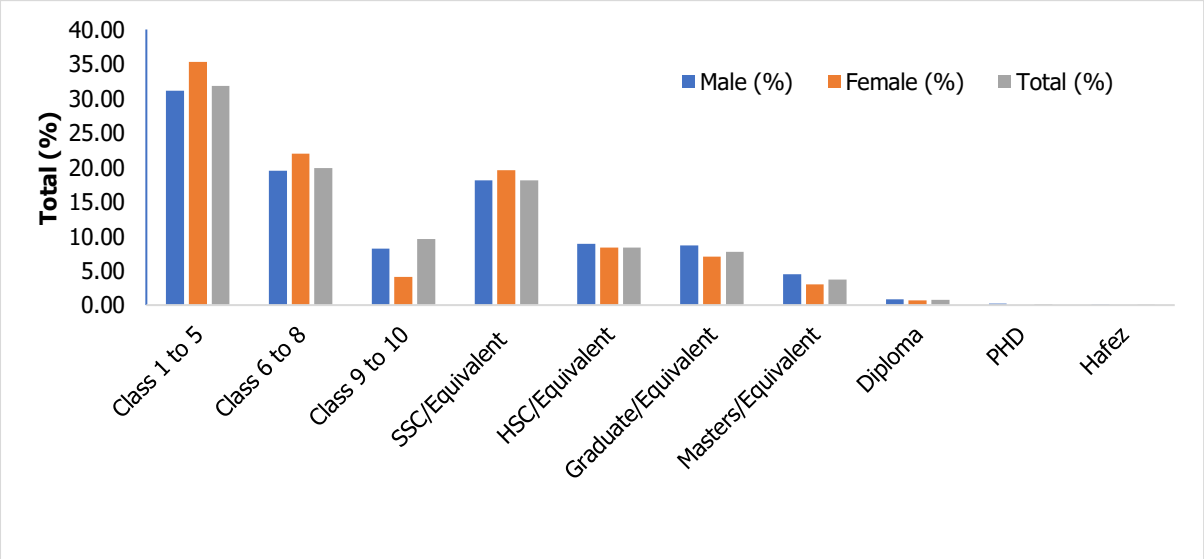


Figure IV.45: Level of Education of Affected Population

h) Occupation of the Affected HH Population

211. Figure IV-46 below presents the distribution of total population of the affected HHs; wherefrom is evident that about 30% affected people are shop/hotel owner, 27.7% are Worker, 25.4% businessmen, and 2.2% are jobless. People related to agricultural profession are about 3.5%.

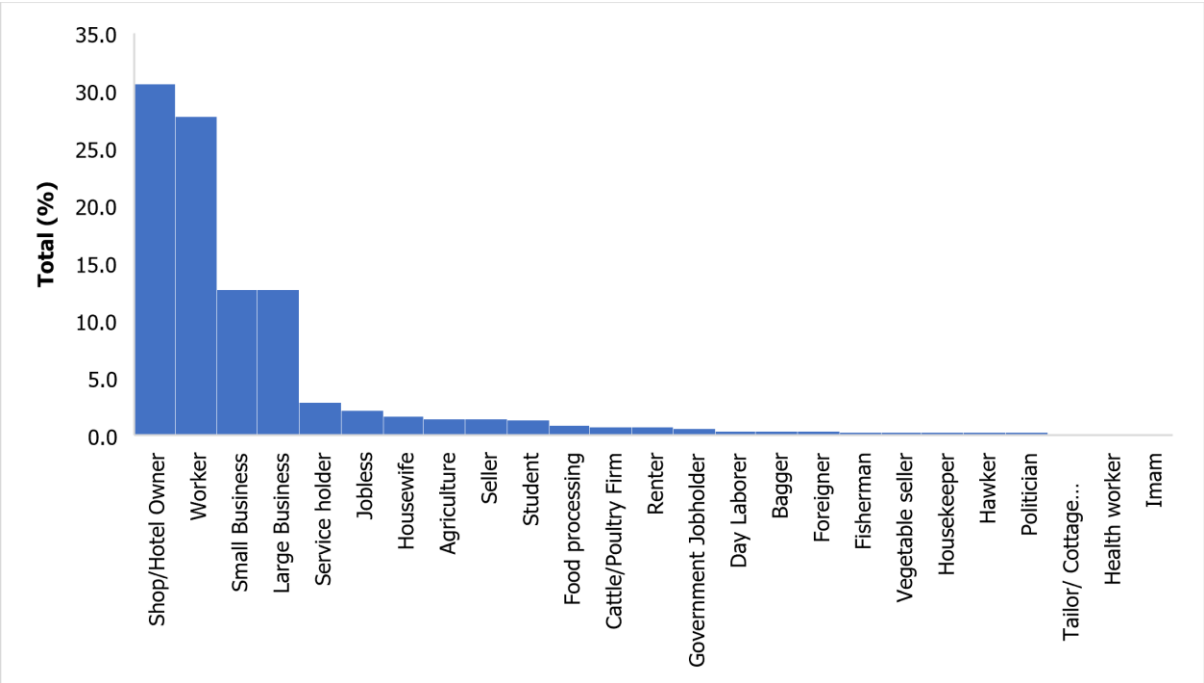


Figure IV.46: Distribution of Affected People by Occupation (15 years and above)

i) Income Level of the Affected HHs

212. As shown in Figure IV-46, the average monthly income of the affected HHs is BDT 27,742; while 71.5% HHs reported their monthly income ranged between BDT 15,000 to 30,000. While 27.2% HHs are within the range of monthly income BDT 30,000 to 45,000. Only 0.7% reported their monthly income is less than BDT 15,000.

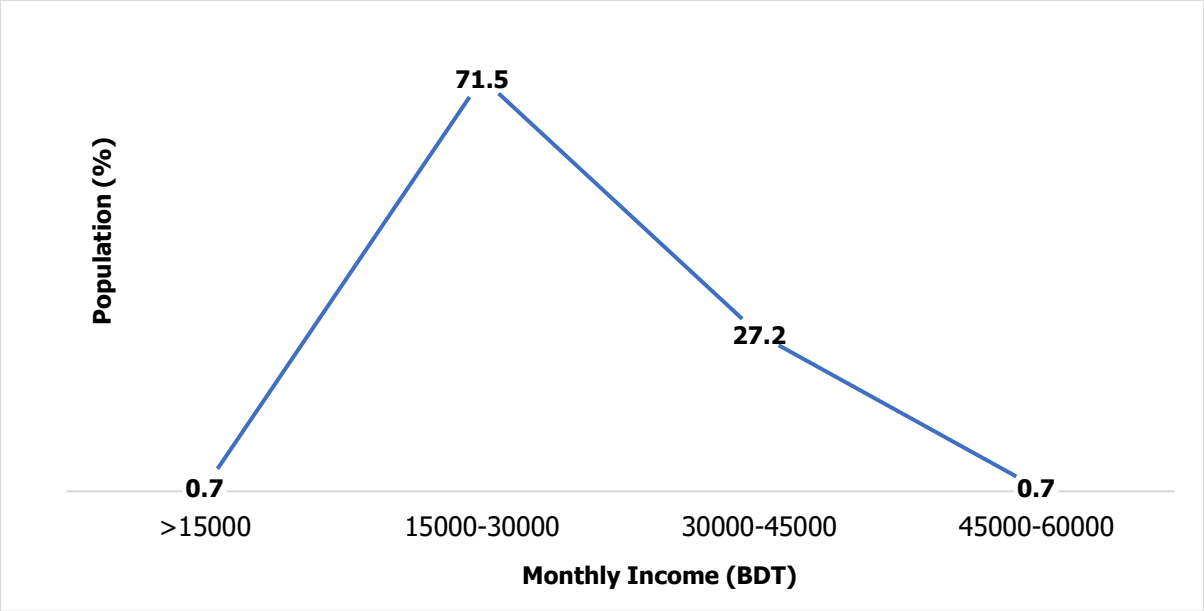


Figure IV.47: Monthly Income of Affected HHs

213. About 60.6% of the sampled HHs reported to have account with any Bank and over 39.4% HHs have any member associated with NGOs - about 9.1% with of BRAC, 4.5% with ASA, 7.6% with Grameen Bank, 6.1% with TMSS and so on.

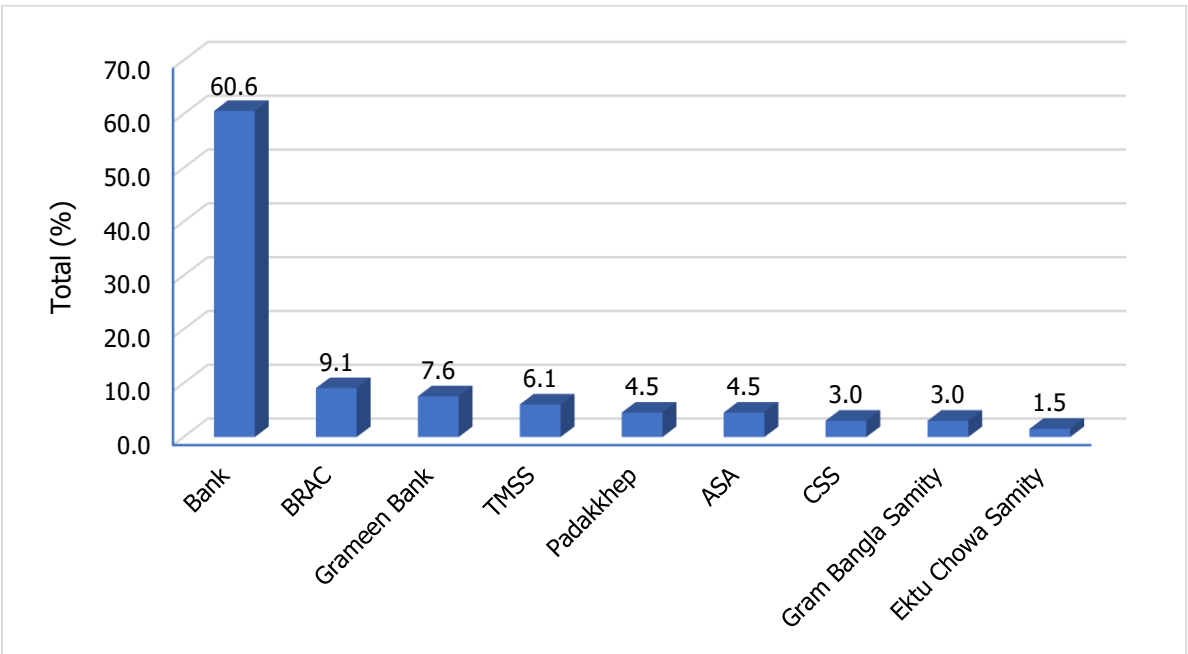


Figure IV.48: Distribution of Affected HHs by Involvement with Financial Services

j) Affected HHs by Amount of Own Land

214. Figure IV-49 shows that out of total surveyed HHs, about 33.5% HHs have 2 to 5 decimal lands, about 21.1% HHs have 2 to 5 decimal lands, about 19.3% HHs owning 1-2 decimal and 8.1% HHs own 0-1 decimal of land.

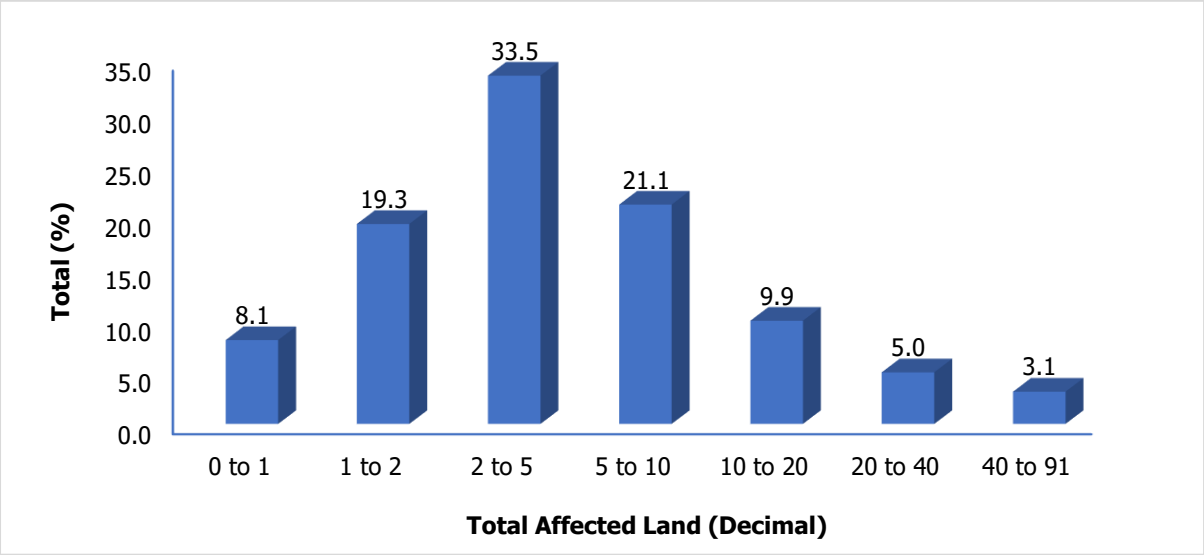


Figure IV.49: Distribution of Affected HHs by Amount of Own Land

k) Mostly Affected HHS Ratio

215. As per the socio-economic survey, the project mostly affected people would be the owner of the land (75% HHs). Around 8% women, 3% disabled people, 2% senior people, 1% child and 6% transport owner can be affected from project activities. In the project influence area, 50% project affected people living there from less than 20 years. Again, 28%, 6%, and 16% people living there from 20 to 40 years, 41 to 60, 61 to 95 years, accordingly.

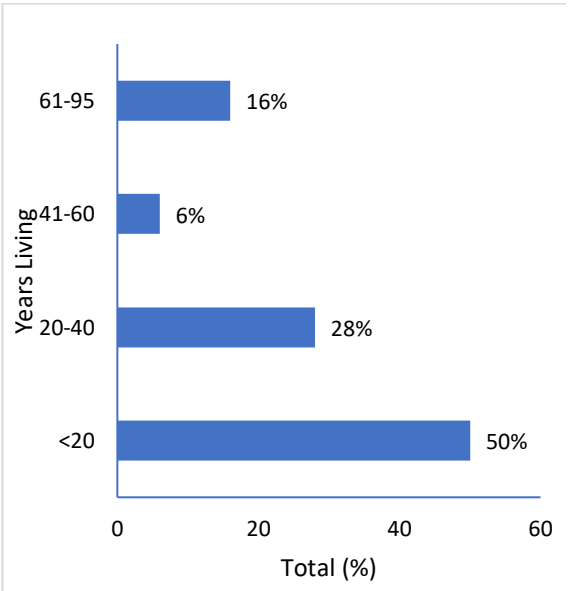


Figure IV.50: Distribution of affected HHs by Amount of Own Land

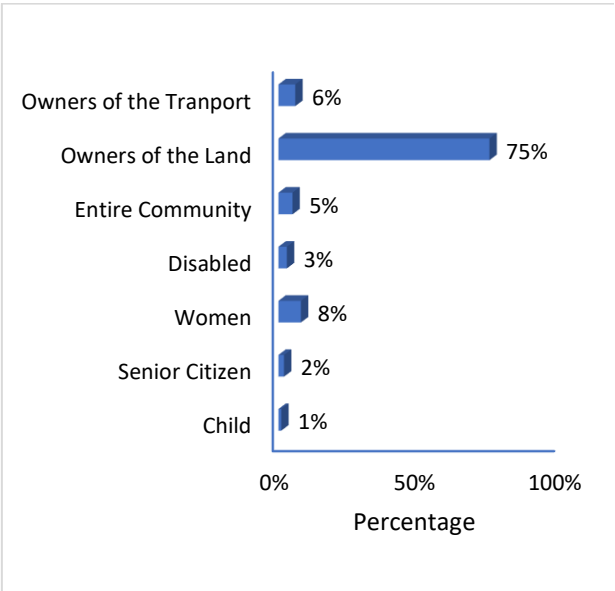


Figure IV.51: Distribution of Affected HHs By Amount of Own Land

I) Access to Drinking Water, Sanitation and Energy Sources

216. About 100% of sampled HHs in the project area reported use of drinking water from supply or pipe water. In the project affected area, 56% of sampled HHs reported pond/waterbody availabilities.

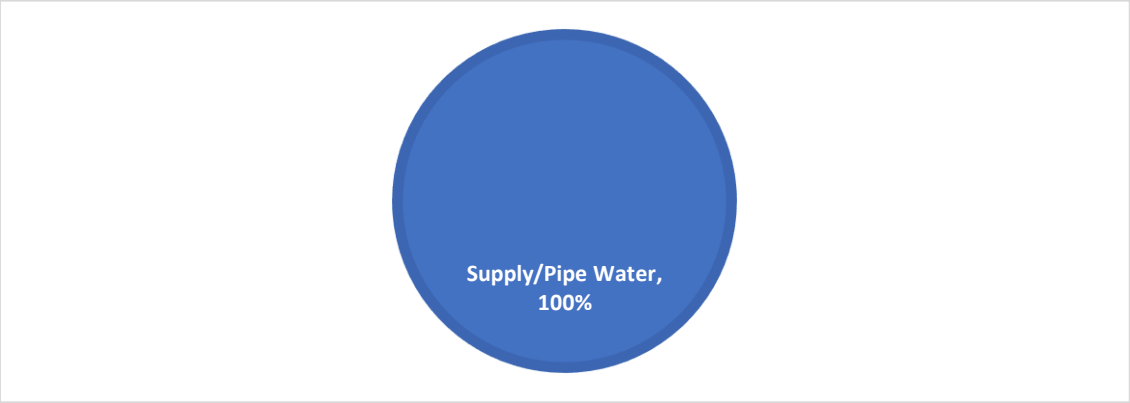


Figure IV.52: Distribution of Affected HHs by Drinking Water Sources

217. Despite the on-going GoB efforts to ensure safe sanitation of 100% HHs, about 99% HHs along the project road alignment are presently using sanitary latrines. Only 1% people use kacha latrines in the project affected area. In the case of solid waste management, 3% HHs from project affected area have no idea about SWM, while 97% people is familiar with this and some of them are practicing solid waste management in their households.

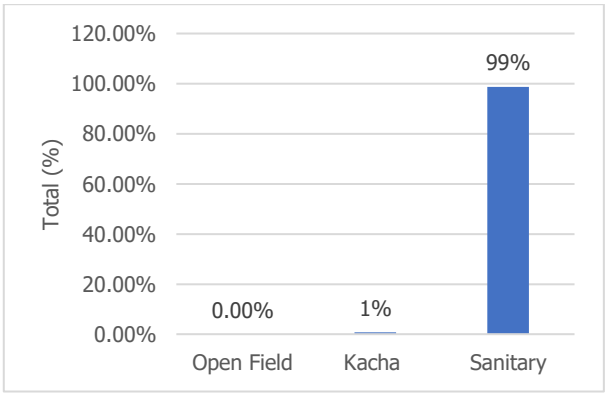


Figure IV.53: Distribution of Affected HHs by Sanitation Status

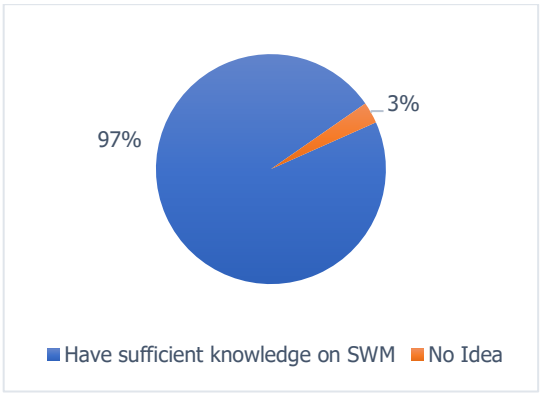


Figure IV.54: Distribution of Affected HHs by Knowledge about Solid Waste Management

218. Almost 99.9% of HHs along the project road alignment has access to electricity supply network as shown in Figure IV-54.

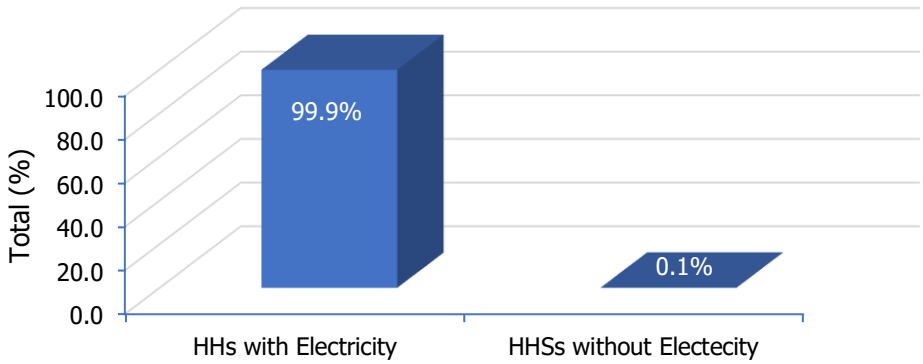


Figure IV.55: Distribution of Affected HHs by use of Electricity

m) Vulnerable HHs

219. Land acquisition will lead to physical and economic displacement at the individual, HH and community levels. However, the impact of land acquisition will have disproportionate impact on vulnerable and disadvantaged groups. Due to land acquisition and civil works, vulnerable groups may lose jobs and other income earning opportunities, land and homestead and forgo social networks with the wider community on whom they might depend. Appropriate long-term mitigation will be devised to eradicate the challenges faced by vulnerable groups or at the minimum ensure that they are at least as well off as before. Vulnerable groups would also include those farmers and individuals who (after acquisition of land) would become small/marginal farmers or landless.

220. Needs and concerns of the locals including disadvantaged groups like physically challenged individuals were incorporated. All remodeled bus stops shall have universal access (ramp) with railing to aid physically challenged persons. Provision of public amenities like toilets at bus shelter, drinking water, provision of streetlight in settlement areas, road safety during construction particularly at socially sensitive locations such as hospitals, schools, etc. were also incorporated.

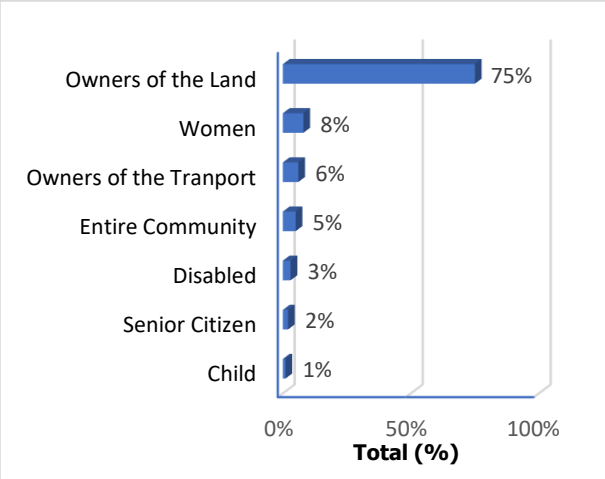


Figure IV.56: Distribution of Affected HHs by mostly Affected People Ratio

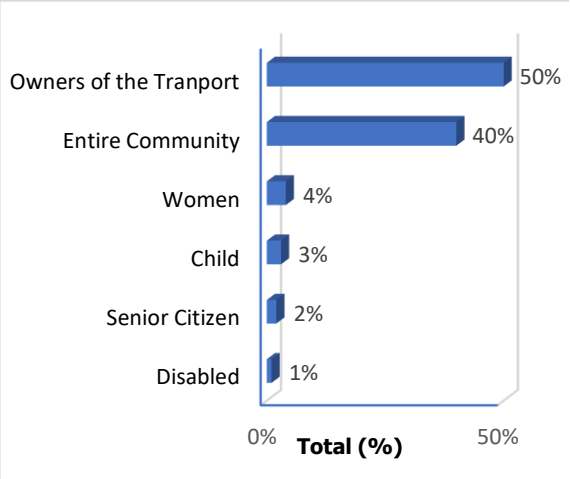


Figure IV.57: Distribution of Affected HHs by Beneficiary's Ratio

n) Disease Pattern in the Project Influence Area

221. As shown in Figure IV-57 below, about 32% of the sampled HHs reported to have cough/cold disease, 31% have reported diarrhea and over 29% HHs have suffered Dengue fever; other diseases reported by HHs are – Pneumonia, virus fever, allergy, and COVID-19.

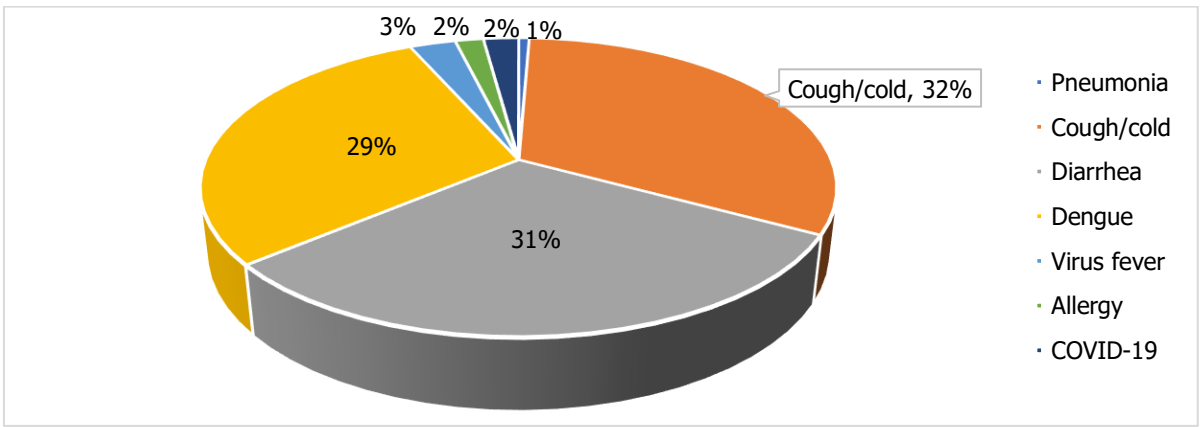


Figure IV.58: Distribution of Affected HHs by Disease Pattern

o) Health Service Providers Availability in the Project Influenced Area

222. Majority of HHs in the project affected area take health services from the private clinic (26.3%), district hospital (26%) and from qualified private physicians (25.4%). Remaining depends on upazila health complex, maternity clinic, community health clinic, quack, union health complex and NGO run health centers as shown in Figure IV-59.

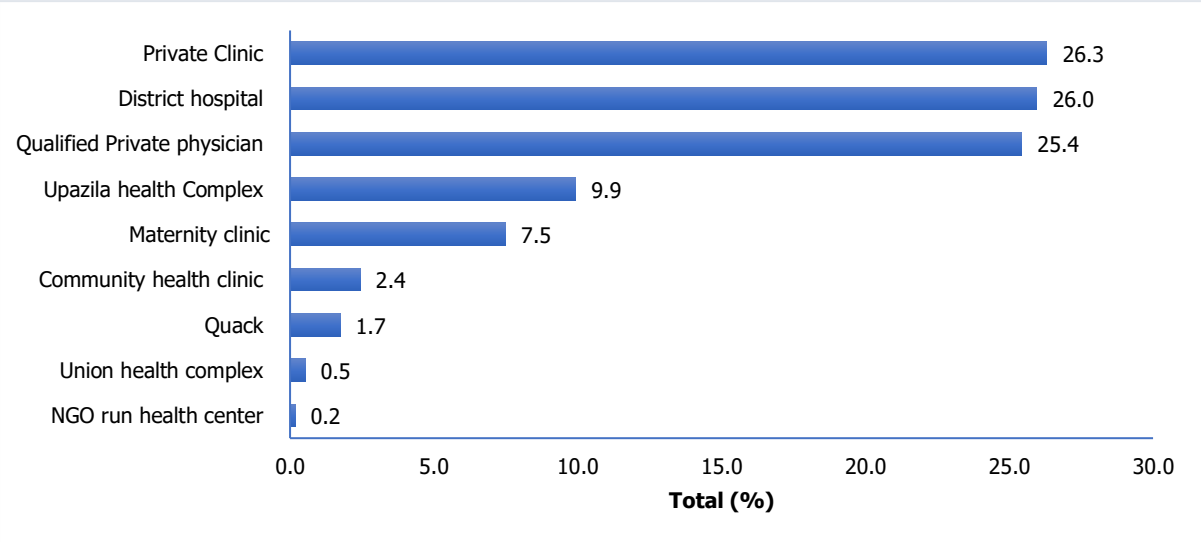


Figure IV.59: Distribution of Affected HHs by Health Service Providers Availability

p) Child Labor Status in the Project Influenced Area

223. According to Bangladesh Labor Law, 2006, the minimum legal age for employment is 14. Though, child laboring is strictly forbidden by GoB and AIIB guidelines, there are some child laboring issues in Bangladesh due to poverty. In the project influence area, child laborers are largely engaged in car workshops which is around 48.5%. They are also working as grocery storekeeper, Tempo (Three-Wheeler) driver/ helper, Construction worker, Day laborer, tea shopkeeper, Bus/Truck helper, and Garments worker.

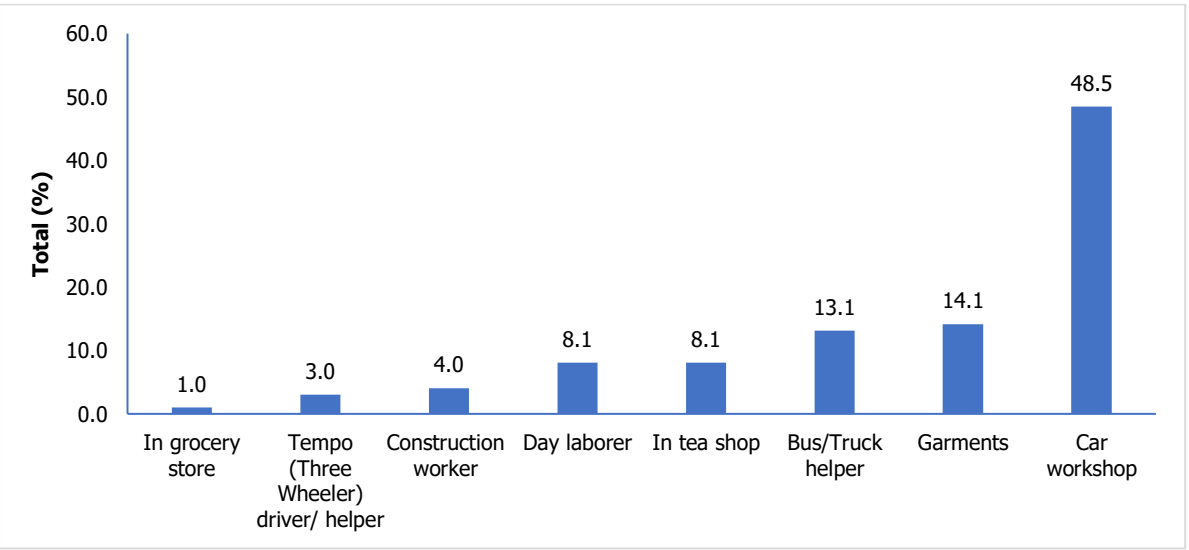


Figure IV.60: Child Labor Status in the Project Influenced Area

q) Cultural Property Resources (CPR)

224. Cultural property is a unique, nonrenewable resource that is important for learning about the diversity of human history and cultures. There are 31 CPR has been identified during the socio-economic field survey in June 2022. The detail list is presented below.

Table IV-24: List of CPR along the Alignment

Chainage	Dimension	Name of the CPR	Village Name	Ward	Union	Upazila
0+000-0+000	Left	Khankaye Jame Masjid	Chattogram Road	3	NCC	Siddhirganj
0+000-0+100	Right	Chattogram Road Police Box	Chattogram Road	1	NCC	Siddhirganj
1+100-1+200	Right	Demra Police Check Post	Golakata	67	DSCC	Demra
1+200-1+300	Left	NCC Gate	Golakata	67	DSCC	Demra
1+900-2+000	Left	Sarulia Jatri Chawni	Rani Mohal	68	DSCC	Demra
1+900-2+000	Left	Hazrat Khaja Sobahan Shah Darbar	Rani Mahal-67	67	DSCC	Demra
2+100-2+200	Right	Demra Fire Station	Sarulia	68	DSCC	Demra
2+200-2+300	Left	Bangladesh Awami League Office	Sarulia	68	DSCC	Demra
2+200-2+300	Right	Demra Police Fari	Sarulia, Demra Dhaka	68	DSCC	Demra
2+200-2+300	Right	Baitul Nazat Jame Masjid	Saruia, Demra, Dhaka	68	DSCC	Demra
2+300-2+400	Left	Demra DPDC Control Room	Sarulia	68	DSCC	Demra
2+500	Right	BTCL	68 Sarulia	68	DSCC	Demra
2+500-2+600	Left	WASA	Beside of the Sarulia Market	68	DSCC	Demra
2+600-2+700	Right	DPDC Ltd.	Demra Chourasta	68	DSCC	Demra
2+900-3+300	Right	Demra Chourasta Mor Jame Masjid	Demra Chourasta Mor Masjid	68	DSCC	Demra
5+100-5+200	Left	E-Haq School & College	Amulia Atik Market	70	DSCC	Demra
5+300-5+400	Left	Amulia Baitun Nur Jame Masjid	Amulia Baitun Nur Jame Masjid	70	DSCC	Demra
6+600-6+700	Left	6 No. BIT Police Office	Mostam Majhi	70	DSCC	Demra
7+600-7+700	Right	6 No. Bit Police Box	Nogdarpar	75	DSCC	Khilgaon
7+800-7+900	Right	Baitul Aman Jame Masjid	Nagdarpar	75	DSCC	Khilgaon
8+600-8+700	Right	Mosjid Akbor Jame Mosjid	Nondipara	74	DSCC	Khilgaon
10+100-10+200	Right	Waste Dumping	Demra Dutch Bangla Bank	2	DSCC	Rampura
11+100-11+200	Right	Bonoshree Traffic Police Box and Nagorik Sheba Center	TV Center	98	DSCC	Rampura
11+300-11+400	Right	Rampura Thana Police Help Desk	TV Center	98	DSCC	Rampura
12+300-12+400	Right	Tourist Police Box	TV Centre, Rampura Dhaka	98	DSCC	Rampura
12+400-12+500	Right	Rampura Jatri Chawni	TV Centre, Rampura Dhaka	98	DSCC	Rampura

Chainage	Dimension	Name of the CPR	Village Name	Ward	Union	Upazila
12+400-12+500	Left	Rampura BTV Bhaban	TV Centre, Rampura Dhaka	98	DSCC	Rampura
12+400-12+500	Right	Rampura Traffic Police Box	TV Centre, Rampura Dhaka	98	DSCC	Rampura
12+400-12+500	Right	Dhaka North City Corporation	TV Centre, Rampura Dhaka	98	DSCC	Rampura
12+400-12+500	Right	Bangladesh Awami Motor Chalak League	TV Centre, Rampura Dhaka	98	DSCC	Rampura
12+400-12+500	Right	Rampura TV Bhaban Panir Pump	Rampura	98	DSCC	Rampura

V. ANALYSIS OF ALTERNATIVE

A. General

225. Project alternatives have been studied as a part of this EIA process. Alternative analysis has been conducted in detail to foresee environment, economic and social impact of each alternative. This chapter also provides an overview of the various commercially available technologies for the treatment of sewage in an environmentally sound manner and are successfully running in developed countries in particular and recommend the most suitable set of options for the project area keeping in view its land requirement, energy consumption, complexity of operations, and handling.

226. The construction of the proposed project is based on national and international regulations focusing on assessing the city requirements with regards to the transport issue and then determining the most suitable and effective technology and location for construction of the required infrastructure.

227. This process of analysis of the different alternatives for Improvement of the Hatirjheel-Rampura-Bonoshree Ideal School and College Sheikherjaiga-Amulia-Demra Highway into 4-lanes (including link to Chattogram Road intersection and access to Tarabo) through PPP ensures that a well-informed decision is taken regarding the selection of the most optimal option amongst the possible options that are brought into consideration.

B. No Project Alternatives

228. From a purely physical and environmental point of view, the 'do-nothing' approach is preferable to any project implementation since it would avoid creation of any of the adverse impacts associated with a new road/bridge. The without project alternative is not acceptable since this will strongly reduce the potential for socio-economic development of the country. Despite having great potential, the industrial and commercial growth is retarded mainly due to absence of safe and reliable transportation facility. The road is proposed to be constructed as an access-controlled road and shall act as a new high quality congestion free gateway to Dhaka City. With increased connectivity to Chattogram, Sylhet, Narayanganj, and other eastern districts of Bangladesh, this route will aid in easing the congestion in Dhaka City.

229. Besides, the "No Project" Alternative would result in the continued deterioration of the road, bridges and drainage structures along the RoW, thereby impeding the economic development of the Project area. All positive benefits would be foregone. The relatively minor, less than significant environmental impacts (such as noise and short-term air quality impacts due to maintenance activities) and inconveniences (such as traffic diversions) would be avoided in the short-run. In the long run, however, the steadily declining state of the roadway would severely hamper economic development in the area.

230. Therefore, the 'no-project' alternative is unacceptable, and the potential socio-economic benefits of implementation of such Project far outweigh the adverse impacts, all of which can be controlled and minimized to an acceptable level.

C. Design Alternatives

231. Only the components of the project road's road design that involved alternative analysis were taken into consideration. Alternative road alignments weren't taken into consideration because the Rampura-Amulia-Demra Road will be used as the basis for this project's road development.

232. The following are the design possibilities taken into account for the project road:

- Option 1- Entirely elevated road on piers above the existing road.
- Option 2- Combination of elevated and at grade road.
- Option 3 - Combination of elevated and at grade road with realignment at one location.

233. Details of the design aspect are presented in Table V-1.

Table V-1: Comparison of Design Alternatives

Chainage	Option 1	Option 2	Option 3
0+000 to 0+500	Elevated road with concentric widening (Connecting Siddhirganj Power Hub Road)		
0+000 to 3+000	Elevated road with Concentric widening		
3+000 to 4+500	Elevated road with concentric widening		To avoid the congested area near Demra Staff quarters, proposed realignment directly connecting 3+000 to 4+500
4+500			At grade Toll Plaza
4+500 to 7+600	Elevated road with concentric widening	At Grade Concentric widening on the existing road	
7+600 to 10+400	Elevated road with Concentric widening		
10+400 to 12+600	Elevated on the existing alignment with horizontal shift for two bridges and at the canal near Bonoshree		

Source: Information and initial design document shared by design consultant

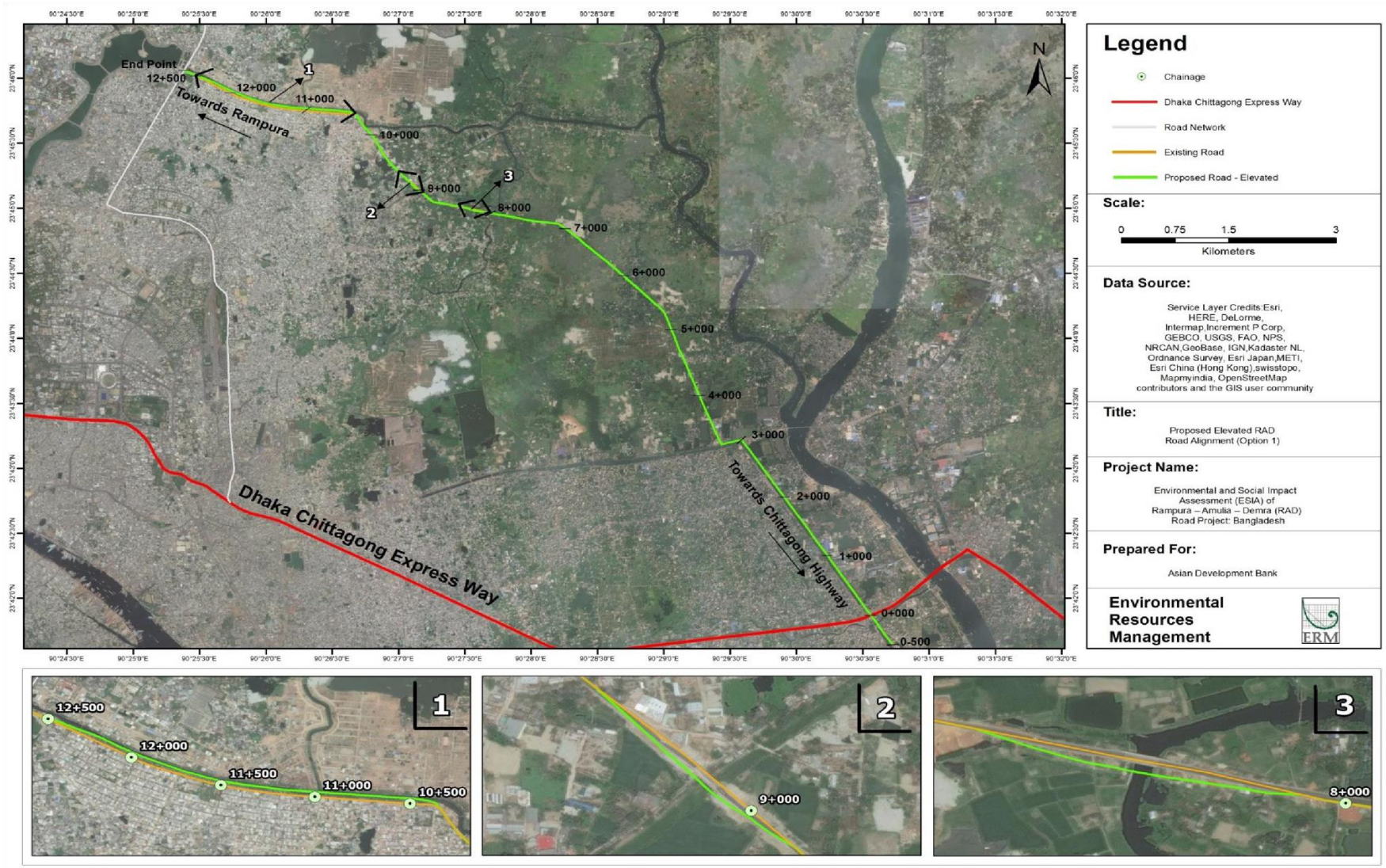


Figure V.1: Alignment Option 1

(**Source:** EIA of Improvement of Hatirjheel-Rampura-Bonoshree Ideal School and College-Sheikherjaiga-Amulia-Demra Highway into 4-lanes (including link to Chattogram Road intersection and access to Tarabo) through Public Private Partnership, 2020)

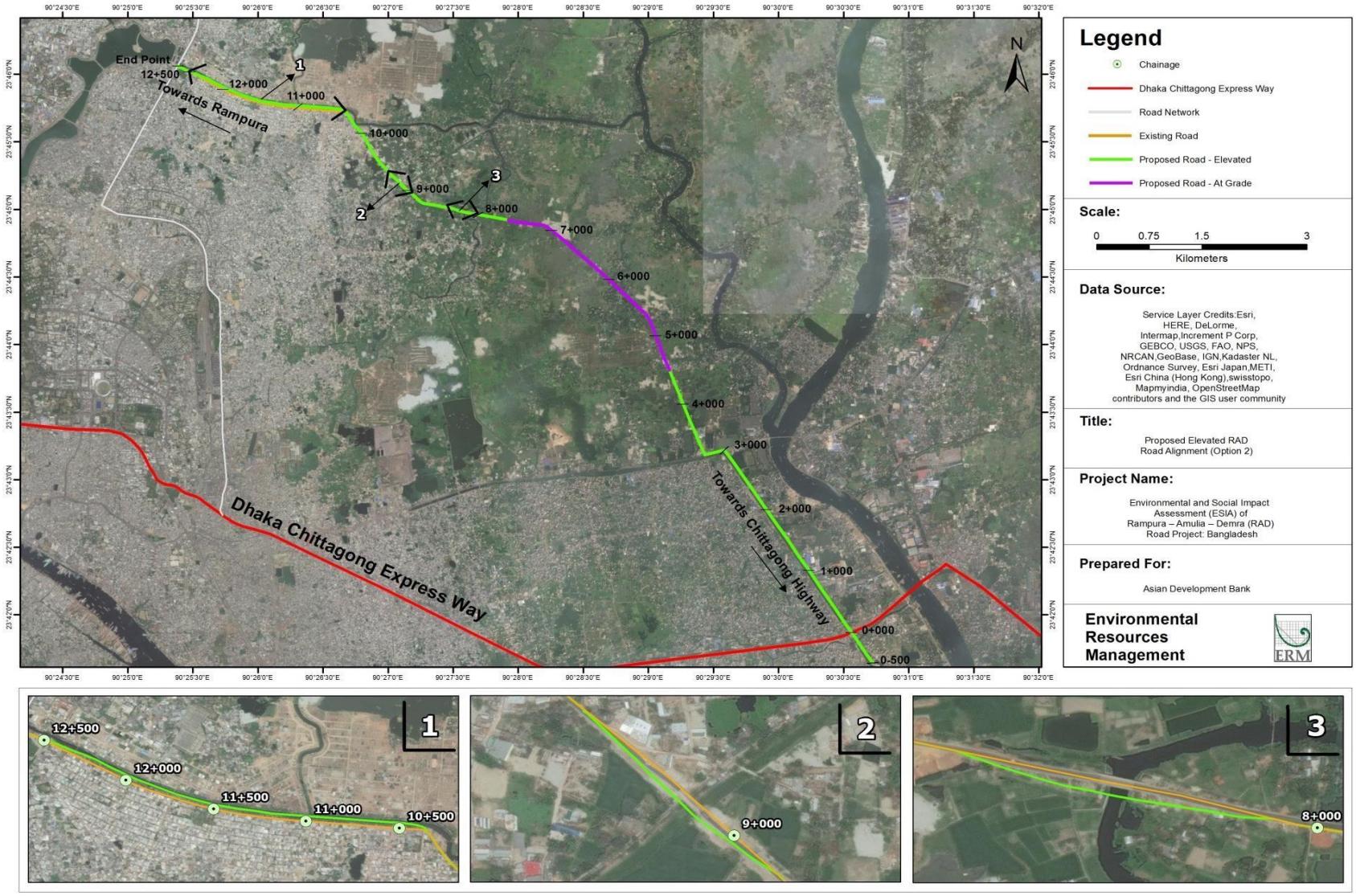


Figure V.2: Alignment Option 2

(**Source:** same as above)

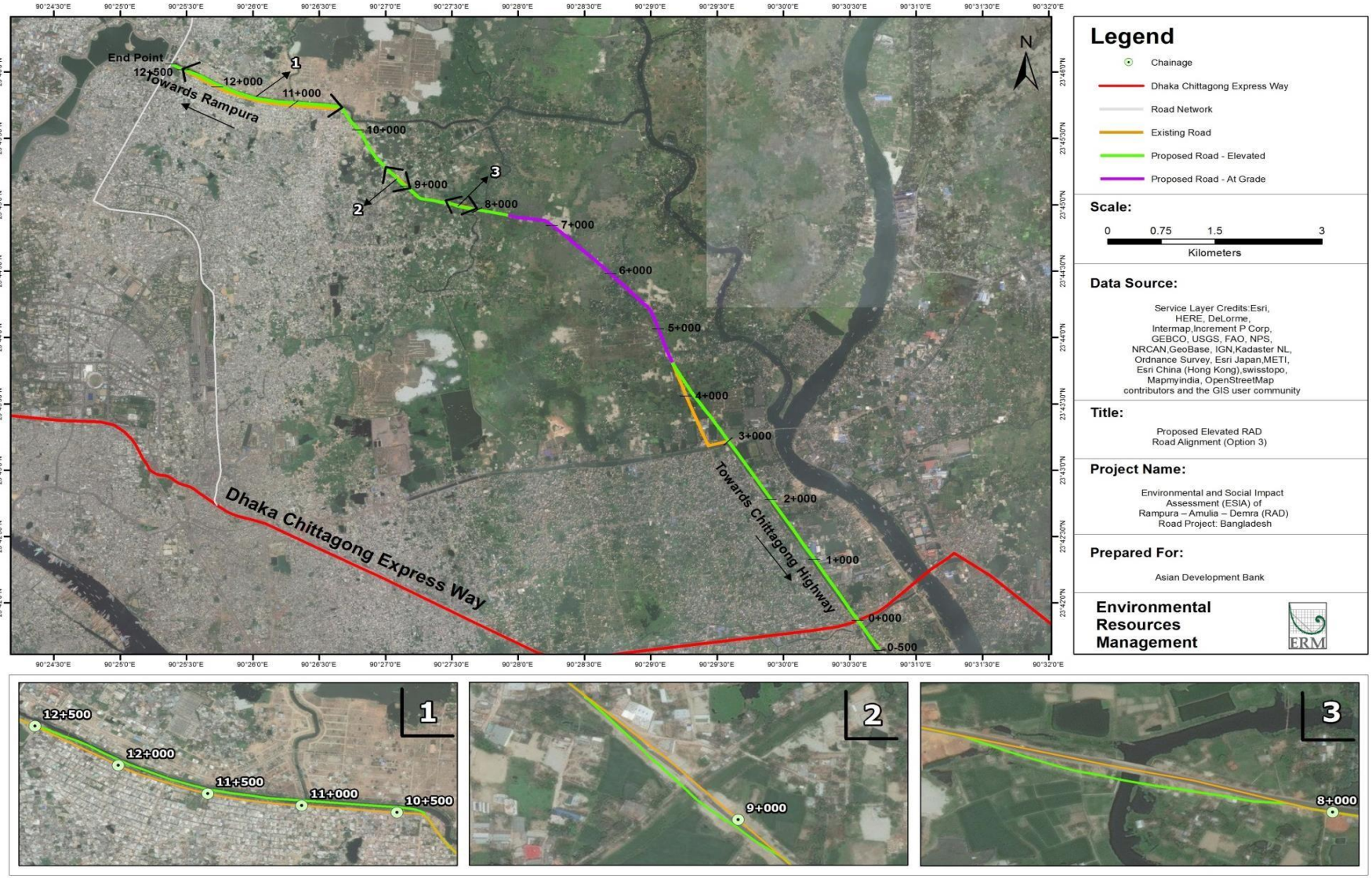


Figure V.3: Alignment Option 3

(**Source:** Same as above)

Table V-2: Analysis of Alternative

SI	Assessment Parameters	Option 1	Option 2	Option 3
1	**Technical Feasibility**	As per design aspect, this will be the most suitable (but expensive) design for the small stretch (only 13.5 km) of access control high way.	As per design aspect, this will create a roller coaster effect on the small stretch of access control high way project and ultimately it will reduce the average speed of traffic.	As per design aspect, it will improve the technical design of the road as this option can avoid the "S" curve at Demra staff circle and improve the geometrics of the road.
2	**Economic Feasibility**	Construction cost will be more (BDT 25,710 million) as elevated highways are more expensive to build than at grade highways	Construction is relatively less (BDT 20,430 million) compared to option 1 as it is mix of elevated and at grade options.	Construction is lowest (BDT 18,677 million) compared to option 1 and 2 as it is mix of elevated and at grade option and realignment at Demra staff circle
3	**Environmental Aspect**			
3.1	Tree Cutting	Road side tree cutting will be less.	All road side trees need to be cut for construction activity.	All road side trees need to be cut for construction activity.
3.2	Filling of Surface Water Bodies	Filling of surface water bodies will be not required as the proposed piers will be located on the existing road.	Partly filling of surface water body will be required for erection of piers.	Partly filling of surface water body will be required for reclamation of land both for existing alignment and in the realignment section.
3.3	Diversion of Surface Water Channel	Diversion of channel will be not required	Temporary diversion will be required for construction activity	Temporary diversion will be required for construction activity
3.4	Chances of Environmental Contamination	Chances of contamination of surface water body, soil, ground water will be comparatively less from foreign materials like silver sand as the land filling activity is quite less.	Chances of Contamination of surface water body, soil, ground water will be more from foreign materials like silver sand as significant land filling activity is required for this option.	Chances of Contamination of surface water body, soil, ground water will be more from foreign materials like silver sand as significant land filling activity is required for this option.
3.5	Water Logging due to Blocking of Natural Drainage Channels	Chances of blocking of natural drainage channel is not anticipated as entire road will be elevated	Possibility of blocking of natural drainage channel is high as about 3 km stretch of the project road will be at-grade.	Possibility of blocking of natural drainage channel is high as about 4 km stretch of the project road will be at-grade with an at grade toll plaza.
3.6	Agricultural Land	Mainly barren land will be used.	More agricultural land will be used. However, a number of settlements are along the route.	Agricultural Land plus urban residential land will be used.
4	**Social Aspect**			

SI	Assessment Parameters	Option 1	Option 2	Option 3
4.1	Land Requirement	Land requirement is less as the proposed width of the road for the elevated stretch is 18 meter	Land requirement is more as the proposed width of the road is 32 meter in the at-grade section	• Land requirement is more as the proposed width of the road is 32 meter in at-grade section. • New land is required for the realignment section. • Physical displacement will be less as this concept will avoid the congested commercial area of Demra Staff circle.
4.2	Resettlement and Rehabilitation (R&R) Issue	R & R issue is comparatively less as a smaller number of road side communities are likely to be impacted due to road construction	R & R issue is comparatively more as all road side communities along the existing road need to be removed from their road side location.	• R & R issue is comparatively more as all road side communities along the project road need to be removed. • Affected persons along the new alignment need to be rehabilitated at other locations. • R & R issue is comparatively less than option 2 as the road alignment will be avoiding the highly congested areas like Demra Staff Quarter area.
4.3	Resettlement and Rehabilitation (R&R) Cost	R & R cost is low as new land requirement is less	R&R cost is relatively high as new land requirement is more	R&R cost is relatively high as new land requirement is more both for at grade and realignment sections
4.4	Issue related to removing religious structure	Issue related to removing religious structure will not arise as removing religious structures will be not required as part of this option	Issue related to removing religious structure may arise as shifting of some religious structure from road side may be required.	Issue related to removing religious structure may arise as shifting of some religious structure from road side may be required.
4.5	Religious Structure	Religious structure will be affected but less	Religious structure will be affected but less	Religious structure will be affected
4.6	Educational Institutions	Educational institutes will be affected	Educational institutes will be affected	Educational institutes will be affected
5	**Community Safety**	Safe for road side users and surrounding communities more so as elevated stretch reduces possible interactions between both.	Option 2 scores poorly in this aspect as its design inherently creates a roller coaster effect and thereby road users are exposed to increased possibilities of traffic conflicts and road accidents	In terms of safety of road users and surrounding communities Option 3 scores most among the options as it improves road geometrics through proposed realignments and considerably reduces possibility of traffic conflicts and road accidents.

234. This evaluation is solely based on data provided by the technical consultant (including the conceptual design), observations made during a site visit, and the project team's expert judgment. According to the study indicated above, Option 3 has the lowest project cost and requires the least amount of physical relocating because it avoids the heavily populated commercial districts close to Demra Staff Circle.

235. There isn't much of a difference between the options in terms of environmental concerns, with the exception of Option 1 requiring less tree cutting. Option 3 has the highest rating for overall road user and community safety since it improves road geometry through suggested realignments and significantly lowers the likelihood of traffic conflicts and accidents. However, Option 2 performs poorly in terms of safety because of the roller coaster effect that its design automatically produces, which exposes users of the roads to more chances of traffic collisions and accidents.

236. Out of the three choices, Option 3 have been chosen which will include a new entry and exit ramp in Meradia section as per the design.

VI. EVALUATION OF ENVIRONMENTAL AND SOCIAL RISKS, IMPACTS & MITIGATION MEASURES

A. General

237. Due to the initiative, individuals and communities living in the project's influence area will experience both positive and negative environmental and social effects. The projected area is busy, and project interventions exacerbate traffic congestion. Congestion on this and adjacent other roadways is a common and uncontrollable occurrence. Furthermore, due to the project's size, there may be an inflow of migrant workers in the project areas, posing a slew of socio-economic issues. As a result of the civil works, community health and safety and gender-based violence incidents may increase. These are some of the most important aspects of this evaluation.

238. During the impact assessment survey, residents, potential PAPs residing in the project area were all included in a participatory process. The use of a participative process aids in the identification of public concerns and needs in connection to the project's impact and possible mitigation strategy. In designing alternatives, efforts have been made to accommodate their perspectives as much as possible. Construction-related risks and impacts, such as increased risk to workers' and communities' health and safety, increased traffic flow and traffic-related accidents, and social issues associated with increased labor influx, such as gender-based violence and child labor, are expected to occur during construction.

- However, there are no predicted measurable adverse impacts on the critical habitat that could compromise its ability to function;
- There is no predicted reduction in the population of any recognized endangered or critically endangered species;
- The Project will not involve significant conversion or degradation of critical habitats;

239. So, a Biodiversity Management Plan is not required and thus has not been prepared.

B. Anticipated Potential Impacts and Mitigation Measures

1. Pre-Construction Stage

a) Climate

Impact

240. Bangladesh is one of the most vulnerable countries in the world in terms of global warming and climate change considerations. It is noted, that due to Global Warming and Greenhouse gas impacts the trends of rainfall, temperatures and humidity are changing. The design of the road will therefore need to consider changes and potential increases in rainfall, temperature, and wind speed.

Mitigation

241. More intensive and prolonged rainfall has been considered during the design phase and special design measures is included in the final design.

242. The project design considered withstand unusually high rainfall patterns in road design, and pavement design. On the road sections along the waterbody, in order to prevent the subgrade from

being eroded by the waterbody, six-prism block will be used to protect the embankment slope from flooding. These constructions need to be scheduled during pre-monsoon season to avoid potential disaster caused by excessive rainfall and consequent flooding.

b) Landscape/Topography

Impact

243. Adverse impacts on the topography /landscape of the project area may occur. Since the project road mostly passes through flat terrain with no major changes of height, impacts on topography are likely to be minimal and no special design requirements are needed.

244. The topography in the project area will change to some extent because of construction of the proposed project related structures such as toll plaza, at grade {K4+525.5'K8+602 of toll road section and SK4+150~SK8+602 of service road section (Service Roads both sides of at-grade Toll Road)} and elevated sections {K1+154.113~K4+525.5 of toll road section and SK1+ 154.113~SK4+150 (Service Roads both sides of elevated Toll Road) of service road section}, interchanges etc. Visual changes to the topography would be permanent and minor negative in nature.

Mitigation

245. During the pre-construction phase, harmonization with the surrounding natural scenery was taken into consideration when designing toll plaza, at grade and elevated sections, interchanges, etc. Visual changes to the topography will be of permanent but slightly adverse in nature and need mitigation measures except that the project design should consider aesthetic concerns.

c) Land Acquisition and Resettlement

Impact

One of the major projects related impact will be the land acquisition (about 30.46 acres)[2] for the Project RoW that will result in causing disturbance to the affected residents of the project area. A minimum ROW width of 32.2m is assumed where the ROW is constrained, retaining wall structures are proposed to eliminate additional land acquisition otherwise required for the embankment side slope.

246. Land acquisition will cause removal of cultural and commercial structures, resettlement of affected people, removal of vegetation, relocation of utilities and inconvenience to the local people and animal living in and around the land area to be acquired. The resettlement is anticipated to cause mainly three types of social impacts such as psychological stress, split of communities, and loss of livelihoods or business opportunities. The adjacent crop land and water bodies will also be affected because of land acquisition.

Mitigation

247. The mitigation measures include:

- ✓ Careful alignment selection by the designer to minimize the impacts by avoiding the important environmental components, settlements etc.

[2] Previous Resettlement Plan for Rampura-Amulia-Demra (RAD) Road Project: Bangladesh, March 2022

- ✓ The horizontal alignment of Toll Road must follow the Existing Lane alignment as far as possible to minimize the land acquisition as well as impacts on the existing building/infrastructure along the existing two-lane roadway facility.
- ✓ The land acquisition will be restricted to bare minimum required.
- ✓ Provision of protection works like retaining/toe wall is kept confining the embankment with in RoW /minimizing the width to be acquires.
- ✓ Land acquisition and resettlement plan has been prepared by the social and resettlement specialists following the national legal frameworks and AIIB's ESF in order to deliver proper compensation and resettlement of the affected people. The total estimated resettlement cost for affected structure is BDT. 3,290,549,295.
- ✓ A proper judicious compensation package has already been prepared for affecters and giving compensation amount before the affecters shifting.

d) Removal of Commercial Infrastructure

Impact

248. The project road will require removal of several commercial infrastructures located within the ROW. As a result, commercial infrastructure such as shops, filling station, industries and so on located within the ROW will be essential to relocate and/or demolish. There are 867 commercial infrastructures within ROW which will be directly affected because of the project intervention. There are number of filling stations, industries, and factories within ROW of the road alignment. Removal of commercial structure will cause financial loss of the businessman and the owner(s).

Table VI-1: Commercial Structures Loss due to this Project Intervention

Titled (HH)		Non-Titled (informal/Squatters) (HH)				Total
Permanent	Tenant	Permanent	Temporary	Tenant	Vendors	
185	105	57	349	43	129	867

Source: SIA and RAP survey, June 2022

Mitigation

249. Emphasis had been given on the appropriate selection of the alignment so that less destruction of commercial infrastructure can be ensured. However, some infrastructure felled within the RoW of the proposed alignment has to be demolished and relocated where possible. In this case, proper compensation must be provided at first as per the national legal frameworks and AIIB's ESF. It should be kept in mind that consultation with the affected people has to be made before relocating any infrastructure.

e) Damage to Public Utilities

Impact

250. Due to the proposed project, public utilities (total 952) will be affected (see below table) creating disruption of public services and inconvenience to the residents. This impact is temporary and may be considered as moderately negative in nature.

Table VI-2: List of Utilities along the Alignment

List of Utilities along the Alignment			
Sl.	**Chainage**	**Electric Pole**	**Electric Tower**
1	0+000 to 0+200	17	1
2	0+000 to 1+000	69	1
3	1+000 to 2+000	63	
4	2+000 to 3+000	58	
5	3+000 to 4+000	38	
6	4+000 to 5+000	64	
7	5+000 to 6+000	61	
8	6+000 to7+000	79	
9	7+000 to 8+000	84	
10	8+000 to 9+000	101	
11	10+000 to 11+000	109	
12	11+000 to 12+000	104	
13	12+000 to 13+000	103	
Total		**950**	**2**

Mitigation

251. Mitigation measures will include -

- ✓ Provision in the design and budget for the relocation of the existing utility infrastructures wherever required; and
- ✓ All public utilities (e.g., water pipes, gas pipes, power/ telephone lines likely to be affected by the proposed project will be relocated well ahead of time before the actual commencement of the construction work.

f) Tree Cutting and Wildlife

Impact

252. The improvement work will require felling the existing planted roadside trees and homestead trees outside the ROW if realignment is necessary. Most of the trees and vegetation, now present in the affected stretches of lands are within the present ROW, but most will outside of the ROW.

253. A total of 5820 number of small (less than 30 cm girth at waist height), medium (30-60 cm girth at waist height), and large (over 60 cm girth at waist height) trees along with saplings from roadsides may be felled or trimmed during the construction phase. Tree felling will affect timber and bio-mass production potential directly at local level. Ecological impacts can be reversed planting site specific tree species as per the directives of Social Forestry Act (2004).

Table VI-3: Trees Affected on Private Land

Trees on Private Land				
Type	**Large**	**Medium**	**Small**	**Saplings**
Fruit	72	98	54	556
Timber	87	122	45	301
Total	**159**	**220**	**99**	**857**

Table VI-4: Trees Affected on Public Land

Trees on Public Land				
Type	**Large**	**Medium**	**Small**	**Saplings**
Fruit	243	355	45	658
Timber	556	443	387	1798
Total	**799**	**798**	**432**	**2456**

254. Any loss of trees will impact on other flora and may affect wildlife, particularly birds and mammals that rely on trees their food source. In addition, the loss of tree may increase soil erosion from rain cut. Apart from trees and undergrowth other vegetation affected will be bamboo bush and other native vegetation. Excavation of borrow pits will add to the destruction of flora.

Mitigation

255. Mitigation measures will include -

- ✓ No trees shall be felled unless they are directly in the path of the project road and clearly defined, or unless they created a safety hazard to the future operation of road;
- ✓ Upon completion of embankment works turfing and planting should be done on embankment and slopes. Dense and well rooted growth of permanent grasses should be planted to eliminate dust and erosion;
- ✓ Replanting of about 17460 trees, should consist of a multi-species mix of local vegetation including fruit trees, fast growing (fuel) trees and timber trees;
- ✓ RHD will be responsible for the compensatory tree planting program by forming an "Environmental and Social Team" in coordination with the Arboriculture Department of RHD. The tree cutting programme will not start until RHD will get permission from Arboriculture Department (AD). RHD's compensatory planting will be in rows as per the prescription of AD e.g., three tree seedlings to be planted for each tree felled, after the project construction activities are completed. This ratio may be more in the case of social forestry trees as per any mutual understanding arrived at with tree owners before cutting the social trees. These trees will be planted primarily along the road within the RoW. The social forestry can be planted on the area allocated by local authorities;
- ✓ Planting will be done as soon as the construction of the road is completed. Maintenance is the key to the establishment of the plantation and therefore regular monitoring of plantation will be carried out by Dhaka RAD Elevated Expressway Company Limited;
- ✓ Forestation programmes should be initiated, covering the road ROW, any embankments to compensate for the loss of vegetation, to reduce the risk of erosion of the banks, and finally as a noise reducing wall.

g) Change of Local Hydrology/Drainage Congestion

Impact

256. No major impacts are expected on hydrological aspects occur due to the intervention of the project construction activities. However, hydrological, morphological, and ecological aspects have direct bearing on hydrological structures location selection. A detail list of the waterbodies along the alignment is presented below.

Table VI-5: Waterbodies along the At Grade and Elevated Section with Chainage Distribution

SI	Cross Section Type	From Chainage	To Change	Waterbody (Chainage)	Quantity
1.	Service Roads both sides of elevated Toll Road	K1+154.113	K4+525.5	CH 01+050km, 01+650km, CH 02+100km, CH. 02+250 – CH. 02+200km, CH. 02+450 – CH. 02+400km, CH 03+0550 km, CH 03+250km	7
2.	Service Roads both sides of Toll Plaza	K4+525.5	K4+900	--	--
3.	Service Roads both sides of at grade Toll Road	K4+900	K8+602	CH 05+550km, CH 05+550km, CH 05+550km, CH. 06+500 – CH. 06+450km, CH 08+100 - 08+050km, CH. 08+100 – CH. 08+050km,	6
4.	Service Roads both sides of elevated Toll Road	K8+602	K9+350	--	--
5.	Service Roads both sides of elevated Toll Road	K9+350	K9+750	--	--
6.	Service Roads both sides of elevated Toll Road	K9+750	K10+230	--	--
7.	Service Roads both sides of elevated Toll Road	K10+230	K10+930	--	--
8.	Service Roads both sides of elevated Toll Road	K10+930	K11+230	--	--
9.	Service Roads both sides of elevated Toll Road	K11+230	K11+330	--	--
10.	Service Roads both sides of elevated Toll Road	K11+330	K13+614.125	CH 12+250km, CH. 12+100 – CH. 12+050km	2

Mitigation

257. Possible impacts are temporary and minor negative, however following mitigation measures will be incorporated:

- ✓ On general road sections, the precast concrete drainage ditch is used on the side of filling subgrade. The sidewalk is adopted with the cast-in-place rectangular concrete drainage ditch, and the transverse D30HDPE pipe is used to export the water outside the embankment for normal road arch sections, the pavement drainage is mainly implemented through cross fall of pavement, the scattered drainage is adopted to drain the water into the ditch. On city and town road sections, the ponding water on the pavement inflows into the water collecting well on the side of road and led into the side ditch on the road side through crosswise water trough. On super-elevated road sections, the water on the pavement flows to the inside of super-elevation section, and the collected water inside super-elevated flows into the side ditch, drainage ditch or natural ditch. The ponding water on general pavement is removed by the pavement cross fall, and the interlayer stagnant water is removed by the blind ditch and the concealed pipe with transverse drainage tube to enhance the durability of the pavement.;

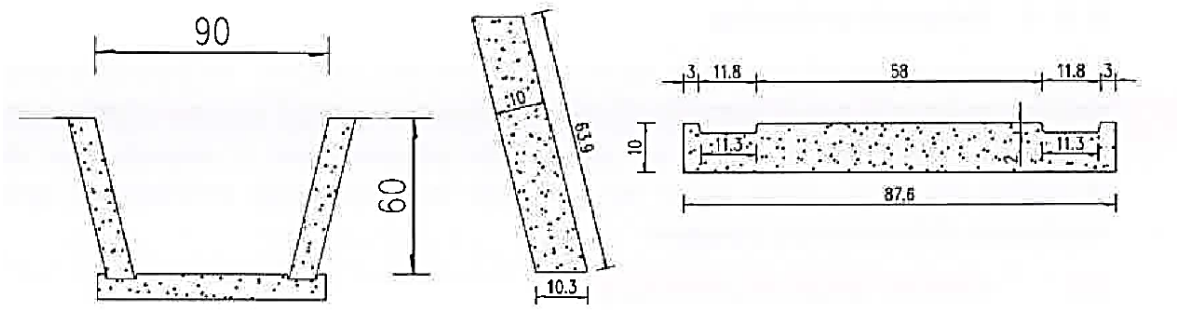


Figure VI.1: Subgrade Drainage Ditch Design

- ✓ According to the design principles in this project, the infiltrated rainwater from the surfacing should be discharged as soon as possible to avoid that subgrade are soaked for a long time.
- ✓ Wastes should not be disposed near any water body. All waste depending on its characteristics, should be disposed off in a controlled manner.
- ✓ The dredged material from the adjacent waterbodies shall be tested for presence for heavy metals and other pollutants before its reuse.

h) Water Bodies and Fisheries

Impact

258. Several surface water bodies (e.g. rivers, canals, ponds, ditches) are located adjacent to the alignment. The adjacent mills are continuing the pollution to the waterbodies specially by discharging dyes without any treatment directly to the rivers (Shitalakshya and Balu River). These two major waterbodies are well outside the impact zone (see Table VI-6) and no further pollution shall be occurred due to the project intervention work.

Figure VI.2: Existing Pollution in Shitalakshya River

Mitigation

259. For any construction/engineering work over the water bodies, proper measures need to be taken to keep the existing water flow as usual as possible. Moreover, to protect the fisheries habitat, erosion and siltation have to be kept in control. Majority of the species recorded from the project area are common to less common within the project area. Again, these species are widely distributed throughout the country. The project area is mainly distributed with farmlands and fish ponds, while subgrades are mainly fill subgrades, and sand filling subgrade shall be adopted due to difficulty in borrowing soil. However, the ECAs will not be hampered by the intervention of this project activities. Therefore, it is not required to prepare a Biodiversity Management Plan for this project. The detail distances from the centerline of the alignment are presented below.

Table VI-6: Distances from Centerline of the Alignment to the adjacent ECA

C/S and Chainage No.	Distance from ECA (m)	River/ECA Name
C/S No. 01 CH. 00+050 km	910	Shitalakshya
C/S No. 10 CH. 00+450 km	915	Shitalakshya
C/S No. 15 CH. 00+700 km	917	Shitalakshya
C/S No. 20 CH. 00+950 km	893	Shitalakshya
C/S No. 25 CH. 01+200 km	852	Shitalakshya
C/S No. 30 CH. 01+450 km	702	Shitalakshya
C/S No. 35 CH. 01+750 km	559	Shitalakshya
C/S No. 40 CH. 01+950 km	486	Shitalakshya
C/S No. 45 CH. 02+200 km	415	Shitalakshya
C/S No. 5 CH. 00+200 km	906	Shitalakshya
C/S No. 50 CH. 02+450 km	431	Shitalakshya
C/S No. 55 CH. 02+700 km	482	Shitalakshya
C/S No. 60 CH. 02+950 km	583	Balu
C/S No. 60 CH. 02+950 km	587	Shitalakshya
C/S No. 65 CH. 03+200 km	650	Balu
C/S No. 70 CH. 03+450 km	786	Balu
C/S No. 75 CH. 03+700 km	976	Balu
C/S No. 80 CH. 03+950 km	841	Balu
C/S No. 85 CH. 04+200 km	741	Balu
C/S No. 90 CH. 04+450 km	717	Balu
C/S No. 95 CH. 04+700 km	722	Balu
C/S No. 100 CH. 04+950 km	770	Balu
C/S No. 105 CH. 05+200 km	932	Balu

260. This is a clear indication that, the project intervention work will not have any negative impact over these critical areas.

2. Construction Stage

a) Landscape/Topography

Impact

261. As a result of construction, topography of the Project area will be changed. One of the important activities during construction will be the cutting and dismantling of existing infrastructure will have impact on the topography of the Project Area. Moreover, excavations of ponds/ditches for the filling materials may affect the aquatic species. Clearing vegetation from the ROW will cause appearance change of the landscape. This impact is temporary and minor impact in nature.

Mitigation

262. Mitigation measure for this impact is proper landscaping with greening facilities which have been already been considered in the design (see Figure III-9, Chapter 3). Construction camps should be constructed at suitable place to minimize this impact. Vegetation clearing has to be at minimum level as possible. After completion of road construction, trees shall be planted along sections of road near the populous residential areas to mitigate impact of traffic noise to residents living along the road, and to improve landscape along the road also to restore the aesthetic value of the area. All the affected areas will be restored to their original levels.

b) Loss Top Soil

Impact

263. Due to construction activities during the construction phase which will include ground clearing (removal of vegetative cover), grading, excavation, trenching, vehicular and pedestrian traffic, and construction and installation of facilities may lead to loss of topsoil (0.5 m from the surface) in ROW. The potential impacts on top soil are:

- ✓ Loss of top soil by wind and water erosion;
- ✓ Removal of top soil for construction from outside the RoW;
- ✓ Compaction of top soil;
- ✓ Covering of top soil by project works.
- ✓ Compaction of topsoil due to vehicular and pedestrian movement

Mitigation

264. Mitigation measures will include:

- ✓ The stockpiles will be done in slopes of 2:1 to reduce surface runoff and enhance percolation through the mass of stored soil.
- ✓ Locate topsoil stockpiles in areas outside drainage lines and protect from erosion.
- ✓ Construct diversion channels and silt fences around the topsoil stockpiles to prevent erosion and loss of topsoil.
- ✓ Spread the topsoil to maintain the physico-chemical and biological activity of the soil. The stored top soil will be utilized for covering all disturbed area and along the proposed plantation sites.

- ✓ Prior to the re-spreading of topsoil, the ground surface will be ripped to assist the bonding of the soil layers, water penetration and revegetation.
- ✓ Limit equipment and vehicular movements to within the approved construction zone.
- ✓ Remove unwanted materials from top soil like grass, roots of trees and similar others.

c) Dredging and Dredged Materials

Impact

265. Dredging may be required to source borrow material for the construction of the proposed road improvement activities. If necessary then these dredged materials will be collected from river bed during the construction period after having required permission from relevant authorities and supervision engineers. Disposal of the dredged materials on the land for stockpiled and filling up of the project sites will generate a huge outflow from wet dredged materials that contain high turbidity and potentially impact of the soil quality of nearby vegetation. Dredging of riverbed materials has physical and ecological impacts on the river. Dredging may cause increased river bank erosion and flood at downstream of a particular river. The quality of the surface water will be degraded because of dredging and spilling/seepage of oil and lubricants from the dredging machines. Local people will be temporarily disturbed due to noise during dredging.

Mitigation

266. If require, then the following mitigative measures defined for this activity are (i) obtaining permits for extraction sites and quantities from appropriate authorities and adhering to the prescribed extraction volume limits per site, and (ii) conducting a survey at each dredging site to establish water quality conditions while the dredging is on-going. Moreover, a dredged materials management plan (DMMP) should be prepared to manage potential environmental impacts associated with the dredging, stockpiled of dredged materials and filling of the project sites by dredged materials. Prior to start dredging and disposal of dredged materials on land, the contractor (The Company) should prepare site wise method statement (MS) in which environmental issue and its mitigation will be included. However, dredging must not be carried out when the fish are likely to be breeding in the affected surface water bodies, or in the period normally from April to August between spawning and the subsequent emergence of juvenile fish. To the end, water samples will be collected upstream and downstream of the dredger while in full operation and tested for nutrient, sediment loads, heavy metals as well as oil and grease concentrations, and river bed dredged materials of the selected rivers need to be tested by the contractor(The Company).

d) Soil Contamination

Impact

267. Due to construction of the proposed project, soil contamination may take place around borrow pits, road cuttings, embankments, construction camps, workshop areas, equipment washing yards, asphalt plants, batching plants, fuel, and chemical storage areas, etc. Soil contamination may affect the road stability in worst cases may reduce the economic productivity of land and biodiversity in the project area.

268. During transportation of machine and materials, the cultivable lands beyond the proposed ROW may get compacted due to movement of vehicle and construction equipment, setting up

construction camps. Dumping of construction debris on fields adjoining the acquired areas, may lead to impairment of soil. Parking of vehicles by the side of roads also leads to soil compaction and may spoil the soil characteristics necessary for cultivation. Soil in the project area may also get contaminated particularly from the bituminous wastes, spillage of oil and grease, mixing with construction materials, at the construction sites. The impacts of soil contamination would be temporary and moderate negative.

Mitigation

269. The movement of construction vehicles, machinery and equipment will be restricted to the corridor or identified route. The unusable, non-saleable, non-hazardous construction waste shall be disposed of in the properly delineated places.

270. All efforts shall be made to prevent soil contaminations. Following measures shall be taken to prevent the same.

- ✓ The construction vehicle shall be fueled or repaired/serviced at the designated place with proper arrangement of waste collection and disposal. The arrangement shall include, cemented floor with dyke around for fuel storage and filling as well repairing of construction equipment.
- ✓ Soil contamination by bitumen, fuel and chemical storages shall be minimized by siting them on an impervious base within an embanked area and secured by fencing. The base and walls of the embankment shall be impermeable and of sufficient capacity to contain of the total volume of stored fuels and chemicals.
- ✓ The disposal of waste asphalt shall be made in approved locations such as borrow pits or natural depressions and shall not be within the RoW. Unless located in areas with impervious soils, encapsulation with pre-laid impervious liners including walls and capping is required with the objective to prevent water percolating through the waste materials and leaching toxic chemicals into the surrounding soils. On completion of disposal at the site, the area shall be capped with a compacted thickness of impermeable soil covered and with the top soil and shall be finally landscaped.

e) Air Pollution and Dust

Impact

271. The capital of Bangladesh, which has a large population, continues to top lists of places with the poorest air quality. The capital's air pollution "has reached an alarming level." This is mostly caused by the unchecked emission of dust from building sites, car exhaust, and brick kiln smoke. During construction phase, there are two main sources of air emissions i.e., mobile sources and fixed sources. Mobile sources are mostly vehicles involved in construction activities while emissions are from fixed sources that include diesel generator sets, construction equipment (e.g., compressors) and excavation/ grading activities. Certain amount of dust and gaseous emissions will be generated during the construction phase from road construction machineries. Pollutants of primary concern include Suspended Particulate Matter (SPM) and Respirable Suspended Particulate Matter (RSPM). However, suspended dust particles are coarse and settle within a short distance of construction area. Therefore, impact in nearby inhabited area will be direct but temporary and restricted within the closed vicinity of the construction activities only.

272. Localized emissions are also anticipated from hot mix plants and batching plants. These emissions would be in the form of coarse particulate matter and will settle down in close vicinity of construction site. Further, this will be a temporary phase. Hence, no significant impact is expected during the construction phase. Emissions may be carried over longer distances depending upon the wind speed, direction, temperature of surrounding air and atmospheric stability. Construction work involves breaking up, digging, crushing, transporting, and dumping large quantities of dry material. During construction, the continuous operation of machinery and movement of heavy trucks and vehicles may generate gaseous emissions. It will inevitably lead to an increase in suspended particulate matter (SPM) in and around the construction zones. Emissions from crushers and quarry sites can cause health impacts, i.e., coughing, flue, difficulty in inhaling, irritation in eyes and reduction in visibility. This impact is temporary and major negative in nature.

273. However, from the ambient air quality test result it is clear that the baseline condition is already deteriorated from different activities. So, the project construction work will not have any significant impact over the project area as appropriate mitigation measures will be undertaken as stated in the EMP.

Mitigation

274. Mitigation measures will include:

- ✓ The stockpiles of construction material shall be sprinkled with water. Water should be sprayed at asphalt mixing site and temporary service and access roads. After compacting, water should be sprayed on the earthwork regularly to prevent dust. Construction equipment will be maintained to a good standard and idling of engines discouraged. Machinery causing excessive pollution (e.g., visible clouds of smoke) will be banned from construction sites;
- ✓ The Contractor((The Company) will submit a dust suppression program to RHD prior to construction. The plan will detail action to be taken to minimize dust generation (e.g., spraying of roads with water), and will identify equipment to be used.
- ✓ Road pavement design should be such that tyre friction due to vehicle movement will be reduced. Vehicles delivering loose and fine materials like sand and fine aggregates shall be covered to reduce dust pollution on existing road.
- ✓ Dust control by equipping asphalt hot mix and batching plants with fabric filters or wet scrubbers to reduce the level of dust emissions;
- ✓ Hot mix plants should be located at least 500 m away from the populated areas and be fitted with high stack (30m) to allow adequate dispersion of emissions. Further, the hot mix plants must be sited at least 1 km in the downwind direction from the nearest human settlement. Regular maintenance of machinery and equipment shall be carried out. Diesel Generating (DG) sets shall be fitted with stacks of adequate height. Low sulphur diesel will be used in DG sets as well as machineries. Dust mask will be provided to the workers. Proper dust collection system should be ensured at crushers and continuous sprinkling of water;

275. Air pollution monitoring shall be carried out as per monitoring plan and corrective action shall be taken in case of deviation. The air quality condition of the project area is already deteriorated so the project activity will not be adding to the existing pollution.

f) Noise and Vibration

Impact

276. The residents of Dhaka, the nation's capital, had previously found excessive noise to be an annoyance, but it has since grown to alarming proportions. The constant and substantial annoyance caused by the city's traffic noise enters homes, hospitals, schools, and offices. But in major cities around the world, including Dhaka, noise pollution is becoming more and more of a problem. Zaidi carried out a study in relation to the cause of noise pollution. He discovered that 55% of noise originated from automobiles, 20% from building and garage work, and 14% from the metal industry.[3] During construction, noise is likely to be generated form site clearing, excavation, concrete mixing, crushers, piling in bridge construction. The general noise levels during construction phase such as due to working of heavy earth moving equipment and machineries installation may sometimes go up to 100 dB(A) or more at the work sites[4]. Under the worst-case scenario, it is assumed that all this equipment generate noise from a common point. The increase in noise levels due to operation of various construction equipment is expected to increase the noise level from 100 dB (A) at a distance of 1 m to 52.1 dB (A) at a distance of 250 m from the sources. The vehicular increase during construction is likely to be limited and may not have any significant contributions to increase in ambient noise level.

277. Vibrations caused by movements of heavy construction equipment, pile driving operations, operation of crushing, ballasting and aggregating plants will disturb the residents unless operation times are fixed by discussing with local representatives. The vibration caused by some of the construction activities such as the roller compaction of the embankment, movement of heavy material transport vehicles, driving of piles and erection of bridges may be detrimental to the neighbouring structures. List of sensitive receptors along the project alignment is presented below.

Table VI-7: Sensitive Receptors along the Project Alignment

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance meter
1	Chattogram Road Mosque	23.697027	90.509129	Near CH. 00+000	68.46
2	Chan Super Market	23.697254	90.508876	Near CH. 00+000	72.42
3	Hirajhil Women's' Madrasha	23.696878	90.507362	Near CH. 00+000	228
4	Lion Eye Service	23.697641	90.50817	CH. 00+050 – CH. 00+000	109
5	Madina Eye Hospital	23.698262	90.509411	CH. 00+050 – CH. 00+000	34
6	Tekpara Chairman Bari Jam-e Masjid	23.699255	90.508632	CH. 00+200 – CH. 00+150	25
7	Shifa International School	23.700432	90.505504	CH. 00+450 – CH. 00+400	173.16
8	Sarulia Cattle Market	23.708413	90.501892	CH. 01+400 – CH. 01+350	7.54
9	Titas Gas Ideal High School	23.71203	90.500337	CH. 01+850 – CH. 01+800	98.19

[3] Noise Pollution Modelling In Dhaka City: A GIS Approach. (2022). https://www.lawyersnjurists.com/article/noise-pollution-modelling-in-dhaka-city-a-gis-approach/

[4] The noise level from various construction equipment /machinery is (all levels are in dB(A)): Dozers (95-100), front Loaders (72-84), Backhoes (72-93), Tractors (76-96), Toppers/Trucks (82-94), Concrete mixers (75-83), Concrete pumps (75-83), Concrete pumps (81-83), Cranes (movable) (75-86), Vehicular Traffic (construction material & plant & Machinery) (85-98), Dg Set (90-95), Pumps (69-71), Compressors (74-86), Pneumatic Wrenches (83-88), Jack Hammer and rock drills (81-98), Pile Drivers (peak) (95-105).

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance meter
10	Baitun-nazat Jam-e-Masjid	23.714664	90.497199	CH. 02+250 – CH. 02+200	6.83
11	Life and Care Medical Services	23.714738	90.496517	CH. 02+300 – CH. 02+250	60.26
12	Shamsul Haque General Hospital	23.714878	90.496517	CH. 02+300 – CH. 02+250	51.40
13	Sarulia Bazar	23.716063	90.496279	CH. 02+350 – CH. 02+300	24.74
14	Sarulia Bazar Jam-e-Masjid	23.716149	90.496559	CH. 02+450 – CH. 02+400	41.61
15	M.A. Sattar High School	23.717454	90.498666	CH. 02+450 – CH. 02+400	12.09
16	Fulmati Islamia Alim Madrasha	23.716523	90.496422	CH. 02+450 – CH. 02+400	20.61
17	Staff Quarter Jam-e-Masjid	23.720484	90.49162	CH. 03+100 – CH. 03+050	114.04
18	Tropical Hospital	23.720055	90.490181	CH. 03+200 – CH. 03+150	260.53
19	Akmal Shopping Complex	23.720779	90.490345	CH. 03+250 – CH. 03+200	196.56
20	Demra Ideal College	23.72173	90.489535	CH. 03+350 – CH. 03+300	198.04
21	Baitun-Nur Jam-e-Masjid	23.721931	90.48949	CH. 03+400 – CH. 03+350	187.85
22	Jamir Ali Super Market	23.728014	90.487171	CH. 04+050 – CH. 04+000	15.93
23	Aligarh Model University	23.732778	90.484709	CH. 04+650 – CH. 04+600	23.87
24	Haji Atik Market	23.736836	90.483493	CH. 05+100 – CH. 04+050	9.25
25	E-Haque School and College	23.736653	90.483318	CH. 05+100 – CH. 04+050	16.56
26	Amulia Baitun-Nur Jam-e-Masjid	23.737626	90.482277	CH. 05+250 – CH. 05+200	16
27	Amulia Mendipur Masjid and Madrasa	23.739455	90.479871	CH. 05+550 – CH. 05+500	43.27
28	Haji Aman Market	23.740041	90.479908	CH. 05+600 – CH. 05+550	5.88
29	Aichi Medical College & Hospital	23.740726	90.478854	CH. 05+750 – CH. 05+700	13.39
30	Iram Chottor Bazar	23.74631	90.472563	CH. 06+650 – CH. 06+600	12.19
31	Baitul Aman Jam-e-Masjid	23.749568	90.461226	CH. 07+900 – CH. 07+850	14.42
32	Imam Baag Jam-e-Masjid	23.752407	90.454209	CH. 08+700 – CH. 08+650	126.82
33	Masjidul Akbar Jam-e-Masjid	23.751442	90.453277	CH. 08+750 – CH. 08+700	17.05
34	Baitul Quran Madrasa	23.752363	90.453888	CH. 08+750 – CH. 08+700	102.43
35	Liberty College	23.754399	90.450014	CH. 09+200 – CH. 09+150	16.65
36	Yamagata Dhaka Friendship General Hospital	23.761464	90.443958	CH. 10+200 – CH. 10+150	86.48
37	Famous Specialized Hospital	23.76195	90.443408	CH. 10+300 – CH. 10+250	54.83
38	Al Razi Islamia pvt Hospital	23.762244	90.439927	CH. 10+650 – CH. 10+600	39.75
39	Bosuti Maa O Shishu Hospital	23.762461	90.438651	CH. 10+800 – CH. 10+750	27.50
40	Academia	23.762445	90.437935	CH. 10+900 – CH. 10+850	35.82
41	Nur Majid Ayurbedic College	23.762511	90.437778	CH. 10+900 – CH. 10+850	29.16
42	Intelligentsia School and College	23.762397	90.437495	CH. 10+900 – CH. 10+850	42.97
43	Advanced Hospital	23.762545	90.436777	CH. 11+000 – CH. 10+950	35.10

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance meter
44	Farazi Hospital Limited	23.762504	90.43626	CH. 11+050 – CH. 11+000	45.65
45	Proper Health Care & Hospital	23.762713	90.435165	CH. 11+150 – CH. 11+100	41.39
46	Bangladesh Fertility Hospital LTD	23.762729	90.435056	CH. 11+150 – CH. 11+100	42.63
47	National Ideal Girls' College	23.762754	90.434919	CH. 11+200 – CH. 11+150	42.35
48	National Ideal English Version	23.762763	90.434837	CH. 11+200 – CH. 11+150	43.32
49	National Ideal School, Bonoshree	23.762794	90.434634	CH. 11+200 – CH. 11+150	43.26
50	Bonoshree Adarsha Bidyaniketon School	23.762909	90.434168	CH. 11+250 – CH. 11+200	42.20
51	Ideal School & College	23.76333	90.432153	CH. 11+450 – CH. 11+400	54.51
52	Bonoshree Central Jam-e-Masjid	23.763567	90.431472	CH. 11+550 – CH. 11+500	50.45
53	Rajdhani Ideal School and College	23.764227	90.430001	CH. 11+700– CH. 11+650	37.17
54	Holy Crescent School	23.764441	90.429426	CH. 11+750 – CH. 11+700	40.02
55	Oxford International School	23.766467	90.425843	CH. 12+200 – CH. 12+150	16.37
56	East West University	23.768277	90.425361	CH. 12+350 – CH. 12+300	146.66

278. However, from the noise and vibration level measurement result it is clear that the baseline condition is already deteriorated from different activities. So, the project construction work will not have any significant impact over the project area as appropriate mitigation measures will be undertaken as stated in the EMP.

Mitigation

279. All mitigation measures mentioned below should be taken to minimize the impacts of noise in the project area. These measures include, but are not limited to the following:

- ✓ Selection of latest equipment and plant with reduced noise level ensured by suitable in-built damping techniques and appropriate muffling devices.
- ✓ All powered mechanical equipment and machinery shall be fitted with noise abating gear such as mufflers for effective sound reducing, in full compliance with the DoE regulations.
- ✓ Vehicles and equipment should be fitted with silencer and maintained well. Mufflers should be used during pile driving hydraulic mechanism to ensure noise level is below 85 dB(A).
- ✓ The noisiest operations should be performed during daytime. Proper equipment maintenance and restricted operation between 0700 to 1800 hours will reduce noise.
- ✓ The construction equipment/machinery (stationary) shall be placed away from inhabited areas. Provision of temporary noise barrier shall be made near sensitive locations like schools, religious places and hospitals. If temporary noise barriers are not feasible then regulate construction activity and timing so as the impact intensity is minimized.
- ✓ The workers should be provided with personal protection devices as earplugs and earmuffs.
- ✓ In areas, where there are structures likely to be affected by vibrations because of the construction activities, precaution will be taken to minimize the vibration and the resulting impact.

- ✓ Noise and vibration monitoring shall be carried out as per the suggested monitoring plan.

g) Surface Water Quality

Impact

280. The project road passes two major water bodies (Shitalakshya and Balu River) which are ECA enlisted and other small to medium waterbodies. Construction activities may have localized impact in terms increase TSS level in canal water. Since this will be a temporary phenomenon, no significant adverse impact is anticipated during this phase.

281. Surface water might get contaminated due to the disposal of construction waste generated from the project activity. Uncontrolled dumping of wastes, sewage, dredge materials, and accidental spillage of fuels and chemicals into the water bodies may greatly pollute them. Disposal of sewage and wastes from the construction camps to surface water bodies without treatment will deteriorate the water quality. The seasonal ditches and ponds are unlikely to be affected from construction activities. This contamination will not only endanger the aquatic life but will also result in jeopardizing the health of natives that use this water for meeting domestic requirement. The impact on these water bodies will be only for the period of construction and will vanish as the construction work is over. However, the two ECA are not subject to negative impact from the project intervention distant from the project alignment.

Mitigation

282. The Contractor (The Company) shall always undertake to prevent water pollution because of his activities, and shall implement the measures to control water pollution that shall include, but not be limited to the followings-

- ✓ The Contractor (The Company) shall comply with the national legislation and other regulations currently applied in Bangladesh as they relate to water pollution control.
- ✓ Protection of the water environment shall be recognized as a key constraint for any construction work. The Contractor (The Company) shall devise and arrange methods of working to minimize water quality impacts to the satisfaction of the PIU.
- ✓ The Contractor (The Company) shall always ensure that all existing water courses and drains within, and adjacent to, the site are kept safe and free from any debris and any excavated materials arising from the works.
- ✓ For construction of the bridge piers bundled site boundaries shall be established to prevent any wastewater discharging directly to the water body environment.
- ✓ The earthwork sites where exposed land surface is vulnerable to runoff, etc. shall be consolidated and/or covered;
- ✓ The Contractor (The Company) shall ensure that rain run-off from the construction sites is not deposited directly into any watercourse.
- ✓ All drainage facilities and erosion and sediment control structures shall be regularly inspected and maintained to always ensure proper and efficient operation and particularly following rainstorms.
- ✓ Wastewater shall be collected, re-used and/or disposed of off-site after oil/grease removal and settlement of suspended solids. Sediment tanks of sufficient capacity, constructed from

pre-formed individual cells of approximately 6-8m3 capacities shall be used at all sites for settling wastewaters prior to disposal.

- ✓ Construction wastes shall be collected and re-used wherever possible. Otherwise, should be disposed in the small deposit area invulnerable to surface run-off, along with soil erosion prevention measures.
- ✓ The material stockpile sites shall be located far away from water bodies and areas prone to surface run-off. If some must be placed near bridge construction sites, the stockpiles should be surrounded by interception ditches or retaining structures to prevent the erosion and materials into the water bodies. The loose materials should be bagged and covered.
- ✓ The fuel storage and equipment maintenance yard should have weather/rain protection and should be on concrete pads to prevent dripping and leaking oils from entering the water bodies via surface runoff. All spoil soil disposal sites should only be allowed in the dedicated areas where will be erosion control measures and landscaping plan following the disposal operations.
- ✓ For construction of the project road, there should be strict waste control plan to restrict discharge or dumping of any directly discharge of wastewater, slurry, waste, fuels and waste oil into the water. All these materials should be collected and disposed at the banks. The slurry and sediment should be pumped to the banks for disposal and should not be allowed to discharge to the rivers directly.
- ✓ Drainage from vehicle maintenance areas, plant servicing areas and vehicle wash bays shall be passed via a petrol interceptor prior to discharge.
- ✓ The Contractor (The Company) shall ensure that no tools or machinery are washed in any water source or areas that drain into an existing watercourse.
- ✓ The Contractor (The Company) shall weekly check all equipment for prevention of oil and or lubrication leaks and ensure that all equipment oil and lubrication replacements are performed only in bounded maintenance and repair areas.

h) Groundwater Quality

Impact

283. Increased demand of groundwater is anticipated during the construction phase for construction activities and domestic purposes. Uncontrolled extraction of water may also affect availability of waters to locals. In addition to that, construction waste, if left unattended will result in forming leachate which will percolate through the soil strata and will reach underground water table and hence, will end up contaminating it.

284. 10 boreholes are drilled along proposed alignment, with design borehole depth of 35-60m.

Mitigation

285. Mitigation measures will include

- ✓ Pumping of groundwater should be from deep aquifers of more than 300 m to supply arsenic free water. Safe and sustainable discharges are to be ascertained prior to selection of pumps.
- ✓ Tube wells will be installed with due regard for the surface environment, protection of groundwater from surface contaminants, and protection of aquifer cross contamination.

- ✓ In case of unavailability of safe potable water, verified supply water will be used throughout the construction period.
- ✓ All tube wells, test holes, monitoring wells that are no longer in use or needed shall be properly decommissioned.
- ✓ Install monitoring wells both upstream and downstream areas near construction yards and construction camps to regularly monitor the water quality and water levels.
- ✓ Protect groundwater supplies of adjacent lands.
- ✓ During the construction, in case that geological conditions in some areas are discovered to be unfavorable after drilling, pile-side post-grouting and pile-bottom post-grouting are advised to ensure enough bearing capacity of piles, reducing the pile length and thereby lowering the project cost

i) Drainage Congestion

Impact

286. Run off from storage of construction material near water bodies, or uncontrolled disposal may cause temporary drainage congestion, especially near the locations of service areas, and construction sites. Stockpiling of fill materials dredged from the riverbeds for construction of the embankment may result erosion and subsequent deposition in the adjacent crop fields. The hydrological impacts of the project are primarily limited due to faster post monsoon drainage caused due to faster fall of water level in the drainage channels following the monsoon season. Furthermore, all the area does not have proper drainage facility. Only beginning part has but later mostly rural/semi urban area and does not have structure drainage system. The project area is not prone to flood as per secondary data collection and information gathered during consultations. As per assessment and considering the existing road levels some parts of the road stretch is likely to be affected by flood respectively.

Mitigation

287. Construction shall be so planned that there is no drainage congestion. Wastes should not be disposed near any water body. All waste depending on its characteristics, should be disposed off in a controlled manner. Adequate cross drainage structure shall be provided to easily drain off water to canals and other lowland areas. Drainage works can also be designed with the provision of lower volume of water to drain in other low-lying areas, but the regulators are to be provided in such cases to permit controlled drainage rates and the consequent water levels.

j) Terrestrial Fauna

Impact

288. The vibration of equipment, noise, wastewater, and exhausts gas are often considered to be disturbances to animals. These could drive animals away from their current habitats. However, impacts caused by construction works to terrestrial animals are considered manageable, because the amphibians found along the project road inhabit mainly in the cultivated farmlands or brooks.

289. During the construction phase, trees around the construction sites may be cut down and cause damage to the habitat of wild animals. Illegal hunting may also occur and pose the threat to wild animals. The practice of consuming wild animals as food may widespread. It promotes catching and hunting wild animals such as reptiles (frogs, snakes), birds etc. Biodiversity loss is usually observed as

one or both of: (1) reduced area occupied by species and community types and (2) reduced abundance of species or condition of communities and ecosystems. The likelihood of any biodiversity component persisting or surviving in the long-term declines with both lower abundance and reduced habitat area. If biodiversity loss is out of control, it will trigger off over-exploitation of the natural biological resources and even exhaust the resources.

290. Ditching and construction of temporary construction sites and access roads may lead to damage and deterioration of local ecosystems. It is likely that the development of the expressway will generate significant quantities of spoil materials which will be required to be removed off-site and either disposed-of or contained in stable storage and dumping areas.

291. This will include temporary and permanent dumping areas, which will need to be managed with respect to landslide stability, embankment stability, drainage control, erosion protection (wind and water) and sediment. Spoil stockpiling in small valleys or river banks will directly affect the habitat of animals. However, these animals may find alternate habitats in the areas around the project road and return to their previous habitat when the vegetation is recovered after the completion of construction.

292. During construction phase, air pollution, wastewater, and solid waste generated by the construction works may also deteriorate the animals' habitat and may force them to evacuate to another habitat. As an example, the construction of bridges may cause degradation of river water quality, loss of habitat, loss of food sources for reptiles, amphibians, fishes, etc.

Mitigation

293. In total of 69 and 38 species of wildlife are included in the Schedule 1 and 2 respectively under Wildlife (Conservation and Security) Act, 2012. Therefore, conservation activities need to be included without causing harm to the species. Almost all protected species are widely distributed and are less common to common within the area. Therefore, the species will not be at further risk due to much localized intervention. However, contractor (The Company) shall

- ✓ Setting up and implementation code of conducts to workers, including no catching or hunting fish and wildlife, and no consumption of wildlife products.
- ✓ Provision of environmental training with information on the importance of biological diversity, and its relationships with sustainable development.
- ✓ Limit the construction works within the designated sites allocated to the contractor (The Company).
- ✓ Minimize the tree removal during the bird breeding season. If works must be continued during the bird breeding season, a nest survey will be conducted by a qualified biologist prior to commence of works to identify and located active nests.
- ✓ Provide adequate knowledge to the workers regarding protection of flora and fauna, and relevant government regulations and punishments for illegal poaching.

k) Aquatic Species

Impact

294. The water courses may be contaminated by the pollutants generated from the construction sites and workers' camps, such as sediments in wastewater discharged from excavated areas, nutrients and biological contents in domestic sewage discharged from worker's camps, and oil and

grease leaked from construction machineries. Water pollution may change the dominance and the composition of the plankton. Water pollution will reduce species numbers and relative abundances of populations. Construction materials stored near the watercourses, uncovered excavated soil, stone dumps, and construction wastes may be easily washed out and flow into the water sources by rainfall, thus pollute the watercourses, change the water's pH value and deteriorate the aquatic animals' habitats. This can lead to plankton and benthos deaths and aquatic biomass reduction in the construction areas. However, impacts to plankton and benthos are considered insignificant. Major waterbodies e.g.; the Shitalakshya and Balu River are being polluted from adjacent dye factory and will not get affected from the project construction activities as they are located at a good distance from the alignment. Moreover, another waterbody located at CH 00+800km (beside Demra-Narayanganj Road) is also get polluted as the waterbody is connected with adjacent sewer system.

Mitigation

295. Mitigation measures will include

- ✓ Provision of environmental training with information on the importance of biological diversity, and its relationships with sustainable development;
- ✓ Contain oil immediately on waterbody in case of accidental spillage from vessels and in this regard, make an emergency oil spill containment plan to be supported with enough equipment, materials and human resources;
- ✓ Do not dump wastes, be it hazardous or non-hazardous into the nearby water bodies

l) Fisheries

Impact

296. The construction work may lead to the loss of fish habitat due to increased turbidity, decreased dissolved oxygen in the water, and reduction of food sources including temporary decline of plankton and benthos organisms. However, these impacts are short-term, reversible, and happen only during the construction phase. At CH 01+050km, CH 02+100km, CH 02+200 – 02+250km, CH 03+550km, CH 05+500, CH 08+050 - 08+100 waterbodies are located which are being used for aquaculture. The unplanned construction activities may cause hamper the practice. Besides, the below impacts may occur.

297.

- ✓ Loss of floodplain areas and burrow pits/ponds with consequent loss of aquatic fauna and flora
- ✓ Earth/sand filling activities may produce fine dust particle which affect the physiological functioning of plants and animals, in addition to respiratory disturbances to human.

Mitigation

298. Mitigation measures will include

- ✓ Do not dump wastes, be it hazardous or non-hazardous into the nearby water bodies or in the river
- ✓ Inspect any area of a water body containing fish that is temporarily isolated for the presence of fish, and all fish shall be captured and released unharmed in adjacent fish habitat

- ✓ Install and maintain fish screens etc. on any water intake with drawing water from any water body that contain fish.
- ✓ Ensure the earth filling is done in dry season to avoid killing of the floodplain and many burrow pits fishes.

m) Pollution from Wastes

Impact

299. The construction process will take at least 3 years[5] and as a result, the construction camps will take a semi-permanent appearance. Most of the waste generated will include construction wastes (solid wastes: piece of rods, woods, bricks, stones, containers, electric wire, pipes etc. liquid waste: paint, bitumen, oil etc.) and general wastes (solid wastes: papers, plastic containers, residues of food, fruits etc. and liquid waste: from kitchen and bathroom etc.). These wastes will be generated due to construction camps, construction activities and materials used for construction. If inadequate arrangements exist for the disposal of above-mentioned wastes, there will be negative impact on the soil, aesthetic beauty of area and workers' health and safety. Possibilities of bitumen and oil leaks spread of contaminants brought through material transport including invasive species, etc.

Mitigation

300. Mitigation measures will include

- ✓ Develop waste management plan (see Appendix 5) for various specific waste streams (e.g., reusable waste, flammable waste, construction debris, food waste etc.) prior to commencing of construction and submit to RHD for approval.
- ✓ Prepare spill control procedures (see Appendix 6) and submit the plan for RHD approval.
- ✓ Train the relevant construction personnel in handling of fuels and spill control procedures.
- ✓ Store dangerous goods in bunded areas on a top of a sealed plastic sheet away from watercourses.
- ✓ Refueling shall occur only within bunded areas.
- ✓ Make available MSDS (see Appendix 7) for chemicals and dangerous goods on-site.
- ✓ Place a high emphasis on good housekeeping practices.
- ✓ Store hazardous materials above flood plain level.
- ✓ Put containers and drums in temporary storages in clearly marked areas, where they will not be run over by vehicles or heavy machinery. The area shall preferably slope or drain to a safe collection area in the event of a spill.
- ✓ Put containers and drums in permanent storage areas on an impermeable floor that slopes to a safe collection area in the event of a spill or leak.
- ✓ Take all precautionary measures when handling and storing fuels and lubricants, avoiding environmental pollution.

[5] Environmental Impact Assessment (EIA) Study of Improvement of Hatirjheel-Rampura-Bonoshree Ideal School and College-Sheikherjaiga-Amulia-Demra Highway into 4-lanes (including link to Chattogram Road intersection and access to Tarabo) through Public Private Partnership, January 2022.

n) Asphalt Hot Mix Plant, Rock Crushing, and Bitumen Supply

Impact

301. Rock crushing activities will generate noise and dust, and asphalt hot-mix plant and pavement works will generate gas and odour while compaction of the pavement will also generate noise and dust. Notwithstanding those emissions from powered mechanical equipment that supply crushed rock and asphalt will be rapidly dispersed, they will need to be sited carefully to avoid complaints. It is also possible that soil may be contaminated by oils and chemicals at asphalt/bitumen plant sites, workshop areas, and equipment washing yards. The contamination may limit the future use of the land for agricultural purposes.

302. Due to construction activities waste will be generated at construction and contractor's (The Company) camp site. The construction waste will include wastewater, oil spillage from machinery, hazardous waste, and solid waste etc. This will result in unhygienic conditions, health risk to work force and public at the camp site. Following are the types and sources of construction waste:

- ✓ Oil, grease etc. from construction machinery;
- ✓ Hazardous and solid waste from waste construction material and food;
- ✓ Waste water from washing and sprinkling; and
- ✓ Sanitary waste from staff toilets.

Mitigation

303. Although emissions from powered mechanical equipment that supply crushed rock and asphalt will be rapidly dispersed, they will need to be sited carefully to avoid complaint. To maintain the existing air quality of the project area in a condition acceptable to the local population, compliance with the following mitigation measures will be needed:

- ✓ Cement batching and aggregate mixing plant will be located as far as possible (at least 500 m from settlements and habitation near the project corridor, or as required by environmental regulations;
- ✓ All conditions of DoE permits and local guidelines will be observed;
- ✓ Dust suppression equipment will be installed at cement and aggregate mix plants;
- ✓ Areas of construction, as well as the haul road, will be kept damp by watering. The construction area where local roads are used for hauling, they shall be kept in serviceable condition, and any damage will be repaired promptly without interference to local travel routes;
- ✓ All hot-mix plants, crushers, and batching plants will be located in agreement with the local district or municipality and installed in a sealed area only after receiving approval from the relevant local authority and DoE.

304. Mitigation measures will include

- ✓ Organize disposal of all wastes generated during construction in an environmentally acceptable manner. This will include consideration of the nature and location of disposal site, to cause less environmental impact.

- ✓ Transport waste of dangerous goods, which cannot be recycled, to a designated disposal site approved by DOE. Vehicles transporting solid waste shall be covered with tarps or nets to prevent spilling waste along the route
- ✓ Train and instruct all personnel in waste disposal practices and procedures as a component of the environmental induction process.
- ✓ Provide absorbent and containment material (e.g., absorbent matting) where hazardous material is used and stored and personnel trained in the correct use.
- ✓ Provide protective clothing, safety boots, helmets, masks, gloves, goggles, to the construction personnel, appropriate to materials in use.
- ✓ Make sure all containers, drums, and tanks that are used for storage are in good condition and are labeled with expiry date. Any container, drum, or tank that is dented, cracked, or rusted might eventually leak. Check for leakage regularly to identify potential problems before they occur.
- ✓ Minimize the production of waste materials by 3R (Reduce, Recycle and Reuse) approach.
- ✓ Segregate and reuse or recycle all the wastes, wherever practical.
- ✓ Prohibit burning of solid waste.
- ✓ Provide reuse containers at each worksite.
- ✓ Request suppliers to minimize packaging where practicable.
- ✓ Avoid the use of material with greater potential for contamination by substituting them with more environmentally friendly materials.
- ✓ Maintain all construction sites in a cleaner, tidy and safe condition and provide and maintain appropriate facilities as temporary storage of all wastes before transportation and final disposal.

o) Construction Yard

Impact

305. The precise locations of construction camps and other facilities such as workshops, equipment washing yards, construction material storage areas, haul routes and disposal sites for construction waste will be finally decided by PROJECT COMPANY and RHD in consultation with Contractor (The Company). However, the siting of these facilities may cause a number of issues such as loss of plantation and vegetation, permanent physical and visual impact on the area and pollution risks if construction materials are extracted from the river bed. The construction process will take several years, with the result that the camps will take on a semi-permanent appearance. The people and the changes they bring can have significant impacts on the local communities and social structures. Substantial numbers of workers will inhabit the area in temporary camps loading local infrastructure and causing ambient social influence. Most important aspects are pollution risk of soil and surface water due to sanitation of the labour camps and wastes from the camps.

Mitigation

306. The Contractor (The Company) shall

- ✓ The proposed construction yard sites are located 800m left side from CH K4+500. A map is presented below.

- ✓ Consider the location of construction camps away from communities to avoid social conflict in using the natural resources such as water or to avoid the possible adverse impacts of the construction camps on the surrounding communities.
- ✓ Submit to the PIU for approval a detailed layout plan for the development of the construction camp showing the relative locations of all temporary buildings and facilities that are to be constructed together with the location of site roads, fuel storage areas (for use in power supply generators), solid waste management and dumping locations, and drainage facilities, prior to the development of the construction camps.
- ✓ Local authorities responsible for health, religious and security shall be duly informed on the set up of camp facilities to maintain effective surveillance over public health, social and security matters.
- ✓ Adequate housing, safe and reliable water supply for all workers.
- ✓ Hygienic sanitary facilities and sewerage system. The toilets and domestic wastewater will be collected through a common sewerage. Provide separate latrines and bathing places for males and females with total isolation by wall or by location. The minimum number of toilet facilities required is one toilet for every ten persons.
- ✓ Paved internal roads. Ensure with grass/vegetation coverage to be made of the use of top soil that there is no dust generation from the loose/exposed sandy surface. Pave the internal roads of at least haring-bond bricks to suppress dusts and to work against possible muddy surface during monsoon.
- ✓ Provide in-house community/common entertainment facilities. Dependence of local entertainment outlets by the construction camps to be discouraged/prohibited to the extent possible.
- ✓ Ensure proper collection and disposal of solid wastes within the construction camps.
- ✓ Insist waste separation by source; organic wastes in one pot and inorganic wastes in another pot at household level.
- ✓ Locate the garbage pit/waste disposal site min 500 m away from the residence so that peoples are not disturbed with the odour likely to be produced from anaerobic decomposition of wastes at the waste dumping places. Encompass the waste dumping place by fencing and tree plantation to prevent children to enter and play with.
- ✓ Provide adequate health care facilities and first aid facility round the clock within construction sites. Maintain stock of medicines in the facility and appoint fulltime designated first aider or nurse.
- ✓ Train all construction workers in basic sanitation and health care issues and safety matters, and on the specific hazards of their work.
- ✓ Provide adequate drainage facilities throughout the camps to ensure that disease vectors such as stagnant water bodies and puddles do not form. Regular mosquito repellent sprays during monsoon.
- ✓ Provide appropriate security personnel (police/home guard or private security guards) and enclosures to prevent unauthorized entry in to the camp area.
- ✓ Maintain register to keep a track on a head count of persons present in the camp at any given time.

- ✓ Dismantle camps in phases and as the work gets decreased and not wait for the entire work to be completed
- ✓ Reuse the demolition debris to a maximum extent. Dispose remaining debris at the designated waste disposal site by RHD.
- ✓ Handover the construction camps with all built facilities as it is if agreement between both parties (contactor and land-owner) has been made so.
- ✓ Restore the site to its condition prior to commencement of the works or to an agreed condition with the landowner.

Figure VI.3: Proposed Construction Yard Sites

p) Occupational Health and Safety (OHS)

Impact

307. Construction workers are more likely to face occupational health hazards such as minor or major injuries due to lack of general safety requirements and precautions applicable while working at construction sites, and handling with machines and equipment, use of equipment and driving vehicles and so on. Poorly designed temporary labour camp and sanitation facilities may pose a health threat and nuisance to the workers. Uncontrolled vending of food and drinking water at the work site may also pose a risk with respect to the transmission of contagious diseases like Typhoid, Diarrhea, Malaria, and Dengue in particular. Construction workers will be required to handle hazardous materials such as cement, bitumen, chemicals, fuels, and so on which will increase health risks of the workers if personal protective equipment are not used. Although presently total ratio of the affected people in Bangladesh by HIV/AIDS is far less than 0.1%, however this percentage is slowly being increased due to injection drug users and overseas migrant workers returned to Bangladesh.

308. Additionally, the pandemic COVID-19 has serious threats on the workers who will be working closely at the project site. Following social distancing may not be possible at all the time to do some specific construction works. Therefore, the contractor (The Company) has to maintain a strict Health & Safety Plan to avoid the contamination by the COVID-19 among the personnel related to the sub-project.

Mitigation

309. Major Mitigation measures will include the following while detail mitigation measures are presented in "Chapter VII - Labor and Occupational Safety, Health, and Environment (OSHE)".

- ✓ Obligatory insurance against accidents for labors/workers;
- ✓ Prepare a detailed Health & Safety Plan for the construction period.
- ✓ Providing basic medical training to specified work staff and basic medical service and supplies to workers;
- ✓ Layout plan for camp site, indicating safety measures taken by the contractor (The Company), e.g., firefighting equipment, safe storage of hazardous material, first aid, security, fencing, and contingency measures in case of accidents;
- ✓ Protection devices (ear muffs) will be provided to the workers doing job in the vicinity of high noise generating machines;
- ✓ Provision of adequate sanitation, washing, cooking and dormitory facilities including light up to satisfaction;
- ✓ Provision of protective clothing for labors handling hazardous materials, e.g., helmet, adequate footwear for bituminous pavement works, protective goggles, gloves etc.;
- ✓ Adequate signage, lightning devices, barriers, yellow tape and persons with flags during construction to manage traffic at construction sites, haulage and access roads.
- ✓ Prepare and maintain Safe Work Procedure of COVID-19 (see Appendix 7) at the construction site as well as at base camps.

q) Community Health and Safety

Impact

310. The construction activities and vehicular movement at construction sites and access service roads may result in road side accidents particularly inflicting local communities who are not familiar with presence of heavy equipment. This is a temporary and minor negative impact. Quality of groundwater and surface water resources available in the nearby local communities may be affected due to the construction activities, oil spillage and leakage, roadside accidents etc. The labour works with different transmittable diseases may cause spread out of those diseases in the residents. The borrow pit areas located near the residential, settlements, may cause accident for the people moving near to those areas.

Mitigation

311. Mitigation measures will include:

- ✓ Prepare a detailed Health & Safety Plan for the construction period.
- ✓ There should be proper control on construction activities and oil spillage leakage of vehicles.
- ✓ The labour works with different transmittable diseases should be restricted within the construction site.
- ✓ Efforts will be made to create awareness about road safety among the drivers operating construction vehicles;
- ✓ 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, particularly at urban areas and at sensitive/accident-prone spots.
- ✓ Reducing the impacts of vector borne diseases on long-term health effect of workers should be accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease;
- ✓ During construction work, pedestrian and vehicular passages should be provided for crossing near settlement
- ✓ Use of water should not disturb public water availability. Source of water should be selected carefully.

r) Traffic Congestion/ Road Accidents

Impact

312. The existing highway is one of the busiest roads. The influx of heavy construction vehicles used for the construction work may cause road accident if they are not moved following traffic rules. The construction work beside the existing highway road will impede regular movement of the vehicles. The construction workers, pedestrians and onlookers are also prone to accidents. Road accident may also occur at road crossing during construction work.

313. Due to construction activities, traffic management may be a problem in the project area. This may result in traffic jams and cause inconvenience to the people passing through the road crossings at proposed interchanges due to movement of vehicles carrying construction materials. The construction vehicles will add more traffic and as a result, traffic congestion and road accidents will be increased. Traffic congested areas along the alignment are presented in the below table where mitigation measures are required.

Table VI-8: Traffic Congested Areas with Chainage Distribution

Location	Chainage (km)
Chattogram Road	0+000 – 0+250
Sarulia Bazar	2+900 - 3+350
Demra Circle	2+900 - 3+350
Meradia Bazar	10+300 - 10+500
Bonoshree	11+000 - 12+680
Rampura Bridge	12+465

Mitigation

314. The Contractor (The Company) shall

- ✓ Prepare and submit a traffic management plan to the RHD for his approval at least 30 days prior to commencing work on any project component involved in traffic diversion and management.
- ✓ Include in the traffic management plan to ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours, temporary road, temporary bridges temporary diversions, necessary barricades, warning signs / lights, road signs etc.

- ✓ Provide signs at strategic locations of the roads complying with the schedules of signs contained in the Bangladesh Traffic Regulations.
- ✓ Restrict truck deliveries, where practicable, to day time working hours.
- ✓ Restrict the transport of oversize loads.
- ✓ Operate road traffics/transport vehicles, if possible, to non-peak periods to minimize traffic disruptions.
- ✓ Enforce on-site speed limit
- ✓ Install and maintain a display board at each important road intersection on the roads to be used during construction, which shall clearly show the project information in both Bangla and English.
- ✓ In Rampura-Demra direction, because a proposed new ramp will block the passage between the residents on the left of toll road and the service roads, a diversion road will be added to connect the service road to meet the needs of the residents' travel.
- ✓ Gate-type direction indication sign should be arranged at places 150 m ahead of the diversion section of elevated layer.
- ✓ Anti-collision buckets should be arranged ahead of toll island and the diversion point of toll road.

315. A schematic diagram for traffic diversion is presented in the below figure.

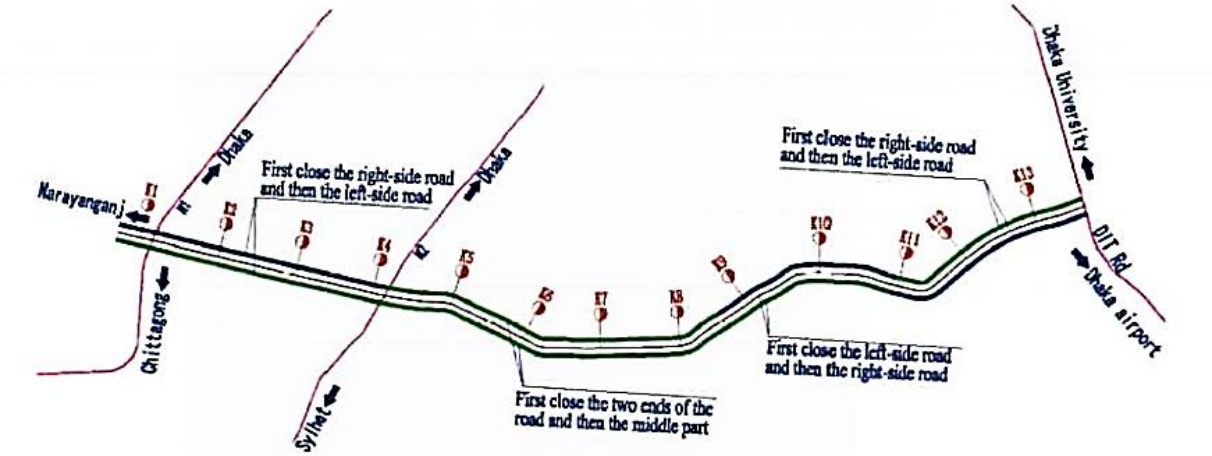


Figure VI.4: Schematic Diagram for Traffic Diversion

s) Income/Employment

Impact

316. Normal living of the local people will be affected for a certain period. Income loss in a lower scale will be happened due to the rehabilitation of the households. Unplanned occupation of roadside land for habitation and commercial purpose may alter the land use of the project area beyond the project-acquired area.

317. During construction activities, local unemployed people will get employment and increased income. The immediate benefits to the poorest residents in the project impact areas include employment in construction activities; and subsistence allowances and other benefits under resettlement, and increased income from petty business during construction. It is also expected that

during the construction phase several other employment opportunities with contractor's (The Company) office would be available for local people. Details of business loss is presented in the below table.

Table VI-9: Business Loss among the Affected Households (HHs) due to this Project Intervention

Types of Loss	Titled (HH)		Non-Titled (informal/Squatters) (HH)				Total (HH)
	Permanent	Tenant	Permanent	Temporary	Tenant	Vendors	
Residence and Business	19	0	0	0	0	0	**19**
Business only	166	105	57	349	43	129	**848**
Total	**185**	**105**	**57**	**349**	**43**	**129**	**867**

Source: SIA and RAP survey, June 2022

Mitigation

318. In order to minimize the income loss, contractor (The Company) as far as practicable will recruit construction workers from amongst the locals where possible and shall maintain gender equity while employing the locals. Priority shall always be given to people from amongst the PAPs and from those unemployed and belong to the lower income group. Additional benefits will be derived by setting aside-areas within contractor (The Company) camps/labour shed for local people to sell their products or to provide additional services to the workers. Replacement on a suitable location in a better form will be done with the help and consent of the affected local community.

319. Project authorities shall take necessary actions as per the recommendation of Resettlement Action Plan (RAP) and Social Impact Assessment (SIA) which have been prepared and the total compensation for secondary structure only for resettlement is calculated as BDT. 1,671,928,237.

t) Sexual Exploitation, Abuse (SEA) and Sexual Harassment (SH)

Impact

320. The proposed construction project will inevitably increase people's mobility, potentially leading to several social issues, including increased exposure to communicable (e.g., COVID-19) and sexually transmitted diseases (e.g., HIV/AIDS) as a result of an influx of outsiders such as traders, businesspeople, skilled and unskilled migrant laborers, transport workers, and others, all of which could exacerbate social tensions. SEA/SH events are not expected to worsen as a result of the influx of labor, according to focus groups with diverse groups, including women.

Mitigation

321. However, once construction work begins, the risk should be re-evaluated due to the influx of workers and increasing number of activities. A gender and SEA/SH plan are required considering a large labor influx as a precautionary measure. The contractor (The Company) will prepare this document and share with the RHD and AIIB for review and further will update accordingly. This document will be disclosed in the website of the RHD and AIIB both in Bangla and English. A sample table of content is presented in Appendix 9.

u) Tree Plantation

Impact

322. The project implementation activities, at different locations, will invariably involve trees and vegetation to be removed for the upgrade, widening and geometric improvement of the project road.

323. The affected trees on both sides of the proposed road alignment of different fruit and timber trees have proportionate economic, eco-functional and aesthetic significance. Removal of trees will affect the local ecosystem, habitat of local birds, animals and wildlife. Particularly, the wildlife that is living by the affected trees will permanently lose the ecological services from those trees. Therefore, removal of mature trees will cause ecological loss to the environment.

324. During the construction work of the road the compensatory tree plantation with 17460 trees will be conducted which will provide positive impact on the natural environment. Inappropriate selection of tree species and plantation location may not ensure the inherent objective of the tree plantation plan. Moreover, lack of proper care (e.g., watering, securing with fence) by the respective authority will also hinder the process of proper growth of the planted trees.

Mitigation

325. Road design engineer have already selected the best option to minimize the tree cutting by selecting road-widening option based on technical consideration. Public and NGOs will be consulted further before cutting of the old trees if its felling is unavoidable due to technical consideration.

326. RHD will be responsible for the compensatory tree planting program by forming an 'Environmental and Social Team' in coordination with the Arboriculture Department (AD). RHD will inform the Upazila Forest Officer regarding tree cutting and the compensatory tree plantation programme. The respective Forest Officers will encourage the local community (especially women) to participate in this programme. RHD's compensatory planting will be in rows as per the prescription of FD e.g., three tree seedlings to be planted for each tree felled, after the project construction activities are completed. This ratio may be more in the case of social forestry trees as per any mutual understanding arrived at with tree owners before cutting the social trees. These trees will be planted primarily along the road within the ROW and also in the interchanges to increase the aesthetical value of the project. The social forestry can be planted on the area allocated by local authorities. Planting will be done as soon as the construction of the road is completed. Maintenance is the key to the establishment of the plantation and therefore regular monitoring of plantation will be carried out by the executing agency.

327. Plants selected for housing area include Plants selected include *Polyalthia longifolia*, *Terminalia catappa*, *Acacia auriculiformis*, *Ceiba speciosa St.Hih.*, *Hibiscus rosasinensis linn.*, *Bougainvillea glabra choisy*, etc.

328. The compact plantation shall be effective live screens against night glare, dust, noise, and pollutant emissions. These vegetated strips shall develop into a complete ecosystem. Flowering and fruiting shrubs can be planted along the road to beautify the landscape. Planting should however be done keeping in view the principles of landscape designing. At the roundabout, *Terminalia catappa* and *Ceiba speciosa St.Hih*. are used as the backbone trees in the design. The lower layer is matched with low shrubs such as *Hibiscus rosa-sinensis linn*. and *Bougainvillea glabra choisy* and the bottom layer is covered with *Schefflera heptaphylla* to create a road node landscape with flowers all year round and well-arranged.

329. Different species as per the tree plantation plan (see Appendix 10) can be planted at the road shoulder (whereas possible), to substitute the ecological loss occurred because of the tree cutting for the road construction. Moreover, Contractor (The Company) will be responsible to take measures of protecting the planted seedlings until the seedlings grow enough to survive independently. Scope of natural rehabilitation of the local wildlife to the habitat will be created in result of the tree plantation

and growth of the vegetation. If possible, shifted homesteads may be compensated through providing seedlings. Especial care should be taken for biodiversity rich areas during construction. Plantation or green areas will be developed around the interchanges and within the open space in a planned manner which will have a long-term positive impact compared to base environmental condition, because of plantation of higher number of trees compared to deforestation.

3. Operation Stage

a) Air Quality

Impact

330. The bad road conditions, the idling of vehicles and congestions are the main causes of the air and noise pollution at present. The improved road conditions will change this scenario, which will result in the improved ambient air quality. However, in the longer run, increased traffic levels and congestion will lead to PM_{10} and $PM_{2.5}$ pollution levels above the national/international standards, which may result in causing public health risks, nuisance, and other impacts on bio-physical environment.

331. These conditions will result in the rise of vehicular emissions (CO, NO_X, SO_X, PM_{10}, $PM_{2.5}$) associated with the adverse effects on the environment and human. This impact is permanent and positive, in case of improvement of road conditions and minor negative, when traffic volume is increased.

Mitigation

332. Mitigation measures will include:

- ✓ It is proposed to maintain the road conditions especially the shoulders and embankment turfing.
- ✓ Setting up of a system to monitor air quality along project area in accordance with the applicable standards/limits;
- ✓ Roadside tree plantations as applicable and feasible under harsh climatic conditions; plants should be selected in accordance with their ability to absorb emissions;
- ✓ Densely populated trees shall be planted close to school, and religious places.
- ✓ Regular road maintenance to ensure good surface condition;
- ✓ Regular vehicle checks to control/ensure compliance with air quality standards;
- ✓ Best traffic management practices shall also be adopted to regulate the traffic. Enforcement and penalties against traffic rules violators.

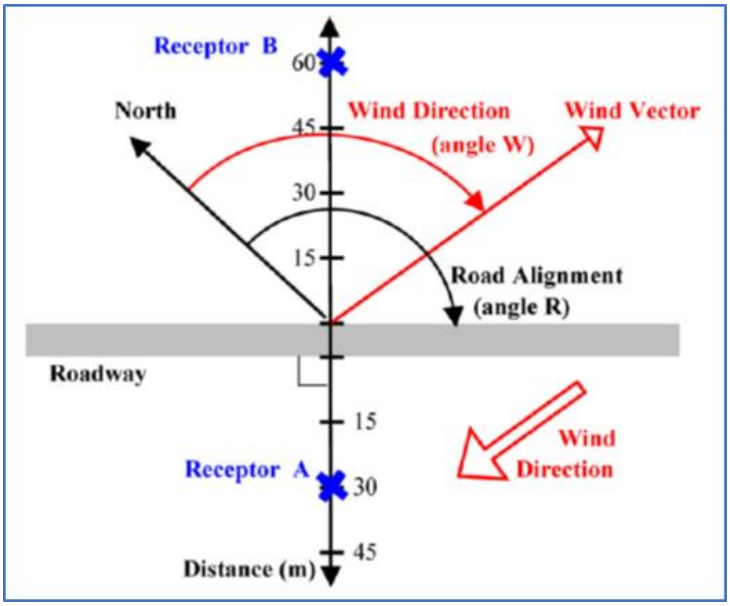
(1) Air Pollution Modeling

(a) Applicability of Air Pollution Model for the Proposed Road

333. Automobile sources are threatening issue in urban air quality, no exception for the proposed RAD road alignment. Besides, ill maintained road condition, rampant growth in automobiles and inadequate road network worsen the scenario of this city. Thus, the air quality management demands constant attention. CALINE4 is a widely used line source Gaussian air pollutant dispersion model, developed by California Department of Transportation. The model has been formerly used for modelling dispersion of CO, $PM_{2.5}$, PM_{10} and NOx. This current study deals with application of this

CALINE4 model for vehicular NOx dispersion. CALROADS View, a tool reportedly used in literatures for CALINE4 dispersion modelling is applied here. A pollutant contour has been generated around the study area with the help of CALROADS View for NOx, CO and PM in the study.

334. CALINE4 is one of the more popular Gaussian-based line source models. With appropriate input data, simulation models can be used to predict short- and long-term air pollution concentrations at desired locations called "receptors," and multiple receptors can be used to represent spatial and temporal gradients at regional, urban and local scales. The development of the site-specific emission information that "drives" such models is not trivial. Vehicle emissions depend on many factors, including the number, speed, type and age of vehicles, all of which can vary significantly over the course of a day. Emission/dispersion models do not require data from existing pollutant monitoring sites to estimate near-road concentrations and exposures, although such information may be used to estimate the "background" component of concentrations contributed by other "local" and "regional" emission sources, i.e., those not explicitly modeled because they are distant, too numerous, or too difficult to simulate. The drawbacks of dispersion models include, among others, extensive input data requirements, errors due to unmeasured variability in emissions and other parameters, the need for accurate locational information, simplified and possibly unrealistic model assumptions, the relevance of the background estimates, and a need for validation.



335. CALINE4, a line-source Gaussian plume dispersion model originally developed by the California Department of Transportation to predict 1-hr and 8-hr CO concentrations at pre-determined receptor positions near roadways. The model can also simulate formation and dispersion of NO_2, using a simple set of reactions to predict its formation from precursors NO and O_3, and PM, using algorithms to model deposition and settling processes. Required inputs include roadway geometry, hourly surface meteorology, traffic volume and emission rates. Individual highway segments are divided into a series of elements, each modeled as an "equivalent" finite line source that is normal to the wind direction and centered at the element's midpoint, from which incremental concentrations are computed and summed to predict the concentrations at designated receptors.

(b) Location of the Grid

336. The grid dimension for the proposed location is 20 X 20 km^2 with center point at 23.738406°N and 90.470085°E (Zone 46Q in UTM coordinates system). This grid domain covers the whole of road alignment.

337. In order to study CALINE4 model of NOx, CO and PM, ''Hatirjheel-Rampura-Bonoshree Ideal School and College-Sheikherjaiga-Amulia-Demra highway'' is selected (Figure VI-2). This is one of the major roadways in the city.

338. The major motorized fleet types of this road are taxi/private car, auto, two wheels, public transport (bus) and trucks. For the study, primary data are collected from 3 locations around the road network, sample was collected for 24 hours.

Table VI-10: Air Quality Sampling Location

Date	Location Name	GPS
26 June 2022	Beside Rampura Bridge Police Box, Rampura, Dhaka C/S No. -251 CH. 12+450 km	23.767401°N 90.423261°E
28 June 2022	Mostam Haji Mor, Rampura, Dhaka C/S No. -134 CH. 06+650 km	23.746545°N 90.472206°E
30 June 2022	Near Sugandha Hospital, Chattogram Road, Dhaka C/S No. -01 CH 00+000 km	23.697662°N 90.509537°E

339. A CALINE4 (CALROADS View) model is validated for predicting NOx, PM and CO concentration with respect to randomly selected data from the same measured air pollutant and Traffic data. This validated model is further used to generate pollutant level contour for NOx, CO and PM nearby the study area.

(c) Methodology

340. Air monitoring was carried out at all the Three locations for key pollutants. Nitrogen dioxide (NO2), Carbon mono-oxide and respirable suspended particulate matter (PM_{10} & $PM_{2.5}$) are monitored with AEROQUAL. Prediction of all the pollutants were done by CALRoads View model.

341. Wind speed data are taken from Bangladesh Meteorological Department Dhaka weather station. Standard values of NO_2 photoly rate constant is taken 0.015/s and ratio of NO/NO_2 being 0.32 respectively.

342. Where, v h is wind speed at receptor height, i.e., 1m, v is wind speed at height of actual measurement i.e., 16 m, h is height at which wind speed is being calculated (1 m), H is height, at which wind speed is measured (16 m). It is observed that wind speed in all cases in 16 m height remains nearly between 2m/s, which are expected to further reduce in 10 m height for any type of stability class. Thus, the wind speed at 10m height can be taken below 2m/s in all cases. With reference to 'key to stability categories', stability class is then taken to be B throughout the study and hence p value being 0.389.

343. The wind speed data mentioned are collected from BMD, instrument is installed at 16m height. The data is converted to the value at 1 m height by standard equation. It is expected to be reduced in receptor height of 1m as per the given equation:

$$V_h = V \times (h/H)^{p}$$

(i) Inputs for CALRoads View Model

344. Stability class is then considered B throughout the study.

Table VI-11: Stability Classes

A: Extremely unstable conditions
B: Moderately unstable conditions
C: Slightly unstable conditions
D: Neutral conditions
E: Slightly Stable conditions
F: Moderately Stable Conditions
G: Extremely Stable

345. Forecasted traffic volume for year 2049 have been used in the model. Table-4 represents the forecasted traffic data for year 2049.

Table VI-12: Traffic Volume Forecast Results of Different Types in Feature Years of This Project (veh/day)

Years	Semi-trailer	Large truck	Medium Truck	Light Truck	Large Bus	Mini Bus	Micro bus	Utility	Car/ Tax	Total	Per hour
2024	1360	1965	2054	1530	320	1618	1472	718	4097	15134	631
2030	1859	2685	2881	2151	441	2237	2052	1018	5689	21013	876
2035	2260	3265	3662	2747	574	2737	2588	1285	6964	26082	1087
2040	2674	3863	4416	3319	698	3186	3124	1543	8156	30979	1291
2045	3042	4395	5066	3811	810	3563	3603	1770	9176	35236	1469
2049	3270	4723	5469	4125	881	3812	3906	1915	9767	37868	1578

Emission factors for PM, NO_2, CO

Table VI-13: Emission Factor for Carbon Monoxide in (gm/mile)[6]

Year	Four Wheelers		CNG	Buses	Auto	LCV		HCV	
	Petrol	Diesel		CNG	CNG	Diesel	CNG	Diesel	CNG
2010	4.84	0.096	0.096	5.98	1.601	5.89	5.15	6.31	5.99

Table VI-14: Emission Factors for PM and NOx in (gm/mile)[7]

Vehicles	Two Wheelers	Taxi/ Private Car	Auto	Light Commercial Vehicle	Bus/ Truck
PM Emission Factor (gram/ mile/ vehicle)	0.024	0.902	0.19	1.607	3.241
NOx Emission Factor (gram/ mile/ vehicle)	1.05	0.306	0.483	18.096	4.88

346. The various inputs data required to run the CALRoads View model are given in Table VI-12.

[6] Research Association of India (ARAI), 2008
[7] ARAI, 2007

Table VI-15: Input for CALRoads View Model

Meteorological Variables	
Averaging time (min)	60 min
Surface roughness coefficient (cm)	400 cm
Settling velocity (cm/s)	0 cm/sec
Deposition velocity (cm/s)	0 cm/sec
Wind speed (m/s)	1.37 m/s
Wind direction increment angle (degree)	22.4
Stability class	B
Ambient atmospheric temperature	29°C
Mixing height (m)	1000 meters
Height of receptor (m)	1.8 m

(d) Results

347. CALINE4 (CALROADS View) model is validated against measured NOx, CO, PM concentrations, which is further applied in predicting of the pollutant.

(i) $PM_{2.5}$

348. The receptors closer to the road alignment have higher value of $PM_{2.5}$. The receptors that are closer to the alignment have all exceeded the DoE and WB/IFC EHS Standard values. The highest value of $PM_{2.5}$ concentration is 117.7 µg/m^3.

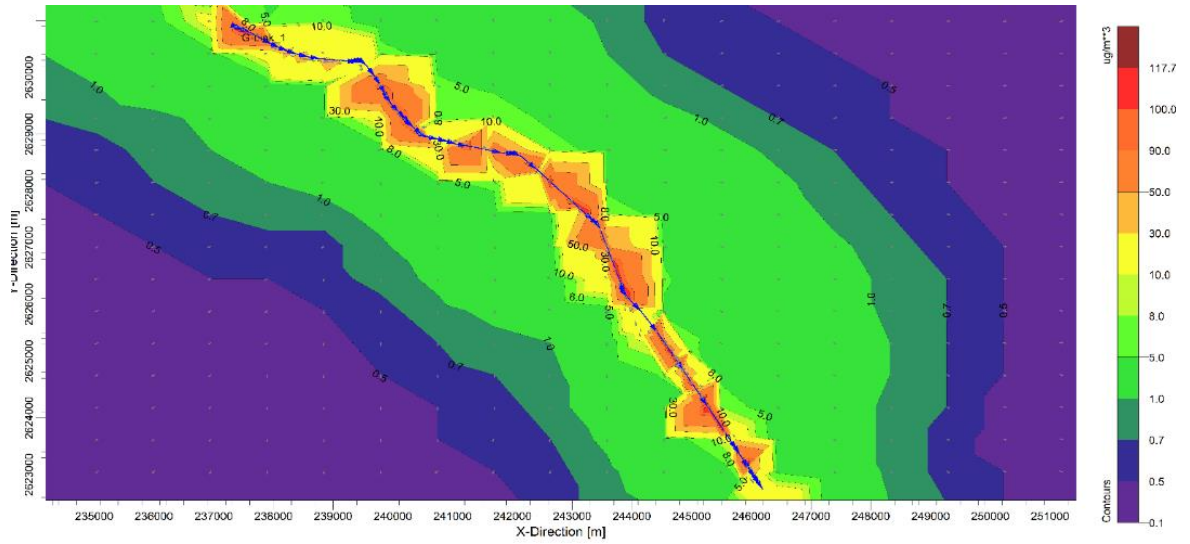


Figure VI.5: Contour Map of $PM_{2.5}$ Concentration (2049)

Table VI-16: CALINE4 Prediction of $PM_{2.5}$ Concentrations Based on Future (2049) Scenario

Receptor SL	Location	Latitude (°N)	Longitude (°E)	Chainage	$PM_{2.5}$ (µg/m³)	Distance wise Concentration[8]		
						60m	120m	240m
1	Rampura Water Pump	23.767555	90.423333	CH. 12+465 – CH. 12+450	108.50			
2	Bangladesh Television Rampura	23.76714	90.424512	CH. 12+350 – CH. 12+300	109.70	91.2	77.3	52.2
3	East West University	23.768277	90.425361	CH. 12+350 – CH. 12+300	7.6			
4	Oxford International School	23.766467	90.425843	CH. 12+200 – CH. 12+150	103.90			
5	Rampura Khal	23.766348	90.426627	CH. 12+100 – CH. 12+050	100.30			
6	Holy Crescent School	23.764441	90.429426	CH. 11+750 – CH. 11+700	41.20			
7	Rajdhani Ideal School and College	23.764227	90.430001	CH. 11+700– CH. 11+650	42.50			
8	Bonoshree Central Jam-e-Masjid	23.763567	90.431472	CH. 11+550 – CH. 11+500	34.80			
9	Ideal School & College	23.76333	90.432153	CH. 11+450 – CH. 11+400	28.60			
10	Bonoshree Adarsha Bidyaniketon School	23.762909	90.434168	CH. 11+250 – CH. 11+200	35.10	26.4	16	9.1
11	National Ideal School, Bonoshree	23.762794	90.434634	CH. 11+200 – CH. 11+150	31.80			
12	National Ideal English Version	23.762763	90.434837	CH. 11+200 – CH. 11+150	31.50			
13	National Ideal Girls' College	23.762754	90.434919	CH. 11+200 – CH. 11+150	31.80			
14	Bangladesh Fertility Hospital LTD	23.762729	90.435056	CH. 11+150 – CH. 11+100	31.20			
15	Proper Health Care & Hospital	23.762713	90.435165	CH. 11+150 – CH. 11+100	31.20			
16	DPDC Substation Bonoshree	23.762639	90.435631	CH. 11+100 – CH. 11+050	29.40			
17	Farazi Hospital Limited	23.762504	90.43626	CH. 11+050 – CH. 11+000	23.40			
18	Advanced Hospital	23.762545	90.436777	CH. 11+000 – CH. 10+950	43.40			
19	Intelligentsia School and College	23.762397	90.437495	CH. 10+900 – CH. 10+850	36.80			
20	Nur Majid Ayurbedic College	23.762511	90.437778	CH. 10+900 – CH. 10+850	50.50	41.6	28.3	16.7
21	Academia	23.762445	90.437935	CH. 10+900 – CH. 10+850	43.50			
22	Bosuti Maa O Shishu Hospital	23.762461	90.438651	CH. 10+800 – CH. 10+750	47.90			
23	Al Razi Islamia pvt Hospital	23.762244	90.439927	CH. 10+650 – CH. 10+600	32.20			
24	Famous Specialized Hospital	23.76195	90.443408	CH. 10+300 – CH. 10+250	23.20			
25	Dhaka Metropolitan Police, Rampura Thana	23.761305	90.443476	CH. 10+300 – CH. 10+250	13.90			
26	Yamagata Dhaka Friendship General Hospital	23.761464	90.443958	CH. 10+200 – CH. 10+150	14.00			
27	Tourist Police Headquarter	23.760018	90.446414	CH. 09+900 – CH. 09+850	57.70			
28	Messrs. Quality Timber & Saw Mill	23.757508	90.447825	CH. 09+600 – CH. 09+550	103.90	88.2	63.9	39.5

[8] One location from each cluster of sensitive locations has been focused to determine 'Distance Wise Concentration'. That is why the other respective cells are kept blank.

Receptor SL	Location	Latitude (°N)	Longitude (°E)	Chainage	$PM_{2.5}$ (µg/m³)	Distance wise Concentration[8]		
						60m	120m	240m
29	Royal Ranch & Dairy	23.756417	90.448249	CH. 09+450 – CH. 09+400	99.20			
30	Central Warehouse	23.754839	90.449736	CH. 09+250 – CH. 09+200	102.20			
31	Liberty College	23.754399	90.450014	CH. 09+200 – CH. 09+150	93.60			
32	Majumder Timber Furniture and Door	23.753645	90.450901	CH. 09+050 – CH. 09+000	105.00	92.7	70.3	49.7
33	Baitul Quran Madrasa	23.752363	90.453888	CH. 08+750 – CH. 08+700	11.30			
34	Masjidul Akbar Jam-e-Masjid	23.751442	90.453277	CH. 08+750 – CH. 08+700	9.40			
35	Imam Baag Jam-e-Masjid	23.752407	90.454209	CH. 08+700 – CH. 08+650	59.90			
36	Messrs Rahim Afroz Gastec	23.751688	90.4535	CH. 08+700 – CH. 08+650	97.30			
37	Samarai Cattle Farm	23.751489	90.453677	CH. 08+700 – CH. 08+650	88.30			
38	Nagdarpar Pond	23.750185	90.459169	CH. 08+100 – CH. 08+050	30.60			
39	Nagdarpar Sarkar Bari Graveyard	23.74967	90.461026	CH. 07+900 – CH. 07+850	58.60			
40	Baitul Aman Jam-e-Masjid	23.749568	90.461226	CH. 07+900 – CH. 07+850	104.10	89.9	66.2	48.6
41	Bismillah Timber Traders	23.74915	90.464493	CH. 07+550 – CH. 07+500	35.80			
42	Iram Chottor Bazar	23.74631	90.472563	CH. 06+650 – CH. 06+600	99.00			
43	Mostomajhi Pond	23.745182	90.473166	CH. 06+500 – CH. 06+450	27.30			
44	Maxim Group	23.743085	90.476404	CH. 06+100 – CH. 06+050	80.50			
45	Aichi Medical College & Hospital	23.740726	90.478854	CH. 05+750 – CH. 05+700	105.00			
46	Haji Aman Market	23.740041	90.479908	CH. 05+600 – CH. 05+550	105.20			
47	Amulia Mendipur Masjid and Madrasa	23.739455	90.479871	CH. 05+550 – CH. 05+500	27.70			
48	Panjeri Godown	23.738885	90.481154	CH. 05+450 – CH. 05+400	113.20	98.5	72.4	56.3
49	Amulia Baitun-Nur Jam-e-Masjid	23.737626	90.482277	CH. 05+250 – CH. 05+200	67.20			
50	Aranya Furniture Limited	23.737109	90.483125	CH. 05+150 – CH. 05+100	110.00	87.6	61.7	49.8
51	E-Haque School and College	23.736653	90.483318	CH. 05+100 – CH. 04+050	93.50			
52	Haji Atik Market	23.736836	90.483493	CH. 05+100 – CH. 04+050	90.60			
53	Active Corporation	23.73555	90.484458	CH. 04+950 – CH. 04+900	47.60			
54	Snigdha Rajshahi Nursery	23.734502	90.484185	CH. 04+850 – CH. 04+800	93.40			
55	Shonar Bangla Timber and Saw Mill	23.733565	90.484971	CH. 04+700 – CH. 04+650	52.20			
56	Aligor Model University	23.732778	90.484709	CH. 04+650 – CH. 04+600	37.30			
57	Imtex Packaging	23.731854	90.485265	CH. 04+550 – CH. 04+500	86.70			
58	Gouripur Timber Mill	23.73151	90.48569	CH. 04+500 – CH. 04+450	102.60			
59	Chattogram VIP Timber And Saw Mill	23.730512	90.485931	CH. 04+350 – CH. 04+300	107.60	85.1	60.5	39.6
60	Jamir Ali Super Market	23.728014	90.487171	CH. 04+050 – CH. 04+000	102.20			
61	SHIMU EPS Packaging Industries Limited	23.727611	90.486939	CH. 04+050 – CH. 04+000	71.50			
62	KKR Enterprise	23.725935	90.487748	CH. 03+850 – CH. 03+800	114.50	91.6	72.8	50.1

Receptor SL	Location	Latitude (°N)	Longitude (°E)	Chainage	$PM_{2.5}$ (µg/m³)	Distance wise Concentration[8]		
						60m	120m	240m
63	ALLIED Group	23.726082	90.487877	CH. 03+850 – CH. 03+800	76.40			
64	Dominus Agro Industries Limited	23.725668	90.488135	CH. 03+800 – CH. 03+750	109.40			
65	Sheikher Jaiga Pond	23.724121	90.487747	CH. 03+700 – CH. 03+650	12.90			
66	Messrs Sharif Timber Saw Mill	23.724161	90.488832	CH. 03+600 – CH. 03+550	38.10			
67	Sajek Sami Timber & Saw Mill	23.723883	90.488585	CH. 03+600 – CH. 03+550	28.20			
68	Baitun-Nur Jam-e-Masjid	23.721931	90.48949	CH. 03+400 – CH. 03+350	17.30			
69	Demra Ideal College	23.72173	90.489535	CH. 03+350 – CH. 03+300	16.30			
70	Akmol Shopping Complex	23.720779	90.490345	CH. 03+250 – CH. 03+200	14.30			
71	Tropical Hospital	23.720055	90.490181	CH. 03+200 – CH. 03+150	11.30			
72	Staff Quarter Jam-e-Masjid	23.720484	90.49162	CH. 03+100 – CH. 03+050	15.20			
73	Staff Quarter Pond	23.720642	90.492903	CH. 03+050 – CH. 03+000	111.30			
74	Karim Jute Mill Pond	23.719024	90.49447	CH. 02+800 – CH. 02+750	46.10			
75	Karim Jute Mills Limited	23.71785	90.495074	CH. 02+650 – CH. 02+600	113.40	88.7	59.2	38.2
76	DPDC Sarulia 33KV Substation	23.717665	90.495342	CH. 02+650 – CH. 02+600	63.60			
77	BTCL Telephone Building, Dhaka	23.716605	90.49602	CH. 02+500 – CH. 02+450	109.10			
78	Fulmoti Islamia Alim Madrasha	23.716523	90.496422	CH. 02+450 – CH. 02+400	30.40			
79	M.A. Sattar High School	23.717454	90.498666	CH. 02+450 – CH. 02+400	5.90			
80	Sarulia Bazar	23.716063	90.496279	CH. 02+450 – CH. 02+400	39.30			
81	Sarulia Jam-e-Masjid	23.716149	90.496559	CH. 02+450 – CH. 02+400	116.10	99.4	62.8	43.3
82	Sarulia Pond	23.715261	90.496554	CH. 02+350 – CH. 02+300	41.60			
83	68 no. Ward Awami League Office	23.71521	90.496911	CH. 02+300 – CH. 02+250	115.80			
84	Shamsul Haque General Hospital	23.714878	90.496517	CH. 02+300 – CH. 02+250	20.70			
85	Life and Care Medical Services	23.714738	90.496517	CH. 02+300 – CH. 02+250	18.00			
86	Baitun-nazat Jam-e-Masjid	23.714664	90.497199	CH. 02+250 – CH. 02+200	114.10			
87	Bangladesh Police Demra Police Fari	23.714758	90.497522	CH. 02+250 – CH. 02+200	44.90			
88	Police Fari Pond	23.714404	90.49719	CH. 02+250 – CH. 02+200	45.20			
89	Demra Fire Station	23.714044	90.498056	CH. 02+150 – CH. 02+100	41.80			
90	Al-Aqsa Steel Mills LTD	23.71262	90.498616	CH. 02+000 – CH. 01+950	108.40			
91	Titas Gas Field	23.712122	90.49914	CH. 01+900 – CH. 01+850	115.00	96.5	64.1	38.7
92	Bangladesh Police UN Warehouse	23.710599	90.497427	CH. 01+850 – CH. 01+800	13.60			
93	Titas Gas Ideal High School	23.71203	90.500337	CH. 01+850 – CH. 01+800	4.90			
94	Gas Transmission Company Limited City Gate Station	23.710924	90.500289	CH. 01+750 – CH. 01+700	44.60			
95	Haque Construction	23.709747	90.500946	CH. 01+600 – CH. 01+550	112.50			

Receptor SL	Location	Latitude (°N)	Longitude (°E)	Chainage	$PM_{2.5}$ (µg/m³)	Distance wise Concentration[8]		
						60m	120m	240m
96	Sarulia Cattle Market	23.708413	90.501892	CH. 01+400 – CH. 01+350	112.40			
97	Shitolokkha Fish Nursery	23.708235	90.50181	CH. 01+400 – CH. 01+350	112.00			
98	Apollo Ispat Complex LTD	23.704802	90.504403	CH. 00+950 – CH. 00+900	117.70	97.3	79.1	56.
99	ARBAB Group	23.704203	90.505896	CH. 00+800 – CH. 00+750	14.00			
100	Shifa International School	23.700432	90.505504	CH. 00+450 – CH. 00+400	6.90			
101	Jibon Fish Farm	23.699386	90.508165	CH. 00+200 – CH. 00+150	115.80	96.3	77.8	55
102	Tekpara Chairman Bari Jam-e Masjid	23.699255	90.508632	CH. 00+200 – CH. 00+150	46.20			
103	Madina Eye Hospital	23.698262	90.509411	CH. 00+050 – CH. 00+000	10.30			
104	Lion Eye Service	23.697641	90.50817	CH. 00+050 – CH. 00+000	35.50			
105	Hirajhil Women's Madrasha	23.696878	90.507362	Near CH. 00+000	5.30			
106	Chan Super Market	23.697254	90.508876	Near CH. 00+000	15.10			
107	Chattogram Road Mosque	23.697027	90.509129	Near CH. 00+000	16.50			
DoE Standard					**60 µg/m³**			
WB/IFC EHS					**25 µg/m³**			

(ii) PM_{10}

349. The receptors closer to the road alignment have higher value of PM_{10}. The receptors that are closer to the alignment have all exceeded the DoE and WB/IFC EHS Standard values. The highest value of PM_{10} concentration is 255.5 µg/m^3.

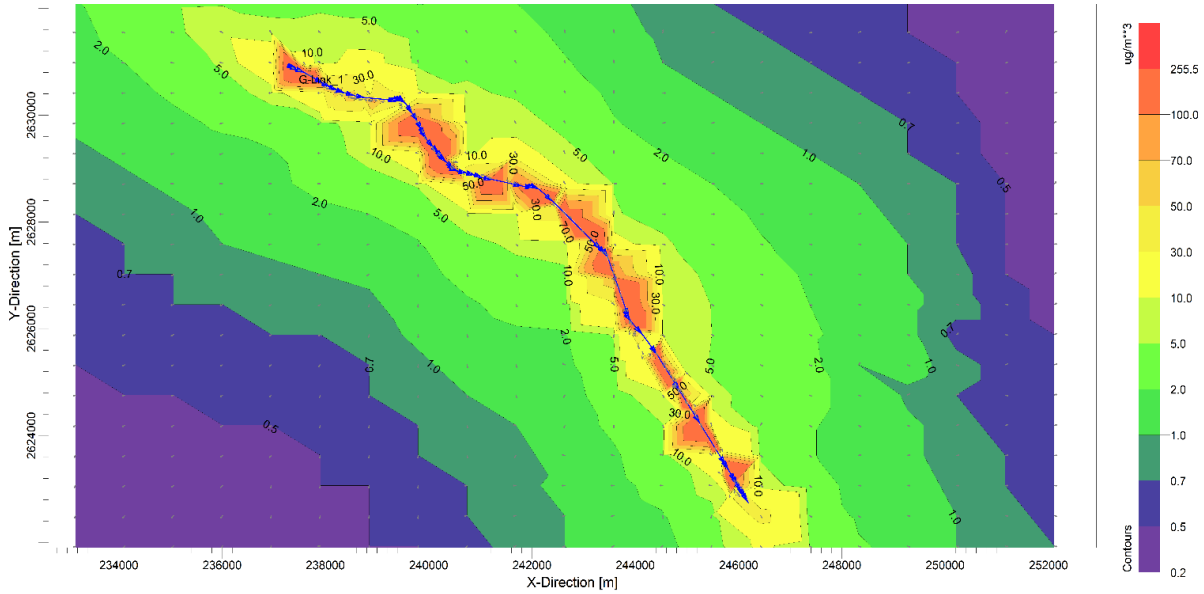


Figure VI.6: Contour Map of PM_{10} Concentration (2049)

Table VI-17: CALINE4 Prediction of PM_{10} Concentrations Based on Future (2049) Scenario

Receptor SL	Location	Latitude	Longitude	Chainage	PM_{10} (µg/m^3)	Distance wise Concentration[9]		
						60 m	120 m	240 m
1	Rampura Water Pump	23.767555	90.423333	CH. 12+465 – CH. 12+450	180.80	155.1	122	87.6
2	Bangladesh Television Rampura	23.76714	90.424512	CH. 12+350 – CH. 12+300	182.80	158.3	119.4	90.1
3	East West University	23.768277	90.425361	CH. 12+350 – CH. 12+300	12.70			
4	Oxford International School	23.766467	90.425843	CH. 12+200 – CH. 12+150	173.10	144.2	116.6	86.3
5	Rampura Khal	23.766348	90.426627	CH. 12+100 – CH. 12+050	167.20			
6	Holy Crescent School	23.764441	90.429426	CH. 11+750 – CH. 11+700	68.70			
7	Rajdhani Ideal School and College	23.764227	90.430001	CH. 11+700– CH. 11+650	70.80			
8	Bonoshree Central Jam-e-Masjid	23.763567	90.431472	CH. 11+550 – CH. 11+500	58.10			
9	Ideal School & College	23.76333	90.432153	CH. 11+450 – CH. 11+400	47.70			
10	Bonoshree Adarsha Bidyaniketon School	23.762909	90.434168	CH. 11+250 – CH. 11+200	58.50			
11	National Ideal School, Bonoshree	23.762794	90.434634	CH. 11+200 – CH. 11+150	53.00			
12	National Ideal English Version	23.762763	90.434837	CH. 11+200 – CH. 11+150	52.50			
13	National Ideal Girls' College	23.762754	90.434919	CH. 11+200 – CH. 11+150	52.90			
14	Bangladesh Fertility Hospital LTD	23.762729	90.435056	CH. 11+150 – CH. 11+100	52.00			
15	Proper Health Care & Hospital	23.762713	90.435165	CH. 11+150 – CH. 11+100	51.90			
16	DPDC Substation Bonoshree	23.762639	90.435631	CH. 11+100 – CH. 11+050	48.90			
17	Farazi Hospital Limited	23.762504	90.43626	CH. 11+050 – CH. 11+000	39.00			
18	Advanced Hospital	23.762545	90.436777	CH. 11+000 – CH. 10+950	72.30			
19	Intelligentsia School and College	23.762397	90.437495	CH. 10+900 – CH. 10+850	61.30			
20	Nur Majid Ayurbedic College	23.762511	90.437778	CH. 10+900 – CH. 10+850	84.10	67.4	49.5	37.8
21	Academia	23.762445	90.437935	CH. 10+900 – CH. 10+850	72.60			
22	Bosuti Maa O Shishu Hospital	23.762461	90.438651	CH. 10+800 – CH. 10+750	79.80			
23	Al Razi Islamia pvt Hospital	23.762244	90.439927	CH. 10+650 – CH. 10+600	53.70			
24	Famous Specialized Hospital	23.76195	90.443408	CH. 10+300 – CH. 10+250	38.70			
25	Dhaka Metropolitan Police, Rampura Thana	23.761305	90.443476	CH. 10+300 – CH. 10+250	23.10			
26	Yamagata Dhaka Friendship General Hospital	23.761464	90.443958	CH. 10+200 – CH. 10+150	23.40			
27	Tourist Police Headquarter	23.760018	90.446414	CH. 09+900 – CH. 09+850	96.20	77.1	61.2	44.9
28	Messrs. Quality Timber & Saw Mill	23.757508	90.447825	CH. 09+600 – CH. 09+550	173.20	157.4	121.3	99.7
29	Royal Ranch & Dairy	23.756417	90.448249	CH. 09+450 – CH. 09+400	165.30			

[9] One location from each cluster of sensitive locations has been focused to determine 'Distance Wise Concentration'. That is why the other respective cells are kept blank.

Receptor SL	Location	Latitude	Longitude	Chainage	PM_{10} (µg/m³)	Distance wise Concentration[9]		
						60 m	120 m	240 m
30	Central Warehouse	23.754839	90.449736	CH. 09+250 – CH. 09+200	170.40			
31	Liberty College	23.754399	90.450014	CH. 09+200 – CH. 09+150	156.10			
32	Majumder Timber Furniture and Door	23.753645	90.450901	CH. 09+050 – CH. 09+000	174.90	155.8	131.2	100.1
33	Baitul Quran Madrasa	23.752363	90.453888	CH. 08+750 – CH. 08+700	18.80			
34	Masjidul Akbar Jam-e-Masjid	23.751442	90.453277	CH. 08+750 – CH. 08+700	15.60			
35	Imam Baag Jam-e-Masjid	23.752407	90.454209	CH. 08+700 – CH. 08+650	99.90			
36	Messrs Rahim Afroz Gastec	23.751688	90.4535	CH. 08+700 – CH. 08+650	162.10			
37	Samarai Cattle Farm	23.751489	90.453677	CH. 08+700 – CH. 08+650	147.20			
38	Nagdarpar Pond	23.750185	90.459169	CH. 08+100 – CH. 08+050	51.00			
39	Nagdarpar Sarkar Bari Graveyard	23.74967	90.461026	CH. 07+900 – CH. 07+850	97.70			
40	Baitul Aman Jam-e-Masjid	23.749568	90.461226	CH. 07+900 – CH. 07+850	173.60			
41	Bismillah Timber Traders	23.74915	90.464493	CH. 07+550 – CH. 07+500	59.70			
42	Iram Chottor Bazar	23.74631	90.472563	CH. 06+650 – CH. 06+600	165.00			
43	Mostomajhi Pond	23.745182	90.473166	CH. 06+500 – CH. 06+450	45.50			
44	Maxim Group	23.743085	90.476404	CH. 06+100 – CH. 06+050	134.20			
45	Aichi Medical College & Hospital	23.740726	90.478854	CH. 05+750 – CH. 05+700	174.90			
46	Haji Aman Market	23.740041	90.479908	CH. 05+600 – CH. 05+550	175.40	151.23	120.3	97.6
47	Amulia Mendipur Masjid and Madrasa	23.739455	90.479871	CH. 05+550 – CH. 05+500	46.20			
48	Panjeri Godown	23.738885	90.481154	CH. 05+450 – CH. 05+400	188.70	167.2	139.56	117.2
49	Amulia Baitun-Nur Jam-e-Masjid	23.737626	90.482277	CH. 05+250 – CH. 05+200	112.00			
50	Aranya Furniture Limited	23.737109	90.483125	CH. 05+150 – CH. 05+100	183.40	169.1	145.2	121.9
51	E-Haque School and College	23.736653	90.483318	CH. 05+100 – CH. 04+050	155.90			
52	Haji Atik Market	23.736836	90.483493	CH. 05+100 – CH. 04+050	151.00			
53	Active Corporation	23.73555	90.484458	CH. 04+950 – CH. 04+900	79.30			
54	Snigdha Rajshahi Nursery	23.734502	90.484185	CH. 04+850 – CH. 04+800	155.70			
55	Shonar Bangla Timber and Saw Mill	23.733565	90.484971	CH. 04+700 – CH. 04+650	87.00			
56	Aligor Model University	23.732778	90.484709	CH. 04+650 – CH. 04+600	62.40			
57	Imtex Packaging	23.731854	90.485265	CH. 04+550 – CH. 04+500	144.50			
58	Gouripur Timber Mill	23.73151	90.48569	CH. 04+500 – CH. 04+450	171.00			
59	Chattogram VIP Timber And Saw Mill	23.730512	90.485931	CH. 04+350 – CH. 04+300	179.30	156.39	130.1	111.2
60	Jamir Ali Super Market	23.728014	90.487171	CH. 04+050 – CH. 04+000	170.30			
61	SHIMU EPS Packaging Industries Limited	23.727611	90.486939	CH. 04+050 – CH. 04+000	119.50			
62	KKR Enterprise	23.725935	90.487748	CH. 03+850 – CH. 03+800	190.80	169.5	138.7	107
63	ALLIED Group	23.726082	90.487877	CH. 03+850 – CH. 03+800	127.40			
64	Dominus Agro Industries Limited	23.725668	90.488135	CH. 03+800 – CH. 03+750	182.30			

Receptor SL	Location	Latitude	Longitude	Chainage	PM_{10} (µg/m³)	Distance wise Concentration[9]		
						60 m	120 m	240 m
65	Sheikher Jaiga Pond	23.724121	90.487747	CH. 03+700 – CH. 03+650	21.50			
66	Messrs Sharif Timber Saw Mill	23.724161	90.488832	CH. 03+600 – CH. 03+550	63.50			
67	Sajek Sami Timber & Saw Mill	23.723883	90.488585	CH. 03+600 – CH. 03+550	47.00			
68	Baitun-Nur Jam-e-Masjid	23.721931	90.48949	CH. 03+400 – CH. 03+350	28.90			
69	Demra Ideal College	23.72173	90.489535	CH. 03+350 – CH. 03+300	27.20			
70	Akmol Shopping Complex	23.720779	90.490345	CH. 03+250 – CH. 03+200	23.80			
71	Tropical Hospital	23.720055	90.490181	CH. 03+200 – CH. 03+150	18.90			
72	Staff Quarter Jam-e-Masjid	23.720484	90.49162	CH. 03+100 – CH. 03+050	25.40			
73	Staff Quarter Pond	23.720642	90.492903	CH. 03+050 – CH. 03+000	185.50	166.2	136.3	111.7
74	Karim Jute Mill Pond	23.719024	90.49447	CH. 02+800 – CH. 02+750	76.80			
75	Karim Jute Mills Limited	23.71785	90.495074	CH. 02+650 – CH. 02+600	172.2			
76	DPDC Sarulia 33KV Substation	23.717665	90.495342	CH. 02+650 – CH. 02+600	189.90			
77	BTCL Telephone Building, Dhaka	23.716605	90.49602	CH. 02+500 – CH. 02+450	106.00			
78	Fulmoti Islamia Alim Madrasha	23.716523	90.496422	CH. 02+450 – CH. 02+400	9.90			
79	M.A. Sattar High School	23.717454	90.498666	CH. 02+450 – CH. 02+400	182.70			
80	Sarulia Bazar	23.716063	90.496279	CH. 02+450 – CH. 02+400	50.70			
81	Sarulia Jam-e-Masjid	23.716149	90.496559	CH. 02+450 – CH. 02+400	65.50			
82	Sarulia Pond	23.715261	90.496554	CH. 02+350 – CH. 02+300	194.60	174.2	144.2	116.7
83	68 no. Ward Awami League Office	23.71521	90.496911	CH. 02+300 – CH. 02+250	69.30			
84	Shamsul Haque General Hospital	23.714878	90.496517	CH. 02+300 – CH. 02+250	194.10			
85	Life and Care Medical Services	23.714738	90.496517	CH. 02+300 – CH. 02+250	34.90			
86	Baitun-nazat Jam-e-Masjid	23.714664	90.497199	CH. 02+250 – CH. 02+200	30.30			
87	Bangladesh Police Demra Police Fari	23.714758	90.497522	CH. 02+250 – CH. 02+200	190.10			
88	Police Fari Pond	23.714404	90.49719	CH. 02+250 – CH. 02+200	74.80			
89	Demra Fire Station	23.714044	90.498056	CH. 02+150 – CH. 02+100	75.30			
90	Al-Aqsa Steel Mills LTD	23.71262	90.498616	CH. 02+000 – CH. 01+950	69.60			
91	Titas Gas Field	23.712122	90.49914	CH. 01+900 – CH. 01+850	180.70			
92	Bangladesh Police UN Warehouse	23.710599	90.497427	CH. 01+850 – CH. 01+800	193.60	168.3	137.5	119.7
93	Titas Gas Ideal High School	23.71203	90.500337	CH. 01+850 – CH. 01+800	22.60			
94	Gas Transmission Company Limited City Gate Station	23.710924	90.500289	CH. 01+750 – CH. 01+700	74.40			
95	Haque Construction	23.709747	90.500946	CH. 01+600 – CH. 01+550	190.20			
96	Sarulia Cattle Market	23.708413	90.501892	CH. 01+400 – CH. 01+350	191.00			
97	Shitolokkha Fish Nursery	23.708235	90.50181	CH. 01+400 – CH. 01+350	186.70			
98	Apollo Ispat Complex LTD	23.704802	90.504403	CH. 00+950 – CH. 00+900	196.20	175.5	144.9	124.3

Receptor SL	Location	Latitude	Longitude	Chainage	PM_{10} (µg/m^3)	Distance wise Concentration[9]		
						60 m	120 m	240 m
99	ARBAB Group	23.704203	90.505896	CH. 00+800 – CH. 00+750	28.80			
100	Shifa International School	23.700432	90.505504	CH. 00+450 – CH. 00+400	15.70			
101	Jibon Fish Farm	23.699386	90.508165	CH. 00+200 – CH. 00+150	255.50	232.6	191.5	136.9
102	Tekpara Chairman Bari Jam-e Masjid	23.699255	90.508632	CH. 00+200 – CH. 00+150	98.20			
103	Madina Eye Hospital	23.698262	90.509411	CH. 00+050 – CH. 00+000	22.00			
104	Lion Eye Service	23.697641	90.50817	CH. 00+050 – CH. 00+000	75.80			
105	Hirajhil Women's Madrasha	23.696878	90.507362	Near CH. 00+000	11.30			
106	Chan Super Market	23.697254	90.508876	Near CH. 00+000	32.60			
107	Chattogram Road Mosque	23.697027	90.509129	Near CH. 00+000	36.80			
DoE Standard						**150 µg/m^3**		
WB/IFC EHS						**50 µg/m^3**		

(iii) NO_2

350. The receptors closer to the road alignment have higher value of NO_2. Some of the receptors have exceeded the WB/IFC EHS standard limit. All receptors are within the DoE standard value. The highest value of NO_2 concentration is 0.05 PPM.

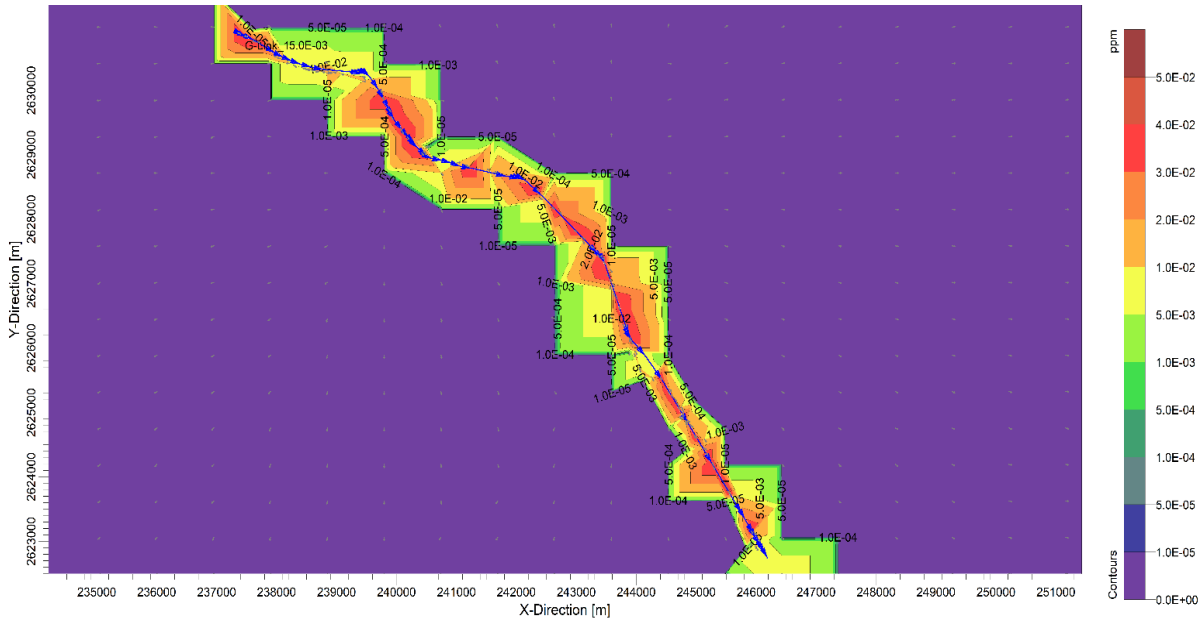


Figure VI.7: Contour Map of NO_2 Concentration (2049)

Table VI-18: CALINE4 Prediction of NO_2 Concentrations Based on Future (2049) Scenario

Receptor SL	Location	Latitude	Longitude	Chainage	NO_2 (ppm)	Distance wise Concentration[10]		
						60 m	120 m	240 m
1	Rampura Water Pump	23.767555	90.423333	CH. 12+465 – CH. 12+450	0.04			
2	Bangladesh Television Rampura	23.76714	90.424512	CH. 12+350 – CH. 12+300	0.04	0.03	0.01	0.00
3	East West University	23.768277	90.425361	CH. 12+350 – CH. 12+300	0.00			
4	Oxford International School	23.766467	90.425843	CH. 12+200 – CH. 12+150	0.04			
5	Rampura Khal	23.766348	90.426627	CH. 12+100 – CH. 12+050	0.04			
6	Holy Crescent School	23.764441	90.429426	CH. 11+750 – CH. 11+700	0.02			
7	Rajdhani Ideal School and College	23.764227	90.430001	CH. 11+700– CH. 11+650	0.02			
8	Bonoshree Central Jam-e-Masjid	23.763567	90.431472	CH. 11+550 – CH. 11+500	0.01			
9	Ideal School & College	23.76333	90.432153	CH. 11+450 – CH. 11+400	0.01			
10	Bonoshree Adarsha Bidyaniketon School	23.762909	90.434168	CH. 11+250 – CH. 11+200	0.01			
11	National Ideal School, Bonoshree	23.762794	90.434634	CH. 11+200 – CH. 11+150	0.01			
12	National Ideal English Version	23.762763	90.434837	CH. 11+200 – CH. 11+150	0.01			
13	National Ideal Girls' College	23.762754	90.434919	CH. 11+200 – CH. 11+150	0.01	0.00	0.00	0.00
14	Bangladesh Fertility Hospital LTD	23.762729	90.435056	CH. 11+150 – CH. 11+100	0.01			
15	Proper Health Care & Hospital	23.762713	90.435165	CH. 11+150 – CH. 11+100	0.01			
16	DPDC Substation Bonoshree	23.762639	90.435631	CH. 11+100 – CH. 11+050	0.01			
17	Farazi Hospital Limited	23.762504	90.43626	CH. 11+050 – CH. 11+000	0.01			
18	Advanced Hospital	23.762545	90.436777	CH. 11+000 – CH. 10+950	0.02	0.01	0.00	0.00
19	Intelligentsia School and College	23.762397	90.437495	CH. 10+900 – CH. 10+850	0.01			
20	Nur Majid Ayurbedic College	23.762511	90.437778	CH. 10+900 – CH. 10+850	0.02			
21	Academia	23.762445	90.437935	CH. 10+900 – CH. 10+850	0.02			
22	Bosuti Maa O Shishu Hospital	23.762461	90.438651	CH. 10+800 – CH. 10+750	0.02	0.01	0.00	0.00
23	Al Razi Islamia pvt Hospital	23.762244	90.439927	CH. 10+650 – CH. 10+600	0.01			
24	Famous Specialized Hospital	23.76195	90.443408	CH. 10+300 – CH. 10+250	0.01			
25	Dhaka Metropolitan Police, Rampura Thana	23.761305	90.443476	CH. 10+300 – CH. 10+250	0.01			
26	Yamagata Dhaka Friendship General Hospital	23.761464	90.443958	CH. 10+200 – CH. 10+150	0.01			
27	Tourist Police Headquarter	23.760018	90.446414	CH. 09+900 – CH. 09+850	0.02			
28	Messrs. Quality Timber & Saw Mill	23.757508	90.447825	CH. 09+600 – CH. 09+550	0.04	0.03	0.01	0.00
29	Royal Ranch & Dairy	23.756417	90.448249	CH. 09+450 – CH. 09+400	0.04			

[10] One location from each cluster of sensitive locations has been focused to determine 'Distance Wise Concentration'. That is why the other respective cells are kept blank.

Receptor SL	Location	Latitude	Longitude	Chainage	NO_2 (ppm)	Distance wise Concentration[10]		
						60 m	120 m	240 m
30	Central Warehouse	23.754839	90.449736	CH. 09+250 – CH. 09+200	0.04			
31	Liberty College	23.754399	90.450014	CH. 09+200 – CH. 09+150	0.04			
32	Majumder Timber Furniture and Door	23.753645	90.450901	CH. 09+050 – CH. 09+000	0.04	0.02	0.00	0.00
33	Baitul Quran Madrasa	23.752363	90.453888	CH. 08+750 – CH. 08+700	0.00			
34	Masjidul Akbar Jam-e-Masjid	23.751442	90.453277	CH. 08+750 – CH. 08+700	0.00			
35	Imam Baag Jam-e-Masjid	23.752407	90.454209	CH. 08+700 – CH. 08+650	0.02			
36	Messrs Rahim Afroz Gastec	23.751688	90.4535	CH. 08+700 – CH. 08+650	0.04	0.03	0.01	0.00
37	Samarai Cattle Farm	23.751489	90.453677	CH. 08+700 – CH. 08+650	0.03			
38	Nagdarpar Pond	23.750185	90.459169	CH. 08+100 – CH. 08+050	0.01			
39	Nagdarpar Sarkar Bari Graveyard	23.74967	90.461026	CH. 07+900 – CH. 07+850	0.02			
40	Baitul Aman Jam-e-Masjid	23.749568	90.461226	CH. 07+900 – CH. 07+850	0.04			
41	Bismillah Timber Traders	23.74915	90.464493	CH. 07+550 – CH. 07+500	0.01			
42	Iram Chottor Bazar	23.74631	90.472563	CH. 06+650 – CH. 06+600	0.04			
43	Mostomajhi Pond	23.745182	90.473166	CH. 06+500 – CH. 06+450	0.01			
44	Maxim Group	23.743085	90.476404	CH. 06+100 – CH. 06+050	0.03			
45	Aichi Medical College & Hospital	23.740726	90.478854	CH. 05+750 – CH. 05+700	0.04	0.02	0.01	0.00
46	Haji Aman Market	23.740041	90.479908	CH. 05+600 – CH. 05+550	0.04			
47	Amulia Mendipur Masjid and Madrasa	23.739455	90.479871	CH. 05+550 – CH. 05+500	0.01			
48	Panjeri Godown	23.738885	90.481154	CH. 05+450 – CH. 05+400	0.04			
49	Amulia Baitun-Nur Jam-e-Masjid	23.737626	90.482277	CH. 05+250 – CH. 05+200	0.03			
50	Aranya Furniture Limited	23.737109	90.483125	CH. 05+150 – CH. 05+100	0.04			
51	E-Haque School and College	23.736653	90.483318	CH. 05+100 – CH. 04+050	0.04	0.03	0.01	0.00
52	Haji Atik Market	23.736836	90.483493	CH. 05+100 – CH. 04+050	0.04			
53	Active Corporation	23.73555	90.484458	CH. 04+950 – CH. 04+900	0.02			
54	Snigdha Rajshahi Nursery	23.734502	90.484185	CH. 04+850 – CH. 04+800	0.04			
55	Shonar Bangla Timber and Saw Mill	23.733565	90.484971	CH. 04+700 – CH. 04+650	0.04			
56	Aligor Model University	23.732778	90.484709	CH. 04+650 – CH. 04+600	0.02			
57	Imtex Packaging	23.731854	90.485265	CH. 04+550 – CH. 04+500	0.01			
58	Gouripur Timber Mill	23.73151	90.48569	CH. 04+500 – CH. 04+450	0.03	0.02	0.00	0.00
59	Chattogram VIP Timber And Saw Mill	23.730512	90.485931	CH. 04+350 – CH. 04+300	0.04			
60	Jamir Ali Super Market	23.728014	90.487171	CH. 04+050 – CH. 04+000	0.04			
61	SHIMU EPS Packaging Industries Limited	23.727611	90.486939	CH. 04+050 – CH. 04+000	0.04			
62	KKR Enterprise	23.725935	90.487748	CH. 03+850 – CH. 03+800	0.03			
63	ALLIED Group	23.726082	90.487877	CH. 03+850 – CH. 03+800	0.04	0.03	0.01	0.00
64	Dominus Agro Industries Limited	23.725668	90.488135	CH. 03+800 – CH. 03+750	0.03			

Receptor SL	Location	Latitude	Longitude	Chainage	NO_2 (ppm)	Distance wise Concentration[10]		
						60 m	120 m	240 m
65	Sheikher Jaiga Pond	23.724121	90.487747	CH. 03+700 – CH. 03+650	0.04			
66	Messrs Sharif Timber Saw Mill	23.724161	90.488832	CH. 03+600 – CH. 03+550	0.00			
67	Sajek Sami Timber & Saw Mill	23.723883	90.488585	CH. 03+600 – CH. 03+550	0.01			
68	Baitun-Nur Jam-e-Masjid	23.721931	90.48949	CH. 03+400 – CH. 03+350	0.01			
69	Demra Ideal College	23.72173	90.489535	CH. 03+350 – CH. 03+300	0.01			
70	Akmol Shopping Complex	23.720779	90.490345	CH. 03+250 – CH. 03+200	0.01			
71	Tropical Hospital	23.720055	90.490181	CH. 03+200 – CH. 03+150	0.00			
72	Staff Quarter Jam-e-Masjid	23.720484	90.49162	CH. 03+100 – CH. 03+050	0.01			
73	Staff Quarter Pond	23.720642	90.492903	CH. 03+050 – CH. 03+000	0.04	0.02	0.00	0.00
74	Karim Jute Mill Pond	23.719024	90.49447	CH. 02+800 – CH. 02+750	0.02			
75	Karim Jute Mills Limited	23.71785	90.495074	CH. 02+650 – CH. 02+600	0.04			
76	DPDC Sarulia 33KV Substation	23.717665	90.495342	CH. 02+650 – CH. 02+600	0.02			
77	BTCL Telephone Building, Dhaka	23.716605	90.49602	CH. 02+500 – CH. 02+450	0.04			
78	Fulmoti Islamia Alim Madrasha	23.716523	90.496422	CH. 02+450 – CH. 02+400	0.01			
79	M.A. Sattar High School	23.717454	90.498666	CH. 02+450 – CH. 02+400	0.02			
80	Sarulia Bazar	23.716063	90.496279	CH. 02+450 – CH. 02+400	0.04			
81	Sarulia Jam-e-Masjid	23.716149	90.496559	CH. 02+450 – CH. 02+400	0.02	0.00	0.00	0.00
82	Sarulia Pond	23.715261	90.496554	CH. 02+350 – CH. 02+300	0.04			
83	68 no. Ward Awami League Office	23.71521	90.496911	CH. 02+300 – CH. 02+250	0.01			
84	Shamsul Haque General Hospital	23.714878	90.496517	CH. 02+300 – CH. 02+250	0.01			
85	Life and Care Medical Services	23.714738	90.496517	CH. 02+300 – CH. 02+250	0.02			
86	Baitun-nazat Jam-e-Masjid	23.714664	90.497199	CH. 02+250 – CH. 02+200	0.04	0.02	0.00	0.00
87	Bangladesh Police Demra Police Fari	23.714758	90.497522	CH. 02+250 – CH. 02+200	0.02			
88	Police Fari Pond	23.714404	90.49719	CH. 02+250 – CH. 02+200	0.02			
89	Demra Fire Station	23.714044	90.498056	CH. 02+150 – CH. 02+100	0.04			
90	Al-Aqsa Steel Mills LTD	23.71262	90.498616	CH. 02+000 – CH. 01+950	0.04	0.01	0.00	0.00
91	Titas Gas Field	23.712122	90.49914	CH. 01+900 – CH. 01+850	0.01			
92	Bangladesh Police UN Warehouse	23.710599	90.497427	CH. 01+850 – CH. 01+800	0.02			
93	Titas Gas Ideal High School	23.71203	90.500337	CH. 01+850 – CH. 01+800	0.04			
94	Gas Transmission Company Limited City Gate Station	23.710924	90.500289	CH. 01+750 – CH. 01+700	0.04			
95	Haque Construction	23.709747	90.500946	CH. 01+600 – CH. 01+550	0.04			
96	Sarulia Cattle Market	23.708413	90.501892	CH. 01+400 – CH. 01+350	0.04			
97	Shitolokkha Fish Nursery	23.708235	90.50181	CH. 01+400 – CH. 01+350	0.04			
98	Apollo Ispat Complex LTD	23.704802	90.504403	CH. 00+950 – CH. 00+900	0.05	0.035	0.01	0.00

Receptor SL	Location	Latitude	Longitude	Chainage	NO_2 (ppm)	Distance wise Concentration[10]		
						60 m	120 m	240 m
99	ARBAB Group	23.704203	90.505896	CH. 00+800 – CH. 00+750	0.01			
100	Shifa International School	23.700432	90.505504	CH. 00+450 – CH. 00+400	0.00			
101	Jibon Fish Farm	23.699386	90.508165	CH. 00+200 – CH. 00+150	0.04			
102	Tekpara Chairman Bari Jam-e Masjid	23.699255	90.508632	CH. 00+200 – CH. 00+150	0.02			
103	Madina Eye Hospital	23.698262	90.509411	CH. 00+050 – CH. 00+000	0.01			
104	Lion Eye Service	23.697641	90.50817	CH. 00+050 – CH. 00+000	0.00			
105	Hirajhil Women's Madrasha	23.696878	90.507362	Near CH. 00+000	0.00			
106	Chan Super Market	23.697254	90.508876	Near CH. 00+000	0.01	0.00	0.00	0.00
107	Chattogram Road Mosque	23.697027	90.509129	Near CH. 00+000	0.01			
DoE Standard						**0.1 ppm**		
WB/IFC EHS						**0.03 ppm**		

(iv) CO

351. The receptors closer to the road alignment have higher value of CO. The receptors that are closer to the alignment have all exceeded both the DoE and WB/IFC EHS Standard values. The rest of the values are within the standard Limit. The highest value of CO concentration is 14.7 PPM.

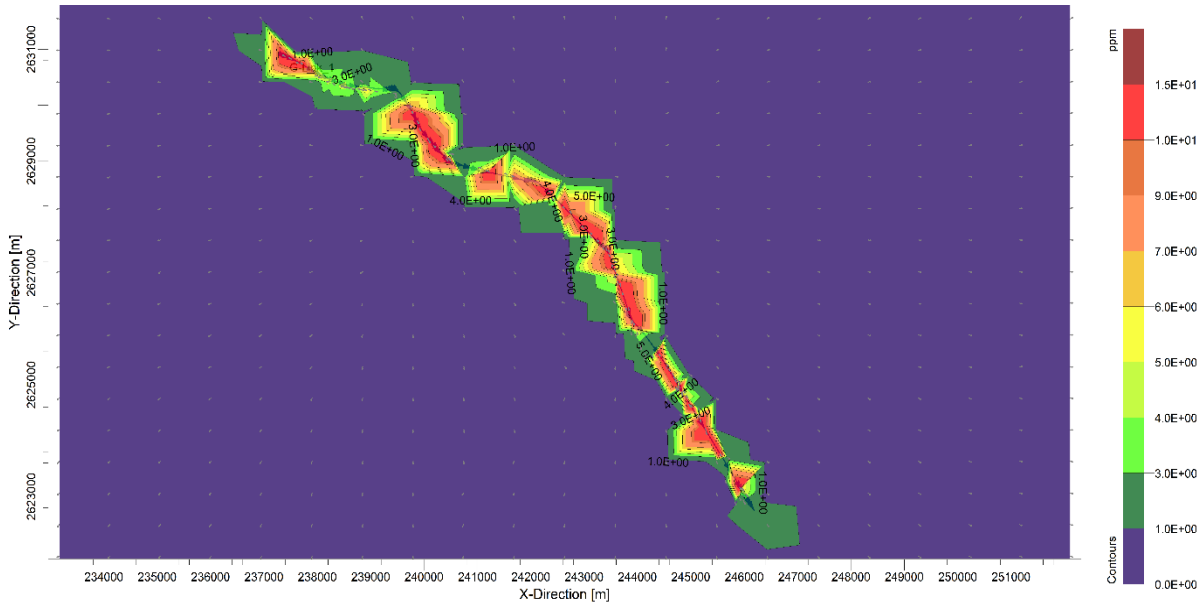


Figure VI.8: Contour Map of CO Concentration (2049)

Table VI-19: CALINE4 Prediction of CO Concentrations Based on Future (2049) Scenario

Receptor SL	Location	Latitude	Longitude	Chainage	CO (ppm)	Distance wise Concentration[11]		
						60 m	120 m	240 m
1	Rampura Water Pump	23.767555	90.423333	CH. 12+465 – CH. 12+450	13.50			
2	Bangladesh Television Rampura	23.76714	90.424512	CH. 12+350 – CH. 12+300	13.70	8.2	4.5	1.1
3	East West University	23.768277	90.425361	CH. 12+350 – CH. 12+300	1.00			
4	Oxford International School	23.766467	90.425843	CH. 12+200 – CH. 12+150	12.90	7.9	5.1	1.5
5	Rampura Khal	23.766348	90.426627	CH. 12+100 – CH. 12+050	12.50			
6	Holy Crescent School	23.764441	90.429426	CH. 11+750 – CH. 11+700	5.10			
7	Rajdhani Ideal School and College	23.764227	90.430001	CH. 11+700– CH. 11+650	5.30			
8	Bonoshree Central Jam-e-Masjid	23.763567	90.431472	CH. 11+550 – CH. 11+500	4.40			
9	Ideal School & College	23.76333	90.432153	CH. 11+450 – CH. 11+400	3.60			
10	Bonoshree Adarsha Bidyaniketon School	23.762909	90.434168	CH. 11+250 – CH. 11+200	4.40			
11	National Ideal School, Bonoshree	23.762794	90.434634	CH. 11+200 – CH. 11+150	4.00			
12	National Ideal English Version	23.762763	90.434837	CH. 11+200 – CH. 11+150	3.90			
13	National Ideal Girls' College	23.762754	90.434919	CH. 11+200 – CH. 11+150	4.00			
14	Bangladesh Fertility Hospital LTD	23.762729	90.435056	CH. 11+150 – CH. 11+100	3.90			
15	Proper Health Care & Hospital	23.762713	90.435165	CH. 11+150 – CH. 11+100	3.90			
16	DPDC Substation Bonoshree	23.762639	90.435631	CH. 11+100 – CH. 11+050	3.70			
17	Farazi Hospital Limited	23.762504	90.43626	CH. 11+050 – CH. 11+000	2.90			
18	Advanced Hospital	23.762545	90.436777	CH. 11+000 – CH. 10+950	5.40	3.1	1.1	0.2
19	Intelligentsia School and College	23.762397	90.437495	CH. 10+900 – CH. 10+850	4.60			
20	Nur Majid Ayurbedic College	23.762511	90.437778	CH. 10+900 – CH. 10+850	6.30			
21	Academia	23.762445	90.437935	CH. 10+900 – CH. 10+850	5.40			
22	Bosuti Maa O Shishu Hospital	23.762461	90.438651	CH. 10+800 – CH. 10+750	6.00			
23	Al Razi Islamia pvt Hospital	23.762244	90.439927	CH. 10+650 – CH. 10+600	4.00			
24	Famous Specialized Hospital	23.76195	90.443408	CH. 10+300 – CH. 10+250	2.90			
25	Dhaka Metropolitan Police, Rampura Thana	23.761305	90.443476	CH. 10+300 – CH. 10+250	1.80			
26	Yamagata Dhaka Friendship General Hospital	23.761464	90.443958	CH. 10+200 – CH. 10+150	1.80			
27	Tourist Police Headquarter	23.760018	90.446414	CH. 09+900 – CH. 09+850	7.20	5.9	3.1	0.9
28	Messrs. Quality Timber & Saw Mill	23.757508	90.447825	CH. 09+600 – CH. 09+550	12.90	8.3	4.7	2.2
29	Royal Ranch & Dairy	23.756417	90.448249	CH. 09+450 – CH. 09+400	12.30			

[11] One location from each cluster of sensitive locations has been focused to determine 'Distance Wise Concentration'. That is why the other respective cells are kept blank.

Receptor SL	Location	Latitude	Longitude	Chainage	CO (ppm)	Distance wise Concentration[11]		
						60 m	120 m	240 m
30	Central Warehouse	23.754839	90.449736	CH. 09+250 – CH. 09+200	12.70			
31	Liberty College	23.754399	90.450014	CH. 09+200 – CH. 09+150	11.70			
32	Majumder Timber Furniture and Door	23.753645	90.450901	CH. 09+050 – CH. 09+000	13.10	10.3	5.6	2.3
33	Baitul Quran Madrasa	23.752363	90.453888	CH. 08+750 – CH. 08+700	1.40			
34	Masjidul Akbar Jam-e-Masjid	23.751442	90.453277	CH. 08+750 – CH. 08+700	1.20			
35	Imam Baag Jam-e-Masjid	23.752407	90.454209	CH. 08+700 – CH. 08+650	7.50			
36	Messrs Rahim Afroz Gastec	23.751688	90.4535	CH. 08+700 – CH. 08+650	12.10			
37	Samarai Cattle Farm	23.751489	90.453677	CH. 08+700 – CH. 08+650	11.00			
38	Nagdarpar Pond	23.750185	90.459169	CH. 08+100 – CH. 08+050	3.80			
39	Nagdarpar Sarkar Bari Graveyard	23.74967	90.461026	CH. 07+900 – CH. 07+850	7.30			
40	Baitul Aman Jam-e-Masjid	23.749568	90.461226	CH. 07+900 – CH. 07+850	13.00	8.9	4.3	1.3
41	Bismillah Timber Traders	23.74915	90.464493	CH. 07+550 – CH. 07+500	4.50			
42	Iram Chottor Bazar	23.74631	90.472563	CH. 06+650 – CH. 06+600	12.30			
43	Mostomajhi Pond	23.745182	90.473166	CH. 06+500 – CH. 06+450	3.40			
44	Maxim Group	23.743085	90.476404	CH. 06+100 – CH. 06+050	10.00			
45	Aichi Medical College & Hospital	23.740726	90.478854	CH. 05+750 – CH. 05+700	13.10			
46	Haji Aman Market	23.740041	90.479908	CH. 05+600 – CH. 05+550	13.10			
47	Amulia Mendipur Masjid and Madrasa	23.739455	90.479871	CH. 05+550 – CH. 05+500	3.50			
48	Panjeri Godown	23.738885	90.481154	CH. 05+450 – CH. 05+400	14.10	9.2	3.6	1.7
49	Amulia Baitun-Nur Jam-e-Masjid	23.737626	90.482277	CH. 05+250 – CH. 05+200	8.40			
50	Aranya Furniture Limited	23.737109	90.483125	CH. 05+150 – CH. 05+100	13.70			
51	E-Haque School and College	23.736653	90.483318	CH. 05+100 – CH. 04+050	11.60			
52	Haji Atik Market	23.736836	90.483493	CH. 05+100 – CH. 04+050	11.30			
53	Active Corporation	23.73555	90.484458	CH. 04+950 – CH. 04+900	5.90			
54	Snigdha Rajshahi Nursery	23.734502	90.484185	CH. 04+850 – CH. 04+800	11.60			
55	Shonar Bangla Timber and Saw Mill	23.733565	90.484971	CH. 04+700 – CH. 04+650	6.50			
56	Aligor Model University	23.732778	90.484709	CH. 04+650 – CH. 04+600	4.70			
57	Imtex Packaging	23.731854	90.485265	CH. 04+550 – CH. 04+500	10.80			
58	Gouripur Timber Mill	23.73151	90.48569	CH. 04+500 – CH. 04+450	12.80			
59	Chattogram VIP Timber And Saw Mill	23.730512	90.485931	CH. 04+350 – CH. 04+300	13.40			
60	Jamir Ali Super Market	23.728014	90.487171	CH. 04+050 – CH. 04+000	12.70			
61	SHIMU EPS Packaging Industries Limited	23.727611	90.486939	CH. 04+050 – CH. 04+000	8.90			
62	KKR Enterprise	23.725935	90.487748	CH. 03+850 – CH. 03+800	14.20	9.1	3.8	1.12
63	ALLIED Group	23.726082	90.487877	CH. 03+850 – CH. 03+800	9.50			
64	Dominus Agro Industries Limited	23.725668	90.488135	CH. 03+800 – CH. 03+750	13.60			

Receptor SL	Location	Latitude	Longitude	Chainage	CO (ppm)	Distance wise Concentration[11]		
						60 m	120 m	240 m
65	Sheikher Jaiga Pond	23.724121	90.487747	CH. 03+700 – CH. 03+650	1.60			
66	Messrs Sharif Timber Saw Mill	23.724161	90.488832	CH. 03+600 – CH. 03+550	4.80			
67	Sajek Sami Timber & Saw Mill	23.723883	90.488585	CH. 03+600 – CH. 03+550	3.50			
68	Baitun-Nur Jam-e-Masjid	23.721931	90.48949	CH. 03+400 – CH. 03+350	2.20			
69	Demra Ideal College	23.72173	90.489535	CH. 03+350 – CH. 03+300	2.10			
70	Akmol Shopping Complex	23.720779	90.490345	CH. 03+250 – CH. 03+200	1.80			
71	Tropical Hospital	23.720055	90.490181	CH. 03+200 – CH. 03+150	1.40			
72	Staff Quarter Jam-e-Masjid	23.720484	90.49162	CH. 03+100 – CH. 03+050	1.90			
73	Staff Quarter Pond	23.720642	90.492903	CH. 03+050 – CH. 03+000	13.90			
74	Karim Jute Mill Pond	23.719024	90.49447	CH. 02+800 – CH. 02+750	5.80			
75	Karim Jute Mills Limited	23.71785	90.495074	CH. 02+650 – CH. 02+600	12.90			
76	DPDC Sarulia 33KV Substation	23.717665	90.495342	CH. 02+650 – CH. 02+600	14.10	9.6	4.4	2.1
77	BTCL Telephone Building, Dhaka	23.716605	90.49602	CH. 02+500 – CH. 02+450	7.90			
78	Fulmoti Islamia Alim Madrasha	23.716523	90.496422	CH. 02+450 – CH. 02+400	13.60			
79	M.A. Sattar High School	23.717454	90.498666	CH. 02+450 – CH. 02+400	3.80			
80	Sarulia Bazar	23.716063	90.496279	CH. 02+450 – CH. 02+400	0.80			
81	Sarulia Jam-e-Masjid	23.716149	90.496559	CH. 02+450 – CH. 02+400	14.40	9.7	4.1	2.3
82	Sarulia Pond	23.715261	90.496554	CH. 02+350 – CH. 02+300	4.90			
83	68 no. Ward Awami League Office	23.71521	90.496911	CH. 02+300 – CH. 02+250	5.20			
84	Shamsul Haque General Hospital	23.714878	90.496517	CH. 02+300 – CH. 02+250	14.40			
85	Life and Care Medical Services	23.714738	90.496517	CH. 02+300 – CH. 02+250	2.60			
86	Baitun-nazat Jam-e-Masjid	23.714664	90.497199	CH. 02+250 – CH. 02+200	2.30			
87	Bangladesh Police Demra Police Fari	23.714758	90.497522	CH. 02+250 – CH. 02+200	14.20			
88	Police Fari Pond	23.714404	90.49719	CH. 02+250 – CH. 02+200	5.60			
89	Demra Fire Station	23.714044	90.498056	CH. 02+150 – CH. 02+100	5.60			
90	Al-Aqsa Steel Mills LTD	23.71262	90.498616	CH. 02+000 – CH. 01+950	5.20			
91	Titas Gas Field	23.712122	90.49914	CH. 01+900 – CH. 01+850	13.50			
92	Bangladesh Police UN Warehouse	23.710599	90.497427	CH. 01+850 – CH. 01+800	14.30	9.3	4.1	1.6
93	Titas Gas Ideal High School	23.71203	90.500337	CH. 01+850 – CH. 01+800	1.70			
94	Gas Transmission Company Limited City Gate Station	23.710924	90.500289	CH. 01+750 – CH. 01+700	5.60			
95	Haque Construction	23.709747	90.500946	CH. 01+600 – CH. 01+550	14.00			
96	Sarulia Cattle Market	23.708413	90.501892	CH. 01+400 – CH. 01+350	14.00			
97	Shitolokkha Fish Nursery	23.708235	90.50181	CH. 01+400 – CH. 01+350	13.90			
98	Apollo Ispat Complex LTD	23.704802	90.504403	CH. 00+950 – CH. 00+900	14.70	10.1	4.3	2.1

Receptor SL	Location	Latitude	Longitude	Chainage	CO (ppm)	Distance wise Concentration[11]		
						60 m	120 m	240 m
99	ARBAB Group	23.704203	90.505896	CH. 00+800 – CH. 00+750	1.80			
100	Shifa International School	23.700432	90.505504	CH. 00+450 – CH. 00+400	0.90			
101	Jibon Fish Farm	23.699386	90.508165	CH. 00+200 – CH. 00+150	14.40			
102	Tekpara Chairman Bari Jam-e Masjid	23.699255	90.508632	CH. 00+200 – CH. 00+150	5.80			
103	Madina Eye Hospital	23.698262	90.509411	CH. 00+050 – CH. 00+000	4.40			
104	Lion Eye Service	23.697641	90.50817	CH. 00+050 – CH. 00+000	0.70			
105	Hirajhil Women's Madrasha	23.696878	90.507362	Near CH. 00+000	1.30			
106	Chan Super Market	23.697254	90.508876	Near CH. 00+000	1.90			
107	Chattogram Road Mosque	23.697027	90.509129	Near CH. 00+000	2.10			
DoE Standard						**9 ppm**		
WB/IFC EHS						**10 ppm**		

(2) Estimation of Green House Gas (GHG) Emission using Transport Emissions Evaluation Model for Projects (TEEMP)

352. Green House Gas (GHG) emission likely to be generated from the project roads have been computed using the Transport Emissions Evaluation Model for Projects (TEEMP) developed by Clean Air Asia14, the Institute for Transportation and Development Policy and with funding from ADB. TEEMP is an excel based tool to assess the equivalent CO_2 gross emissions without (business as usual or BAU) and with the project improvements (with project scenario or WPS). The main improvements from the project that was considered for the model are better surface roughness with less than 2.5m/km, and widening of project road from 2 lanes to 4 lanes. These were translated into increases in traffic speeds and fuel consumption. The model has also been used for CO_2 emission assessment during construction stage. It also allows for the inclusion of impacts related to traffic congestion with and without project through provisions for inserting data on the traffic numbers, lane width, number of lanes and volume/capacity saturation limit. The model also computes for emission and emission intensity of PM and NOx.

Table VI-20: Fuel Efficiency (km/l)

Scenario	2022				2050			
	Petrol	Diesel	LPG	CNG	Petrol	Diesel	LPG	CNG
Car	15.00	18.00	30.0	30.0	11.00	18.00	30.0	30.0
LCV		8.00				8.00		
Bus		6.00				6.00		
HCV		8.00				8.00		

Table VI-21: Emission Standards of Fleet (%)

Vehicle Type	Current Scenario				Post 29 Years		
	Pre-Euro	Euro I	Euro II	Euro III	Euro I	Euro II	Euro III
Car			20%	80%		20%	80%
LCV		10%	20%	70%	10%	20%	70%
Bus		10%	20%	70%	10%	20%	70%
HCV		10%	20%	70%	10%	20%	70%

353. Traffic forecasts were taken from Detailed Project Report and is shown in Table VI-20. The corresponding growth rates for different vehicle types are indicated in Table.

Table VI-22: Annual Average Daily Traffic (AADT) for the Project Road (13.5 Km)

Section	Vehicle Type	2024	2025	2030	2035	2040	2045	2049
1	Car	7520	5530	7600	10040	12280	14020	15760
	LCV	10990	8070	11100	14650	17920	20470	23010
	Bus	6430	4730	6500	8590	10500	11990	13490
	HCV	15290	11250	15430	20410	24950	28490	32030

354. Input parameters as considered for all the project roads are as given in Table VI-21. Design period is considered to be 30 years and volume capacity saturation limit is considered based on the current traffic velocity and is considered as 2.0 for the entire project road.

Table VI-23: Input Parameters for TEEMP

No.	Particular	BAU	WPS
1	Lane width (m)	3.5	5.5
2	Lane length (km)	12.5	13.5
3	Number of lanes	2	4
4	Roughness (m/km)	6	2.5
5	Induced Traffic		0.2
6	Start of Assessment Year	2022	2022

355. Maximum PCU for 2 and 4 lanes were considered as 36,000 and 80,000, respectively. In the absence of emission factors data for vehicles in Bangladesh, emission factors were mostly taken from another road project IEE report prepared by the ADB (SASEC Dhaka-Northwest Corridor Road Project, Phase 2: Elenga-Hatikamrul Road Expansion Initial Environmental Examination[12]).

Table VI-24: CO_2 Emission Factors for Different Vehicle Types

Vehicle Type	CO_2 Emission Factor (kg/L)	
	Gasoline	Diesel
Cars	2.24	2.59
HCV		3.21
Bus		3.61
LCV		3.50

356. It was assumed that car, HCV, bus and LCV constitute 40% respectively of the total local traffic.

357. Emissions from road construction were estimated by using the emission factor for rural/urban roads, by using ADB - Carbon footprint 1 (http://www.adb.org/documents/reports/estimating-carbon-footprints-road- projects/default.asp), which is equivalent to 2,115,200 kg CO_2/km of road construction. So, total 2,85,55,200 kg of CO_2 or 28,555.2 tons will be emitted in for 13.5 km expressway during road construction.

358. The proposed road widening and upgrading resulting to surface roughness and road capacity improvements have implications in CO_2 emissions. Improved roughness results to higher speed and lesser emissions while increase in vehicles in the new road increases emissions. These factors are further affected by traffic congestion once the volume/capacity saturation limit was reached.

359. The project road section-wise CO_2 emission intensity is provided in Table the design life of the road is 50 years. Total CO_2 emission at business-as-usual, project without induced traffic, and project with induced traffic were estimated as 54,052.60 tons/km, 37,659.08 tons/km, and 41,742.41 tons/km, respectively.

360. Emissions from PM and NOx were likewise shown in Table VI-23. PM and NOx emissions are higher during with project scenario, as a result of more vehicles using the road compared to the BAU scenario.

[12] https://www.adb.org/projects/documents/ban-40540-016-iee

Table VI-25: Output and Output Intensity of CO_2, PM and NO_X

Parameters	GHG / Pollutants	Project Scenario		
		BAU	WPS (without induced traffic)	WPS (with induced traffic)
Output (tons/km)	CO_2	54,052.60	37,659.08	41,742.41
	PM	317.40	1,688.44	1,372.92
	NOx	295.98	1,586.43	1,279.52
Output Intensity (tons/year)	CO_2	23,298.53	17,530.95	19,431.81
	PM	136.81	786.00	639.12
	NOx	127.58	738.51	595.64

361. In terms of intensity, total CO_2 emissions at business-as-usual, with-project (without induced traffic) and with project (with induced traffic) scenarios were estimated at 23,298.53 tons/year, 17,530.95 tons/year and 19,431.81 tons/year, respectively. These values are significantly below the 100,000 tons CO_2 e/year threshold set in ADB SPS 2009. Since the model does not include the SOx therefore, it was not possible to calculate its amount.

b) Noise and Vibration

Impact

362. During the operational phase, the noise levels are anticipated to increase due to traffic related noise pollution, vibrations from engines and tires and mainly use of pressure horns. The main source of noise during the operation phase is the traffic. It can be estimated that ambient noise level will increase due to the increased traffic. However, the better road condition and less congestion on roads will reduce the net noise levels at market and other crowded places. The Noise levels are likely to reach the acceptable levels at 500 m from the road. Some sensitive locations within 500m of the road may be affected due to higher noise levels than the stipulated 45 dB(A). Overall, impact on noise environment is considered moderate during the operation phase.

Mitigation

363. This impact is permanent and moderate negative in nature. Mitigation measures will include:

- ✓ The project is located in the urban area of Dhaka. The degree of urbanization along the line is relatively high. At present, the traffic flow on the old road is large. The current monitoring value of the noise of each acoustic environment sensitive point along the project has seriously exceeded the standard (the EIA report has corresponding monitoring value). The traffic noise mainly comes from machinery. Motor vehicle engine noise, tire friction noise and horn noise, especially the horn noise, are the most harsh, giving people the strongest impact on the senses. Therefore, only setting up sound barriers on newly built roads cannot fundamentally solve the problem of excessive noise, and the sound barriers have little effect on the reduction of whistle noise.
- ✓ It is recommended to set up no-sounding signs and traffic management and punishment measures for the main acoustic environment sensitive points along the line, control the noise pollution of motor vehicle whistles, and control the main noise sources.
- ✓ Take noise reduction forest belt measures instead of sound barrier measures at sensitive points with conditions, such as hedges.

- ✓ According to monitoring results, additional sound barriers in form of trees and hedges will be discussed with the affected people and planted if agreed;
- ✓ It is also suggested that surface roughness of the roads is maintained as per the design characteristics and honking should be discouraged through signboard displays.
- ✓ Signs for sensitive zones (health centres / educational institutions etc.) to disallow the use of pressure horns;
- ✓ Enforcement and penalties against traffic rules violators; and
- ✓ Noise monitoring shall be carried out as per the suggested monitoring plan.

(1) Noise Modeling

364. The proposed project will upgrade the existing Rampura – Amulia – Demra two-way road to four-way excess road. This will generate additional traffic and consequently alter the noise environment along the route of the roadway. The FHWA Traffic Noise Model popularly known as TNM (version 3.1) software is used for noise pollution modeling for the assessment of the noise pollution propagation generated from traffic. The TNM Software allows to create robust and useful numeric simulations. TNM combines these full-throttle noise emission levels with its internal speed computations to account for the full effect (noise emissions plus speed) of roadway grades and traffic-control devices. TNM computes the effect of intervening ground (defined by its type, or optionally by its flow resistivity) with theory-based acoustics that have been calibrated against field measurements. In addition, TNM allows sound to propagate underneath selected intervening roadways and barriers, rather than being shielded by them.

365. TNM computes three measures of highway traffic noise:

- ✓ $LAeq_{1h}$: hourly A-weighted equivalent sound level (1HEQ);
- ✓ Ldn : day-night average sound level (DNL); and
- ✓ Lden : Community Noise Equivalent Level (CNEL), where "den" stands for day/evening/ night.

366. The TNM model was used in this project in combination with GIS application software to graphically represent modelling results.

(a) Basic Data and Assumptions

367. Noise emission from vehicles along the route is modelled as steady-state line source. Such modelling needs traffic projection for next few planning years. According to a recent study (Ullah et al. 2015)[13] annual growth rate of traffic volume in major three highways of Bangladesh is about 20%. Given the annual growth rate, for this modelling exercise, projections were prepared for the year 2049 derived from Traffic Demand Study report by Dhaka RAD Elevated Expressway Company Limited[14]. The major intersections and traffic counts are given in Table VI-24 below.

[13]Ullah MA, Nikraz H. and Hoque MH 2015. Comparison of Traffic Growth Factors in Three Major Highways of Bangladesh: A Case Study. Journal of Traffic and Transportation Engineering 3 (2015) 111-117.
[14]Dhaka RAD Elevated Expressway Company Limited. 2022. Improvement of the Hatirjheel-Rampura-Bonoshree Ideal School and College-Sheikherjaiga-Amulia-Demra Highway Into 4-Lanes Through PPP. Page 59.

Table VI-26: Traffic Volume Forecast Results of Different Vehicle Types in Feature Years of the Project (veh/d)

Years	Semi-trailer	Large Truck	Medium Track	Light Track	Large Bus	Mini bus	Micro Bus	Utility	Car/Taxi	Total
2024	1360	1965	2054	1530	320	1618	1472	718	4097	15134
2030	1859	2685	2881	2151	441	2237	2052	1018	5689	21013
2035	2260	3265	3662	2747	574	2737	2588	1285	6964	16082
2040	2674	3863	4416	3319	698	3186	3124	1543	8156	30979
2045	3042	4395	5066	3811	810	3563	3603	1770	9176	35236
2049	3270	4723	5469	4125	881	3812	3906	1915	9767	37868

(b) Model Setup

368. In the TNM, the reference level is the Vehicle Noise Emission Level, which refers to the maximum sound level emitted by a vehicle pass-by at a reference distance of 15 meters (50 feet). Adjustments are then made to the emission level to account for traffic flow, distance, and shielding.

369. These factors are related by the following equation:

$$L_{Aeq1h} = EL_i + A_{traff(i)} + A_d + A_s \quad \text{.....(1)}$$

where EL_i represents the vehicle noise emission level for the i-th vehicle type,

$A_{traff(i)}$ represents the adjustment for traffic flow, the vehicle volume and speed for the i-th vehicle type,

A_d represents the adjustment for distance between the roadway and receiver and for the length of the roadway, and

A_s represents the adjustment for all shielding and ground effects between the roadway and the receiver.

370. TNM requires a generic environment setup. In this generic environment the following parameters were considered:

Temperature: 300C
Humidity: 70%
Road width: 14m
Building Blocks: Identified from google earth imagery
Tree and terrain zone: identified from google earth imagery
Pavement: Hard soil

371. The setup environment is shown in Figure VI-7. The output environment is presented in Figure VI-8.

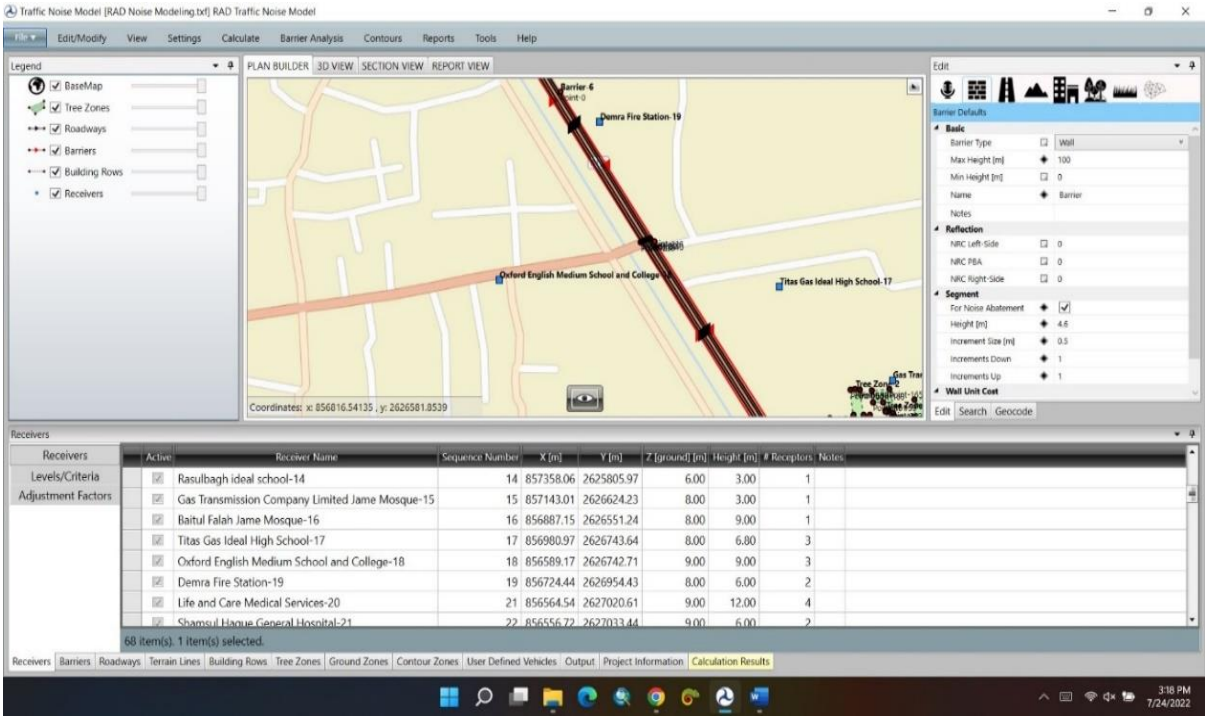


Figure VI.9: Setup Environment of the TNM for this Project

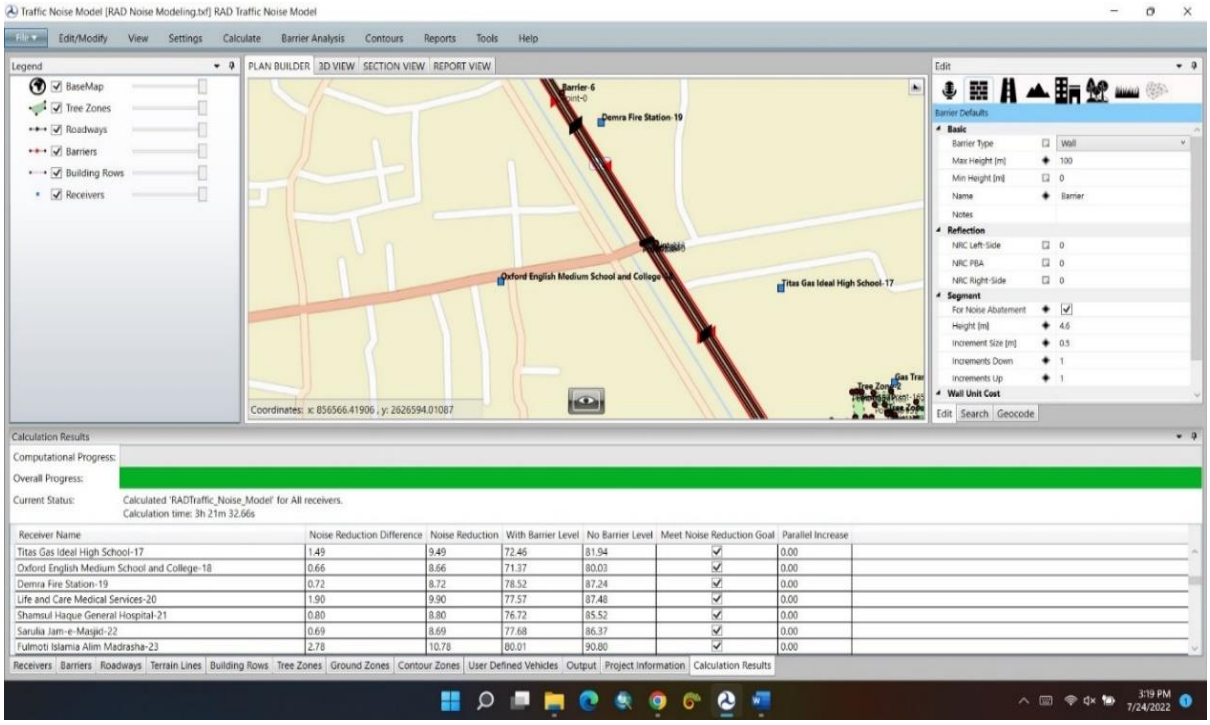


Figure VI.10: Result Output of TNM

(c) Results

372. 68 of these sensitive receptors were randomly chosen and used in the modelling exercise and results are given in Table VI-27.

373. Since the TNM predicts 62 sensitive receptors that might be substantially and sound level impacted by the year 2049, the barrier analysis was done which proposes from 3 to 5.2m at the

designated chainages. A further detail analysis during design may tell exact place and length of the barrier to place.

Table VI-27: Modelling Results of Baseline Scenario (2049) of Noise Prediction (Without Barriers)

Receiver				Modeled Traffic Noise Levels				
Name	No.	Nb. R.R.	Existing	LAeq		Increase over Existing		Type of Impact
			LAeq	Calc.	Absolute Criterion	Calc.	Relative Criterion	
			dBA	dBA	dBA	dBA	dBA	
Bhumi Polly Jame Masjid and Complex	1	1	54.4	78.1	54.0	23.7	10.0	Both
Demra Substation, DPDC	2	4	62.8	84.3	69.0	21.5	10.0	Both
Sugandha Hospital	3	3	67.8	81.1	69.0	13.3	10.0	Both
Chattogram Road Mosque	4	1	72.3	83.4	69.0	11.1	10.0	Both
Hirajhil Women's Madrasha	5	4	70.7	86.0	69.0	15.3	10.0	Both
Narayanganj Polytechnic Institute	6	5	61.2	79.9	69.0	18.7	10.0	Both
Lion Eye Service	7	5	75.8	86.7	69.0	10.9	10.0	Both
Madina Eye Hospital	8	2	73.2	85.0	69.0	11.9	10.0	Both
Baitur Rahman Jame Mosque	9	1	66.9	74.5	69.0	7.6	10.0	Nominal
Glass Factory Jame Mosque	10	1	72.6	81.1	69.0	8.5	10.0	Nominal
Tekpara Chairman Bari Jam-e Masjid	11	1	61.7	85.1	69.0	23.4	10.0	Both
Shifa International School	12	4	62.9	80.0	69.0	17.1	10.0	Both
Ali Akber School and College	13	5	52.5	80.6	54.0	28.0	10.0	Both
Rasulbagh ideal school-	14	1	59.6	82.2	54.0	22.6	10.0	Both
Gas Transmission Company Limited Jame Mosque	15	1	61.8	79.1	69.0	17.3	10.0	Both
Baitul Falah Jame Mosque	16	1	62.8	85.7	69.0	22.9	10.0	Both
Titas Gas Ideal High School	17	3	59.8	81.9	69.0	22.1	10.0	Both
Oxford English Medium School and College	18	3	61.8	80.0	69.0	18.3	10.0	Both
Demra Fire Station	19	2	67.8	87.2	69.0	19.4	10.0	Both
Life and Care Medical Services	20	4	64.9	87.5	69.0	22.6	10.0	Both
Shamsul Haque General Hospital	21	2	64.0	85.5	69.0	21.5	10.0	Both

Receiver				Modeled Traffic Noise Levels				
Name	No.	Nb. R.R.	Existing	LAeq		Increase over Existing		Type of Impact
			LAeq	Calc.	Absolute Criterion	Calc.	Relative Criterion	
			dBA	dBA	dBA	dBA	dBA	
Sarulia Jam-e-Masjid	22	2	67.7	86.4	69.0	18.7	10.0	Both
Fulmoti Islamia Alim Madrasha	23	5	64.8	90.8	69.0	26.0	10.0	Both
BTCL Telephone Building, Dhaka	24	3	66.0	87.5	69.0	21.5	10.0	Both
DPDC Sarulia 33KV Substation	25	3	67.2	89.7	69.0	22.6	10.0	Both
Staff Quarter Jam-e-Masjid	26	2	66.5	83.8	69.0	17.3	10.0	Both
Tropical Hospital	27	5	70.6	78.2	69.0	7.6	10.0	Nominal
Demra Ideal College	28	7	68.9	80.4	69.0	11.6	10.0	Both
Baitun-Nur Jam-e-Masjid	29	2	69.3	79.2	69.0	9.9	10.0	Nominal
Aligor Model University	30	1	58.8	86.7	69.0	27.9	10.0	Both
Amulia Mendipur Masjid and Madrasa	31	3	63.5	88.7	57.2	25.2	10.0	Both
Imam Bagh Jam-e-Masjid	32	1	56.3	83.7	69.0	27.4	10.0	Both
Baitul Quran Madrasa	33	4	55.8	84.2	54.0	28.4	10.0	Both
Uttargao Jame Mosque	34	1	63.1	84.0	54.0	20.9	10.0	Both
DPDC Power House	35	1	53.9	77.8	69.0	23.9	10.0	Both
Tourist Police Headquater	36	7	73.9	91.9	69.0	17.9	10.0	Both
Angarzora ahleadeeth Jame Mosque	37	1	53.8	82.7	54.0	28.9	10.0	Both
Yamagata Dhaka Friendship General Hospital	38	7	59.9	86.9	69.0	27.0	10.0	Both
Dhaka Metropolitan Police, Rampura Thana	39	1	62.3	82.4	69.0	20.1	10.0	Both
Famous Specialized Hospital	40	7	71.6	89.3	69.0	17.7	10.0	Both
National Ideal School Campus 2	41	5	77.6	89.9	69.0	12.2	10.0	Both
Al Razi Islamia pvt Hospital	42	6	76.8	90.0	69.0	13.2	10.0	Both
Bosuti Maa O Shishu Hospital	43	6	65.4	90.4	69.0	24.9	10.0	Both
Academia Bonoshree Campus	44	6	63.9	89.8	69.0	25.9	10.0	Both

Receiver				Modeled Traffic Noise Levels				
Name	No.	Nb. R.R.	Existing	LAeq		Increase over Existing		Type of Impact
			LAeq	Calc.	Absolute Criterion	Calc.	Relative Criterion	
			dBA	dBA	dBA	dBA	dBA	
Nur Majid Ayurbedic College	45	5	63.4	91.1	69.0	27.7	10.0	Both
Intelligentsia School and College	46	7	61.8	88.8	69.0	27.0	10.0	Both
Advanced Hospital	47	6	64.9	90.1	69.0	25.2	10.0	Both
Farazi Hospital Limited	48	3	67.8	91.9	69.0	24.1	10.0	Both
DPDC Substation Bonoshree	49	4	70.3	90.6	69.0	20.3	10.0	Both
Proper Health Care & Hospital	50	5	72.3	90.3	69.0	17.9	10.0	Both
National Ideal Girls' College and Bangladesh Fertility Hospital LTD	51	6	70.7	90.1	69.0	19.3	10.0	Both
National Ideal English Version	52	6	69.9	89.9	69.0	19.9	10.0	Both
National Ideal School, Bonoshree	53	6	73.8	90.3	69.0	16.4	10.0	Both
Bonoshree Adarsha Bidyaniketon School	54	6	75.9	89.9	69.0	14.0	10.0	Both
Ideal School & College	55	4	67.9	89.7	69.0	21.8	10.0	Both
C Block Mosque Jame Mosque	56	3	58.3	83.7	54.0	25.4	10.0	Both
Bonoshree Central Jam-e-Masjid	57	1	68.2	88.9	54.0	20.8	10.0	Both
Rajdhani Ideal School And College	58	5	69.5	90.2	69.0	20.7	10.0	Both
National Ideal School and College	59	4	51.8	77.6	54.0	25.7	10.0	Both
Holi Crescent School	60	6	53.7	79.2	54.0	25.5	10.0	Both
Somalia Embassy Bangladesh	61	5	53.2	81.1	54.0	27.8	10.0	Both
Oxford International School	62	6	63.8	88.6	69.0	24.8	10.0	Both
Purbachal Baitul Mukkadem Jame Mosque	63	1	57.0	82.0	54.0	25.1	10.0	Both
Aftab Nagar ideal School & College	64	5	49.8	86.1	54.0	36.3	10.0	Both
Baitul Atiq jame Mosque	65	1	50.8	81.6	54.0	30.7	10.0	Both
East West University	66	10	68.9	78.8	69.0	9.9	10.0	Nominal
Bangladesh Television Center	67	10	64.9	76.9	69.0	12.0	10.0	Both

Receiver				Modeled Traffic Noise Levels				
Name	No.	Nb. R.R.	Existing	LAeq		Increase over Existing		Type of Impact
			LAeq	Calc.	Absolute Criterion	Calc.	Relative Criterion	
			dBA	dBA	dBA	dBA	dBA	
Rampura Ekramunessa Girls High School	68	2	67.9	74.1	69.0	6.2	10.0	Nominal

Note:

- "Nominal" Type of Impact: If the predicted Noise level were increased from the Absolute Criterion
- "Substantial" Type of Impact: If the difference between the Predicted Noise Level and Existing Noise Level were increased than the Relative Criterion (10 dBA).
- "Both" Type of Impact: If the Nominal type of impact and Substantial type impact both occurred.

Table VI-28: Modelling Results of Baseline Scenario (2049) of Noise Prediction (With Barriers)

Receiver				Modeled Traffic Noise Levels								
Name	No.	DUs	Existing LAeq	All Abatement Barriers at Zero Height					With Abatement Barriers			
				LAeq		Increase over Existing		Type of Impact	Calc. LAeq	Noise Reduction		Calc. Minus Goal
				Calc.	Absolute Criterion	Calc.	Relative Criterion			Calc.	Goal	
			dBA	dBA	dBA	dBA	dBA		dBA	dBA	dBA	dBA
Bhumi Polly Jame Masjid and Complex	1	1	54.4	78.1	54.0	23.7	10.0	Both	69.8	8.3	8.0	0.3
Demra Substation, DPDC	2	4	62.8	84.3	69.0	21.5	10.0	Both	74.4	9.9	8.0	1.9
Sugandha Hospital	3	3	67.8	81.1	69.0	13.3	10.0	Both	72.3	8.9	8.0	0.9
Chattogram Road Mosque	4	1	72.3	83.4	69.0	11.1	10.0	Both	73.0	10.3	8.0	2.3
Hirajhil Women's Madrasha	5	4	70.7	86.0	69.0	15.3	10.0	Both	76.9	9.1	8.0	1.1
Narayanganj Polytechnic Institute	6	5	61.2	79.9	69.0	18.7	10.0	Both	70.4	9.5	8.0	1.5
Lion Eye Service	7	5	75.8	86.7	69.0	10.9	10.0	Both	76.0	10.7	8.0	2.7
Madina Eye Hospital	8	2	73.2	85.0	69.0	11.9	10.0	Both	75.8	9.3	8.0	1.3
Tekpara Chairman Bari Jam-e Masjid	9	1	61.7	85.1	69.0	23.4	10.0	Both	76.8	8.4	8.0	0.4
Shifa International School	10	4	62.9	80.0	69.0	17.1	10.0	Both	71.8	8.2	8.0	0.2
Ali Akber School and College	11	5	52.5	80.6	54.0	28.0	10.0	Both	71.1	9.4	8.0	1.4
Rasulbagh ideal school	12	1	59.6	82.2	54.0	22.6	10.0	Both	73.6	8.6	8.0	0.6
Gas Transmission Company Limited Jame Mosque	13	1	61.8	79.1	69.0	17.3	10.0	Both	70.5	8.6	8.0	0.6
Baitul Falah Jame Mosque	14	1	62.8	85.7	69.0	22.9	10.0	Both	76.0	9.7	8.0	1.7
6Titas Gas Ideal High School	15	3	59.8	81.9	69.0	22.1	10.0	Both	72.5	9.5	8.0	1.5
Oxford English Medium School and College	16	3	61.8	80.0	69.0	18.3	10.0	Both	71.4	8.7	8.0	0.7
Demra Fire Station	17	2	67.8	87.2	69.0	19.4	10.0	Both	78.5	8.7	8.0	0.7
Life and Care Medical Services	18	4	64.9	87.5	69.0	22.6	10.0	Both	77.6	9.9	8.0	1.9
Shamsul Haque General Hospital	19	2	64.0	85.5	69.0	21.5	10.0	Both	76.7	8.8	8.0	0.8
Sarulia Jam-e-Masjid	20	2	67.7	86.4	69.0	18.7	10.0	Both	77.7	8.7	8.0	0.7
Fulmoti Islamia Alim Madrasha	21	5	64.8	90.8	69.0	26.0	10.0	Both	80.0	10.8	8.0	2.8

Receiver				Modeled Traffic Noise Levels								
				All Abatement Barriers at Zero Height					With Abatement Barriers			
				LAeq		Increase over Existing				Noise Reduction		
Name	No.	DUs	Existing LAeq	Calc.	Absolute Criterion	Calc.	Relative Criterion	Type of Impact	Calc. LAeq	Calc.	Goal	Calc. Minus Goal
			dBA	dBA	dBA	dBA	dBA		dBA	dBA	dBA	dBA
BTCL Telephone Building, Dhaka	22	3	66.0	87.5	69.0	21.5	10.0	Both	77.3	10.2	8.0	2.2
DPDC Sarulia 33KV Substation	23	3	67.2	89.7	69.0	22.6	10.0	Both	79.4	10.3	8.0	2.3
Staff Quarter Jam-e-Masjid	24	2	66.5	83.8	69.0	17.3	10.0	Both	75.8	8.0	8.0	0.0
Demra Ideal College	25	7	68.9	80.4	69.0	11.6	10.0	Both	71.7	8.7	8.0	0.7
Aligarh Model University	26	1	58.8	86.7	69.0	27.9	10.0	Both	78.5	8.2	8.0	0.2
Amulia Mendipur Masjid and Madrasa	27	3	63.5	88.7	57.2	25.2	10.0	Both	79.2	9.5	8.0	1.5
Imam Bagh Jam-e-Masjid	28	1	56.3	83.7	69.0	27.4	10.0	Both	75.4	8.3	8.0	0.3
Baitul Quran Madras	29	4	55.8	84.2	54.0	28.4	10.0	Both	75.9	8.3	8.0	0.3
Uttar gao Jame Mosque	30	1	63.1	84.0	54.0	20.9	10.0	Both	75.4	8.6	8.0	0.6
DPDC Power House	31	1	53.9	77.8	69.0	23.9	10.0	Both	69.7	8.1	8.0	0.1
Tourist Police Headquater	32	7	73.9	91.9	69.0	17.9	10.0	Both	83.0	8.8	8.0	0.8
Angarzora ahleadeeth Jame Mosque	33	1	53.8	82.7	54.0	28.9	10.0	Both	73.7	9.0	8.0	1.0
Yamagata Dhaka Friendship General Hospital	34	7	59.9	86.9	69.0	27.0	10.0	Both	78.6	8.3	8.0	0.3
Dhaka Metropolitan Police, Rampura Thana	35	1	62.3	82.4	69.0	20.1	10.0	Both	70.6	11.8	8.0	3.8
Famous Specialized Hospital	36	7	71.6	89.3	69.0	17.7	10.0	Both	79.9	9.4	8.0	1.4
National Ideal School Campus 2	37	5	77.6	89.9	69.0	12.2	10.0	Both	77.4	12.5	8.0	4.5
Al Razi Islamia pvt Hospital	38	6	76.8	90.0	69.0	13.2	10.0	Both	78.6	11.4	8.0	3.4
Basuti Maa O Shishu Hospital	39	6	65.4	90.4	69.0	24.9	10.0	Both	79.0	11.4	8.0	3.4
Academia Bonoshree Campus	40	6	63.9	89.8	69.0	25.9	10.0	Both	78.5	11.2	8.0	3.2
Nur Majid Ayurbedic College	41	5	63.4	91.1	69.0	27.7	10.0	Both	77.6	13.5	8.0	5.5
Intelligentsia School and College	42	7	61.8	88.8	69.0	27.0	10.0	Both	77.7	11.1	8.0	3.1
Advanced Hospital	43	6	64.9	90.1	69.0	25.2	10.0	Both	81.1	8.9	8.0	0.9

Receiver				Modeled Traffic Noise Levels								
				All Abatement Barriers at Zero Height					With Abatement Barriers			
				LAeq		Increase over Existing				Noise Reduction		
Name	No.	DUs	Existing LAeq	Calc.	Absolute Criterion	Calc.	Relative Criterion	Type of Impact	Calc. LAeq	Calc.	Goal	Calc. Minus Goal
			dBA	dBA	dBA	dBA	dBA		dBA	dBA	dBA	dBA
Farazi Hospital Limited	44	3	67.8	91.9	69.0	24.1	10.0	Both	76.0	15.9	8.0	7.9
DPDC Substation Bonoshree	45	4	70.3	90.6	69.0	20.3	10.0	Both	76.8	13.8	8.0	5.8
Proper Health Care & Hospital	46	5	72.3	90.3	69.0	17.9	10.0	Both	78.1	12.1	8.0	4.1
National Ideal Girls' College and Bangladesh Fertility Hospital LTD	47	6	70.7	90.1	69.0	19.3	10.0	Both	81.5	8.6	8.0	0.6
National Ideal English Version	48	6	69.9	89.9	69.9	89.9	69.0	Both	77.7	12.1	8.0	4.1
National Ideal School, Bonoshree	49	6	73.8	90.3	73.8	90.3	69.0	Both	78.2	12.1	8.0	4.1
Bonoshree Adarsha Bidyaniketon School	50	6	75.9	89.9	75.9	89.9	69.0	Both	79.3	10.7	8.0	2.7
Ideal School & College	51	4	67.9	89.7	67.9	89.7	69.0	Both	75.4	14.3	8.0	6.3
C Block Mosque Jame Mosque	52	3	58.3	83.7	58.3	83.7	54.0	Both	75.2	8.5	8.0	0.5
Bonoshree Central Jam-e-Masjid	53	1	68.2	88.9	68.2	88.9	54.0	Both	75.0	13.9	8.0	5.9
Rajdhani Ideal School and College	54	5	69.5	90.2	69.5	90.2	69.0	Both	78.2	11.9	8.0	3.9
National Ideal School and College	55	4	51.8	77.6	51.8	77.6	54.0	Both	67.1	10.5	8.0	2.5
Holi Crescent School	56	6	53.7	79.2	53.7	79.2	54.0	Both	69.1	10.1	8.0	2.1
Somalia Embassy Bangladesh	57	5	53.2	81.1	53.2	81.1	54.0	Both	70.2	10.9	8.0	2.9
Oxford International School	58	6	63.8	88.6	63.8	88.6	69.0	Both	77.7	10.9	8.0	2.9
Purbachal Baitul Mukkadem Jame Mosque	59	1	57.0	82.0	57.0	82.0	54.0	Both	72.9	9.1	8.0	1.9
Aftab Nagar ideal School & College	60	5	49.8	86.1	49.8	86.1	54.0	Both	77.0	9.1	8.0	1.9
Baitul Atiq jame Mosque	61	1	50.8	81.6	54.0	30.7	10.0	Both	71.1	10.4	8.0	2.4
Bangladesh Television Center	62	10	64.9	76.9	69.0	12.0	10.0	Both	68.6	8.3	8.0	0.3

Table VI-29: Modelling Results of Baseline Scenario (2049) of Noise Prediction (Barriers Details)

Barrier Name	Type	Height		Point		Coordinates			Height [m]	Thickness [mm]	Length [m]	Segment			
		Min [m]	Max [m]	Name	Number	X [m]	Y [m]	Z [m]				Area Unit Cost [$/m²]	Volume Unit Cost [$/m³]	[Additional] Linear Unit Cost [$/m]	On Structure
Barrier-1	Wall	0.00	100.00	Point-0	0	858211.90	2625335.00	9.00	4.00	100	713	50	50	0	No
				Point-6	6	858092.20	2625256.00	10.50	4.00			50	50	0	No
				Point-3	4	857935.60	2625187.00	18.00	4.00			50	50	0	No
				Point-1	1	858165.80	2624854.00	10.00	4.00			50	50	0	No
Barrier-2	Wall	0.00	100.00	Point-7	7	858096.00	2624925.00	11.00	5.00	100	728	50	50	0	No
				Point-8	8	857919.80	2625177.00	18.00	5.00			50	50	0	No
				Point-10	9	857673.60	2625074.00	11.00	4.60			50	50	0	No
				Point-12	10	857507.40	2625051.00	9.00	4.60			50	50	0	No
Barrier-3	Wall	0.00	100.00	Point-0	2	857503.90	2625060.00	9.00	4.60	100	580	50	50	0	No
				Point-1	3	857681.20	2625097.00	14.00	4.60			50	50	0	No
				Point-3	5	857900.60	2625198.00	18.00	4.60			50	50	0	No
				Point-7	12	857808.20	2625332.00	18.00	4.60			50	50	0	No
Barrier-4	Wall	0.00	100.00	Point-8	13	857737.60	2625476.00	18.00	4.00	100	457	50	50	0	No
				Point-9	14	857923.80	2625207.00	18.00	4.00			50	50	0	No
				Point-11	15	858045.90	2625261.00	15.00	4.00			50	50	0	No
Barrier-5	Wall	0.00	100.00	Point-12	16	857762.20	2625399.00	18.00	4.60	100	785	50	50	0	No
				Point-13	17	857314.10	2626043.00	18.00	4.60			50	50	0	No
Barrier-6	Wall	0.00	100.00	Point-0	11	856668.80	2626993.00	18.00	4.30	100	830	50	50	0	No
				Point-10	24	856805.00	2626799.00	18.00	4.60			50	50	0	No
				Point-1	19	856970.20	2626566.00	18.00	5.00			50	50	0	No

Barrier Name	Type	Height		Point		Coordinates			Height [m]	Thickness [mm]	Length [m]	Segment			
		Min [m]	Max [m]	Name	Number	X [m]	Y [m]	Z [m]				Area Unit Cost [$/m²]	Volume Unit Cost [$/m³]	[Additional] Linear Unit Cost [$/m]	On Structure
				Point-3	20	857148.10	2626313.00	18.00	5.00			50	50	0	No
Barrier-7	Wall	0.00	100.00	Point-4	18	857039.60	2626438.00	18.00	4.80	100	888	50	50	0	No
				Point-5	21	856952.80	2626559.00	18.00	4.80			50	50	0	No
				Point-7	22	856785.90	2626797.00	18.00	4.80			50	50	0	No
				Point-9	23	856527.40	2627167.00	18.00	4.80			50	50	0	No
Barrier-8	Wall	0.00	100.00	Point-11	25	856353.30	2627441.00	18.00	3.50	100	416	50	50	0	No
				Point-12	26	856595.10	2627102.00	18.00	3.50			50	50	0	No
Barrier-9	Wall	0.00	100.00	Point-0	27	855616.50	2628293.00	18.00	4.60	100	988	50	50	0	No
				Point-5	31	855880.80	2627967.00	18.00	4.60			50	50	0	No
				Point-4	28	856027.90	2627806.00	18.00	4.60			50	50	0	No
				Point-1	30	856197.80	2627640.00	18.00	4.60			50	50	0	No
				Point-3	29	856263.70	2627545.00	8.00	4.60			50	50	0	No
Barrier-10	Wall	0.00	100.00	Point-6	32	855388.40	2628840.00	8.00	4.60	100	346	50	50	0	No
				Point-8	34	855359.20	2628906.00	8.00	4.60			50	50	0	No
				Point-7	33	855262.40	2629161.00	8.00	4.60			50	50	0	No
Barrier-11	Wall	0.00	100.00	Point-9	35	854685.00	2629873.00	8.00	4.20	100	293	50	50	0	No
				Point-10	36	854756.60	2629810.00	8.00	4.20			50	50	0	No
				Point-12	37	854899.90	2629670.00	8.00	4.20			50	50	0	No
Barrier-12	Wall	0.00	100.00	Point-13	38	851798.40	2631271.00	18.00	4.10	100	678	50	50	0	No
				Point-14	39	852144.20	2630949.00	18.00	4.10			50	50	0	No

Barrier Name	Type	Height		Point		Coordinates			Height [m]	Thickness [mm]	Length [m]	Segment			
		Min [m]	Max [m]	Name	Number	X [m]	Y [m]	Z [m]				Area Unit Cost [$/m²]	Volume Unit Cost [$/m³]	[Additional] Linear Unit Cost [$/m]	On Structure
				Point-16	40	852173.10	2630929.00	18.00	4.10			50	50	0	No
				Point-18	41	852347.60	2630904.00	18.00	4.10			50	50	0	No
Barrier-13	Wall	0.00	100.00	Point-0	42	851135.50	2632151.00	18.00	3.40			50	50	0	No
				Point-1	43	851312.30	2631908.00	18.00	3.90	100	742	50	50	0	No
				Point-3	44	851554.40	2631537.00	18.00	3.90			50	50	0	No
Barrier-14	Wall	0.00	100.00	Point-4	45	848856.50	2632532.00	9.00	4.60			50	50	0	No
				Point-0	54	848884.00	2632586.00	9.00	4.60			50	50	0	No
				Point-5	47	848935.90	2632694.00	13.50	4.60			50	50	0	No
				Point-7	48	849086.60	2632622.00	18.00	4.60			50	50	0	No
				Point-9	49	849242.20	2632544.00	18.00	4.60			50	50	0	No
				Point-11	50	849585.10	2632369.00	18.00	4.60			50	50	0	No
				Point-13	51	849914.10	2632253.00	18.00	4.60	100	3110	50	50	0	No
				Point-15	52	850251.60	2632186.00	18.00	4.60			50	50	0	No
				Point-17	53	850773.90	2632153.00	18.00	4.60			50	50	0	No
				Point-19	46	851124.10	2632132.00	18.00	4.60			60	60	0	No
				Point-28	60	851297.40	2631898.00	18.00	4.60			60	60	0	No
				Point-21	56	851499.60	2631589.00	18.00	4.60			60	60	0	No
Barrier-15	Wall	0.00	100.00	Point-1	64	849594.30	2632390.00	18.00	4.60			60	60	0	No
				Point-2	59	849918.70	2632269.00	18.00	4.60	100	503	60	60	0	No
				Point-4	60	850079.30	2632238.00	18.00	4.60			60	60	0	No

Barrier Name	Type	Height		Point		Coordinates			Height [m]	Thickness [mm]	Length [m]	Segment			
		Min [m]	Max [m]	Name	Number	X [m]	Y [m]	Z [m]				Area Unit Cost [$/m²]	Volume Unit Cost [$/m³]	[Additional] Linear Unit Cost [$/m]	On Structure
Barrier-16	Wall	0.00	100.00	Point-2	65	849008.60	2632836.00	9.00	4.60	100	592	60	60	0	No
				Point-3	66	848951.30	2632722.00	13.50	4.60			60	60	0	No
				Point-5	67	849368.80	2632506.00	18.00	4.60			60	60	0	No

374. Sample Aluminum Sheet Noise barrier are provided in the below figure. Based on the monitoring of noise pollution in the operation stage, sound barrier/plantations shall be adopted.

(2) Vibration Modeling

(i) Introduction

375. Vibration caused by traffic is a serious urban issue and an environmental disturbance that has long been tolerated. However, it has become a frequent source of public dissatisfaction. Although the level of traffic-induced, in-dwelling vibration is controllable through design and planning decisions, it has received little attention in the urban design and planning literature. The number and size of vehicles increased rapidly in tandem with the improvement of people's living conditions. People are becoming more aware of the impact of noise and vibration caused by vehicle load. For starters, vehicles can cause road or bridge vibration. The surrounding ground then radiates vibration waves outward, causing nearby structures to vibrate. Finally, the safety of people living in adjacent structures may be put at risk. The analysis of traffic-induced ground vibration and adjacent structures is quite complex because the problem involves a large number of unknown factors, many of which are stochastic. Building and ground vibrations have a negative impact on structures. Some effects are:

- Damage to buildings structure, including fatigue damage such as cracking and breakage,
- Damage to buildings contents, including sensitive electronic equipment and work of art,
- Disturbance to humans' comfort,
- Audible effects such as structure-borne noise and secondary rattling of building elements or contents.

376. Many studies have been conducted in the field of environmental vibration caused by vehicle load. However, the majority of them are focused on subway or rail traffic induced vibration, particularly acting on ground vibration rather than adjacent building vibration.

(ii) Objectives

377. The objective of this vibration data collection work is to

- ✓ study the ground and building vibrations caused by large-scale buses and trucks on adjacent road.
- ✓ secondly vertical velocity of the ground near a highway is measured at 20m interval away from the road.
- ✓ The vertical velocity time history curve is measured to check whether the collected data can be used for prediction or not.
- ✓ Then prediction of vertical velocity at different sensitive location to identify whether the project can be implemented.
- ✓ Finally, the results and justification of this study are giving to this kind of buildings near the highway.

(iii) Methodology

(a) General

378. Ground vibrations can be grouped into three categories based on their frequency content. Those that are low frequency which includes vibrations of frequency smaller than 2 Hz, medium frequency with frequencies greater than 2 Hz. and the extreme case of vibration whose frequency can reach to 1000 Hz.

379. Traffic induced vibration is caused by the interaction between the dynamic forces produced by vehicles and the road. The dynamic forces on roads that induce vibrations are generally three types. The impact force of the tires, which produce vibrations of 800–1500 Hz, impact force due to unsuspended mass of the vehicle, which produces vibrations of frequencies 10–15 Hz, and impact force due to, suspends mass of the vehicle, which produces vibrations 1–2 Hz. Impact force of the tires contribution to the ground-borne vibration is negligible.[15] Thus, the frequency content of traffic induced ground vibration lies between 2–15 Hz. Different vehicles induce different magnitudes of vibrations. Vehicle characteristics including its weight and suspension system have an effect on the magnitude of ground vibration it induces. Additionally, the speed of the vehicle also affects the magnitude of ground vibration. The other parameter, which affects the magnitude of ground vibration, is road surface characteristics. The rougher the road surface is the higher the vibration magnitude will be.[16][17]

380. Vibration induced by traffic travels through the soil until it completely attenuates to zero due to energy loss. There have been several attempts to measure traffic induced ground vibrations. Watts [4] observed that heavy vehicles generate vibrations, which can be sensed in 5m distance. Due to smaller vibration amplitudes, it is obvious that traffic induced ground vibrations attenuate in relatively shorter distance.

(b) Data Collection and Analysis

381. Traffic-induced ground vibration is measured in this study using a digital vibration meter in accordance with ISO 2954 by allowing various types of vehicles to pass through different types of roads at different speeds.

[15] Jerry J. Hajek, Chris T. Blaney, David K. Hein, Mitigation of highway traffic-induced vibration Session on Quiet Pavements: Reducing Noise and Vibration, Annual Conference of the Transportation Association of Canada, Charlottetown, Prince Edward Island:s.n. (2006)
[16] Daha S Aliyu, Yusuf Abdulfatah Abdu, Danjuma A Yusuf, Transmission of ground vibration on road side structures, Eu. J. Adv. Eng. Technol. (2016), pp. 43-46
[17] G. Kouroussis, D.P. Connolly, O. Verlinden, Railway induced ground vibrations — a review of vehicle effects Int. J. Rail Transport. (2014) Vol. 00

Figure VI.11: Digital Vibration Meter in accordance with ISO 2954

382. The device is intended for simple on-site vibration measurement as well as predictive measurement. Data was collected in three locations: 1. Amulia, 2. Sarulia, and 3. Bonoshree. All measurements were taken 100 meters away from the road at 20-meter intervals. In the chainage area of the road total 107 sensitive location is founded during survey. A prediction model is being prepared to predict peak particle velocity at all the sensitive location.

383. MATLAB software is used to analyze all the collected data. It is extremely difficult in Microsoft Excel to analyze large amounts of data at once with accuracy and proper graph plotting. As a result, MATLAB is used to plot the graph and visualize the data in order to compare it to the standards.

(iv) Results and Discussions

384. It can be concluded that the velocity of vibration decreases gradually with the increasing of the distance between measuring point and vibration source (the highway).

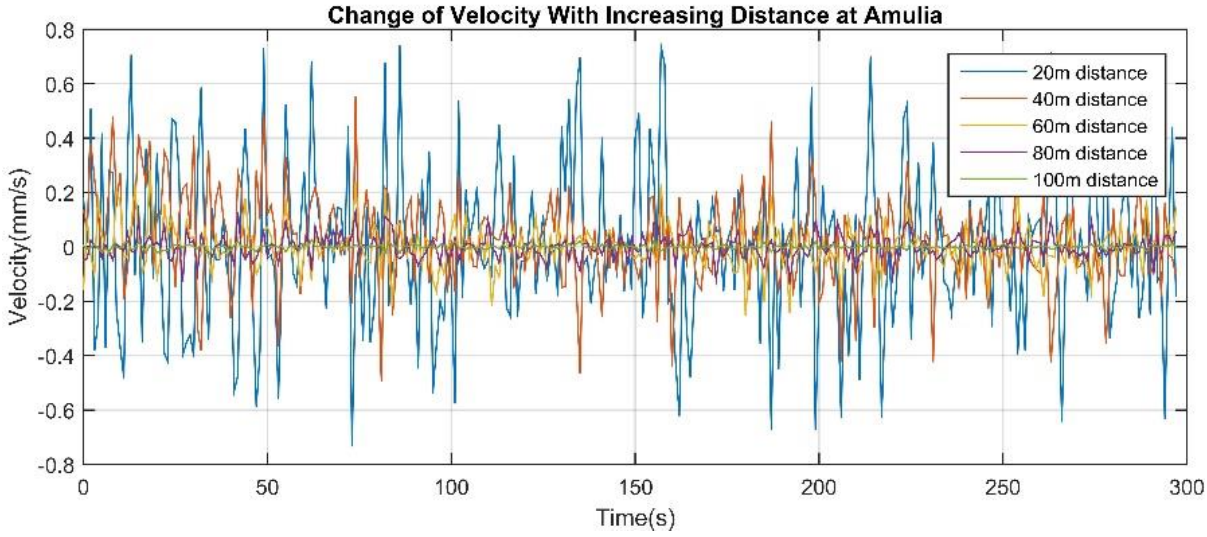


Figure VI.12: Decreasing Velocity with Increasing Distance Respect to Time at Amulia

385. The ground frequency induced by vehicle load is mainly concentrate between 8-20Hz. The amplitude decreases rapidly with the increasing of the distance between measuring points and

vibration sources. However, the predominance frequency band corresponding to the response signal changes little. From the analysis of the existing data, it can be seen that the values of peak particle velocity are below 1mm/s at all the places throughout the road.

Table VI-30: Peak Vibration Velocity Changing with the Distance away from the Road

Amulia		Sarulia		Bonoshree	
Distance	Velocity(mm/s)	Distance	Velocity(mm/s)	Distance	Velocity(mm/s)
0	0.740281	0	0.931175	0	0.814309
20	0.552254	20	0.663174	20	0.575438
40	0.283525	40	0.445845	40	0.390102
60	0.129791	60	0.256404	60	0.21367
80	0.026374	80	0.09442	80	0.059563

386. A prediction model is created by collecting all the peak values at various distances from the road. All the peaks indicate that the vibration velocity decreases linearly with distance. In this case, a linear prediction model is sufficient. The predicted plot is nearly identical to the actual plot, indicating that the prediction's accuracy is adequate. The predicted graph shows that the peak particle velocity at all sensitive locations is less than 1mm/s, which is well below the standards.

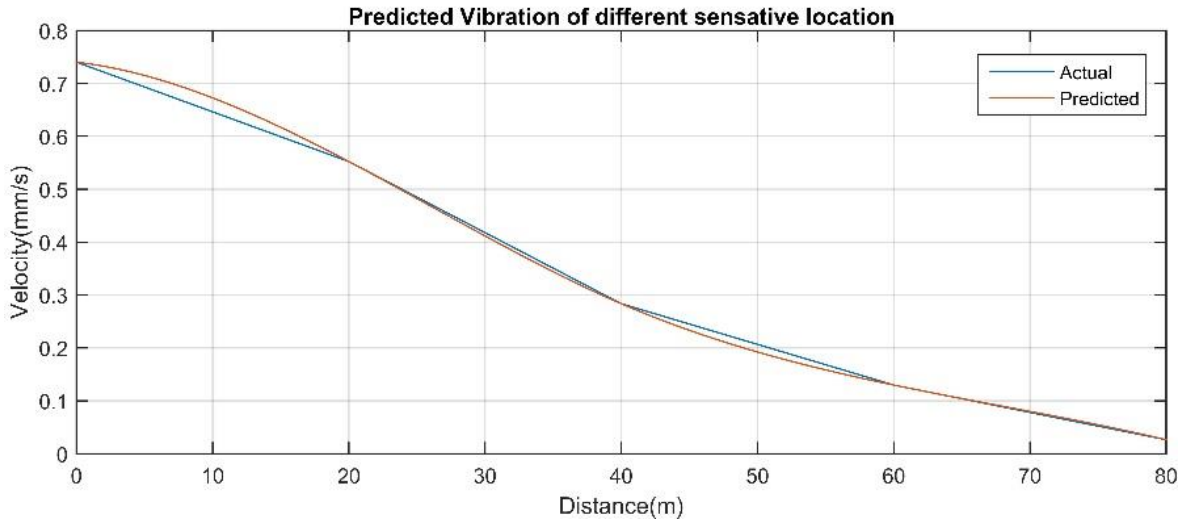


Figure VI.13: Prediction of Vibration Velocity at Amulia

387. Sample graphs are presented in Figure VI-10 and Figure VI-11. Detail graphs are presented in Appendix 1.

388. The standard DIN 4150-3 defines the values which must be met to avoid damage and impact on structures. Different PPV limits apply depending on the building types in the frequency range from 1 Hz to 100 Hz:

- from 20 mm/s up to 50 mm/s – for buildings used for commercial and industrial buildings,
- from 4 mm/s up to 20 mm/s for residential buildings, from 3 mm/s up to 10 mm/s for building sensitive to vibration that has great intrinsic value

Table VI-31: Distance of Sensitive Location from the Road and Vibration Velocity

Name	Latitude	Longitude	Distance (Meter)	Velocity(mm/s)
Rampura Water Pump	23.767555	90.423333	3.8	0.7727

Name	Latitude	Longitude	Distance (Meter)	Velocity(mm/s)
Bangladesh Television Rampura	23.76714	90.424512	1.48	0.8002
East West University	23.768277	90.425361	155.25	0.05956
Oxford International School	23.766467	90.425843	8.25	0.7086
Rampura Khal	23.766348	90.426627	39.53	0.399
Holy Crescent School	23.764441	90.429426	18.56	0.5959
Rajdhani Ideal School and College	23.764227	90.430001	14.46	0.6388
Bonoshree Central Jam-e-Masjid	23.763567	90.431472	23.79	0.5457
Ideal School & College	23.76333	90.432153	27.46	0.5075
Bonoshree Adarsha Bidyaniketon School	23.762909	90.434168	5.72	0.7463
National Ideal School, Bonoshree	23.762794	90.434634	9.81	0.6964
National Ideal English Version	23.762763	90.434837	9.99	0.6845
National Ideal Girls' College	23.762754	90.434919	8.63	0.7086
Bangladesh Fertility Hospital LTD	23.762729	90.435056	9.43	0.6964
Proper Health Care & Hospital	23.762713	90.435165	8.81	0.7086
DPDC Substation Bonoshree	23.762639	90.435631	9.22	0.6964
Farazi Hospital Limited	23.762504	90.43626	12.78	0.6613
Advanced Hospital	23.762545	90.436777	2.92	0.7863
Intelligentsia School and College	23.762397	90.437495	11.54	0.6728
Nur Majid Ayurbedic College	23.762511	90.437778	4.28	0.7594
Academia	23.762445	90.437935	4.8	0.7594
Bosuti Maa O Shishu Hospital	23.762461	90.438651	2.63	0.7863
Al Razi Islamia pvt Hospital	23.762244	90.439927	10.13	0.6845
Famous Specialized Hospital	23.76195	90.443408	9.65	0.6964
Dhaka Metropolitan Police, Rampura Thana	23.761305	90.443476	81.11	0.05956
Yamagata Dhaka Friendship General Hospital	23.761464	90.443958	60.81	0.2137
Tourist Police Headquarter	23.760018	90.446414	50.7	0.3008
Messrs. Quality Timber & Saw Mill	23.757508	90.447825	20.84	0.5754
Royal Ranch & Dairy	23.756417	90.448249	10.3	0.6845
Central Warehouse	23.754839	90.449736	0.77	0.8143
Liberty College	23.754399	90.450014	12.58	0.6613
Majumder Timber Furniture and Door	23.753645	90.450901	7.82	0.7209
Baitul Quran Madrasa	23.752363	90.453888	109.18	0
Masjidul Akbar Jam-e-Masjid	23.751442	90.453277	11.33	0.6728
Imam Baag Jam-e-Masjid	23.752407	90.454209	139.19	0
Messrs Rahim Afroz Gastec	23.751688	90.4535	27.9	0.5075
Samarai Cattle Farm	23.751489	90.453677	19.62	0.5856
Nagdarpar Pond	23.750185	90.459169	43.37	0.3633
Nagdarpar Sarkar Bari Graveyard	23.74967	90.461026	30.08	0.4798
Baitul Aman Jam-e-Masjid	23.749568	90.461226	22.54	0.5257
Bismillah Timber Traders	23.74915	90.464493	47.72	0.2159
Iram Chottor Bazar	23.74631	90.472563	26.08	0.4682
Mostomajhi Pond	23.745182	90.473166	26.44	0.454
Maxim Group	23.743085	90.476404	19.8	0.5657
Aichi Medical College & Hospital	23.740726	90.478854	1.69	0.7325

Name	Latitude	Longitude	Distance (Meter)	Velocity(mm/s)
Haji Aman Market	23.740041	90.479908	13.36	0.6406
Amulia Mendipur Masjid and Madrasa	23.739455	90.479871	37.38	0.3187
Panjeri Godown	23.738885	90.481154	17.95	0.579
Amulia Baitun-Nur Jam-e-Masjid	23.737626	90.482277	10.24	0.6727
Aranya Furniture Limited	23.737109	90.483125	7.02	0.7
E-Haque School and College	23.736653	90.483318	2.1	0.7325
Haji Atik Market	23.736836	90.483493	27.18	0.454
Active Corporation	23.73555	90.484458	62.26	0.1193
Snigdha Rajshahi Nursery	23.734502	90.484185	6.36	0.7079
Shonar Bangla Timber and Saw Mill	23.733565	90.484971	35.85	0.2949
Aligor Model University	23.732778	90.484709	15.82	0.617
Imtex Packaging	23.731854	90.485265	2.15	0.7325
Gouripur Timber Mill	23.73151	90.48569	26.08	0.4682
Chattogram VIP Timber And Saw Mill	23.730512	90.485931	1.95	0.7325
Jamir Ali Super Market	23.728014	90.487171	20.87	0.5523
SHIMU EPS Packaging Industries Limited	23.727611	90.486939	14.08	0.629
KKR Enterprise	23.725935	90.487748	3.83	0.7275
ALLIED Group	23.726082	90.487877	15.84	0.617
Dominus Agro Industries Limited	23.725668	90.488135	21.47	0.5386
Sheikher Jaiga Pond	23.724121	90.487747	75.93	0.04926
Messrs Sharif Timber Saw Mill	23.724161	90.488832	28.94	0.43989
Sajek Sami Timber & Saw Mill	23.723883	90.488585	8.01	0.6914
Baitun-Nur Jam-e-Masjid	23.721931	90.48949	5.44	0.7151
Demra Ideal College	23.72173	90.489535	8.33	0.6914
Akmol Shopping Complex	23.720779	90.490345	28.92	0.4257
Tropical Hospital	23.720055	90.490181	16.93	0.592
Staff Quarter Jam-e-Masjid	23.720484	90.49162	68.57	0.08965
Staff Quarter Pond	23.720642	90.492903	49.81	0.1923
Karim Jute Mill Pond	23.719024	90.49447	22.94	0.5107
Karim Jute Mills Limited	23.71785	90.495074	7.49	0.7
DPDC Sarulia 33KV Substation	23.717665	90.495342	26.26	0.4682
BTCL Telephone Building, Dhaka	23.716605	90.49602	16.44	0.6047
Fulmoti Islamia Alim Madrasha	23.716523	90.496422	45.64	0.2333
M.A. Sattar High School	23.717454	90.498666	305	0
Sarulia Jam-e-Masjid	23.716149	90.496559	35.57	0.497
Sarulia Pond	23.715261	90.496554	19.19	0.6751
Sarulia Bazar	23.716063	90.496279	5.46	0.8579
68 no. Ward Awami League Office	23.71521	90.496911	6.19	0.8438
Shamsul Haque General Hospital	23.714878	90.496517	48.98	0.3671
Life and Care Medical Services	23.714738	90.496517	55.05	0.3014
Baitun-nazat Jam-e-Masjid	23.714664	90.497199	4.48	0.8722
Bangladesh Police Demra Police Fari	23.714758	90.497522	32.04	0.5285
Police Fari Pond	23.714404	90.49719	18.02	0.6872
Demra Fire Station	23.714044	90.498056	31.25	0.5392
Al-Aqsa Steel Mills LTD	23.71262	90.498616	9.68	0.8025

Name	Latitude	Longitude	Distance (Meter)	Velocity(mm/s)
Titas Gas Field	23.712122	90.49914	6.08	0.8438
Bangladesh Police UN Warehouse	23.710599	90.497427	230	0
Titas Gas Ideal High School	23.71203	90.500337	105.75	0
Gas Transmission Company Limited City Gate Station	23.710924	90.500289	32.91	0.5285
Haque Construction	23.709747	90.500946	14.27	0.737
Sarulia Cattle Market	23.708413	90.501892	18.55	0.6872
Shitolokkha Fish Nursery	23.708235	90.50181	5.99	0.8438
Apollo Ispat Complex LTD	23.704802	90.504403	11.4	0.7758
ARBAB Group	23.704203	90.505896	102.28	0
Shifa International School	23.700432	90.505504	147.92	0
Jibon Fish Farm	23.699386	90.508165	9.06	0.8025
Tekpara Chairman Bari Jam-e Masjid	23.699255	90.508632	32.32	0.5285
Madina Eye Hospital	23.698262	90.509411	38.88	0.4661
Lion Eye Service	23.697641	90.50817	104.93	0
Hirajhil Women's Madrasha	23.696878	90.507362	226.46	0
Chan Super Market	23.697254	90.508876	69.51	0.1798
Chattogram Road Mosque	23.697027	90.509129	63.83	0.2216

389. As per the above modeling output most vulnerable structures along the alignment are identified which is presented in the below table.

Table VI-32: Most Vulnerable Structures Location along the Alignment

Location	GPs	Chainage
Siddhirganj Pool and Channel of Bridge, Demra-Narayanganj Road, Siddhirganj	23.697956° N 90.509873° E	C/S No. -01 CH. 00+000 km
Chattogram Road Bus Stop, Chattogram Road, Siddhirganj	23.697996° N 90.508800° E	Between C/S No. -01 to -02 CH. 00+000 km to 00+050 km
Market Road, Siddhirganj	23.697291° N 90.508415° E	C/S No. -02 CH. 00+050 km
Demra-Ranimohol, Chattogram Road, Demra	23.703378° N 90.505408° E	Between C/S No. -16 to -15 CH. 00+750 km to 00+700 km
Wasa Road, Sarulia Bazar, Demra	23.715870° N 90.496441° E	C/S No. -49 CH. 02+400 km
Ahamad Bawany Jute Mill Road, Staff Quarter-Boro Vanga Road, Demra, Dhaka	23.723531° N 90.48889° E	C/S No. -72 CH. 03+550 km
Mendipur, Amulia, Dhaka	23.740045° N 90.479908° E	C/S No. -113 CH. 05+600 km
Shekher Jayga-Staff Quarter Road, Amulia, Dhaka	23.736666° N 90.483381° E	C/S No. -113 CH. 05+600 km
Chan Para More, Amulia, Dhaka	23.746771° N 90.471898° E	C/S No. -135 CH. 06+700 km
Bonoshree Staff Quarter, Demra, Road, Bonoshree, Dhaka	23.750560° N 90.456136° E	C/S No. -169 CH. 08+400 km
Bonoshree Staff Quarter-Demra Road, Bonoshree, Dhaka	23.7512° N 90.453853° E	Between C/S No. -174 to -173 CH. 08+650 km to 08+600 km
Meradia Hut, Rampura, Dhaka	23.762119° N 90.44419° E	C/S No. -205 CH. 10+200 km
D Block Bus Stop, Bonoshree Main Road, Bonoshree, Dhaka	23.762773° N 90.435958° E	C/S No. -222 CH. 11+050 km
Bonoshree main Road, Bonoshree, Dhaka	23.763700° N 90.431436° E	Between C/S No. -232 to -231 CH. 11+550 km to 11+500 km

Location	GPs	Chainage
Rampura Bridge Dam, Bir Uttam Rafiqul Islam Ave, Rampura, Dhaka	23.767725° N 90.423233° E	C/S No. -250 CH. 12+450 km
Rampura Bridge Bus stop, DIT road, Rampura, Dhaka	23.768008° N 90.423386° E	C/S No. -251 CH. 12+465 km

c) Water Pollution (Surface and Groundwater)

Impact

390. The surface water bodies may get flooded and polluted due to uncontrolled release of contaminated stormwater/road runoff from road surfaces. The pollutants associated with the road-runoff include, hydrocarbons, heavy, corrosive products and suspended solids including insoluble heavy metals as colloidal materials from traffic. The worst contamination generally takes place during the first flush of runoff from roads after a spell of dry weather. The level of pollution is directly related to the traffic volume. The pollution risk from accidental spillage may increase moderately. In the long run, the increased traffic volume and faster traffic speeds would increase the risk of accidental spillage, which could have medium adverse impact on surface water quality. The natural drainage of road runoff across embankments or discharge of runoff into water bodies from large area of carriageway may have medium adverse impacts on ponding and the flood risk to downstream locations.

391. Groundwater may get polluted due to contaminated road runoff on earthen shoulders and embankments planted with grasses. Additionally, the project may lead to faster urbanization near the project area. This will exert stress on the availability of groundwater in the project area.

Mitigation

392. The following mitigation measures are proposed to attenuate water quality related impacts:

- ✓ According to the monitoring results of river water quality in the EIA report, many indicators across the rivers of the project have seriously exceeded the standard. Under normal circumstances, the runoff of newly built roads is mainly rainwater, which will be mixed with a small amount of oil pollution and solid suspended particles, which will not have a significant impact on the water quality of the river. It is recommended to take speed limit and traffic control measures on the cross-river road section to ensure the safe passage of vehicles transporting hazardous chemicals and reduce the risk of leakage of hazardous chemicals.
- ✓ To discharge rapid removal of stormwater/road runoff, cross slopes and longitudinal drainage will be provided in the design. Well-designed cross drainage structures limit ponding across embankments;
- ✓ Proper drainage system with sedimentation ponds will be provided to avoid contamination by run-off and oil spills, especially drainage will be provided for oil spills near water channels to prevent any contamination;
- ✓ Retention basins with reedbeds provided in the design will improve the quality of polluted storm-water/road runoff;
- ✓ Drainage and collection structures on the road project, particularly in areas near the river and irrigation canals, shall be designed such that spills of hazardous materials shall not result to contamination of these watercourses

- ✓ Prior to operation, an emergency response plan for spills of hazardous materials and oil will be prepared.

d) Cultural/Sensitive Structure

Impact

393. Loss of cultural/sensitive structures such as mosques, prayer grounds, temples and madrasa, school and hospital will cause stress/tense on the PAPs. Cultural/sensitive structures (mosque, graveyards, temple, college, school, and madrasa) adjacent up to 250 m away from the ROW boundary will not be affected due to the noise and dust pollution.

Mitigation

394. Proper rehabilitation of the affected people and the religious and cultural monuments and structures will eventually ease out the stresses and this will not remain a significant issue over the time. Aluminum sheet-based noise barrier to be used and plantation on the boundary of the affected cultural sites may reduce the magnitude of noise level.

e) Road Accident/Road Safety

Impact

395. The increased vehicular movement and speed may result in road safety issues like traffic accidents. The accidents may also be due to tiredness. This impact is permanent but moderately adverse in nature, since the frequency of accidents may be lowered, but their intensity may be quite severe due to enhanced speeds at which vehicles will move.

Mitigation

396. EIAs of road projects in RHD does not include road safety. However, RHD has established the Road Safety Division. This division has been conducting a formal road safety audit on selected spots of the national highway in the recent past under different projects. It is developing standard road designs to improve road safety. RHD has also been implementing and conducting accidents remedial measures and road safety training courses for its engineers. However, the below measures will ensure further safety.

- ✓ By enforcing speed limits and imposing penalties on the traffic violators will ensure the road safety.
- ✓ Traffic signs will be provided to facilitate road users about speed limits, rest areas, eating establishments etc. Warning messages will also be displayed at appropriate locations to aware drivers about likely accidents due to over speeding.
- ✓ All the lanes, median, sharp bends will be reflectorized to facilitate travelers in the night time.
- ✓ Proper lighting arrangement on the proposed highway will be done at required places.
- ✓ The BRTA rules should be followed strictly in every relevant case.
- ✓ Sidewalk and necessary safe road crossing facility should be provided at and near the cultural, religious, educational or other places where people has frequent movement.

f) Traffic Congestion

Impact

The following traffic congestion impacts may occur during the operational period of the project.

- ✓ Congestion reduction in existing road
- ✓ Increased local congestion around ramp touch-down points
- ✓ Long-term increase in traffic volume

Mitigation

397. As management tools for road traffic, the traffic signs should be standardized in order to improve the efficiency of road traffic, provide prohibition, limiting and indication services for vehicles and pedestrians, and regulate, control and guide the flow of vehicles and pedestrians; Introduce the geological conditions and the surrounding environment of some section at driving direction to the: vehicles and pedestrians in advance. Fully utilize the functions of roads, and carry out fine design and targeted design on the premise of fully understanding the planned project and surrounding road network conditions so that the design can be sustainable.

- ✓ Direction indication signs and speed limit signs should be arranged at places 150 m ahead of road intersections.
- ✓ Intersection signs and pedestrian crossing warning signs should be arranged at a places 150m ahead of the farming roads.
- ✓ Prompt signs indicating; that the road section is a toll road and pedestrians and non-motor vehicles are prohibited should be arranged on elevated layers.
- ✓ Signs of toll plaza should be arranged ahead of the entrance/exit of toll plaza; advanced notice signs should be arranged at the places 500 m and 1 km ahead of the toll plaza.
- ✓ Gate-type direction indication sign should be arranged at places 150 m ahead of the diversion section of elevated layer.
- ✓ Signs of height limit, width limit, speed limit, and height limit framework should be arranged ahead of toll plaza.

g) Split of Communities

Impact

398. A separate road will be constructed. Along with the existing, a new road will cause more distance to cross the local people. Thus, the community and residence will be divided due to the access controlled wide highway. The residential areas and agricultural land of the villages along the road would be divided into fragmented areas due to the proposed improvement. Residents' daily activities, production activities, etc. would be significantly affected. In several cases, the expressway would not only split the communities, but also cause hindrance to people in accessing to the schools, hospitals, markets, administrative agencies, mosques etc. This is considered as a major impact of the road during operation phase.

Mitigation

399. Besides, several cross structures (underpass and overpass) for residents and local vehicles are designed. There are few residential areas along the project corridor were observed and the cumulative impacts are very minimum regarding this issue.

h) Income/Job Opportunities

Impact

400. The proposed Project will promote better business opportunities such as new petrol pumps and hotels. Due to increase of traffics, more people will be involved to operate the additional traffics.

Mitigation

401. As a regulatory authority RHD will monitor of the road. Illegal infrastructure development and encroachment along the road have to be checked and controlled by RHD. No infrastructure should be built just adjacent to the road.

C. Risk Assessment of the Project

402. This section identifies the potential impacts that the various elements of the proposed Project may have on aspects of the physical, biological, and socio-economic environment. The identification of the potential impacts will be considered for pre-construction, construction and post-construction phase. The activities undertaken during each of these Project stages form the basis for potential impact identification and analysis.

1. Methodology for Risk Assessment

403. All socio-economic and environmental impact assessment methods, including risk assessment, incorporate a degree of inherent uncertainty. This is largely due to the unavoidable variations and uncertainties characterized by natural, social and economic systems. However, the use of risk assessment allows analysis of risks (or potential impacts) to be classified on an empirical scale. Such a scale is useful because it limits the inherent subjective and interpretive nature of impact assessment. Further accuracy in risk assessment results is driven by the workshop approach to hazard categorization and through the application of experienced expert knowledge.

404. Certain impacts identified in this section have the potential to be significant. The determination of whether a given potential impact is significant depends on several factors:

- The potential for on-site and off-site impacts;
- The potential for direct and indirect impacts;
- The frequency and duration of a potential impact;
- The geographic area affected by a potential impact
- The period of time affected by any potential impact;
- The sensitivity of the receiving environment; and
- The degree of confidence with which the potential impacts of the action/activity are known and understood.

405. Measures of potential impact significance as part of the Project planning and assessment phase presented in this EIA have been determined using a risk-based model. The risk-based model is a two-dimensional matrix of ‘magnitude of impact’ and ‘likelihood’. Both are assigned score between 1 and 5 based on severity or probability and multiplied to obtain the ‘risk band’.

406. The 'magnitude of impact' is a 5-point based scale set by expert's judgment. The scale and its explanation are given in Table VI-33.

Table VI-33: Explanation and Assignment of Scores to 'Magnitude of Impact'

Color Band	Incidental	Minor	Moderate	Major	Severe/catastrophic
Score	Score: 1	Score: 2	Score: 3	Score: 4	Score: 5
Explanation	Impacts such as localized or short-term effects on habitat, species or environmental media.	Localized, long-term degradation of sensitive habitat or widespread, short-term impacts to habitat, species or environmental media	Impacts such as localized but irreversible habitat loss or widespread, long-term effects on habitat, species or environmental media	Widespread and persistent changes in habitat, species or environmental media	Persistent reduction in ecosystem function on a landscape scale or significant disruption of a sensitive species.

407. The 'likelihood' is also a 5-point based scale set by expert's judgment. The scale and its explanation are given below.

Table VI-34: Explanation and Assignment of Scores to 'Likelihood'

Color Band	Rare	Unlikely	Seldom	Occasional	Likely
Score	Score: 1	Score: 2	Score: 3	Score: 4	Score: 5
Explanation	Rare or unheard of	Reasonable to expect that the consequence will not occur during this project though has occurred several times in industry	Exceptional conditions may allow consequences to occur within the project lifetime	Conditions may allow the consequence to occur during the project lifetime, or the event has occurred within similar projects	Consequence can reasonably be expected to occur in life the project

408. Therefore, "Risk" factor is derived from the following equation:

Risk = Magnitude x likelihood

409. The score of 'Risk' ranges from 1 to 25. The score is classified in 3 classes. The explanation is given in Table VI-35. The score matrix for risk assessment has been used to identify the priority environmental impact and their mitigation plan.

Table VI-35: Two-Dimensional Risk Assessment Matrix

Impact			Magnitude Of Impact				
			Incidental	Minor	Moderate	Major	Severe/cats.
			Score: 1	Score: 2	Score: 3	Score: 4	Score: 5
LIKELIHOOD	Rare	Score: 1	1	2	3	4	5
	Unlikely	Score: 2	2	4	6	8	10
	Seldom	Score: 3	3	6	9	12	15
	Occasional	Score: 4	4	8	12	16	20
	likely	Score: 5	5	10	15	20	25

2. Risk Assessment Matrix

410. Based on the above methodology, risk assessment has been carried out for this project which is presented in the below table.

Table VI-36: Risk Assessment Matrix for the Proposed Project

Sl No.	Issues & Impacts	Risk Assessment		Risk Factor	Mitigation & Monitoring Required		Duration of Impact	Required Controls	Comparison with Regulation
		Magnitude	likelihood		Yes	No			
1.0 Pre-Construction Phase									
1.1	Land Acquisition Purchase	4	4	16	X		Long Term	Mitigation measures are already given in the EMP.	• The Acquisition and Requisition of Immovable Property Act, 2017
1.2	Site clearance	1	1	1	X		Short Term	Mitigation measures are already given in the EMP.	• National Land Use Policy, 2001
1.3	Removal of Vegetation	3	3	9	X		Long Term	Mitigation measures are already given in the EMP.	• The Forest Act (1927) and the Forest (Amendment) Act (2000) • National Forest Policy (amendment), 1994 • The Private Forests Ordinance, 1959
1.4	Existing aquaculture activities	1	1	1	X		Short Term	Mitigation measures are already given in the EMP.	• National Fisheries Policy, 1999 • The Protection and Conservation of Fish Act, 1950 (amended in 1982 • Protection and Conservation of Fish Rules, 1985 • Private Fisheries Protection Act, 1889
2.0 Construction Phase									
2.1	Dust Pollution	4	3	12	X		Long Term	Mitigation measures are already given in the EMP.	• USEPA office of solid waste and emergency response, hazardous waste land treatment, SW-874 (April 1983, page 273)
2.2	Water Resource	1	2	2	X		Short Term	Mitigation measures are already given in the EMP. Water quality test is proposed for monitoring along with sediment quality.	• Environment Conservation Rules, 1997 • Bangladesh Water Act, 2013 • Bangladesh Water Rules, 2018 • Bangladesh Water Development Board Act, 2000 • National Water Policy, 1999 • Water Resource Planning Act, 1992

Sl No.	Issues & Impacts	Risk Assessment		Risk Factor	Mitigation & Monitoring Required		Duration of Impact	Required Controls	Comparison with Regulation
		Magnitude	likelihood		Yes	No			
									• National Water Management Plan, 2001 (Approved in 2004) • National Water Bodies Protection Act, 2000 • Groundwater Management Ordinance, 1985
2.3	Air Quality	4	5	20	**X**		Long Term	Mitigation measures are already given in the EMP. Air quality test is proposed for monitoring.	• Environment Conservation Rules, 1997
2.4	Noise and vibration generation	4	5	20	**X**		Long Term	Mitigation measures are already given in the EMP. Noise level measurement is proposed for monitoring.	• Sound pollution (control) Rules, 2006
2.5	Waste generation	2	2	4	**X**		Short Term	Mitigation measures are already given in the EMP.	• National 3R Strategy for Waste Management, 2010 • Bangladesh Standards and Guidelines for Sludge Management, 2015
2.6	Ecosystem	3	3	9	**X**		Long Term	Mitigation measures are already given in the EMP.	• Environment Conservation Rules, 1997 • National Environmental Policy, 2018 • Bangladesh Biodiversity Act, 2017 • Wildlife Conservation (Protection and Safety) Act, 2012 • National Biodiversity Strategy & Action Plan, 2004 • Biosafety Guidelines of Bangladesh (2007)
2.7	Traffic congestion	4	5	20	**X**		Long Term	Mitigation measures are already given in the EMP.	• The Vehicle Act, 1927
2.8	Socio-economic status	3	4	12	**X**		Long Term	The contractor/Dhaka RAD Elevated Expressway	• The Acquisition and Requisition of Immovable Property Act, 2017

Sl No.	Issues & Impacts	Risk Assessment		Risk Factor	Mitigation & Monitoring Required		Duration of Impact	Required Controls	Comparison with Regulation
		Magnitude	likelihood		Yes	No			
								Company Limited in association with the RHD will be maintaining this issue.	• Bangladesh Labor Act, 2006(as amended through July 22, 2013) • Bangladesh Labor Rules, 2015 • National Human Rights Commission Act, 2009
2.9	Community Health and Safety	2	2	4	**X**		Short Term	Mitigation measures are already given in the EMP.	• Bangladesh National Building Code (BNBC), 2020 • Standing Orders on Disaster, 2010 • Biosafety Guidelines of Bangladesh (2007) • Bangladesh Labor Act, 2006(as amended through July 22, 2013) • Bangladesh Labor Rules, 2015 • National Human Rights Commission Act, 2009
2.10	Workers Health and Safety	3	3	9	**X**		Short Term	Mitigation measures are already given in the EMP.	• Bangladesh National Building Code (BNBC), 2020 • Standing Orders on Disaster, 2010 • Biosafety Guidelines of Bangladesh (2007) • Bangladesh Labor Act, 2006(as amended through July 22, 2013) • Bangladesh Labor Rules, 2015 • National Human Rights Commission Act, 2009
2.11	GBV and SH Issues	2	2	4	**X**		Short Term	Mitigation measures are already given in the EMP.	• Women and Children Act 2000 • Bangladesh Labor Rules, 2015 • National Human Rights Commission Act, 2009
3.0 Operation Phase									

Sl No.	Issues & Impacts	Risk Assessment		Risk Factor	Mitigation & Monitoring Required		Duration of Impact	Required Controls	Comparison with Regulation
		Magnitude	likelihood		Yes	No			
3.1	Water resource	1	1	1	X		Short Term	Mitigation measures are already given in the EMP.	• Environment Conservation Rules, 1997 • Bangladesh Water Act, 2013 • Bangladesh Water Rules, 2018 • Bangladesh Water Development Board Act, 2000 • National Water Policy, 1999 • Water Resource Planning Act, 1992 • National Water Management Plan, 2001 (Approved in 2004) • National Water Bodies Protection Act, 2000 • Groundwater Management Ordinance, 1985
3.2	Fisheries	1	1	1	X		Short Term	Mitigation measures are already given in the EMP.	• National Fisheries Policy, 1999 • The Protection and Conservation of Fish Act, 1950 (amended in 1982 • Protection and Conservation of Fish Rules, 1985
3.3	Ecosystem	2	2	4	X		Short Term	Mitigation measures are already given in the EMP. Tree Plantation is suggested	• Environment Conservation Rules, 1997 • National Environmental Policy, 2018 • Bangladesh Biodiversity Act, 2017 • Wildlife Conservation (Protection and Safety) Act, 2012 • National Biodiversity Strategy & Action Plan, 2004 • Biosafety Guidelines of Bangladesh (2007)
3.4	Waste Management	2	3	6	X		Short Term	Mitigation measures are already given in the EMP.	• National 3R Strategy for Waste Management, 2010 • Bangladesh Standards and Guidelines for Sludge Management, 2015

Sl No.	Issues & Impacts	Risk Assessment		Risk Factor	Mitigation & Monitoring Required		Duration of Impact	Required Controls	Comparison with Regulation
		Magnitude	likelihood		Yes	No			
3.5	Air Quality	3	3	9	X		Long Term	Mitigation measures are already given in the EMP.	• Environment Conservation Rules, 1997
3.6	Noise and vibration generation	3	2	6	X		Long Term	Mitigation measures are already given in the EMP.	• Sound pollution (control) Rules, 2006
3.7	Traffic Congestion	2	2	4	X		Long Term	Mitigation measures are already given in the EMP.	• The Vehicle Act, 1927

411. Some impacts, such as emissions and noise that will keep increasing through the operation period despite some mitigation, will be residual impacts for which mitigation will inevitably be less than fully satisfactory. These residual impacts will be significantly compensated for by positive impacts such as increased employment and business opportunities, as well as enhanced integration in the regional economy. It should be noted that air quality and noise impacts from the project may ultimately represent an improvement over the situation that is likely to develop under the current trajectory (the no-project alternative).

412. The baseline condition of the project area suggests that the environmental quality is already deteriorated. So, the project construction work will not add further to this pollution.

413. The greatest concern facing the environment in the vicinity of the project area is rapid urbanization and the uncontrolled growth of industries as a result of easier importation of materials from abroad through the sea port. A proactive multi-stakeholder planning process among the RHD, the city corporations (Dhaka North, Dhaka South and Narayanganj) and Pourashava level is required to be proposed to address this threat. If this effort is initiated early and with dedication, the potential for effective mitigation may be substantial, although there is no guarantee of success. It should be noted that the imposition of land use controls is ultimately a political process, and the relative power of interested agencies and beneficiaries will determine success or failure.

414. Taking into the account all the foregoing, it is considered that the impacts expected from the proposed project investments do not rise to a level of magnitude, severity or complexity that would justify further detailed study and development of novel or specialized mitigation strategies. The investments at this location are appropriately assigned to “Category A” for Environment.

VII. LABOR AND OCCUPATIONAL SAFETY, HEALTH, AND ENVIRONMENT (OSHE)

A. General

415. The primary objective of ESS-1 as per AIIB on "Environmental & Social Assessment & Management" is to promote sound labour management relationships and enhance the development benefits of a project by treating workers in the project fairly while also providing them with safe and healthy working conditions.

1. Impacts On Labor

416. The construction of proposed project will entail employment of a significant number of labors especially during construction. The majority percent of labor will be locally hired, with the exception of skilled workers who may not be found in the program areas. For the proposed lines, labor requirements are expected to be low and satisfied by local labor. However, health hazards, bad living conditions, and unintentional hazardous risks are all possible dangers faced by both hired trained and non-skilled employees, particularly during the building phase.

417. Similarly, hiring labor from external area may cause social risk on the local communities includes gender-based violence, price hiking of daily used products/foods, etc. Substantial risks are associated in-terms of hiring child labors or forced labors, and due to border districts risk associated to the labor trafficking is also very high. The main labor risks associated with the program are assessed to be related to the potentially hazardous work environment, the associated risk of accidents and labor influx. Based on current conditions it is assessed that the risk of a child or forced labor is negligible, and already managed through national legislation. Potential labor risks:

- Safety issues while at work like injuries/accidents/ fatalities leading to even death, while at work;
- Inadequate accommodation facilities at work force camps, including inadequate sanitation and health facilities
- Inadequate facilities for pregnant women and lactating mothers
- Inadequate facilities for the children of the workforce at workforce camp sites
- Security of women work force
- Short terms effects due to exposure to dust and noise levels, while at work
- Long term effects on life due to exposure to chemical /hazardous wastes
- Non-payment of wages by Employer.
- Non-payment of benefits (compensation, bonus, maternity benefits etc.) by Employer
- Discrimination in Employment (e.g., abrupt termination of the employment, working conditions, wages or benefits etc.)
- Engagement of child labor.
- Sexual harassment at work.
- Forced labor trafficking
- Health risks of labor relating to HIV/AIDS and other sexually transmitted diseases ✓ Unclear terms and conditions of employment

- Discrimination and denial of equal opportunity in hiring and promotions/incentives/training opportunities
- Denial for workers' rights to form workers organizations, etc.
- Absence of a grievance mechanism for labor to seek redressal of their grievances/issues.

418. To reduce these impacts on labor, few mitigation measures will be adopted through respective authorities and contractor(The Company). The following mitigation measures are given below:

- Reduction of labor influx into the project area by sourcing all unskilled labor from within and around the sub-project area. If skilled labor is not available locally, it will be imported from outside the sub-project region, either inside or beyond the district.
- Preparation of Workers' "Camp Management Plan" that addresses specific aspects of the setup and operation of workers' camps, such as differentiating labor camps from material storage locations.
- Conduction of awareness campaigns on HIV/AIDS, STDs, COVID-19, and other communicable diseases.
- Development of a project framework for addressing labor-related concerns.
- Provide information about the Contractor's (The Company) policies and Worker Code of Conduct to the communities in the sub-project area host communities.
- Dhaka RAD Elevated Expressway Company Limited will prepare a SEA/SH Plan. This shall cover awareness-raising, especially among workers and staff which will be circulated among the communities and local stakeholders.
- Preparation and display of signage on SEA/SH prevention and zero-tolerance against SEA/SH will be displayed at the site locations and surrounding.

419. Awareness campaigns on human trafficking will be carried by RAD Elevated Expressway Company Limited in collaboration/ coordination with the local government institutions (LGIs) and relevant government agencies such as, police and BGB.

2. Labor Influx

420. Though project will create substantial number of working opportunities, it is expected that labor influx will not be significant as the construction will be over the period. Most of the unskilled labors will be hired locally. As all the construction will be conducted in the urban areas, it is expected that skilled and unskilled labors will be hired locally. The contractor (The Company) will be responsible for the accommodation of the stay in labor and ensuring labor travel from off site. Some accommodation on site, water supply and sanitation services, etc. will be provided by the contractor. A Labor Management Plan will be prepared by contractor (The Company) for each project site. However, this labor influx may raise many complex issues, particularly regarding potential transmission risks for COVID-19 both within the worksite and for nearby communities. These risks are not only from workers that are mobilized from abroad or returning from abroad, but also workers moving from other regions, where it is likely that migrant workers are expected to work on the project. Adverse Social Impacts due to labor influx can be identified as follows:

- Risk of Social conflict between labors and community people
- Increased risk of illicit behavior and crime

- Influx of additional population and burden on public services
- Increased risk of communicable disease and burden on local health services
- Gender Based violence, child labor and school dropout
- Local inflation of price and increased pressure on accommodation and rent
- Increased of traffic and related accident

3. Safe Working Conditions and Community Health and Safety

421. Analyze Project workers' labor and working facilities, as well as health and safety threats to populations in the project's vicinity. Implement efforts to provide Project workers with safe and healthy working conditions, as well as measures to prevent Project-related accidents, injuries, and disease. Apply to the Project the necessary occupational health and safety regulations of internationally recognized standards, such as the EHSGs and, where applicable, industry-specific EHSGs. Accidents, infections, and occurrences should be documented and reported. Set up procedures for Project workers to report work circumstances that they believe are unsafe or unhealthy. Put in place preventative and emergency readiness and response measures to avoid, or when avoidance is not possible, to reduce the Project's negative risks and consequences on local residents' health and safety. Set up a system for reviewing occupational safety and health performance as well as the working environment on a regular basis. The Client may, at its discretion, apply appropriate International Labor Organization Labor Standards in accordance with this Agreement's requirements.

4. Child Labor And Forced Labor

422. All measures required in order to protect children from jeopardy to their health, safety or morals, will be taken so that children under the age of 18 are not employed for work under the Project. If the laws or regulations of the Member in whose territory the Project is located provide, in conformity with the International Labor Organization's Minimum Age Convention, 1973, that children at least 16 years of age may be employed for such work on condition that their health, safety and morals are fully protected and that they have received adequate specific instruction or vocational training in the relevant branch of activity, such children may be employed, but only in conformity with these laws and regulations. In such cases of employment of children under the age of 18 under the Project, conduct an appropriate risk assessment, together with regular monitoring, of their health, safety, working conditions and hours of work. Take all measures required, in accordance with the Project so that no work or service not voluntarily performed is exacted from an individual under threat of force or penalty (including any kind of forced or compulsory labor, such as indentured labor, bonded labor or similar labor-contracting arrangements, or labor by trafficked persons).

5. Community Health and Safety

423. Community health and safety impacts during the construction and decommissioning phase is common to those of most large industrial facilities. These impacts include, among others, dust, noise, and vibration from construction vehicle transit, and communicable diseases associated with the influx of temporary construction labor.

424. The mitigation measures to address the project impacts on communities' health and safety are listed below.

- Entry of the site personnel in the local communities will be minimized to the extent possible/appropriate.

- The contractor (The Company) will prepare and implement an Occupational Health and Safety (OHS) Plan that will also cover communities' health and safety aspects.
- The contractor (The Company) will prepare and implement a Traffic Management Plan that will also address traffic safety for communities.
- The community will be informed about the nature of construction activities and the associated health and safety risks; awareness raising of the communities will be carried out for this purpose with the help of training sessions, posters, signage, and other similar means.
- Awareness raising of communities will be carried out, in a culturally-sensitive manner, about the communicable diseases including sexually transmitted infections.
- Regular safety monitoring will be carried out at the sensitive receptors
- The construction sites will be fenced as appropriate to minimize entry of the local communities particularly children in the work areas. ▪ Construction camps and other site facilities will be fenced.
- Liaison with the community will be maintained.
- GRM will be established to address community grievances related to health and safety aspects. Residual Impacts Even after implementing the above-listed mitigation measures, the health and safety impacts on local communities cannot be fully mitigated. Strict monitoring will be required to ensure that mitigation measures are effectively and strictly enforced.

6. Occupational Health and Safety

425. Activities such as site preparation, construction activities, operation of construction machinery and equipment, vehicular traffic, and the use of temporary workers' accommodation pose potential risks to the health, safety, security if not managed properly, and therefore wellbeing of construction workers. Health and safety issues associated with the use of temporary accommodation sites include those relating to sanitation, disease, fire, cultural alienation, sleeping space, quality and quantity of food, personal safety and security, temperature control and recreation, amongst others. Some of the Occupational Health and Safety risks which are likely to arise during the construction phase of the Project, and are typical to many construction sites, include: exposure to physical hazards from working on heights, use of heavy equipment including cranes; trip and fall hazards; exposure to dust, noise and vibrations; falling objects; exposure to hazardous materials; and exposure to electrical hazards from the use of tools and machinery. Labors on the Project, particularly sub-contracted construction labors, are vulnerable to risks to their wellbeing, health and safety on a daily basis. Appropriate health and safety management planning and implementation in line with good international industry practice will be implemented by the project team to mitigate the risks as far as possible.

426. The mitigation measures to address the project impacts on workers' health and safety are listed below.

- Contractor (The Company) will have dedicated and qualified staff for ensuring compliance with the OHS Plan.
- The contractor (The Company) will prepare and execute an Occupational Health and Safety (OHS) Plan
- Regular trainings will be provided to the workers on OHS aspects.

- Awareness raising material will be used including posters, signage, booklets, and others
- Firefighting equipment will be made available as required at construction sites, camp sites, and particularly near the fuel storage.
- All site personnel will be screened for communicable diseases including sexually transmitted infections.
- Use of appropriate personal protective equipment (PPE) will be mandatory. No worker (or even visitor) will be allowed on the site without the required PPE (such as hard hat, safety shoes).
- The project drivers will be trained in defensive driving. They will maintain low speed while driving through / near the communities.
- Complete record of accidents and near-misses will be maintained.
- First aid facilities will be made available at the work sites and in the camps. The contractor (The Company) will engage qualified first aider(s).

427. Location and telephone numbers of the nearest hospital will be displayed at appropriate places at work sites and in construction camps. If necessary, the contractor (The Company) will have an ambulance available at the site. Residual Impacts Even after implementing the above-listed mitigation measures, the health and safety impacts on site personnel cannot be fully mitigated. Strict monitoring will be required to ensure that mitigation measures are effectively and strictly enforced.

7. Labor Conditions and Health and Safety Management

428. **Temporary Works:** The Contractor (The Company) shall make sure that all equipment and safeguards required for the construction work such as temporary stair, ladder, ramp, scaffold, hoist, run away, barricade, chute, lift, etc. are substantially constructed and erected, so as not to create any unsafe situation for the workmen using them or the workmen and general public passing under, on or near them.

429. **Health and Safety:** All contractors (The Company) are responsible to:

- Maintain standards of Health and Safety towards all of his employees not less than those laid down by the national standards or statutory regulations.
- Ensure that all of its workers entering the worksite comply with the Occupational Health and Safety. The Contractor (The Company) shall provide all appropriate protective clothing and equipment for the work to be done and ensure its proper use. Where required, safety nets, belts, harnesses and lines shall be provided by the contractor. The “safety directives for work equipment” and “safety directives for protective gears”, as specified in the Occupational Health and Safety Guidelines (attached) shall be followed.
- Provide and maintain in prominent and well-marked positions all necessary first-aid equipment, medical supplies and other related facilities. A sufficient number of trained personnel will be required to be available at all times to render first aid.
- The Contractor (The Company) shall provide or ensure that appropriate safety and/or health signs are in place at their work sites where hazards cannot be avoided or reduced.
- Report to the Engineer promptly and in writing particulars of any accident or unusual or unforeseen occurrences on the site, whether these are likely to affect progress of the work or not.
- Safety orientation prior to working at the work-site;

- Ensure that all equipment and tools, including PPE, used on the work-site are in good working condition, properly maintained;

430. Ensure that equipment is operated only by those workers who have been properly trained and are skilled in the operation of the equipment;

B. Requirements of Labor and Safety, Health, & Environment (OSHE)

1. Health And Safety

a) Health and Safety of Workers and Communities

431. Assess health and safety risks to Project workers and Project-affected communities. For such workers and communities, put in place measures to prevent accidents, injuries and disease (including as appropriate, measures to avoid or minimize exposure to communicable and non-communicable diseases, including pandemics) associated with the Project. Document and report on accidents, diseases and incidents. Put in place and provide relevant information and training to Project workers and affected communities on, preventive and emergency preparedness and response measures to avoid, or where avoidance is not feasible, to minimize adverse risks and impacts of the Project on their health and safety.

b) Occupational Health and Safety

432. In addition to the above general provisions, implement the following measures designed to provide project workers with safe and healthy working conditions: (a) provide personal protective equipment at no cost to Project workers; (b) provide Project workers with facilities appropriate to their work (e.g., hygiene, rest, eating facilities); (c) where accommodation services are provided, provide adequate accommodations for Project workers, including separate and safe accommodations for female workers; (d) put in place workplace processes for Project workers to: (i) report work situations that they believe are not safe or healthy; and (ii) remove themselves from situations which they have reasonable justification to believe present a danger to their life or health; and (e) put in place a system for regular review of occupational health and safety performance and the working environment. The Client may, at its option, apply the relevant International Labor Organization's Labor Standards relating to occupational health and safety, consistent with the requirements of this Section.

c) Labor Influx

433. Assess and appropriately manage the risks of adverse impacts on communities that may result from temporary Project-induced labor influx. If such risks are likely to exist, apply the following principles to be implemented by the Client: (a) seek to avoid or minimize the labor influx by tapping into the local workforce whenever feasible; and (b) assess and manage labor influx risk based on appropriate instruments, depending on the risk factors and their level. This may call for broad requirements in the EMP if the risks are low, or more specialized instruments, such as a site-specific labor influx management plan, a workers' camp management plan, or other instruments with similar purpose, if the risks are high.

2. Labor And Working Conditions

a) Labor Management Relationships

434. Provide a sound labor management relations system for project workers, which includes the following, consistent with relevant national law:

- Clear and understandable written terms of employment made available to project workers in an accessible manner at the time of hiring and when any changes are made to the terms;
- Timely payment for project work;
- Adequate periods of rest;
- Timely written notice of termination of the working relationship;
- Employment based on the principles of equal opportunity, fair treatment and nondiscrimination with respect to any aspect of the employment relationship;
- Compliance with national law relating to workers' organizations and collective bargaining;
- An accessible, understandable and transparent GRM for raising Project workplace concerns, including gender-related concerns, that: (a) does not impede access to other judicial or administrative remedies that might be available under law or through existing arbitration or mediation procedures, or substitute for grievance mechanisms provided through workers unions or collective agreements; (b) involves an appropriate level of management and addresses concerns promptly, using an understandable and transparent process that provides timely feedback to those concerned, without any retaliation; (c) is proportional to the nature and scale and the potential risks and impacts of the Project; and (d) allows for confidential complaints to be raised and addressed, including GBV-related complaints; and (e) provides measures to protect against retaliation; and
- A suitable system designed to inform project workers of the GRM at the time of hiring, and which is made easily accessible to them.

b) Child Labor and Forced Labor

(i) Child Labor

435. In order to protect children from jeopardy to their health, safety and morals, take all measures required so that children under the age of 18 are not employed for work under the Project. However, if the laws or regulations of the Member in whose territory the Project is located provide, in conformity with the International Labor Organization's Minimum Age Convention, 1973, that children at least 16 years of age may be employed for such work on condition that their health, safety and morals are fully protected and that they have received adequate specific instruction or vocational training in the relevant branch of activity, such children may be employed, but only in conformity with these laws and regulations. In such cases of employment of children under the age of 18 under the Project, conduct an appropriate risk assessment, together with regular monitoring, of their health, safety, working conditions and hours of work.

(ii) Forced Labor

436. Take all measures required in connection with the Project so that no work or service not voluntarily performed is exacted from an individual under threat of force or penalty (including any

kind of forced or compulsory labor, such as indentured labor, bonded labor or similar labor-contracting arrangements, or labor by trafficked persons).Assess the risks of forced labor under the Project, and if applicable, include measures in the ESMP (or other Bank-approved document) to address such risks in accordance with this Section.

437. If cases of child labor or forced labor are identified, take immediate steps to correct them, to prevent similar occurrences in the future, and to facilitate the rehabilitation of victims.

C. Overview of Labor Use on the Project

438. For this project, direct workers and contracted workers are the most applicable, as at this stage, significant community labor is not envisioned for the project. The following are the key categories of workers that would be engaged under the project, including groups of workers that are specifically at risk in the COVID-19 context and thus require special attention.

1. Project Management Unit (PMU)

439. The PMU will be constituted by direct project workers who will either be government civil servants engaged in the project or those that will be recruited for the purposes of the project. Specifically, the PMU will comprise: Project Director, Project Coordinator, Procurement Specialist, Financial Management Specialist, Environment specialist, Social Specialist, Monitoring and Evaluation Specialist.

- The Project Director will oversee the project team on the overall day-to-day management and coordination and implementation of the subcomponents of the project.
- The Project Director will also closely liaise with the Task Team from the AIIB and other stakeholders. The Project Coordinator will assist Project Director to ensure that the works are in line with the objectives of the project and is carried out according to the terms of reference.
- The Financial Management Specialist will assist the project team to lead the financial management activities of the project and coordinate with the technical teams and stakeholders assigned to implement the subcomponents.
- The Procurement Specialist will lead the procurement activities of the project and coordinate with the technical teams and stakeholders assigned to implement the subcomponents. Specifically, the Procurement Specialist will work with the Environment and Social specialists to ensure that all the procurement documents adequately reflect environment and social issues, where relevant.
- The Monitoring and Evaluation Specialist will lead the monitoring and evaluation activities of the project and coordinate with the technical teams and stakeholders assigned to implement the subcomponents. The Monitoring and Evaluation Specialist will collect, process and manage data, including those relating to social and environment issues associated with the project, as appropriate, from various sources including health management information system, official documents, etc.
- The Social Specialist will lead the social activities of the project and coordinate with the technical teams and stakeholders assigned to implement the subcomponents. Together with the Environment Specialist, the Social Specialist will primarily be responsible for ensuring that project activities avoid or minimize negative social impacts; and where they cannot be avoided, that

impacts are identified and the necessary mitigation measures are developed and implemented following the relevant laws as well as the AIIB policies.

- The Environmental Specialist will lead the environmental activities of the project and coordinate with the technical teams and stakeholders assigned to implement the subcomponents. Together with the Social Specialist, the Environment Specialist will primarily be responsible for ensuring that project activities avoid and minimize negative environmental impacts; and where they cannot be avoided, that impacts are identified and the necessary mitigation measures are developed and implemented following the relevant laws as well as the AIIB's policies.

2. Direct Workers

440. A "direct worker" is a worker with whom the Program/ Project has a directly contracted employment relationship and specific control over the work, working conditions, and treatment of the project worker. Where government civil servants are working in connection with the project, whether full-time or part-time, they will remain subject to the terms and conditions of their existing public sector employment agreement or arrangement, unless there has been an effective legal transfer of their employment or engagement to the project. People employed or engaged directly by the RAD Elevated Expressway Company Limited on their respective behalf to work specifically in relation to the Project. Direct workers will include the Project Manager/s and respective Supervisors, who are employees of RHD, deployed for the project. The estimated number of direct workers will be decided as per existing institutional arrangements and practices of the RHD.

3. Contracted Workers

441. All workforce deployed by the Contractor (The Company) and the Project Management Consultant will be considered contracted employees. The Contractor (The Company) may also hire multiple sub-contractors and all employees of such sub-contractors will be considered contracted workers as well. Individual consultants with the PIU, people employed or engaged by consultant firms and contractor (The Company) to perform work related to core function i.e., studies and policy development, engineering design, environmental and social management, training and capacity building, awareness campaigns, volunteer training, and minor infrastructure works of locations.

4. Primary Supply Workers

442. A "primary supply worker" is a worker employed or engaged by a primary supplier, providing goods and materials to the project, over whom a primary supplier exercises control for the work, working conditions, and treatment of the person. There will be primary supply workers such as those providing aggregates and raw materials for the construction site. People employed or engaged by primary suppliers of the contractor (The Company) who would, on a continuous basis supply goods for the core function of the project. The project will review the involvement of primary supply workers based on contractors' (The Company) method of procuring construction inputs.

443. When primary supply workers are engaged, it must be ensured that no child and/or forced labor is involved and OHS requirements for the laborers are followed. Further, if security personnel are engaged in safeguarding project sites and material, the IAs will:

- Make reasonable inquiries to verify that the security personnel employed to provide security are not implicated in past abuses;

- Train them adequately (or determine that they are properly trained) in the use of force (and where applicable, firearms), and appropriate conduct toward workers and affected communities; and
- Require them to act within the applicable law and any requirements set out in the ESMP and there must be signed a Code of Conduct, in comprehensible local language, explained and understood including ramifications for non-compliance.

444. Government civil servants, who will provide support to the Project, will remain subject to the terms and conditions of their existing public sector employment agreement or arrangement unless there has been an effective legal transfer of their employment or engagement to the project.

5. Migrant Workers

445. Migrant workers often comprise a significant part of workforce in the Bangladesh, particularly where there is large scale construction/civil works. These workers may be employed for six to eight months given the current situation of the pandemic. There is potential transmission risk of COVID-19 both within the worksite and in nearby communities. These risks are not only from workers that are mobilized from abroad or returning from abroad, but also workers moving from other regions.

D. Assessment of Potential Labor Risks

446. The labor risks for the project can be defined based on the nature and location where project activities will be carried out. Labor risks, including COVID-19 specific risks, in relation to the activities being carried out by the workers, are described below:

Risks	Assessment Details
Labour influx	Modernization and enhancement of civil and restoration works are expected as part of the project. Because the project will only employ a small number of external workers, there will be little labor influx. Specific requirements to address hazards connected with labor influx, such as communicable diseases and SEA/SH, are expected to be modest and will be managed through contractual obligations, code of conduct, and training outlined in this LMP. Under the proposal, male and female workers, persons with disabilities, and other workers from vulnerable groups will be offered equal opportunities for employment, equal wages for equal work, or a standard.
Forced Labor	The "Prevention and Suppression of Human Trafficking Act, 2012" makes debt bondage and forced labor illegal. "Any person who unlawfully forces any other person to work against his or her will, compels to supply labor or services, or holds in debt-bondage to exact from the person any task by using force or other forms of coercion or by threat to do so," the law states. Forced labor, particularly that of local laborers or internal migrants, is a serious offense that must be prevented. The Project will conduct surprise and random inspections on a regular basis to guarantee safeguard compliance.
Labor Camp	Setting up labor camps in project regions might result in land encroachment; also, solid and liquid waste from the labor camp, as well as potential community health issues, particularly SEA/SH dangers, are all serious concerns. During the selection of site for the establishment of the labor camp, it is recommended that it be built away from water bodies, productive land, and settlements. Solid and liquid waste shall not be dumped into bodies of water, and contractor (The Company) will train staff to keep the camps clean. All employees will be subject to a Code of Conduct that will be strictly enforced. There will be a requirement to raise community awareness about the issue.
Gender-based violence (GBV), SEA/SH	The project's risk of GBV including sexual exploitation and abuse (SEA) and sexual harassment (SH) has been assessed to be moderate and manageable. Contractor (The Company) will make sure that workers are provided with the necessary GBV/SEA/SH training and CoCs are signed prior to commencement of works. And adequate measures

Risks	Assessment Details
	will be put in place to mitigate GBV/SEA/SH risks in and around works sites. This will specify a set of measures to prevent GBV/SEA/SH.
Occupational Health and Safety (OHS) and COVID-19 infections	The OHS of those involved in the project is a significant issue as COVID-19 is a highly contagious. Hazards include face-to-face interaction with the general public that increase pathogen exposure, long working hours, psychological distress, fatigue, occupational burnout, and physical and psychological stress. In addition, some infected people may not know that they have become infected and may contribute to the spread unknowingly. Exposure risks can increase for civil workers interacting with individuals with higher risks of contracting COVID-19 and for workers who have exposure to other sources of the virus in the course of their job duties. WHO's COVID-19 OHS Guidelines, AIIB's COVID-19 Considerations in Construction/Civil Works Projects and Public Consultations and Stakeholder Engagement will be referred to minimize the OHS hazards and risks.
Supply chain disruption	Supply of essentials as well as Project related goods and equipment may be hampered due to supply chain disruption due to COVID-19.

E. Assessment Of GBV Risks in Relation to Labor Camps/ Influx

1. Gender Based Violence (GBV)

447. Gender-based violence (GBV), including Sexual Exploitation and Abuse (SEA), is a prevalent global challenge and manifestations likely exist in every environment where the Bank operates. Violence against women and children - and sometimes even against men - contributes to enduring physical and mental harm, while undercutting the ability of survivors, and often their families, to engage in meaningful, productive lives.

448. Finding solutions to reduce and respond to GBV is a critical development imperative, with implications for the productivity, agency and well-being of individuals and communities. Identifying and understanding the risk to women and children, as well as to other vulnerable populations, of SEA and GBV is challenging, yet critical. Risk factors are myriad and cut across multiple spheres, including at the individual, relationship, community, institutional and policy levels. Development projects, depending on their scope, can exacerbate existing risks or create new ones. Project-related risk factors include the size and scale of a project; the scale of labor influx; the extent to which a community has capacity to absorb labor influx or requires separate camp facilities; the inflow of income to workers, which can exacerbate already existing inequities between workers and community members; and the geographic location of project activities.

2. Gender Analysis

a) Gender and Human Rights

449. RHD/ RAD Elevated Expressway Company Limited will emphasize equity and equality in its entire structure and processes. DoE will provide same facility to access and enjoy the same rewards, resources and opportunities regardless of whether they are women or men employees. RHD/ RAD Elevated Expressway Company Limited will prevent all forms of violence in workplace, including verbal, physical, or sexual harassment.

b) Gender In/Equality

450. Decisions relating to the employment or treatment of project workers will not be made on the basis of personal characteristics unrelated to inherent job requirements. The employment of project workers will be based on the principle of equal opportunity and fair treatment, and there will be no discrimination with respect to any aspects of the employment relationship, such as recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, job assignment, promotion, and gender discrimination.

c) Gender Data

451. This EIA collect the sex-desegrated data within the project area. In Bangladesh both man and women are engaged in different project. As like other projects this project will ensure the gender equity.

d) Gender Context

452. The Project document consider gender dimensions of Bangladeshi social, economic, legal and political contexts differentially affecting men, women, and sexual minorities that would for example highlight patriarchal decision-making structures.

e) Gender Access

453. The proposed project intends to create job opportunities for largely male skilled and unskilled people. It will also provide access to woman and sexual minorities.

f) Gender and Care Work

454. This EIA acknowledge that rural Bangladeshi women are overwhelmingly responsible for supplying household energy through their unpaid, time-consuming labor collecting firewood and other fuels for cooking and other energy needs. Without deliberate measures to alleviate time-consuming unpaid care, women are stymied from participating in income-earning opportunities.

g) Gender Inputs

455. It will be anticipated and ensured by the RHD that both man and women will be involved in any activities at any stage of the Project cycle.

h) Recommendations

456. The Project should:

- Recognize and address Bangladeshi institutional structures that benefit men who have dominant decision-making roles.
- Target women with employment and training to promote Project-related income-generating opportunities.
- Address women's unpaid labor-intensive energy activities including firewood and other fuel collection and caring tasks by providing specific time-saving technology to free women's time up for income- earning activities.

- Include women and men equally in consultations before, during, and after implementation and convene separate consultations for each gender.
- Explicitly identify and address women's and men's differential Project roles and needs.

3. Essential Gender Analysis Checklist

457. This qualitative checklist reveals the extent to which gender-related issues are addressed from a rights-based approach:

SI	Qualitative Checklist
1.	Approaches gender issues from a human rights perspective (**gender and human rights**);
2.	Acknowledges and seeks to redress inequalities between men and women, boys and girls; explicitly promotes equality between men and women, boys and girls (**gender in/equality**);
3.	Provides and analyzes sex-disaggregated data as part of the background/justification for the project's existence and design; includes sex-disaggregated indicators for project monitoring purposes (including data on gender participation in planning, implementation and monitoring and evaluation (**gender data**);
4.	Evaluates situations where gender-based violence (GBV) may be more likely to occur and proposes methods to prevent GBV in affected households, communities and among project workers (**gender-based violence**);
5.	Analyzes gender relations, dynamics and inequalities within relevant political, legal, geographic, economic, historical and/or social contexts to be considered throughout the project cycle (**gender in context**);
6.	Examines how gender inequalities uniquely affect men and women/boys' and girls' abilities to participate in the project cycle and benefit from project outputs and outcomes, including whether user fees and other harmful conditions promoted through the project may differentially affect access to services for men and women, boys and girls (**gender access**);
7.	Identifies and seeks to value men's and women's differential unpaid time devoted to traditionally feminine care work, including cooking, cleaning, child care, and water and fuel collection (**gender and care work**);
8.	Promotes the equal opportunity for those who are directly or indirectly affected by the project to participate throughout the project cycle—from planning to implementation to monitoring and evaluation—including women, marginalized men, and other vulnerable groups, as appropriate; collect data on participation by gender (**gender inputs**);
9.	Plans project outputs and outcomes that accommodate and respond to the differential needs of men and women, boys and girls (**gender outputs**); and
10.	Considers the differential longer-term impacts of projects and/or IFI-endorsed policies on women and men, boys and girls (**gender impact**).

4. GBV Risk Assessment

458. When considering GBV risks, there are different "areas of impact" that influence both the nature of the risk, and the appropriate mitigation measures that a project can implement:

- The project site is the location where the project's activities are being undertaken. This includes both the actual locations where civil works are conducted, but also the associated areas such as the locations of workers' camps, quarries, etc.
- The estimated number of project workers or work force at all levels including the labors, who will be engaged in project construction. It is anticipated that about 70% of unskilled and 20% of skilled workforce will be migrant workers. The migrant workers will be housed in project

specific workforce camps and/or rented accommodation in nearby settlement areas and /or towns.

- The project adjoining communities is generally the broader geographic area around the project. This extends beyond the specific location where civil works are being carried out into the wider surroundings. Neighboring communities are at risk of GBV, particularly when workers are highly mobile.
- There are also regional and national areas of impact that will not be affected by specific interventions on a project but may benefit through institutional strengthening and other efforts to address GBV risks. An assessment at the regional and/or national level can give clients and Task Teams an understanding of those experiencing GBV in that country and can give a sense of the type and scale of violence and its acceptability in the communities where AIIB-financed projects are implemented. For example, the less equality between men and women and the more violence against women and girls, the more likely it is that the project will inadvertently reinforce these situations if it does not proactively acknowledge and seek to mitigate this risk.

459. These GBV risks need to be assessed throughout the project's life by monitoring the situation, assessing the effectiveness of risk mitigation measures, and adapting them.

5. Action Plan for Gender Based Violence, Prevention and Response

460. The GBV action plan outlines the key measures for prevention, mitigation and response for:

a) The Potential GBV risks to women and adolescent girls (from adjoining communities) as a result of the influx of migrant labor and,

b) Women workers- All categories of project workers: Direct workers, Contracted workers, Migrant Workers, Community Workers and women staff.

461. In this project it is anticipated that the construction work will be executed by contractors whose workers may be local residents and also will come from outside districts. It is likely that the workers will come into contact with the community and vice-versa. With varied cultural and economic backgrounds, the likely interactions between communities and workers may lead to potential women safety issues, making it pertinent to create awareness on gender issues, gender-based violence and risk mitigation, in particular. If not carefully managed, an influx of labor in the form of rapid migration and settlement of workers or locals can negatively impact a project area, especially in contexts with high prevalence and social acceptability of violence against women and girls. It is therefore essential to take into account labor influxes and drivers of gender-based violence when designing risk assessment strategies and mitigation measures.

462. Robust measures be prepared and implemented to address the risk of gender-based violence in the project and adjoining communities. The purpose of the action plan is to identify the issues, stakeholders, possible service providers and assess their capacity and document the legal and institutional mechanisms that aid in accessing grievance redressal. The action plans will focus on sensitizing the communities and other stakeholders and strengthening their institutional capacities. This plan is intended for and applicable to all project implementing agencies, staff and adjoining communities throughout the project cycle.

6. GBV Training

463. To properly address GBV, the training and sensitizing of workers is essential. These workers include civil works contractors (including sub-contractors and suppliers), supervision consultants, other consultants who may have a presence in the project adjoining communities - as well as the IAs. Projects can seek to embed training modules that incorporate GBV into the regular Occupational Health and Safety (OHS) 'toolbox' meetings with workers, official training and/or standalone training efforts. Linking the curriculum to actors outside the project such as health and education sector professionals may also be beneficial. Training on GBV should be thorough and proportional to the GBV risk.

464. At a minimum, training shall include:

- What GBV, particularly SEA and SH, is and how the project can exacerbate GBV risks;
- Roles and responsibilities of actors involved in the project;
- GBV incident reporting mechanism, accountability structures, and referral procedures within agencies and for community members to report cases related to project staff;
- Services available for survivors of GBV; and,
- Follow-up activities to reinforce training content.

465. As projects are implemented, training on GBV should be made available to the project-affected communities so they can learn about the roles and responsibilities of actors involved in the project, processes for reporting incidents of project-related GBV, and the corresponding accountability structures. Training of both project-affected communities and project implementers allows all stakeholders to understand the risks of GBV, as well as appropriate mitigation and response measures.

VIII. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

A. General

466. Environmental mitigation measures and environmental monitoring requirements will be implemented through an Environmental Management Plan (EMP). The EMP provides details of the environmental impacts, environmental mitigation measures, environment monitoring requirements, and environmental supervision responsibilities.

467. This section provides an approach for managing and monitoring environment related issues for environmental management and resource allocations to be carried out by the Roads and Highways Department (RHD) for mitigating negative impacts of the proposed Project.

B. Objectives of Environmental Management Plan (EMP)

468. Environmental management plan (EMP) is prepared for all the identified environmental and social impacts (as illustrated in Chapter VI) during pre-construction, construction, and operation stages due to implementation of various project activities and associated development. The EMP includes mitigation plan, monitoring plan and environmental monitoring cost.

469. The aim of the EMP is to ensure implementation of the recommended mitigation measures effectively. The mitigation measures are designed either to prevent impacts or by mitigating those to reduce the effect to an acceptable level that complies with the environmental guidelines of DOE and with the guidelines of the AIIB's ESF (2021) by adopting the most suitable techno-economic options. The EMP also ensures that the positive impacts are conserved and enhanced. The main objectives of the EMP for this project are:

- ✓ Define the responsibilities of the project proponents in accordance with the three project phases (pre-construction, construction and operation);
- ✓ Facilitate the implementation of the mitigation measures by providing the technical details of each project impact, and proposing an implementation schedule of the proposed mitigation measures;
- ✓ Define a monitoring mechanism and identify monitoring parameters to ensure that all proposed mitigation measures are completely and effectively implemented;
- ✓ Identify training requirements at various levels and provide a plan for the implementation of training sessions;
- ✓ Identify the resources required to implement the EMP and outline corresponding financing arrangements; and
- ✓ Providing a cost estimate for all proposed EMP actions.

C. Environmental Management Plan (EMP)

470. Mitigation measures for each of the impacts listed in the Table VIII-1 in accordance with the Chapter VI. Responsible institutions/departments for the implementation and supervision of each of the environmental issues have also been illustrated. Mitigation measures have been suggested based on the knowledge of the Environmental Specialist, suggestions of the stakeholders collected during public consultation, and opinions from other relevant specialists.

471. The mitigation measures will be considered successful when comply with the Environmental Quality Standards (EQS), policies, legal requirements set by DoE, other relevant GoB organizations as well as the guidelines of the funding agency e.g.; AIIB's Environment and Social Framework. In absence of DoE's own EQS, international good practice standard/regulations such as World Bank Group's Environment, Health, and Safety guideline will be applied.

Table VIII-1: Environmental Management Plan (Mitigative Measures)

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
1.0 PRE-CONSTRUCTION PHASE						
1.1 Landscape/ Topography	▪ The topography in the project area will change to some extent because of construction of the proposed project related structures such as toll plaza, at grade {K4+525.5'K8+602 of toll road section and SK4+150~SK8+602 of service road section (Service Roads both sides of at-grade Toll Road)} and elevated sections {K1+154.113~K4+525.5 of toll road section and SK1+154.113~SK4+150 (Service Roads both sides of elevated Toll Road) of service road section}, interchanges etc. Visual changes to the topography would be permanent and minor negative in nature; and ▪ Visual changes to topography.	▪ The aesthetic elements (such as plantation) should be incorporated in the design; ▪ Large filling and deep cuts would be avoided, when possible, with the proper alignment planning. ▪ The intersections would be properly designed so as it can be conformable with the existing land form topographically to the extent possible; ▪ The toll plaza would be reasonably located with the structure and colour conformable with the surroundings. Trees would be planted around the toll plaza and in the vacant lands around the intersections as much as possible.	Throughout the alignment, at intersection sites and toll plaza area.	Throughout the pre-construction period.	RHD	PIU
1.2 Land Acquisition and Resettlement	▪ About 30.46 acres of land acquisition. ▪ Resettlement of Affected Persons (PAPs).	▪ The horizontal alignment of Toll Road must follow the Ex1stmg Lane alignment as far as possible to minimize the land acquisition as well as impacts on the existing building/infrastructure along the existing two-lane roadway facility. ▪ Land acquisition and resettlement plan has to be prepared by the social and resettlement specialists following the national legal frameworks and AIIB's ESS 2 in order to deliver proper compensation and resettlement of the affected people;	Throughout the alignment.	Throughout the pre-construction period.	PIU/District Commissioner (DC)	PIU and Project Company

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		▪ Careful alignment and route selection by the designer to minimise resettlement; ▪ Acquire minimal area of land that meets the requirement of the proposed road improvement; and ▪ Allocation of proper compensation according to Resettlement Action Plan (RAP).				
1.3 Removal of Commercial Structures	▪ 867 commercial structures are located within the ROW which will be directly affected.	▪ A compensation plan will be developed as per the RP. ▪ The Project Affected People (PAPs) must be informed through notice in time as though they can get enough time to make plan for relocation/shifting; and ▪ The PAPs will have to be properly compensated and relocated as per the RAP before commencing removal of commercial infrastructure;	Along the alignment at sites identified in the RAP.	Early during the Feasibility Study work, during detailed design stage; always prior to construction starting in the area where the site is located.	PIU/DC	PIU and Project Company
1.4 Removal of Physical, Cultural and Other Community Structures	▪ Total 31 cultural structures are located within ROW.	▪ A compensation plan has been developed as per the RAP. ▪ The people using the infrastructure must be informed prior to removal and/or relocation; and ▪ Removal and/or relocation of community structures will have to be executed after discussion with the local people/users/associated stakeholders.	Along the alignment at CPRs sites identified in the RAP.	Early during the Feasibility Study work, during detailed design stage; always prior to construction starting in the area where the site is located.	PIU/DC	PIU and Project Company
1.5 Damage to Public Utilities	▪ Utility lines will have to be moved disrupting services.	▪ Provision in the design and budget for the relocation of the existing utility infrastructures, wherever required; ▪ All public utilities (e.g., water/gas pipes, power/telephone lines,	Along the alignment.	Permits and locations will be established and included in construction drawing and	PIU /DC/ PDB/BTCL/ Contractor	PIU and Project Company

<table>
<tr><th>Environmental Issues</th><th>Environmental Impacts</th><th>Mitigation Measures</th><th>Location</th><th>Timing/ Duration</th><th>Who will Implement</th><th>Who will Supervise</th></tr>
<tr>
<td></td>
<td>
List of Utilities along the Alignment
<table>
<tr><th>Chainage</th><th>Electric Pole</th><th>Electric Tower</th></tr>
<tr><td>0+000 to 0+200</td><td>17</td><td>1</td></tr>
<tr><td>0+000 to 1+000</td><td>69</td><td>1</td></tr>
<tr><td>1+000 to 2+000</td><td>63</td><td></td></tr>
<tr><td>2+000 to 3+000</td><td>58</td><td></td></tr>
<tr><td>3+000 to 4+000</td><td>38</td><td></td></tr>
<tr><td>4+000 to 5+000</td><td>64</td><td></td></tr>
<tr><td>5+000 to 6+000</td><td>61</td><td></td></tr>
<tr><td>6+000 to 7+000</td><td>79</td><td></td></tr>
<tr><td>7+000 to 8+000</td><td>84</td><td></td></tr>
<tr><td>8+000 to 9+000</td><td>101</td><td></td></tr>
<tr><td>10+000 to 11+000</td><td>109</td><td></td></tr>
<tr><td>11+000 to 12+000</td><td>104</td><td></td></tr>
<tr><td>12+000 to 13+000</td><td>103</td><td></td></tr>
<tr><td>Total</td><td>950</td><td>2</td></tr>
</table>
</td>
<td>mobile tower) likely to be affected by the proposed project will be relocated before the actual commencement of the construction work.
▪ Informing all hospitals, schools, places of worship, and affected communities well in advance;
▪ Utilities will only be removed and relocated with proper agency approvals and permission;
▪ If utilities are damaged during construction, it will be reported to the Consultants and utility authority and repairs will be arranged immediately at the contractor's expense.
▪ Reconnection of utilities will be completed at the shortest practicable time before construction commences.</td>
<td></td>
<td>relocation will take place prior to construction.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.6 Tree Cutting and Wildlife</td>
<td>▪ Cutting of total 5820 trees;
▪ Loss of habitat (roadside, floodplain habitats identified in the project area) of some wildlife in relation to the wetlands, trees and vegetation; and
▪ Relocation/migration of wildlife;
▪ Clearance of vegetation on the ROW along the alignment will cause permanent and/or temporary dislocation of some wildlife because of disturbance on their habitat.
▪ During survey, vegetation clearing, removal of infrastructure and utilities will make the wildlife panic.
▪ During site clearance there is a possibility to injure and/or death of any species.</td>
<td>▪ Get approval from Project Company for clearance of vegetation.
▪ Prior notice to the owners of the trees and ensure proper compensation to the affected people according to the Resettlement Plan; and
▪ During cutting of trees cautious observation is essential regarding smooth and safe relocation/migration of wildlife (if any) and it has to be ensured that no wildlife becomes hurt during tree cutting.
▪ A total of minimum three-time saplings (17460 nos.) against</td>
<td>Along the alignment.</td>
<td>The Tree plantation plan (this plan will be developed during the detailed design stage) will be updated and completed early during the Pre-Construction period. Cutting will take place throughout the construction period and replanting immediately after</td>
<td>Arboriculture Department, RHD/ PIU /DC</td>
<td>PIU, MoEFCC, and Project Company</td>
</tr>
</table>

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
	▪ The birds and its nest on the trees will be directly affected.	felled down trees will be planted during operation stage (preferably during monsoon period). ▪ If a tree of rare species is growing within the ROW and is required to be removed, it will not be felled but uprooted and transplanted in close consultation with the Arboriculture Department; ▪ During clearing of the vegetation, the security of the wildlife species must be ensured. ▪ While clearing vegetation it must be ensured that no wildlife (snakes, and other wildlife species) injure and/or die. ▪ Harming and/or killing of any types of wildlife by the workers of the project must be prohibited. ▪ In case of appearance of any endangered/threatened wildlife species respective regulatory authority must be informed as early as possible. ▪ RHD will be responsible for the compensatory tree planting program by forming an "Environmental and Social Team" in coordination with the Arboriculture Department of RHD.		each section of the road is completed.		
1.7 Water Bodies and Fisheries	▪ Some water bodies will be directly affected; ▪ Pile driving and dredging for the construction will force to migrate the fisheries and other aquatic species.	▪ Proper compensation to the affected people who will lose their culture fisheries ponds; ▪ Flow of water in the rivers must be undisturbed as possible; and ▪ Fallow lands can be prepared into fish ponds through excavation work.	Along the alignment	Throughout the pre-construction period.	PIU /DC/NGO	PIU, DOF and Project Company

<table>
<tr><th>Environmental Issues</th><th>Environmental Impacts</th><th>Mitigation Measures</th><th>Location</th><th>Timing/ Duration</th><th>Who will Implement</th><th>Who will Supervise</th></tr>
<tr>
<td></td>
<td>
<table>
<tr><th>Waterbody (Chainage)</th><th>Quantity</th></tr>
<tr><td>CH 01+050km, 01+650km, CH 02+100km, CH. 02+250 – CH. 02+200km, CH. 02+450 – CH. 02+400km, CH 03+0550 km, CH 03+250km</td><td>7</td></tr>
<tr><td>CH 05+550km, CH 05+550km, CH 05+550km, CH. 06+500 – CH. 06+450km, CH 08+100 - 08+050km, CH. 08+100 – CH. 08+050km,</td><td>6</td></tr>
<tr><td>CH 12+250km, CH. 12+100 – CH. 12+050km</td><td>2</td></tr>
</table>
</td>
<td>
▪ To minimize the production loss of fish, production capacity in the existing fish enriched ponds in the CoI can be enhanced through excavating the ponds.
▪ The project area is mainly distributed with farmlands and fish ponds, while subgrades are mainly fill subgrades, and sand filling subgrade shall be adopted due to difficulty in borrowing soil.. However, the ECAs will not be hampered by the intervention of this project activities. Therefore, it is not required to prepare a Biodiversity Management Plan for this project
<table>
<tr><th>Chainage No.</th><th>Distance from ECA (m)</th></tr>
<tr><td>CH. 00+050 km</td><td>910</td></tr>
<tr><td>CH. 00+450 km</td><td>915</td></tr>
<tr><td>CH. 00+700 km</td><td>917</td></tr>
<tr><td>CH. 00+950 km</td><td>893</td></tr>
<tr><td>CH. 01+200 km</td><td>852</td></tr>
<tr><td>CH. 01+450 km</td><td>702</td></tr>
<tr><td>CH. 01+750 km</td><td>559</td></tr>
<tr><td>CH. 01+950 km</td><td>486</td></tr>
<tr><td>CH. 02+200 km</td><td>415</td></tr>
<tr><td>CH. 00+200 km</td><td>906</td></tr>
<tr><td>CH. 02+450 km</td><td>431</td></tr>
<tr><td>CH. 02+700 km</td><td>482</td></tr>
<tr><td>CH. 02+950 km</td><td>583</td></tr>
<tr><td>CH. 02+950 km</td><td>587</td></tr>
</table>
</td>
<td></td><td></td><td></td><td></td>
</tr>
</table>

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		CH. 03+200 km 650 CH. 03+450 km 786 CH. 03+700 km 976 CH. 03+950 km 841 CH. 04+200 km 741 CH. 04+450 km 717 CH. 04+700 km 722 CH. 04+950 km 770 CH. 05+200 km 932	Balu			
1.8 Labour Standard	Inadequately prepared labour standards, leading to infractions regarding child labour, minimum wage, forced labour, and unsanitary working conditions and unsafe water supplies	Confirm that these standards are specifically incorporated into the contract documents either as clauses or by appending this EMP to the contract.	Construction site and labour camp	Once as contract documentation is being prepared	PIU, and Project Company	PIU, and Project Company
1.9 Technical Capacity to undertake all environmental work	Inability of contractor and RHD or PROJECT COMPANY to implement the EIA and it EMP resulting in a breakdown of safeguards implementation.	▪ RHD/Project Company to conduct a one-day briefing and training for contractors and RHD staff on EIA and EMP implementation, surveys, and data recording	RHD/Project Company Office	Pre-construction period/ Beginning of construction period.	PIU, and Project Company	PIU, and Project Company
2.0 CONSTRUCTION PHASE						
2.1 Landscape/ Topography	▪ Cutting of around 5820 trees and dismantling of existing infrastructure will cause landscape change;	▪ Mitigation measure for this impact is proper landscaping with greening facilities which have been already been considered in the design ▪ Construction camps should be constructed at suitable place to minimize this impact. ▪ Vegetation clearing has to be at minimum level as possible. After completion of road construction, trees shall be planted along sections of road near the populous	Throughout the alignment especially at all construction camp area.	Throughout the construction period.	Contractor, Project Company	PIU and Project Company

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		residential areas to improve landscape along the road. ▪ All the affected areas will be restored to their original levels.				
2.2 Loss of Top Soil	▪ Typical activities during the road construction phase include ground clearing (removal of vegetative cover), grading, excavation, trenching, vehicular and pedestrian traffic, and construction and installation of facilities may lead to loss of topsoil (0.5 m from the surface) in ROW. ▪ Compaction of topsoil due to vehicular and pedestrian movement. ▪ Loss of top soil by wind and water erosion. ▪ Covering of top soil by project works. ▪ Clearing topsoil in proposed embankment area can lead to loss of nutrient.	▪ 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. ▪ Keep soil storage periods as short as possible. ▪ 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. ▪ Mitigate construction-related soil compaction in tree plantation areas by ripping the soil to loosen its structure prior to the spreading of topsoil. ▪ Limit equipment and vehicular movements to within the approved construction zone. ▪ Fertile soil (or top soil) shall be distributed free to local people who need it for their own purpose. The residuals shall be reused to form the ground around the interchanges, the areas along the road within the acquired land, or recover the vegetation in some	Throughout the alignment as well as at all construction camp area.	Throughout the construction period.	Contractor	PIU and Project Company

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		affected areas due to the road project.				
2.3 Dredging and Dredged Materials	▪ Increase of water turbidity and subsequent impact on the aquatic life; ▪ Leakages and spillage from the hydraulic pipeline, impact of air quality and odor from dredge material carrying trucks; and ▪ Dispersion of sediments and release of high sediment laden runoff from the placement sites.	▪ Site selection considering hydrological and river morphological consideration. ▪ Water samples will be collected upstream and downstream of the dredger while in full operation and tested for nutrient, sediment loads, heavy metals as well as oil and grease concentrations. Dredging must not be carried out when the fish are likely to be breeding in the affected surface water bodies, or in the period normally from April to August between spawning and the subsequent emergence of juvenile fish. ▪ The transporting of the dredged materials using watertight dump trucks should not exceed the truck capacity to avoid spillage onto the road and carried out during the night time period (e.g., 21.00 to 05.00).	Dredging sites and dredge material placement sites.	Inspect weekly to ensure that dredge material is properly maintained.	Contractor, Project Company	PIU and Project Company
2.4 Soil Contamination	▪ Dumping of construction debris on fields adjoining the acquired areas, may lead to impairment of soil.	▪ Ensure that dredge materials do not contain heavy metals exceeding the international standards by testing prior to using it; ▪ Outflow from hydraulic fill should have max. retention time to enhance settling at the reclaimed site; ▪ Handling of bitumen, fuel and chemicals at designated site in the construction yards only;	At all work sites, in the impact corridor, including at cut areas.	Inspection as part of the engineering inspection cycle and reporting to Project Company	Contractor, Project Company	PIU and Project Company

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		▪ The movement of construction vehicles, machinery and equipment will be restricted to the corridor or identified route. ▪ The unusable, non-saleable, non-hazardous construction waste shall be disposed of in the properly delineated places. ▪ The construction vehicles shall be fueled or repaired/serviced at the designated place with proper arrangement of waste collection and disposal. The arrangement will include, cemented floor with dyke around for fuel storage and filling as well repairing of construction equipment. ▪ Soil contamination by bitumen, fuel and chemical storages shall be minimized by siting them on an impervious base within an embanked area and secured by fencing. The base and walls of the embankment shall be impermeable and of sufficient capacity to contain of the total volume of stored fuels and chemicals. ▪ The disposal of waste asphalt shall be made in approved locations such as not at natural depressions and shall not be within the ROW. Unless located in areas with impervious soils, encapsulation with pre-laid impervious liners including walls and capping is required with the objective to prevent water percolating through				

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		the waste materials and leaching toxic chemicals into the surrounding soils.				
2.5 Air Pollution and Dust	▪ The ambient levels of CO_X, O_3, NO_X, SO_X, $PM_{2.5}$, and PM_{10} may increase during construction phase is mainly caused by: (1) flying dust produced from mixing lime and soil, (2) material stock grounds, (3) Emission, leakage/ spillover of materials/spoils during transportation, (4) dust from temporary roads and unpaved road surfaces. ▪ Flow of particulate matter from uncovered construction materials carrying vehicles; and ▪ Emissions of air pollutants/GHGs from asphalt plant, machines/engines and firing for bitumen melting.	▪ Earth, rock, or debris shall not be deposited on public or private land as a result of Contractor's operations, including any deposits arising from the movement of construction plant or vehicles. ▪ Provide water spray vehicles to water the unpaved ground, storage piles and other areas where airborne dust may originate. The water spray operation should be carried out in dry and windy day, at least twice a day (morning and afternoon). ▪ Trucks transporting construction materials should meet allowable exhaust gas emission standards and should be carefully covered. ▪ Site for stockpiling soils and sand should be located far more than 500m from the populous residential areas. ▪ All soils excavated from the land surface during the works to construct road foundation shall be transported as soon as possible to the sites for reuse or disposal. ▪ Concentration of construction machinery and vehicles near the populous residential areas should be avoided. ▪ Measures to control air pollution at concrete batching plant, asphalt melting stations, etc.	At all work sites, in the impact corridor.	Inspection as part of the engineering inspection cycle and reporting to Project Company	Contractor, Project Company	PIU and Project Company

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		1. Concrete batching plants, crushing plant sites and their ancillary areas shall be frequently cleaned and watered to minimize any dust emissions. 2. Dry mix batching shall be carried out in a totally enclosed area with exhaust to suitable fabric filters. 3. A suitable air pollution control system shall be installed and operated whenever the batching plant is in operation. 4. All stockpiles of sand and aggregate within the batching plant site shall be enclosed on three sides with geotextile sheets (if they are greater than $20m^3$) and shall be enclosed on three sides with walls extending above the stockpile and 2000mm beyond the front of the stockpile (if they are greater than $50m^3$). 5. The asphalt melting station should be equipped with flue gas control device; operation of asphalt melting will be in enclosed mode; cement and concrete will be mixed within an enclosed structure. 6. Cement and other such fine-grained materials delivered in bulk shall be stored in closed silos fitted with a high-level alarm indicator. The high-level alarm indicators shall be interlocked with the filling line such that in the event of the hopper				

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		approaching an overfill condition, an audible alarm will operate, and the pneumatic line to the filling tanker will close. 7. All air vents on cement silos shall be fitted with suitable fabric filters provided with either shaking or pulse-air cleaning mechanisms. ▪ Measures to control air pollution at construction site: 1. Use temporary barriers to control dust around the construction sites near the populous residential areas. 2. All vehicles shall have their engine turned off while parked on the site. 3. Construction machinery should be located as far as possible from the construction site boundary. 4. Areas within the construction site where there is a regular movement of vehicles shall have a hard surface and be kept clear of loose surface material to the satisfaction of the Project Company. 5. Construction roads should be paved with gravel or asphalt to reduce generation of air-borne dust, and mitigate impacts to residential areas. 6. All roads within the construction sites and roads leading to the sites shall be sprayed by using water bowers with spray bars, hose pipes				

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		etc. to control dust to the satisfaction of the Project Company.				
2.6 Noise and Vibration	▪ Generation of noise due to project activities (e.g., movement of vehicle, construction work, maintenance etc.); ▪ Movement of the heavy construction equipment and vehicles, pile driving operations, operation of crushing, ballasting and aggregating plants, and power generation plants will cause vibration.	▪ Selection of latest equipment and plant with reduced noise level ensured by suitable in-built damping techniques and appropriate muffling devices. ▪ All powered mechanical equipment and machinery shall be fitted with noise abating gear such as mufflers for effective sound reducing, in full compliance with the DoE regulations. ▪ Vehicles and equipment should be fitted with silencer and maintained well. Mufflers should be used during pile driving hydraulic mechanism to ensure noise level is below 85 dB(A). ▪ The noisiest operations should be performed during daytime. Proper equipment maintenance and restricted operation between 0700 to 1800 hours will reduce noise. ▪ The construction equipment/ machinery (stationary) shall be placed away from inhabited areas. Provision of temporary noise barrier shall be made near sensitive locations like schools, religious places and hospitals. If temporary noise barriers are not feasible then regulate construction activity and timing so as the impact intensity is minimized.	Sensitive sites within 100 m of ROW in the vicinity of the sensitive receptors.	Throughout the construction period, and based on noise measurement surveys	Contractor, Project Company	PIU, Project Company and DOE

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		▪ The workers should be provided with personal protection devices as earplugs and earmuffs. ▪ In areas, where there are structures likely to be affected by vibrations because of the construction activities, precaution will be taken to minimize the vibration and the resulting impact. ▪ Noise and vibration monitoring shall be carried out as per the suggested monitoring plan.				
2.7 Surface Water Quality	▪ The project road passes two major water bodies (Shitalakshya and Balu River) which are ECA enlisted and other small to medium waterbodies. Construction activities may have localized impact in terms increase TSS level in canal water. Since this will be a temporary phenomenon, no significant adverse impact is anticipated during this phase. ▪ During the construction phase, wastewater from construction sites is mainly generated from the concrete watering, pier foundation drains, and sand washing. A medium size construction site generally generates about 20 tons/day of wastewater with high level of turbidity and pH. If this wastewater is discharged directly into the surrounding water bodies, it would pollute these water bodies. ▪ Water pollution may cause damage to the breeding and spawning of fish and may pose threat to other aquatic species; ▪ Oil leakage from the operation of machinery during the bridge construction may also cause river water pollution.	▪ The Contractor shall comply with the national legislation and other regulations currently applied in Bangladesh as they relate to water pollution control. ▪ Protection of the water environment shall be recognized as a key constraint for any construction work. The Contractor shall devise and arrange methods of working to minimize water quality impacts to the satisfaction of the Project Company. ▪ The Contractor shall always ensure that all existing water courses and drains within, and adjacent to, the site are kept safe and free from any debris and any excavated materials arising from the Works. ▪ The earthwork sites where exposed land surface is vulnerable to runoff, etc. shall be consolidated and/or covered; ▪ The Contractor shall ensure that rain run-off from the construction	Along the alignment	Throughout the construction period	Contractor, Project Company	PIU, Project Company and DOE

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
	Loose materials such as cement and lime stockpiled near the waterbody may also cause water pollution during rainfall. In addition, domestic wastewater generated from construction camps may also cause water pollution unless it is properly controlled and treated at the site. ▪ During the construction phase, construction camps, warehouse, and material stockpile sites are planned to be set up along the proposed road. Domestic wastewater generated from construction camps may include fecal sewage and would be a potential source of water pollution. Main pollutants in domestic wastewater are COD and BOD_5. This wastewater would pollute the surrounding water bodies if it were discharged directly into these water bodies without treatment.	sites is not deposited directly into any watercourse. ▪ All drainage facilities shall be regularly inspected and maintained to always ensure proper and efficient operation and particularly following rainstorms. ▪ Wastewater shall be collected, re-used and/or disposed of off-site after oil/grease removal and settlement of suspended solids. Sediment tanks of sufficient capacity, constructed from pre-formed individual cells of approximately 6-8 m^3 capacities shall be used at all sites for settling wastewaters prior to disposal. ▪ Construction wastes shall be collected and re-used wherever possible. Otherwise, should be disposed in the small deposit area invulnerable to surface run-off, along with soil erosion prevention measures. ▪ The material stockpile sites shall be located far away from water bodies and areas prone to surface run-off. If some must be placed near bridge construction sites, the stockpiles should be surrounded by interception ditches or retaining structures to prevent the erosion and materials into the water bodies. The loose materials should be bagged and covered. ▪ The fuel storage and equipment maintenance yard should have				

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		weather/rain protection and should be on concrete pads to prevent dripping and leaking oils from entering the water bodies via surface runoff. All spoil soil disposal sites should only be allowed in the dedicated areas where will be erosion control measures and landscaping plan following the disposal operations. ▪ Drainage from vehicle maintenance areas, plant servicing areas and vehicle wash bays shall be passed via a petrol interceptor prior to discharge. ▪ The Contractor shall ensure that no tools or machinery are washed in any water source or areas that drain into an existing watercourse or to the coastal environment. ▪ The Contractor shall weekly check all equipment for prevention of oil and or lubrication leaks and ensure that all equipment oil and lubrication replacements are performed only in bounded maintenance and repair areas.				
2.8 Groundwater Quality	▪ Spillage of oil and chemicals on the soil surface may percolate into the local groundwater aquifer and pollute the groundwater; and ▪ Extraction of excessive groundwater from the locality in the project area for construction work may decrease the level of groundwater table. ▪ 10 boreholes are drilled along proposed alignment, with design borehole depth of 35-60m.	▪ Pumping of groundwater should be from deep aquifers of more than 300 m to supply arsenic free water. Safe and sustainable discharges are to be ascertained prior to selection of pumps. ▪ Tube wells will be installed with due regard for the surface environment, protection of groundwater from surface	Throughout the alignment, especially where the pile placed to depths ≥ 30 m, and where any new wells were dug.	If new wells are dug and toilet facilities built near wells	Contractor, Project Company	PIU, Project Company and DOE

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		contaminants, and protection of aquifer cross contamination. ▪ All tube wells, test holes, monitoring wells that are no longer in use or needed shall be properly decommissioned. ▪ Protect groundwater supplies to adjacent lands. ▪ Supply water shall also be used after proper purification.				
2.9 Drainage Congestion	▪ Run off from storage of construction material near water bodies, or uncontrolled disposal may cause temporary drainage congestion, especially near the locations of service areas, and construction sites. ▪ Stockpiling of fill materials dredged from the riverbeds for construction of the embankment may result erosion and subsequent deposition in the adjacent crop fields. ▪ The hydrological impacts of the project are primarily limited due to faster post monsoon drainage caused due to faster fall of water level in the drainage channels following the monsoon season. Furthermore, all the area does not have proper drainage facility. Only beginning part has but later mostly rural/semi urban area and does not have structure drainage system. ▪ The project area is not prone to flood as per secondary data collection and information gathered during consultations. As per assessment and considering the existing road levels some parts of the road stretch is likely to be affected by flood respectively.	▪ Wastes should not be disposed near any water body. All waste depending on its characteristics, should be disposed off in a controlled manner. ▪ Adequate cross drainage structure shall be provided to easily drain off water to canals and other lowland areas. ▪ Drainage works can also be designed with the provision of lower volume of water to drain in other low-lying areas, but the regulators are to be provided in such cases to permit controlled drainage rates and the consequent water levels.	Along the alignment	Throughout the construction period	Contractor, Project Company	PIU, Project Company and DOE

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
2.10 Vegetation	▪ During the construction phase, particularly at the sites around the bridge, there will be considerable flow of workers and trucks that will lead to the reduction of vegetation cover. ▪ Presence of trucks hauling loose materials which generates air-borne dust will pose a detrimental effect on the growth of plants near the proposed road. The dust accumulating on the leave surface of plants will prevent the photosynthetic function. ▪ The lime and cement will produce hardpan soil if they are dumped to the soil. Although these impacts are short term, a certain period is required to restore the vegetation cover after the works are completed.	▪ Make selective and careful pruning of trees where possible to reduce need of tree removal. ▪ Control noxious weeds by disposing of at designated dump site or burn on site. ▪ Clear only the vegetation that needs to be cleared in accordance with the plans. These measures are applicable to both the construction areas as well as to any associated activities such as sites for stockpiles, disposal of fill and construction of diversion roads, etc. ▪ Don't burn off cleared vegetation – where feasible, chip or mulch and reuse it for the rehabilitation of affected areas, temporary access tracks or landscaping. Mulch provides a seed source, can limit embankment erosion, retains soil moisture and nutrients, and encourages re-growth and protection from weeds. ▪ Return topsoil and mulched vegetation (in areas of native vegetation) to approximately the same area of the roadside it came from. ▪ Avoid work within the drip-line of trees to prevent damage to the tree roots and compacting the soil. ▪ Minimize the length of time the ground is exposed, or excavation left open by clearing and re-	Along the alignment, trees cutting, camp areas	Throughout the construction period	Contractor, Project Company	PIU and Project Company

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		vegetate the area at the earliest practically possible. ▪ Ensure excavation works occur progressively and re-vegetation done at the earliest. ▪ Provide adequate knowledge to the workers regarding nature protection and the need of avoid felling trees during construction. ▪ Supply appropriate fuel in the work camps to prevent fuel wood collection.				
2.11 Terrestrial Fauna	▪ The vibration of equipment, noise, wastewater, and exhausts gas are often considered to be disturbances to animals. These could drive animals away from their current habitats. ▪ During the construction phase, trees around the construction sites may be cut down and cause damage to the habitat of wild animals. ▪ Illegal hunting may also occur and pose the threat to wild animals. ▪ During construction phase, air pollution, wastewater, and solid waste generated by the construction works may also deteriorate the animals' habitat and may force them to evacuate to another habitat. ▪ Construction of temporary construction sites and access roads may lead to damage and deterioration of local ecosystems.	▪ Setting up and implementation code of conducts to workers, including no catching or hunting fish and wildlife, and no consumption of wildlife products. ▪ Provision of environmental training with information on the importance of biological diversity, and its relationships with sustainable development. ▪ Limit the construction works within the designated sites allocated to the contractors. ▪ Minimize the tree removal during the bird breeding season (February-July). If works must be continued during the bird breeding season, a nest survey will be conducted by a qualified biologist prior to commence of works to identify and located active nests. ▪ Minimize the release of oil, oil wastes or any other substances harmful to migratory birds to any	Along the alignment, trees cutting, camp areas	Throughout the construction period	Contractor, Project Company	PIU and Project Company

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		waters or any areas frequented by migratory birds. ▪ Provide adequate knowledge to the workers regarding protection of flora and fauna, and relevant government regulations and punishments for illegal poaching.				
2.12 Aquatic Species	▪ Water pollution may change the dominance and the composition of the plankton. Water pollution will reduce species numbers and relative abundances of populations.	▪ Provision of environmental training with information on the importance of biological diversity, and its relationship with sustainable development. ▪ Do not dump wastes, be it hazardous or non-hazardous into the nearby water bodies or in the river. ▪ Major waterbodies e.g.; the Shitalakshya and Balu River are being polluted from adjacent dye factory and will not get affected from the project construction activities as they are located at a good distance from the alignment. Moreover, another waterbody located at CH 00+800km (beside Demra-Narayanganj Road) is also get polluted as the waterbody is connected with adjacent sewer system.	Water bodies along the alignment	Throughout the construction period	Contractor, Project Company	PIU and Project Company
2.13 Fisheries	▪ At CH 01+050km, CH 02+100km, CH 02+200 – 02+250km, CH 03+550km, CH 05+500, CH 08+050 - 08+100 waterbodies are located which are being used for aquaculture. The unplanned construction activities may cause hamper the practice. Besides, the below impacts may occur.	▪ Do not dump wastes, be it hazardous or non-hazardous into the nearby water bodies or in the river. ▪ Inspect any area of a water body containing fish that is temporarily isolated for the presence of fish, and all fish shall be captured and	Water bodies along the alignment	Throughout the construction period	Contractor, Project Company	PIU and Project Company

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
	▪ The construction work may lead to the loss of fish habitat due to increased turbidity, decreased dissolved oxygen in the water, and reduction of food sources including temporary decline of plankton and benthos organisms. Increase in suspended solids in the waterbodies would drive fishes away from the bridge construction sites during the construction phase. ▪ Ponds are used for exotic fish culture which has little conservation significance.	released unharmed in adjacent fish habitat.				
2.14 Pollution from Wastes	▪ Dismantling of any structure will generate solid waste; and ▪ Kitchen and sewage wastes from labour camp will cause growth of flies and water born germs.	▪ Develop waste management plan for various specific waste (reusable waste, flammable waste, construction debris, food waste etc.) prior to commencing of construction and submit to Project Company for approval. ▪ Prepare spill control procedures and submit the plan for Project Company approval. ▪ Train the relevant construction personnel in handling of fuels and spill control procedures. ▪ Store dangerous goods in bunded areas on a top of a sealed plastic sheet away from watercourses. ▪ Refueling shall occur only within bunded areas. ▪ Make available MSDS for chemicals and dangerous goods on-site. ▪ Place a high emphasis on good housekeeping practices. ▪ Store hazardous materials above flood plain level.	All construction camp and contractor operations areas, such as batching plants and maintenance yards	Monthly	Contractor, Project Company	PIU and Project Company

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		▪ Put containers and drums in temporary storages in clearly marked areas, where they will not be run over by vehicles or heavy machinery. The area shall preferably slope or drain to a safe collection area in the event of a spill. ▪ Put containers and drums in permanent storage areas on an impermeable floor that slopes to a safe collection area in the event of a spill or leak. ▪ Take all precautionary measures when handling and storing fuels and lubricants, avoiding environmental pollution.				
2.15 Asphalt Hot Mix Plant, Rock Crushing, and Bitumen Supply	▪ Rock crushing activities will generate noise and dust, and asphalt hot-mix plant and pavement works will generate gas and odour while compaction of the pavement will also generate noise and dust. ▪ It is also possible that soil may be contaminated by oils and chemicals at asphalt/bitumen plant sites, workshop areas, and equipment washing yards.	▪ Cement batching and aggregate mixing plant will be located as far as possible (at least 300 m from settlements and habitation near the project corridor, or as required by environmental regulations; ▪ All conditions of DoE permits and local guidelines will be observed; ▪ Dust suppression equipment will be installed at cement and aggregate mix plants; ▪ Areas of construction, as well as the haul road, will be kept damp by watering. The construction area where local roads are used for hauling, they shall be kept in serviceable condition, and any damage will be repaired promptly without interference to local travel routes;	All Asphalt hot mix plant, rock crushing plants	Monthly	Contractor, Project Company	PIU and Project Company

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		▪ All batching plants will be installed 800m left side (CH K4+500) from the right of way (RoW).				
2.16 Construction Waste Disposal (Waste water, Oil, Hazardous Waste etc.)	▪ Oil, grease etc. from construction machinery; ▪ Hazardous and solid waste from waste construction material and food; ▪ Waste water from washing and sprinkling; and ▪ Sanitary waste from staff toilets.	▪ Organize disposal of all wastes generated during construction in an environmentally acceptable manner. This will include consideration of the nature and location of disposal site, to cause less environmental impact. ▪ Transport waste of dangerous goods, which cannot be recycled, to a designated disposal site approved by DOE. Vehicles transporting solid waste shall be covered with tarps or nets to prevent spilling waste along the route ▪ Train and instruct all personnel in waste disposal practices and procedures as a component of the environmental induction process. ▪ Provide absorbent and containment material (e.g., absorbent matting) where hazardous material is used and stored and personnel trained in the correct use. ▪ Provide protective clothing, safety boots, helmets, masks, gloves, goggles, to the construction personnel, appropriate to materials in use. ▪ Make sure all containers, drums, and tanks that are used for storage are in good condition and are labelled with expiry date. Any container, drum, or tank that is	All construction camp and contractor operations areas	Monthly	Contractor, Project Company	PIU and Project Company

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		dented, cracked, or rusted might eventually leak. Check for leakage regularly to identify potential problems before they occur. ▪ Minimize the production of waste materials by 3R (Reduce, Recycle and Reuse) approach. ▪ Segregate and reuse or recycle all the wastes, wherever practical. ▪ Prohibit burning of solid waste. ▪ Provide reuse containers at each worksite. ▪ Request suppliers to minimize packaging where practicable. ▪ Avoid the use of material with greater potential for contamination by substituting them with more environmentally friendly materials. ▪ Maintain all construction sites in a cleaner, tidy, and safe condition and provide and maintain appropriate facilities as temporary storage of all wastes before transportation and final disposal.				
2.17 Construction Yards	▪ The siting of construction camps may cause loss of plantation and vegetation, permanent physical and visual impact on the area. ▪ The construction process will take several years, with the result that the camps will take on a semi-permanent appearance; ▪ Impacts on the local communities and social structures; ▪ Pollution risk of soil and surface water due to sanitation of the construction camp;	▪ The construction camps shall not be located within or nearby the sensitive cultural structures and shall not be within 300 meters distance from the existing settlements or might be selected after consultation with local people. ▪ Conducting special briefing and/or on-site training for the contractors and workers on the environmental requirement of the project to understand the environmental	All construction camp and contractor operations areas, such as batch plants and maintenance yards	Monthly and submit to Project Company	Contractor, Project Company	PIU and Project Company

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		requirements of the proposed project and implementation of mitigation measures. The crushing plants, asphalt hot mix and batching plants will not be in environmentally sensitive cultural sites, productive land, or existing settlements. ▪ The construction camps shall not be in sensitive areas and shall be sheltered or sited within hoardings. Water and good sanitation facilities should be provided for the camps. Solid waste and sewage shall be managed according to the national regulations. ▪ The sites for construction camps and associated facilities shall be reinstated by the contractors just after completion of construction works. ▪ Debris, construction wastes, vegetation or other materials shall not be burned on the site. ▪ However, the proposed site for construction yards is located 800m left side (CH K4+500) from the right of way (RoW).				
2.18 Occupational Health and Safety (OHS)	▪ Construction workers are more likely to be affected by occupational health hazard through accident and handling hazardous materials at construction site; and ▪ Construction workers are also likely to be affected by water borne diseases and food poisoning at construction camp.	▪ An OHS plan should be prepared and followed during construction work; ▪ Develop a safe work procedure during COVID-19 pandemic. ▪ Workers have to be provided PPE (high visible vest, hard hat, safety harness, gum boot, life jacket, goggles, ear plugs etc.) and it has	All construction camps	Conduct at work camps every month	Contractor, Project Company	PIU and Project Company

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		to be ensured that they use PPE properly; ▪ First Aid Box should be readily available at construction site and labour camp; and ▪ Separate accommodation and toilet for female workers.				
2.19 Community Health and Safety	▪ Improper health and safety policy maintained at the site may lead to outbreak of different diseases to the surrounding communities / public through the sickness	▪ Proper health and safety plan should be prepared by the Contractors prior to start construction and act accordingly during construction to avoid road accidents and health hazards of the surrounding project community.	All construction areas	At all times during construction	Contractor/ Project Company	PIU and Project Company / Local Authority
2.20 Health and Vector Borne Diseases	▪ Personal and occupational health issues, stemming from unsanitary toilet facilities, lack of potable water and sanitary washing areas can lead to common disease outbreaks in work camps. ▪ Construction work creates areas for water to form stagnant puddles; Also, water can collect in old equipment waste tyre dump stored outside, ideal breeding areas for malaria and dengue mosquitoes.	▪ Undertake check and cleaning at all sites and areas where clean conditions should exist. ▪ Provision of potable water, sanitary toilet facility and hygienic accommodation for workers at camp sites. All potable water supplies will be tested quarterly. ▪ Provision of First-Aid facility for them. Ensure that these facilities are cleaned and disinfected regularly. ▪ Inspect for stagnant water and puddles every 3 days, including stored construction materials such as tires and old oil drums–empty to prevent water ponding.	All work sites and particularly at Construction camps	At least twice per week	Contractor, Project Company	PIU, and Project Company
2.21 Traffic Congestion	▪ Traffic jams causing inconvenience to the people; ▪ The construction vehicles will add more traffic and as a result, traffic congestions and road accidents will be increased.	▪ Prepare and submit a traffic management plan to the PROJECT COMPANY for his approval at least 30 days before commencing work on any project component	All construction areas	At all times during construction	Contractor, Project Company	PIU, and Project Company

<table>
<tr><th>Environmental Issues</th><th>Environmental Impacts</th><th>Mitigation Measures</th><th>Location</th><th>Timing/ Duration</th><th>Who will Implement</th><th>Who will Supervise</th></tr>
<tr><td></td><td><table><tr><th>Location</th><th>Chainage (km)</th></tr><tr><td>Chattogram Road</td><td>0+000 – 0+250</td></tr><tr><td>Sarulia Bazar</td><td>2+900 - 3+350</td></tr><tr><td>Demra Circle</td><td>2+900 - 3+350</td></tr><tr><td>Meradia Bazar</td><td>10+300 - 10+500</td></tr><tr><td>Bonoshree</td><td>11+000 - 12+680</td></tr><tr><td>Rampura Bridge</td><td>12+465</td></tr></table></td><td>involved in traffic diversion and management.
▪ Include in the traffic management plan to ensure uninterrupted traffic movement during construction: detailed drawings of traffic arrangements showing all detours, temporary road, temporary bridges temporary diversions, necessary barricades, warning signs / lights, road signs etc.
▪ Traffic management shall be undertaken in coordination with the local traffic police department;
▪ BRTA traffic rules and regulations should be strictly followed. Divert traffic to follow alternative routes to avoid traffic jams.
▪ Provision to be made for passing traffic during construction.</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2.22 Road Accidents</td><td>▪ The influx of heavy vehicles used for construction work on the road may cause sudden road incident and/or accident.</td><td>▪ In Traffic Management Plan, the road safety measures such as speed breakers, warning signs/lights, road safety signs, zebra crossing, flagman etc. should be included to ensure uninterrupted traffic movement especially at nearby the educational (Schools, colleges, Madrasah etc.), cultural structures (mosques, graveyards, prayer ground etc.) and health complex which are located at the existing road sides as well as at road crossing points during construction stage;</td><td>All construction areas</td><td>At all times during construction</td><td>Contractor, Project Company</td><td>PIU and Project Company</td></tr>
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Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		▪ Provide signs at strategic locations of the roads complying with the schedules of signs contained in the Bangladesh Traffic Regulations; ▪ Restrict truck deliveries, where practicable, to day time working hours; ▪ Restrict the transport of oversize loads. ▪ Operate road traffics/transport vehicles, if possible, to non-peak periods to minimize traffic disruptions; ▪ Enforce on-site speed limit; ▪ Install and maintain a display board at each important road intersection on the roads to be used during construction. ▪ In Rampura-Demra direction, because a proposed new ramp will block the passage between the residents on the left of toll road and the service roads, a diversion road will be added to connect the service road to meet the needs of the residents' travel. ▪ Gate-type direction indication sign should be arranged at places 150 m ahead of the diversion section of elevated layer. ▪ Anti-collision buckets should be arranged ahead of toll island and the diversion point of toll road.				
2.23 Income/Job Opportunities	▪ Some job opportunities for executing the construction activities; and ▪ Income opportunity through generating small business.	▪ Priority should be given to the local poor and affected people during recruitment; and	All construction areas	At all times during construction	Contractor/ NGO/Project Company	PIU and Project Company

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
	▪ A total of 867 HHs will be affected in terms of residence and business.	▪ Gender equity and equal wage have to be ensured.				
2.24 Tree Plantation	▪ A total of 5820 trees to be removed from project construction corridor. ▪ Inappropriate selection of tree species and plantation location may not ensure the inherent objective of the tree plantation plan. ▪ Lack of proper care (e.g., watering, securing with fence) by the respective authority will also hinder the process of proper growth of the planted trees.	▪ Undertake a Tree Plantation Program such that for each tree cut three are planted (about 17460 nos.) and all dead trees to be replanted. ▪ If possible, shifted homesteads may be compensated through providing seedlings. ▪ 127. At the roundabout, *Terminalia catappa* and *Ceiba speciosa St. Hih*. are used as the backbone trees in the design. The lower layer is matched with low shrubs such as *Hibiscus rosa-sinensis linn.* and *Bougainvillea glabra choisy* and the bottom layer is covered with *Schefflera heptaphylla* to create a road node landscape with flowers all year round and well-arranged.	All along the alignment, and according to a tree replanting plan	As construction in an area ceases but not only at end of construction	Contractor/ Project Company	PIU, Project Company and Arboriculture Department
2.25 Labor Issues	▪ Labor unrest and labor rights	▪ Labor Management Procedures to be enforced guaranteeing freedom of association and collective bargain, no discrimination and compliance with the relevant ILO Conventions including honoring the Fundamental Principles and Rights at Work	Construction yard and especially in camps	At all times during construction	Contractor/ NGO/Project Company	PIU and Project Company
2.26 SEA/SH and GBV Issues	▪ SEA/SH and GBV at work ▪ Health risks of labor relating to HIV/AIDS and other sexually transmitted diseases	▪ Integrate SEA/SH and GBV into existing GRM, safety talks/orientations and regular training. ▪ Training of laborers on SEA/SH and GBV issues.	At construction sites and in base camps	Throughout the project construction period	Contractor/ NGO/Project Company	PIU and Project Company

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		▪ Enforce a Code of Conduct for all the workers/officials including the security personnel. ▪ Identify hotspots for SEA/SH and GBV within the project area, including construction work and labor camps alongside local communities, schools and migrant laborers residing in rented accommodations within the adjacent community. ▪ Awareness raising campaigns on GBV and SEA/SH				
2.27 The Construction Period Environmental Completion	▪ Contractor fails to prepare a summary report defining the mitigation and monitoring actions completed and what needs to be continued during the Operating period. The result is a failed or weakened environmental safeguards programme.	▪ Prepare a completion report and deliver to the PIU.	N/A	Complete within the last one month of the Project	Contractor/ Project Company	Project Company
3.0 OPERATION PHASE						
3.1 Construction Period Decommissioning	Inspection of sites to be decommissioned by contractor, are: ▪ work camps; fuels storage areas ▪ waste dump sites; ▪ construct access roads ▪ But not undertaken, leading to chronic environmental problems due to a lack of proper clean-up.	▪ Undertaken a complete construction area inspection.	The entire length of the road	Within the first quarter of operations and before final payment made to contractor.	Contractor/ RHD	RHD/Project Company
3.2 Landscape/ Topography	▪ Structures attached with the road, such as interchanges would cause slight negative effect on landscape.	▪ It can be mitigated by tree plantation along the proposed Corridor. It would also serve as physical barrier between the road and the existing settlements as well as future developments. On the other hand, aesthetic beauty plays an important role. The	Along the entire corridor	At all times	Contractor/ RHD	RHD/Project Company

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		construction of new structures such as toll plaza as well as new carriageway with road side plantation will improve the aesthetics view of the project area.				
3.3 Air Quality	▪ Dust (PM) generated from the road surface dispersed to the air by vehicles running on the roads, and ▪ Toxic gases (NOx, SOx, CO, O_3, CO_2, etc.) generated from vehicle's engines when burning fuel.	▪ The road surface should be maintained periodically to limit dust generated from the aged asphalt layer. ▪ Black smoke producing old engine driven vehicles' movement shall be prohibited. ▪ In terms of intensity, total CO_2 emissions at business-as-usual, with-project (without induced traffic) and with project (with induced traffic) scenarios were estimated at 92,728.65 tons/year, 14,705.53 tons/year and 18,218.74 tons/year, respectively. These values are significantly below the 100,000 tons CO_2 e/year threshold set in ADB SPS 2009.	Along the entire corridor	At all times	Contractor/ RHD	RHD/Project Company
3.4 Noise and Vibration	▪ Noise pollution due to the movement of increased number of vehicles; and ▪ Wildlife particularly the birds will be affected mostly because of noise.	▪ The project is located in the urban area of Dhaka. The degree of urbanization along the line is relatively high. At present, the traffic flow on the old road is large. The current monitoring value of the noise of each acoustic environment sensitive point along the project has seriously exceeded the standard (the EIA report has corresponding monitoring value). The traffic noise mainly comes from machinery. Motor vehicle	To be determined during detailed design period for baseline establishment and as well as during construction period	At all times	Contractor/ RHD	RHD/Project Company

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		engine noise, tire friction noise and horn noise, especially the horn noise, are the most harsh, giving people the strongest impact on the senses. Therefore, only setting up sound barriers on newly built roads cannot fundamentally solve the problem of excessive noise, and the sound barriers have little effect on the reduction of whistle noise. ▪ It is recommended to set up no-sounding signs and traffic management and punishment measures for the main acoustic environment sensitive points along the line, control the noise pollution of motor vehicle whistles, and control the main noise sources. ▪ Take noise reduction forest belt measures instead of sound barrier measures at sensitive points with conditions, such as hedges. ▪ According to monitoring results, additional sound barriers in form of trees and hedges will be discussed with the affected people and planted if agreed; ▪ It is also suggested that surface roughness of the roads is maintained as per the design characteristics and honking should be discouraged through signboard displays. ▪ Signs for sensitive zones (health centres/educational institutions				

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		etc.) to disallow the use of pressure horns; ▪ Enforcement and penalties against traffic rules violators; and ▪ Noise monitoring shall be carried out as per the suggested monitoring plan.				
3.5 Water pollution (surface and groundwater)	▪ Uncontrolled release of contaminated storm-water/road runoff from road surfaces will pollute the surface water. ▪ Accidental spillage of hydrocarbon products from the vehicles moving on the road may cause nearby surface water pollution through surface runoff. Because of the project, many commercial and business structures will be constructed alongside the road which will cause increased groundwater extraction.	▪ Construction of sanitary toilet and arrangement of safe drinking water structures (e.g., deep tube well); ▪ Cross slopes and longitudinal drainage will be constructed to ensure faster removal of storm-water/road runoff; ▪ Drainage and collection structures on the road project, particularly in areas near the river and irrigation canals, shall be designed such that spills of hazardous materials shall not result to contamination of these water courses.	To be determined during detailed design period for baseline establishment and as well as during construction period	At all times	Contractor/ Project Company/ RHD	RHD/Project Company
3.6 Cultural/ Sensitive Structure	▪ Loss of cultural/sensitive structures will cause stress/tense on the PAPs; and ▪ Cultural/sensitive structures adjacent up to 250 m away from the ROW boundary will not be affected due to the noise and dust pollution.	▪ Proper rehabilitation of the cultural/sensitive structures will ease out the stresses of the PAPs.	Along the entire corridor	At all times	RHD/Project Company	RHD/Project Company
3.7 Road Accidents/ Road safety	▪ The increased vehicular movement and speed may result in road safety issues like traffic accidents. The accidents may also be due to tiredness. ▪ The vehicles may not follow speed limit having widened and free road which may cause road accidents.	▪ By enforcing speed limits and imposing penalties on the traffic violators will ensure the road safety. ▪ Traffic signs will be provided to facilitate road users about speed limits, rest areas, eating establishments etc. Warning messages will also be displayed at appropriate locations to aware	Along the entire corridor	At all times	RHD/Project Company	RHD/Project Company

Environmental Issues	Environmental Impacts	Mitigation Measures	Location	Timing/ Duration	Who will Implement	Who will Supervise
		drivers about likely accidents due to over speeding. ▪ All the lanes, median, sharp bends will be reflectorized to facilitate travelers in the night time. ▪ Proper lighting arrangement on the proposed highway will be done at required places. ▪ The BRTA rules should be followed strictly in every relevant case.				
3.8 Split of Communities	▪ Residents' daily activities, production activities, etc. would be significantly affected. ▪ In several cases, the expressway would not only split the communities, but also cause hindrance to people in accessing to the schools, hospitals, markets, administrative agencies, mosques etc.	▪ The locations of cross structures have been carefully determined based on existing and future condition of local areas. ▪ The cross structures combining with the SMVT Lane would help to mitigate impact of the expressway to local resident's movement.	Along the entire corridor	At all times	RHD/Project Company	RHD/Project Company
3.9 Income/ Job Opportunities	▪ Development of new infrastructure of residential, commercial, social and community is expected to be established alongside the upgraded highway.	▪ Illegal infrastructure development and encroachment alongside the road have to be checked and controlled.	Along the entire corridor	At all times	RHD/Project Company	RHD/Project Company

D. Environmental Monitoring Plan (EMoP)

472. The monitoring plan is one of the important tools of the implementing the mitigation plan for the proposed road project. The Monitoring plan provides guidance regarding environmental issues/parameters, location, frequency and means of monitoring.

473. The aim of environmental monitoring during the pre-construction, construction and operation phases of the project road is to compare the monitored data against the baseline condition collected during the study period (particularly during the detailed design stage) to assess the effectiveness of the mitigation measures and the protection of environmental components (e.g., air, water, soil, noise etc.) based on the national environmental standards (e.g., ECR 1997). Since the project is likely to have impact on various components of the environment, a comprehensive monitoring plan covering soil erosion, drainage congestion, tree plantation, air quality, water quality, noise, wildlife movement, workers' and community health and safety and so on need to be developed.

474. An Environmental Monitoring Plan (EMoP) has been prepared (Table VIII-2) along with this EIA for the execution to mitigate or minimize the adverse impacts associated with construction and operational activities of the project on the natural and social environments.

1. Objectives of the Environmental Monitoring Plan

475. The objective of environmental monitoring during the construction and operation phases is to compare the monitored data against the baseline condition collected during the study period to assess the effectiveness of the mitigation measures and the protection of the ambient environment based on national standards. The main objectives of the pre-construction, construction and operation phase monitoring plans will be to:

- ☐ Monitor the actual impact of the works on physical, biological and socioeconomic receptors within the project corridor for indicating the adequacy of the EIA;
- ☐ Recommend mitigation measures for any unexpected impact or where the impact level exceeds that anticipated in the EIA;
- ☐ Ensure compliance with legal and community obligations including safety on construction sites;
- ☐ Monitor the rehabilitation and restoration of construction campsites as described in the EMP;
- ☐ Ensure the safe disposal of excess construction materials.
- ☐ Appraise the adequacy of the EIA with respect to the project's predicted long-term impacts on the corridor's physical, biological and socio-economic environment;
- ☐ Evaluate the effectiveness of the mitigation measures proposed in the EMP and recommend improvements, if and when necessary;
- ☐ Compile periodic accident data to support analyses that will help minimize future risks; and
- ☐ Monitor the survival rate of avenue plantations.

Table VIII-2: Environmental Monitoring Plan

Environmental Issues	Monitoring Method			Responsible Organization	
	Method of Collecting and Reporting	Location	Duration and Frequency	Implement	Supervise
1.0 PRE-CONSTRUCTION PHASE					
1.1 Landscape/ Topography	Consultation with adjacent households along the road	Throughout the alignment, bridges and culverts, embankment height	Throughout the pre-construction period.	Design consultants (DC)	PIU
1.2 Land Acquisition and Resettlement	Ensure that PAPs get compensation as per RAP; and Resettlement of PAPs as per the procedure of RAP.	Along the project's alignment	As per RAP	PIU/District Commissioner (DC)/NGO	PIU and Project Company
1.3 Removal of Commercial Structures	Safe removal/or relocation; and Handling and transport of debris.	Along the project's alignment	As per RAP	PIU/DC/NGO	PIU and Project Company
1.4 Removal of Physical, Cultural and Other Community Structures	The physical cultural and community structures to be relocated in stages, after consultation with local communities. Local communities will be compensated for dismantling and relocating these sites.	Along the project's alignment	As per RAP	PIU/DC/NGO	PIU and Project Company
1.5 Damage to Public Utilities	Ensure that the respective authority of utility service providers and consumers are informed in time; and Inspect those utilities are being relocated at the designated site maintaining proper safety measures	Along the project's alignment	As per RAP and/or utility relocation plan prepared by RHD	PIU /DC/ BPDB/BTCL	PIU and Project Company
1.6 Tree Cutting and Wildlife	Ensure that the respective authority of utility service providers and consumers are informed in time; and Inspect those utilities are being relocated at the designated site	Along the project's alignment	As per RAP and/or utility relocation plan prepared by RHD	Arboriculture Department/ PIU /DC	PIU, MoEFCC, and Project Company

<table>
<tr><th rowspan="2">Environmental Issues</th><th colspan="3">Monitoring Method</th><th colspan="2">Responsible Organization</th></tr>
<tr><th>Method of Collecting and Reporting</th><th>Location</th><th>Duration and Frequency</th><th>Implement</th><th>Supervise</th></tr>
<tr><td></td><td>maintaining proper safety measures</td><td></td><td></td><td></td><td></td></tr>
<tr><td>1.7 Water Bodies and Fisheries</td><td>Inspect waste and field management at camps and record actions taken when non-compliance recorded</td><td>Along the project's alignment</td><td>Construction and operation stage/ Monthly inspection/ Long term</td><td>PIU /DC/NGO</td><td>PIU, DOF and Project Company</td></tr>
<tr><td>1.8 Labour Standard</td><td>Confirm that these standards are specifically incorporated into the contract documents either as clauses or by appending this EMP to the contract.</td><td>Construction site and labour camp</td><td>Once as contract documentation is being prepared</td><td>PIU, and Project Company</td><td>RHD</td></tr>
<tr><td>1.9 Technical Capacity to undertake all environmental work</td><td>Minutes of workshop, attendance list and presentation review</td><td>N/A</td><td>During the pre-construction period</td><td>PIU, and Project Company</td><td>RHD</td></tr>
<tr><td colspan="6">2.0 CONSTRUCTION PHASE</td></tr>
<tr><td>2.1 Landscape/ Topography</td><td>Consultation with adjacent households and RHD authority to get opinion on work being completed.</td><td>Along the project's alignment</td><td>Construction stage/Monthly inspection</td><td>Project Company</td><td>PIU and Project Company</td></tr>
<tr><td>2.2 Loss of Top Soil</td><td>Top soil management</td><td>Along the project's alignment</td><td>Construction stage/Monthly inspection</td><td>Project Company</td><td>PIU and Project Company</td></tr>
<tr><td>2.3 Dredging and Dredged Materials</td><td>Fe, Cu, Pb, Zn, P, SO_4^{2-}</td><td>Proposed dredging sites
4 locations
<table>
<tr><th>Location</th><th>GPs</th><th>Chainage</th></tr>
<tr><td>Nagdarpar Khal, Bonoshree, Dhaka</td><td>23.767237°N 90.427830°E</td><td>C/S No. -142 CH. 12+050 km</td></tr>
<tr><td>Rampura Khal, Rampura, Dhaka</td><td>23.749900°N 90.460027°E</td><td>Between C/S No. -161 to -160 CH.</td></tr>
</table></td><td>Once; during the sourcing</td><td>Contractor/Project Company</td><td>PIU and Project Company</td></tr>
</table>

<table>
<tr><th rowspan="2">Environmental Issues</th><th colspan="4">Monitoring Method</th><th colspan="2">Responsible Organization</th></tr>
<tr><th>Method of Collecting and Reporting</th><th colspan="3">Location</th><th>Duration and Frequency</th><th>Implement</th><th>Supervise</th></tr>
<tr><td></td><td></td><td colspan="3"><table>
<tr><td></td><td></td><td>08+000 km to 07+950 km</td></tr>
<tr><td>Shitalakshya River, Siddhirganj, Dhaka</td><td>23.722250°N 90.499085°E</td><td>C/S No. -61 CH. 03+000 km</td></tr>
<tr><td>Demra Khal, Demra, Dhaka</td><td>24.71991°N 90.49303°E</td><td>C/S No. -60 CH. 02+950 km</td></tr>
</table></td><td></td><td></td><td></td></tr>
<tr><td>2.4 Soil Contamination</td><td>Careful and proper handling of oil and other hazardous liquids by trained personnel; and
Handling/disposal of oil and liquid wastes at designated site; and

pH, Total Organic Matter, Soil Texture, Pb, Cr, Hg, Cd, Zn, Fe, Mn, As, Cu, EC</td><td colspan="3">Along the whole alignment;
Construction yards and dumping sites

4 locations<table>
<tr><th>Location</th><th>GPs</th><th>Chainage</th></tr>
<tr><td>Yamagata Dhaka Friendship Hospital, Rampura</td><td>23.761625° N 90.444196° E</td><td>C/S No. -204 CH. 10+150 km</td></tr>
<tr><td>Beside Bonoshree Main Road</td><td>23.767511° N 90.423707° E</td><td>C/S No. -149 CH. 12+400 km</td></tr>
<tr><td>Demra Ideal College</td><td>23. 72161° N 90. 48959° E</td><td>C/S No. -67 CH. 03+300 km</td></tr>
<tr><td>Beside Sugandha Hospital, Shimrail,</td><td>23.698837° N 90.508504° E</td><td>Between C/S No. -04 to -03 CH. 00+150</td></tr>
</table></td><td>Regular/and or during construction period;

Quarterly</td><td>Contractor/Project Company</td><td>PIU and Project Company</td></tr>
</table>

<table>
<tr><th rowspan="2">Environmental Issues</th><th colspan="3">Monitoring Method</th><th colspan="2">Responsible Organization</th></tr>
<tr><th>Method of Collecting and Reporting</th><th>Location</th><th>Duration and Frequency</th><th>Implement</th><th>Supervise</th></tr>
<tr><td></td><td></td><td>Chattogram Road | | km to 00+100 km</td><td></td><td></td><td></td></tr>
<tr><td>2.5 Air Pollution and Dust</td><td>$PM_{2.5}$, PM_{10}, CO, SO_2, NOx, O_3</td><td>Residential/Populated/Cultural areas near to construction site along the alignment. In particular, the following locations must be given priority for AQM- School, college, hospital; Major populated areas; and Major road intersection points.

6 locations
<table><tr><th>Location</th><th>GPs</th><th>Chainage</th></tr><tr><td>Meradia Bazar, Rampura, Dhaka</td><td>23.762032°N 90.443609°E</td><td>C/S No. - 206 CH. 10+250 km</td></tr><tr><td>Aichi Medical College, Mendipur, Amulia, Dhaka</td><td>23.739986°N 90.479863°E</td><td>C/S No. - 113 CH. 05+600 km</td></tr><tr><td>Bonoshree Central Jame Mosque, Bonoshree, Dhaka</td><td>23.763663°N 90.431573°E</td><td>C/S No. - 231 CH. 11+500 km</td></tr><tr><td>Beside Rampura Bridge Police Box, Rampura, Dhaka</td><td>23.767401°N 90.423261°E</td><td>C/S No. - 250 CH. 12+450 km</td></tr></table></td><td>Quarterly</td><td>Contractor/Project Company</td><td>PIU and Project Company</td></tr>
</table>

<table>
<tr><th rowspan="2">Environmental Issues</th><th colspan="3">Monitoring Method</th><th colspan="2">Responsible Organization</th></tr>
<tr><th>Method of Collecting and Reporting</th><th>Location</th><th>Duration and Frequency</th><th>Implement</th><th>Supervise</th></tr>
<tr><td></td><td></td><td><table>
<tr><td>Staff Quarter Jame Mosque, Demra, Dhaka</td><td>23.720360°N 90.491715°E</td><td>C/S No. - 62 CH. 03+050 km</td></tr>
<tr><td>Near Sugandha Hospital, Chattogram Road, Dhaka</td><td>23.697662°N 90.509537°E</td><td>C/S No. - 01 CH. 00+000 km</td></tr>
</table></td><td></td><td></td><td></td></tr>
<tr><td>2.6 Noise and Vibration</td><td>Measurement of noise level in dBA and vibration in velocity, acceleration, displacement</td><td>Sensitive spots (school, college, mosque, hospital) and construction yard

12 locations for noise level measurement and<table>
<tr><th>Location</th><th>GPs</th><th>Chainage</th></tr>
<tr><td>Meradia Bazar, Rampura, Dhaka</td><td>23.762089° N 90.443466° E</td><td>C/S No. - 207 CH. 10+300 km</td></tr>
<tr><td>Beside National Ideal School and College, Bonoshree, Rampura, Dhaka</td><td>23.762317° N 90.440339° E</td><td>C/S No. - 213 CH. 10+600 km</td></tr>
<tr><td>Bonoshree Central Jame Mosque,</td><td>23.763592° N</td><td>C/S No. - 231 CH.</td></tr>
</table></td><td>Quarterly</td><td>Contractor/Project Company</td><td>PIU and Project Company and RHD</td></tr>
</table>

Environmental Issues	Monitoring Method					Responsible Organization	
	Method of Collecting and Reporting	Location			Duration and Frequency	Implement	Supervise
		Bonoshree, Dhaka	90.431749° E	11+500 km			
		Beside Rampura Bridge Police Box	23.767437°N 90.423241°E	C/S No. -250 CH. 12+450 km			
		Bonoshree Adarsha Bidda Niketon School and College, Bonoshree, Dhaka	23.76306° N 90.43398° E	C/S No. -226 CH. 11+250 km			
		Nandipara Bus Stop, Rampura, Dhaka	23.751376°N 90.453586°E	C/S No. -174 CH. 08+650 km			
		Sarulia Bazar Jame Mosque, Sarulia, Dhaka	23.716238°N 90.496155°E	C/S No. -50 CH. 02+450 km			
		Demra Fire Station, Demra, Dhaka	23.71393° N 90.49777° E	Between C/S No. -44 to -43 CH. 02+150 km to 02+100 km			
		Staff Quarter Jame Mosque,	23.720129^0 N 90.491336^0 E	C/S No. -62 CH. 03+050 km			

<table>
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<tr><th>Method of Collecting and Reporting</th><th>Location</th><th>Duration and Frequency</th><th>Implement</th><th>Supervise</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>Demra, Dhaka</td><td></td><td></td></tr>
<tr><td>Sarulia DPDC, Sarulia, Dhaka</td><td>23.717709°N 90.495160°E</td><td>Between C/S No. -54 to -53 CH. 02+650 km to 02+600 km</td></tr>
<tr><td>Infront of Gas Transmission Company Limited, Demra, Dhaka</td><td>23.710745°N 90.500286°E</td><td>C/S No. -35 CH. 01+700 km</td></tr>
<tr><td>Near Sugandha Hospital, Chattogram Road, Dhaka</td><td>23.697620°N 90.509541°E</td><td>C/S No. -01 Ch. 00=000 km</td></tr>
</table>
6 locations for vibration level measurement
<table>
<tr><th>Location</th><th>GPs</th><th>Chainage</th></tr>
<tr><td>Meradia Bazar, Rampura, Dhaka</td><td>23.762032°N 90.443609°E</td><td>C/S No. -206 CH. 10+250 km</td></tr>
<tr><td>Aichi Medical College, Mendipur,</td><td>23.739986°N 90.479863°E</td><td>C/S No. -113 CH. 05+600 km</td></tr>
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<tr><th rowspan="2">Environmental Issues</th><th colspan="3">Monitoring Method</th><th colspan="2">Responsible Organization</th></tr>
<tr><th>Method of Collecting and Reporting</th><th>Location</th><th>Duration and Frequency</th><th>Implement</th><th>Supervise</th></tr>
<tr><td></td><td></td><td><table>
<tr><td>Amulia, Dhaka</td><td></td><td></td></tr>
<tr><td>Bonoshree Central Jame Mosque, Bonoshree, Dhaka</td><td>23.763663°N 90.431573°E</td><td>C/S No. - 231 CH. 11+500 km</td></tr>
<tr><td>Beside Rampura Bridge Police Box, Rampura, Dhaka</td><td>23.767401°N 90.423261°E</td><td>C/S No. - 250 CH. 12+450 km</td></tr>
<tr><td>Staff Quarter Jame Mosque, Demra, Dhaka</td><td>23.720360°N 90.491715°E</td><td>C/S No. - 62 CH. 03+050 km</td></tr>
<tr><td>Near Sugandha Hospital, Chattogram Road, Dhaka</td><td>23.697662°N 90.509537°E</td><td>C/S No. - 01 CH. 00+000 km</td></tr>
</table></td><td></td><td></td><td></td></tr>
<tr><td>2.7 Surface Water Quality</td><td>Temperature, Turbidity, pH, EC, TSS, TDS, DO, Salinity, Alkalinity, As, COD, BOD, TC, FC, Cu, F, Cd, Fe, Pb, Zn, SO_4^{2-}, Mg.</td><td>From major surface water body;
4 locations<table>
<tr><th>Location</th><th>GPs</th><th>Chainage</th></tr>
<tr><td>Rampura Khal, Rampura, Dhaka</td><td>23.767511^0 N 90.423707^0 E</td><td>C/S No. - 149 CH. 12+400 km</td></tr>
</table></td><td>Quarterly</td><td>Contractor/Project Company</td><td>PIU and Project Company</td></tr>
</table>

<table>
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<tr><th>Method of Collecting and Reporting</th><th colspan="3">Location</th><th>Duration and Frequency</th><th>Implement</th><th>Supervise</th></tr>
<tr><td></td><td></td><td colspan="3"><table>
<tr><td>Deb Dholai Khal, Nagdarpar, Khilgaon</td><td>23.749825^0 N 90.460082^0 E</td><td>C/S No. -160 CH. 07+950 km</td></tr>
<tr><td>Demra khal, Demra, Dhaka</td><td>23. 71991^0 N 90. 49303^0 E</td><td>C/S No. -60 CH. 02+950 km</td></tr>
<tr><td>Shitalakshya river, Siddhirganj, Dhaka</td><td>23.722250°N 90.499085°E</td><td>C/S No. -61 CH. 03+000 km</td></tr>
</table></td><td></td><td></td><td></td></tr>
<tr><td>2.8 Groundwater Quality</td><td>Temperature, Turbidity, pH, EC, TSS, TDS, DO, Salinity, Alkalinity, As, COD, BOD, TC, FC, Cu, F, Cd, Fe, Pb, Zn, SO_4^{2-}, Mg.</td><td colspan="3">Sites where the pile drilling to 30 m depth is conducted and/or where any new wells are dug or a well becomes a camp potable water supply, testing to be undertaken.

4 locations<table>
<tr><th>Location</th><th>GPs</th><th>Chainage</th></tr>
<tr><td>Yamagata Dhaka Friendship Hospital, Rampura</td><td>23.761625° N 90.444196° E</td><td>C/S No. -204 CH. 10+150 km</td></tr>
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<tr><td>Beside Sugandha Hospital,</td><td>23.698837° N</td><td>Between C/S No. -04 to -03 CH.</td></tr>
</table></td><td>Quarterly</td><td>Contractor/Project Company</td><td>PIU and Project Company</td></tr>
</table>

Environmental Issues	Monitoring Method			Responsible Organization	
	Method of Collecting and Reporting	Location	Duration and Frequency	Implement	Supervise
		Shimrail, Chattogram Road | 90.508504° E | 00+150 km to 00+100 km			
2.9 Vegetation	Ensure clearance of vegetation in accordance with the plans and check the re-vegetation done at the earliest	Along the project's alignment	Regular/and or during construction period	Contractor/Project Company	PIU and Project Company
2.10 Terrestrial Fauna	As part of the monthly site inspection, examine embankments, subgrade storage areas, to confirm these facilities are not contributing to environmental degradation	Along the project's alignment	Throughout the Construction Period	Contractor/Project Company	PIU and Project Company
2.11 Aquatic Species	Evaluation of existence of species;	Along the project's alignment	Throughout the Construction Period	Contractor/Project Company	PIU and Project Company
2.12 Fisheries	Confirming the population and change in types of fish species	Along the project's alignment	Throughout the Construction Period	Contractor/Project Company	PIU and Project Company
2.13 Pollution from Wastes	Waste and effluents to be collected and disposed safely to the designated sites;	Construction yard and dumping sites	Weekly	Contractor/Project Company	PIU and Project Company
2.14 Asphalt Hot Mix Plant, Rock Crushing, and Bitumen Supply	Wastes and garbage from bridge construction sites to be disposed properly at the designated sites.	Construction yard and dumping sites	Weekly	Contractor/Project Company	PIU and Project Company
2.15 Construction Waste Disposal (Waste water, Oil, Hazardous Waste etc.)	Checking storage, transportation, handling, and disposal of hazardous waste;	Construction yard, bridge and dumping sites	Weekly	Contractor/Project Company	PIU and Project Company
2.16 Construction Yards	Undertake good housekeeping practices inspection weekly and report results and record what actions taken to mitigate	Construction yard	Weekly	Contractor/Project Company	PIU and Project Company

Environmental Issues	Monitoring Method			Responsible Organization	
	Method of Collecting and Reporting	Location	Duration and Frequency	Implement	Supervise
2.17 Occupational Health and Safety (OHS)	Check quality of food and accommodation at construction camp; Check safe water supply, hygienic toilet at camps, construction of drain at camp sites; Check toilets are close to construction site and separate toilet for female workers; First Aid Box with required tools and medicines; The heavy construction material to handled and stored safely putting due care on public safety; Heavy construction materials at bridges construction sites to be stored and handled safely.	Construction site and labour camp	Regularly	Contractor/Project Company	PIU and Project Company
2.18 Community Health and Safety	Control movement of project traffics especially at densely populated areas such as school, bazars etc. to avoid any accident.	School, college, mosque, bazar etc.	Regularly	Contractor/Project Company	Project Company/ Local Authority
2.19 Health and Vector Borne Diseases	Undertake checks at all sites and instruct contractors to take immediate action if non-compliance identified	Construction site and labour camp	Regularly	Contractor/Project Company	PIU and Project Company
2.20 Traffic Congestion	Traffic volume, composition, and speed	Along the project's alignment	Continuous records	Contractor/Project Company	PIU and Project Company
2.21 Road Accidents	Evaluation of effect of traffic schedules; Fitness of vehicles should be strictly maintained.	Project Company's office	Continuous records	Contractor/Project Company	PIU and Project Company

Environmental Issues	Monitoring Method			Responsible Organization	
	Method of Collecting and Reporting	Location	Duration and Frequency	Implement	Supervise
2.22 Income/Job Opportunities	Control illegal infrastructure development and encroachment alongside	Along the project's alignment	Regularly	RHD/Contractor/ Project Company	PIU and Project Company
2.23 Tree Plantation	Ensure that tree plantation plan is followed properly during planting seedlings of around 17460 trees.	Along the project's alignment	Periodic at the end of the construction of each road section.	RHD/Contractor/ Project Company	Project Company and Arboriculture Department
2.24 Labor Issues	Collection complains or suggestions from the GRM box and also from training session on weekly basis.	Construction yard and camp sites	Monthly	RHD/Contractor/ Project Company	PIU and Project Company
2.25 SEA/SH and GBV Issues	Collection complains or suggestions from the GRM box and also from training session on weekly basis.	At construction sites and in base camps	Throughout the project construction period	Contractor/ Project Company	PIU and Project Company
2.26 Drainage Congestion	Maintain checklist and reporting	Along the alignment	Throughout the project construction period	Contractor/ Project Company	PIU and Project Company
2.27 The Construction Period Environmental Completion Reporting	Prepare a completion report and deliver to the PIU.	N/A	Once at the end of construction period	Contractor/ Project Company	PIU and Project Company
3.0 OPERATION PHASE					
3.1 Construction Period Decommissioning	Inspect to be sure that work camps, fuel storage areas, waste dumps, toilet facilities and construction access roads have been properly decommissioned and no contamination is likely.	All semi-permanent farcicalities	Within one month of operation	Contractor/ RHD/Project Company	RHD/Project Company
3.2 Landscape/ Topography	Consultation with adjacent households and RHD to get opinion on work being completed.	Along the alignment	Regular	Contractor/ RHD/Project Company	RHD/Project Company

<table>
<tr><th rowspan="2">Environmental Issues</th><th colspan="3">Monitoring Method</th><th colspan="2">Responsible Organization</th></tr>
<tr><th>Method of Collecting and Reporting</th><th>Location</th><th>Duration and Frequency</th><th>Implement</th><th>Supervise</th></tr>
<tr><td>3.3 Air Quality</td><td>$PM_{2.5}$, PM_{10}, CO, SO_2, NOx, O_3</td><td>Most busy traffic points

3 Locations
<table><tr><th>Location</th><th>GPs</th><th>Chainage</th></tr><tr><td>Meradia Bazar, Rampura, Dhaka</td><td>23.762032°N 90.443609°E</td><td>C/S No. -206 CH. 10+250 km</td></tr><tr><td>Beside Rampura Bridge Police Box, Rampura, Dhaka</td><td>23.767401°N 90.423261°E</td><td>C/S No. -250 CH. 12+450 km</td></tr><tr><td>Near Sugandha Hospital, Chattogram Road, Dhaka</td><td>23.697662°N 90.509537°E</td><td>C/S No. -01 CH. 00+000 km</td></tr></table></td><td>Semiannually for operating Years 1, 3 and 5.</td><td>Contractor/ RHD/Project Company</td><td>RHD/Project Company</td></tr>
<tr><td>3.4 Noise and Vibration</td><td>Measurement of noise dB(A) and vibration in velocity, acceleration, displacement</td><td>Bus Stoppages/cultural sites along the alignment

6 Locations for both noise and vibration
<table><tr><th>Location</th><th>GPs</th><th>Chainage</th></tr><tr><td>Meradia Bazar, Rampura, Dhaka</td><td>23.762032°N 90.443609°E</td><td>C/S No. -206 CH. 10+250 km</td></tr><tr><td>Bonoshree Central Jame Mosque, Bonoshree, Dhaka</td><td>23.763663°N 90.431573°E</td><td>C/S No. -231 CH. 11+500 km</td></tr></table></td><td>Semiannually for operating Years 1, 3 and 5.</td><td>Contractor/ RHD/Project Company</td><td>RHD/Project Company</td></tr>
</table>

<table>
<tr><th rowspan="2">Environmental Issues</th><th colspan="3">Monitoring Method</th><th colspan="2">Responsible Organization</th></tr>
<tr><th>Method of Collecting and Reporting</th><th>Location</th><th>Duration and Frequency</th><th>Implement</th><th>Supervise</th></tr>
<tr><td></td><td></td><td><table>
<tr><td>Beside Rampura Bridge Police Box, Rampura, Dhaka</td><td>23.767401°N 90.423261°E</td><td>C/S No. - 250 CH. 12+450 km</td></tr>
<tr><td>Mostam Haji Mor, Rampura, Dhaka</td><td>23.746545°N 90.472206°E</td><td>C/S No. - 134 CH. 06+650 km</td></tr>
<tr><td>Staff Quarter Jame Mosque, Demra, Dhaka</td><td>23.720360°N 90.491715°E</td><td>C/S No. - 62 CH. 03+050 km</td></tr>
<tr><td>Near Sugandha Hospital, Chattogram Road, Dhaka</td><td>23.697662°N 90.509537°E</td><td>C/S No. - 01 CH. 00+000 km</td></tr>
</table></td><td></td><td></td><td></td></tr>
<tr><td>3.5 Water pollution (surface and groundwater)</td><td>Temperature, Turbidity, pH, EC, TSS, TDS, DO, Salinity, Alkalinity, As, COD, BOD, TC, FC, Cu, F, Cd, Fe, Pb, Zn, SO_4^{2-}, Mg.</td><td>At major surface water body;
3 Locations<table>
<tr><th>Location</th><th>GPs</th><th>Chainage</th></tr>
<tr><td>Rampura Khal, Rampura, Dhaka</td><td>23.767511^0 N 90.423707^0 E</td><td>C/S No. - 149 CH. 12+400 km</td></tr>
<tr><td>Deb Dholai Khal, Nagdarpar, Khilgaon</td><td>23.749825^0 N 90.460082^0 E</td><td>C/S No. - 160 CH. 07+950 km</td></tr>
</table></td><td>Semiannually for operating Years 1, 3 and 5.</td><td>Contractor/ RHD/Project Company</td><td>RHD/Project Company</td></tr>
</table>

<table>
<tr><th rowspan="2">Environmental Issues</th><th colspan="3">Monitoring Method</th><th colspan="2">Responsible Organization</th></tr>
<tr><th>Method of Collecting and Reporting</th><th>Location</th><th>Duration and Frequency</th><th>Implement</th><th>Supervise</th></tr>
<tr><td></td><td></td><td>
<table>
<tr><td>Shitalakshya river, Siddhirganj, Dhaka</td><td>23.722250°N 90.499085°E</td><td>C/S No. -61 CH. 03+000 km</td></tr>
</table>
Hand pump or supply water adjacent the alignment;

3 Location
<table>
<tr><th>Location</th><th>GPs</th><th>Chainage</th></tr>
<tr><td>Yamagata Dhaka Friendship Hospital, Rampura</td><td>23.761625° N 90.444196° E</td><td>C/S No. -204 CH. 10+150 km</td></tr>
<tr><td>Demra Ideal College</td><td>23. 72161° N 90. 48959° E</td><td>C/S No. -67 CH. 03+300 km</td></tr>
<tr><td>Beside Sugandha Hospital, Shimrail, Chattogram Road</td><td>23.698837° N 90.508504° E</td><td>Between C/S No. -04 to -03 CH. 00+150 km to 00+100 km</td></tr>
</table>
</td><td></td><td></td><td></td></tr>
<tr><td>3.6 Cultural/ Sensitive Structure</td><td>Cultural/sensitive structures adjacent up to 250 m away from the ROW boundary will not be affected due to the noise and dust pollution</td><td>Along the road side in front of the cultural structures</td><td>Regular</td><td>RHD/Project Company</td><td>RHD/Project Company</td></tr>
<tr><td>3.7 Road Accidents/ Road safety</td><td>Traffic signs, kilometre posts, speed breakers (where required) along the road and traffic signal at road crossing have to be provided.</td><td>At designated places (intersection points, cultural structures, School, hospital)</td><td>Regular</td><td>RHD/Project Company</td><td>RHD/Project Company</td></tr>
</table>

Environmental Issues	Monitoring Method			Responsible Organization	
	Method of Collecting and Reporting	Location	Duration and Frequency	Implement	Supervise
3.8 Split of Communities	Clearance at important road such as district road and main road of upazilas	At designated places (intersection points, cultural structures, School, hospital)	Regular	RHD/Project Company	RHD/Project Company
3.9 Income/ Job Opportunities	Control illegal infrastructure development and encroachment alongside	At market areas	Regular	RHD/Project Company	RHD/Project Company

E. Budget for the Environmental Monitoring

476. Most of the mitigation measures require the contractors/project authority to adopt good site practice, which should be part of their normal procedures already, so there are unlikely to be major costs associated with compliance.

477. Mitigation that is the responsibility of RHD and contractor's will be provided as part of their management of the project. The cost estimation for Environmental Mitigation Measures and Monitoring is given in the following. The monitoring budget for Pre-construction and Construction period (3 years) is calculated as BDT 140,551,000 or USD. 1,484,171[18] including the remuneration of Contractor's Environment, Health and Safety Officer whereas for Operation and Establishment & Training (both per year) is calculated as BDT 1,722,000 or USD 18,184. The total duration of the engagement of these experts will be decided as per the requirement of the project after getting approval from the PIU. The below Table VIII-3 only calculated the environmental monitoring cost.

Table VIII-3: Estimated Budget for Environmental Monitoring

Preconstruction and Construction Phase

Component	Item	Unit	Quantity	Rate (in BDT)	Amount (in BDT)
PRE-CONSTRUCTION STAGE					
Utilities shifting	Tree removal, house, shop and infrastructure shifting	Included in the RAP			
Air Quality	Measuring air quality	No.	5	25,000	125,000
Noise	Measuring ambient noise level	No.	16	15,000	240,000
Vibration	Measuring ambient noise level	No.	8	15,000	120,000
Water Quality	Surface water quality	No.	5	25,000	125,000
	Groundwater quality	No.	5	27,000	135,000
Soil Quality	Measuring soil quality	No.	5	25,000	125,000
Riverbed Sediment	Heavy Metals	No.	5	25,000	125,000
Flora-Fauna Survey	Quadrat, Transect Walk, Transect Line	Lump-sum			300,000
Environmental Sensitive Location Survey		Lump-sum			200,000
				Subtotal (BDT)	**1,495,000**
CONSTRUCTION STAGE (3 years)					
Air Quality	Measuring air quality	No.	72	25,000	1,800,000
Noise	Measuring ambient noise level	No.	144	15,000	2,160,000
Vibration	Measuring ambient noise level	No.	72	15,000	1,080,000
Water Quality	Surface water quality	No.	48	27,000	1,296,000
	Groundwater quality	No.	48	25,000	1,200,000
Soil Quality	Measuring soil quality	No.	48	25,000	1,200,000
Riverbed Sediment	Heavy Metals	No.	48	25,000	1,200,000
Tree Plantation and Management	Along the project approach road	No.	17,460	5,000	87,300,000
Environmental hotspot survey	Along the project approach road	Lump-sum			600,000

[18] 1 USD = 94.7 BDT, as per website of Bangladesh Bank dated 07 August 2022, https://www.bb.org.bd/en/index.php

Component	Item	Unit	Quantity	Rate (in BDT)	Amount (in BDT)
Socio-Economic Survey	Along the project approach road	Lump-sum			600,000
Traffic Congestion	Along the project approach road	Lump-sum			600,000
Water Spraying for Dust Suppression	Along the project approach road	Lump-sum			900,000
Remuneration of Environmental Specialist	Throughout the project construction period	month	36	350,000	12,600,000
Remuneration of Social Specialist	Throughout the project construction period	month	36	320,000	11,520,000
Remuneration of Occupational Health and Safety Specialist	Throughout the project construction period	month	36	280,000	10,080,000
Remuneration of Environmental Health and Safety Officer	Throughout the project construction period	month	36	70,000	2,520,000
Waste disposal and management	Disposal and management of construction waste and solar panels of individual households	Lump sum			600,000
Construction Safety	General Safety (provision of PPE like ear muffs, gloves etc.)	Lump sum			600,000
Training& Workshop	Health and Safety, Environmental and social issues, GBV issues etc.	No.	12	50,000	600,000
Health and Safety	Health check-up camps for construction workers	Camp	Lump-sum		600,000
				Subtotal (BDT)	**139,056,000**
				Total (Preconstruction + Construction)	**140,551,000**

Operation and Training

Component	Item	Unit	Quantity/ Year	Rate (in BDT)	Amount (BDT)
OPERATION STAGE (Yearly)					
Air Quality	Monitoring air quality	No.	6	25,000	150,000
Noise	Monitoring ambient noise level	No.	12	15,000	180,000
Vibration	Measuring ambient noise level	No.	12	15,000	180,000
Water	Monitoring surface water	No.	6	25,000	150,000
	Monitoring groundwater	No.	6	27,000	162,000
Environmental and Social Survey	Lump-sum				200,000
Environmental and Social Management	Lump-sum				300,000
				Subtotal (BDT)	**1,322,000**
ESTABLISHMENT AND TRAINING (Yearly)					
Training	Environmental training and awareness (Semi-annual, annual, monthly etc. and on different aspects)	No.	4	50,000	200,000
Management Information System		Lump sum	-	200,000	200,000
				Subtotal (BDT)	**400,000**
				Total (Operation + Establishment and Training)	**1,722,000**

Summary of the Monitoring Budget

Phase	Cost Amount (BDT)
Pre-Construction	1,495,000
Construction (3 years)	139,056,000
Operation (per year)	1,322,000
Establishment and Training (per year)	400,000

IX. STAKEHOLDER ENGAGEMENT PLAN AND FOCUS GROUP DISCUSSION

A. Introduction

478. A public consultation with identified stakeholders is developed, along with an assessment of their interest in the project. Focus group discussions (FGD) are held as part of the stakeholder engagement process in collaboration with the project proponent. The process of public consultation and disclosure is one of the prerequisites of any development project's environmental safeguard aspect and, as such, is an integral part of the corresponding EIA process. Furthermore, it assists the project's proponent in obtaining the necessary public acceptance. The proposed project's consultation process, like all other development projects, adhered to the environmental safeguard requirements applicable to the project. The consultant and project proponent will conduct enough engagement to garner "wide community support," guided by the DoE's stakeholder engagement procedure.

479. The consultation process and its outcomes are to be documented and reflected in the EIA as stakeholders' views and concerns are communicated to decision makers and taken into account by the Project.

480. It is essential that the communities as whole and individual members of the community are given every opportunity to express their views, concerns and worries in connection with the expected and projected environmental impacts and construction impacts for each of the proposed projects. The support of the community is a key indicator of the success of a project and it will therefore be essential that the communities are given the opportunity to express their views during the initial planning and design, during the construction phase and during operation of the projects.

481. RHD recognizes the importance of social and environmental factors in the successful implementation of the proposed project and intends to conduct a comprehensive process of public consultation and environmental investigation. The feedback from the consultation process will be used to shape the social and environmental programs. The goal of consultation is to inform the local community and key stakeholders about the project, gather their feedback on the suggested development program, and incorporate their suggestions into the project's planning and execution phases. The project started with the beginning of a consultation process. The main goal was to give stakeholders the chance to share their opinions during project planning and decision-making processes while also keeping them informed about project proposals and developments.

482. The project's stakeholders, that included key informants, potentially impacted individuals, local community members, local officials, government organizations, and members of NGOs, participated in planned meetings and/or focus group discussions to achieve community involvement. A multidisciplinary team of social and environmental professionals ran the meetings.

483. At meetings, a Project Information Sheet in English and Bengali was distributed to local residents and government officials. Members of the EIA Project team also described Project components, listened to suggestions, and responded to stakeholder questions to the best of their abilities. To maintain a consistent approach and to aid in the gathering of relevant data and information pertaining to each individual stakeholder, specific checklists were also developed.

484. A structured survey questionnaire was distributed to households in the Project area to help create the baseline, identify key concerns of local people, understand how the Project may impact

local people, and log local people's suggestions. Issues and perspectives expressed by various stakeholders have been incorporated into this EIA and, where appropriate, aligned with the development of specific management and mitigation measures.

B. Objectives

485. The overall objective of this public consultation is to define a program for stakeholder engagement, including public information disclosure and consultation, throughout the construction and operation of the proposed project. This outlines the ways in which RHD, RAD and funding agency will communicate with stakeholders and includes a mechanism by which people can raise concerns, provide feedback, or make any complaints about project interventions, the contractors, and the project(s) themselves. Public consultation is a useful tool for managing communications between the implementing agency, the supervision organization and its stakeholders.

486. The Key Objectives can be summarized as follows:

- Identify key stakeholders that are affected, and/or able to influence the Project and its activities;
- Identify the most effective methods, timing and structures through which to share project information, and to ensure regular, accessible, transparent and appropriate consultation;
- Develops a stakeholder's engagement process that provides stakeholders with an opportunity to engage in project planning and design and its implementation;
- Provide guidance for stakeholder engagement such that it meets the standards of national and international best practices
- Establish formal grievance/resolution mechanisms;
- Define roles and responsibilities for the implementation of the project monitoring plan;
- Define reporting and monitoring measures to ensure the effectiveness of the plan and periodical reviews of the plan based on findings.

487. The consultation covers Project design, mitigation and monitoring measures, project-specific sharing of development benefits and opportunities, and implementation issues. During the Project's preparation and implementation, the funding agency (FA) (e.g.; AIIB) expects the Client to engage in meaningful consultation with stakeholders. In the environmental and social assessment documentation, the FA (e.g.; AIIB) requires the Client to include a record of the consultations as well as a list of participants.

C. Methodology for Stakeholder Consultation

488. As part of the EIA process, five (05) focus group discussions were organized and held to record the views and opinions of community members. These consultation meetings were attended by elected representatives, local leaders, school teachers, religious leaders, students, painters, businessmen, service holders, drivers, and others. This collaborative approach was well received by all participants. During the public consultations, social, environmental, and cross-cutting issues such as potential project impacts, activities on environmental and social parameters, identification of sensitive issues, risks, and potential threats from the project were discussed.


FGD_01 (Bonoshree Bus Stop)

FGD_02 (Nagdarpar Bridge Bus Stand)

FGD_03 (Staff Quarter Jmae Masjid Bazar)

FGD_04 (Beside Dhaka-Demra Highway)


FGD_05 (Near Sugandha Hospital)

Figure IX.1: Public consultation and FGD in the project location

489. Table IX-1 indicates the date and place of the group discussion meetings including the number of participants present at each. Names of participants provided in Annex-C.

Table IX-1: Details of Focus Group Discussions

SI	Date	Location	Chainage	Total Participants
1.	26-06-2022	**Bonoshree Bus Stop** 23.76733°N 90.42319°E	CH. 12+450 Km	5
2.	27-06-2022	**Nagdarpar Bridge Bus Stand** 23.749163°N 90.462142°E	CH. 07+650 Km	8
3	29-06-2022	**Demra Staff Quarter Jame Masjid Bazar** 23.720483°N 90.491620°E	CH. 03+100 Km	6
4	29-06-2022	**Beside Dhaka-Demra Highway** 23.719946°N 90.490493°E	CH. 03+100 Km	10
5	30-06-2022	**Near Sugandha Hospital** 23.69711°N 90.50949°E	Beside CH. 00+050 Km	11
Total				**40**

1. Checklist Used for Public Consultation

490. A checklist devised by the consultants was used to enable participants to easily comprehend the issues, so that they could participate in the discussions more effectively and express their opinions and views objectively. This collaborative approach was well received by all participants. During the public consultations, social, environmental, and cross-cutting issues were thoroughly discussed, including the potential impacts of project activities on environmental and social parameters, the identification of sensitive issues, risks, potential threats, public concerns, and project expectations.

2. Consultant Checklist

- Location of consultation
- Name and occupation of participants
- Awareness of participants about the project
- Description of the project

- Benefits of the projects
- Impacts of the Project on social and environmental components
- Community concerns and perception of the Project
- Exception from the project
- Suggestions about the Project

D. Stakeholder Engagement Plan (SEP)

491. Engagement and communication with stakeholders are an important tool for ensuring the transparency, accountability, and effectiveness of development projects. The overarching goal of this Stakeholder Engagement Plan (SEP) is to define a program for stakeholder engagement, including public information disclosure and consultation, throughout the proposed projects' construction, other project activities, and operation.

492. It is essential that the communities as whole and individual members of the community are given every opportunity to express their views, concerns and worries in connection with the expected and projected environmental impacts and construction impacts for each of the proposed projects. The support of the community is a key indicator of the success of a project and it will therefore be essential that the communities are given the opportunity to express their views during the initial planning and design, during the construction phase and during operation of the project.

493. It is essential that an effective and transparent mechanism is designed and established at the earliest opportunity for all members of the community to be able to lodge complaints and grievances.

1. Purpose of Stakeholder Engagement Plan

494. The current Stakeholder Engagement Plan's goal is to define a program for stakeholder engagement, including public information disclosure and consultation, throughout the proposed projects' construction and operation. The SEP outlines how Stakeholder Engagement will be practiced throughout the project and which methods will be used as part of the process, as well as the responsibilities of the RHD Authority and contractor (The Company) in the implementation of Stakeholder Engagement activities. Indeed, while the project is not expected to result in any physical resettlement, land acquisition, and local population involvement are critical to the project's success, ensuring smooth collaboration between project staffs, workers, contractor (The Company), suppliers, and local communities, as well as minimizing and mitigating environmental and social risks.

2. Applicability

495. This Stakeholder Engagement Plan is developed for the current Project design and capacity and is designed to facilitate information disclosure, consultation and participation, grievance redress mechanism including indigenous peoples located within the project area. The plan outlines the project provisions with regards to engaging with the community and also receiving feedback during the project operation.

3. Regulation and Requirement

a) National Requirements

496. Bangladesh has relevant and adequate law/regulation on right to information, information disclosure, transparency during decision making/public hearing etc. Relevant laws and regulations pertaining to these issues are given below:

(1) Constitution of the People's Republic of Bangladesh

497. **Article 36**. Freedom of movement. Subject to any reasonable restrictions imposed by law in the public interest, every citizen shall have the right to move freely throughout Bangladesh, to reside and settle in any place therein and to leave and re-enter Bangladesh.

498. **Article 37.** Freedom of assembly. Every citizen shall have the right to assemble and to participate in public meetings and processions peacefully and without arms, subject to any reasonable restrictions imposed by law in the interests of public order health.

499. **Article 38.** Freedom of association. Every citizen shall have the right to form associations or unions, subject to any reasonable restrictions imposed by law in the interests of morality or public order;

500. **Article 39.** Freedom of thought and conscience, and of speech. (1) Freedom of thought and conscience is guaranteed. (2) Subject to any reasonable restrictions imposed by law in the interests of the security of the State, friendly relations with foreign states, public order, decency or morality, or in relation to contempt of court, defamation or incitement to an offence- (a) the right of every citizen of freedom of speech and expression; and freedom of the press, are guaranteed.

501. **Article 59.** Local Government. (1) Local Government in every administrative unit of the Republic shall be entrusted to bodies, composed of persons elected in accordance with law. (2) Everybody such as is referred to in clause (1) shall, subject to this Constitution and any other law, perform within the appropriate administrative unit such functions as shall be prescribed by Act of Parliament, which may include functions relating to- (a) Administration and the work of public officers; (b) the maintenance of public order; the preparation and implementation of plans relating to public services and economic development.

(2) The Consumers' Right Protection Act, 2009

502. The Consumer Rights Protection Act, 2009 is a bunch of rights of the consumers with advantages where under this Act the consumers can file an administrative complaint only. As per the Act of 2009, no complaint can be entertained by the Court without the approval of the Director General of the Consumer Rights Protection Department. Therefore, only competent government officers are entitled to institute a case under this law against any violation of such laws. A consumer although barred from filing a direct complaint under the Consumers' Rights Protection Act, 2009 but he can file a case under other Laws.

(3) Right to Information Act (RTIA) 2009

503. The Act makes provisions for ensuring free flow of information and people's right to information. The freedom of thought, conscience and speech is recognized in the Constitution as a fundamental right and the right to information is an alienable part of it. The right to information shall ensure that transparency and accountability in all public, autonomous and statutory organizations and

in private organizations run on government or foreign funding shall increase, corruption shall decrease, and good governance shall be established.

(4) Bangladesh Labour Law, 2006 (Amended in 2013) and Labour Code 2015

504. This Law pertains to the occupational rights and safety of workers and the provision of a comfortable work environment and reasonable working conditions.

505. The Labour Law of Bangladesh 2006 bans children under the age of 14 from working. Chapter III of the Act3 under "Employment of Adolescent Worker" puts restrictions on employment of children and adolescents as follows:

- No child shall be employed or permitted to work in any occupation or establishment.
- No adolescent shall be employed or permitted to work in any occupation or establishment, unless: (a) A certificate of fitness in the form prescribed by rules, and granted to him by a registered medical practitioner is in the custody of the employer; and (b) S/He carries, while at work, a token containing a reference to such certificate

4. Requirements of the AIIB

506. As a partner in the delivery of this project, the AIIB's environmental safeguard requirements were carefully considered during the preparation of this EIA. The description of a grievance redress mechanism (GRM) is not required under the GoB environmental legislation but is mandatory for any AIIB-funded project. To that end a step-by-step process is defined in this chapter.

507. The AIIB's ESP of 2021 consolidates the following requirements on information disclosure, consultation and grievance redress mechanism:

a) Information disclosure

508. In accordance with ESS1, the Bank requires the Client to disclose environmental and social information. Furthermore, to improve access to environmental and social information related to Projects, the Bank discloses the Client's documentation within the timeframe specified in Section 65 of ESP.

b) Consultation

509. The consultation covers Project design, mitigation and monitoring measures, project-specific sharing of development benefits and opportunities, and implementation issues. During the Project's preparation and implementation, the Bank expects the Client to engage in meaningful consultation with stakeholders. In the environmental and social assessment documentation, the Bank requires the Client to include a record of the consultations as well as a list of participants.

c) Project-level Grievance Redress Mechanism.

510. The Bank requires the Client to establish, in accordance with the ESP and applicable ESSs, a suitable project-level GRM to receive and facilitate resolution of the concerns and complaints of people who believe they have been adversely affected by the Project's environmental or social impacts, and to inform Project-affected people of its availability.

511. AIIB requires the RHD to establish, in accordance with the ESP and applicable ESSs, a suitable Project-level GRM to receive and facilitate resolution of the concerns or complaints of people who believe they have been adversely affected by the Project's environmental or social impacts, and to inform Project-affected people of its availability. The Bank also requires the Client to establish a GRM for contracted workers under the Project to address workplace concerns, and reflect this in the tender documents for these contracts. AIIB-specific PPM will be developed and disclosed to project-affected peoples. Specifically note that PPM will be made accessible and available both in Bangla and English languages in the website of AIIB.

512. Grievance redress refers to the set of actions available to anyone negatively impacted by the project and not properly dealt with, ignored or overlooked the implementation of mitigative and monitoring measures defined in the EIA. The overriding principle of any GRM is that it must be non-threatening, easily accessible, quick and impartial; delivering decisions to the complainant in an unbiased a-political manner. GRM's have been developed for many past donor-funded projects and have been accepted by the GoB and been reasonably successful in doing what they are supposed to do.

5. Stakeholder Identification and Analysis

513. In order to develop an effective Stakeholder Engagement Plan, it is necessary to determine who the stakeholders are and understand their needs and expectations for engagement, and their priorities and objectives in relation to the Project. People who have significant roles in a project or could be affected by the project and project activities or interested people of the project are considered as stakeholder. Stakeholders could be individuals, group of people or local communities or organizations who may be affected by the project- directly or indirectly; positively or negatively.

514. In general, engagement is directly proportional to impact and influence, and as the extent of impact of a project on a stakeholder group increases, or the extent of influence of a particular stakeholder on a project increase, engagement with that particular stakeholder group shall intensify and deepen in terms of the frequency and the intensity of the engagement method used. All engagement shall proceed on the basis of what are culturally acceptable and appropriate methods for each of the different stakeholder groups targeted.

515. Immediate positive and negative impacts for this Modernization & Capacity Enhancement Project would be faced by surrounding peoples, petty businessmen, passerby, student, teacher and guardian of nearby school, worker and labour force. Community representatives may provide helpful insight into the local settings and act as main conduits for dissemination of the Project-related information and as a primary communication/liaison link between the Project and targeted communities and their established networks. Appropriate stakeholder representatives for this project may be included the following key personnel's-

- RHD top management
- Elected officials of local government
- Community leaders or UP chairman and councilor
- Teachers and other respected persons in the local community's
- Non-elected leaders that have wide recognition within their community, such as chairpersons of local initiative groups, committees, local cooperatives etc.
- Leaders of community-based organizations, local NGOs and women's groups

- The elders and veterans within the affected community
- Religious leaders, including those representing traditional faiths
- Leaders representing local business associations
- Leaders representing working/ labour group

6. Stakeholder Categorization

516. For the purposes of effective and tailored engagement, stakeholders of the proposed project(s) can be divided into the following core categories –

- **Affected Parties** – persons, groups and other entities within the Project Area of Influence (PAI) that are directly influenced (actually or potentially) by the project and/or have been identified as most susceptible to change associated with the project, and who need to be closely engaged in identifying impacts and their significance, as well as in decision-making on mitigation and management measures;
- **Other Interested Parties** – individuals/groups/entities that may not experience direct impacts from the Project but who consider or perceive their interests as being affected by the project and/or who could affect the project and the process of its implementation in some way;

a) Project-Affected Parties

517. Affected Parties include local communities, community members and other parties that may be subject to direct impacts from the project during development phase. Specifically, the following individuals and groups fall within this category –

- Affected Persons who are living nearby the project area
- The local population and local communities including the vulnerable group that include the elderly, physically and mentally disabled persons, single mothers, adolescent girls, minority transgender community and the children who are moving or leaving in the close proximity of the project area
- Residents, business entities, and individual entrepreneurs in the area of the project who are adversely affected owing to the widening of approach road, and others that can benefit from the employment, training and business opportunities offered due to implementation of the project;
- The RHD authority can take the lead in disseminating information about the proposed project to the local communities during the construction activities. Besides local NGOs, having considerable capacity, may tap for disseminating the information and raising awareness of the planned activities among the potentially affected communities in the project area.

b) Other Interested Parties

518. The projects' stakeholders also include parties other than the directly affected communities, including -

- Residents of the other rural settlements within the project area that can benefit from employment and training opportunities stemming from the project;

- Civil society groups and NGOs on the regional, national and local levels, which pursue environmental and socio-economic interests and may become partners of the project.
- Community-based groups and non-governmental organizations (NGOs) working on Gender issues including GBV and Human Rights in the locality that work for and represent local residents and other local interested groups, and act on their behalf;
- GoB officials, permitting and regulatory agencies at the national and regional levels, including environmental, technical, social protection and labor authorities.
- GoB officials at the district level and below including DoE: local Union Parisad, Upazila Parisad in the project area, village administrations; local etc.
- Business owners and providers of services, goods and materials within the project area that will be involved in the project's wider supply chain and transportation business or may be considered for the role of project's suppliers in the future;
- Mass media and associated interested groups including District and local Press Club, local, regional and national print and broadcasting media, digital/web-based entities, and their associations.

c) Vulnerable Groups

519. Persons who may be disproportionately impacted or further disadvantaged by the project as compared with any other groups due to their vulnerable status 19, and that may require special engagement efforts to ensure their equal representation in the consultation and decision-making process associated with the project. Engagement with all identified stakeholders will help ensure the greatest possible contribution from the stakeholder parties toward the successful implementation of the project and will enable the project to draw on their pre-existing expertise, networks and agendas. It will also facilitate both the community's and institutional endorsement of the project by various parties. Access to the local knowledge and experience also becomes possible through the active involvement of stakeholders.

d) Planned Stakeholder Engagement Activities

520. Stakeholder engagement activities will need to provide stakeholder groups with relevant information and opportunities to voice their views on topics that matter to them. Below table presents the stakeholder engagement activities for this project. RHD will undertake for their project(s). The activity types and their frequency are adapted to the three main project stages: project preparation (including design, procurement of contractor (The Company) and supplies), construction, and operation and maintenance.

[19] Vulnerable status may stem from an individual's or group's race, national, ethnic or social origin, color, gender, language, religion, political or other opinion, property, age, culture, literacy, sickness, physical or mental disability, poverty or economic disadvantage, and dependence on unique natural resources.

Table IX-2: Planned Stakeholder Engagement Activities

Stage	Target Stakeholders	Topic(s) of Engagement	Method(s) Used	Location/Frequency	Responsibilities
Stage 1: Project preparation (Project design, Scoping, Resettlement PLANNING, RPF/SEP Disclosure)	**Project Affected People:** - People residing near project area - Petty businessmen around the approach road - School teacher, guardians and students	- EIA, EMP, RAP, SEP disclosures - Assistance in gathering official documents for authorized land uses - Land Purchase Documents - Project scope and rationale - Project E&S principles - Grievance mechanism process	- Public meetings, separate meetings for women and vulnerable - Face-to-face meetings - Mass/social media communication (as needed) - Disclosure of written information - Grievance mechanism - RHD's newsletter and website	- Disclosure of Drafts EIA, RP, SEP, - At beginning of the construction work, all PBS area - Continuous communication through mass/social media and routine interactions	- RHD/PIU
	Other Interested Parties (External) - Representative of Local people and community	- EIA, EMP, RAP, SEP disclosures - Land Purchase process - Identification of land /plots - Project scope, rationale and E&S principles - Grievance mechanism process	- Face-to-face meetings - Joint public/community meetings with local government - Public Disclosure	- Project launch meetings in RHD headquarter and project Office - Meetings in nearby school or college or as an when demanded by the affected community - Disclosure meetings in respective project sites.	- RHD/PIU - Socially responsible for the project
	Other Interested Parties (External) - Press and media - NGOs - Businesses and business organizations - Worker and Contractors - Workers' organizations - Academic institutions - National Government Ministries - General public, tourists, jobseekers	- EIA, EMP, RAP, SEP disclosures - Grievance mechanism - Project scope, rationale and E&S principles	- Public meetings, trainings/workshops (separate meetings specifically for women and vulnerable as needed) - Mass/social media communication - Disclosure of written information - Grievance mechanism - Notice board for employment recruitment	- Project launch meetings in RHD headquarter and project Office - Meetings in project area as needed - Communication through mass/social media (as needed) - Information desks with brochures/posters in affected areas (continuous)	- RHD/PIU
	Other Interested Parties (External)	- Legal compliance issues	- Face-to-face meetings - Invitations to public/community meetings	- Disclosure meetings - Reports as required	- RHD Team & management

Stage	Target Stakeholders	Topic(s) of Engagement	Method(s) Used	Location/Frequency	Responsibilities
	- Other Government Departments including DoE from which permissions/clearances are required; - Other project developers, donors	- Project information scope and rationale and E&S principles - Coordination activities - Land acquisition process - Grievance mechanism process - EIA/EMP/RAP/SEP disclosures	- Submission of required reports		
Stage 2: Construction and mobilization activities	**Project Affected People** - People potentially affected for the construction activities - People residing nearby project area	- Grievance mechanism - Health and safety impacts (EMF, community H&S, community concerns) - Employment opportunities - Project status	- Public meetings, open houses, trainings/workshops - Separate meetings as needed for women and vulnerable - Disclosure of written information - Grievance mechanism - RHD newsletter and website	- Quarterly meetings during construction seasons - Communication through mass/social media as needed - Notice boards updated weekly - Routine interactions	- RHD/PIU - Contractor (The Company)/sub-contractors
	Other Interested Parties (External) - Press and media - NGOs - Businesses and business organizations - Workers' organizations - Academic institutions - National Government Ministries - Local Government Departments - General public, tourists, jobseekers	- Project information - scope and rationale and E&S principles - Project status - Health and safety impacts - Employment opportunities - Environmental concerns - Grievance mechanism process	- Public meetings, open houses, trainings/workshops - Disclosure of written information: brochures, posters, flyers, website, Information boards in RHD - Notice board(s) at construction sites - Grievance mechanism	Same as for PAPs	- RHD/PIU - Contractor (The Company)/sub-contractors
	Other Interested Parties (Internal) - Other RHD's staff - Supervision Consultants	- Project information: scope and rationale and E&S principles	- Face-to-face meetings - Trainings/workshops - Invitations to public/community meetings	Daily, as needed	- RHD/PIU

Stage	Target Stakeholders	Topic(s) of Engagement	Method(s) Used	Location/Frequency	Responsibilities
	- Contractor, sub-contractors, service providers, suppliers and their workers	- Training on EIA/EMP requirements and other sub-management plans - Worker grievance mechanism			
STAGE 3: Operation and Maintenance	**Project Affected People:** - People residing nearby project area	- Satisfaction with engagement activities and GRM - Grievance mechanism process - Damage claim process	- RHD website - Grievance mechanism - RHD's newsletter	- Outreach as needed - Meetings in with local community as needed - Monthly (newsletter)	- RHD/PIU
	Other Interested Parties (External) - Press and media - NGOs - Businesses and business organizations - Workers' organizations - Academic institutions - Local Government Departments - General public, tourists	- Grievance mechanism process - Issues of concern - Status and compliance reports	- Grievance mechanism - RHD's website - Face-to-face meetings - Submission of reports as required	As needed	- RHD/PIU

E. Findings from Focus Group Discussion

1. Key Findings

521. Participants in general welcomed the project and anticipated that it would benefit the national economy in a variety of ways. The following major issues, among others, were raised in public consultation meetings, as previously reported.

- Road construction/widening should commence and end as per schedule and not be delayed or cancelled.
- Trees felled during construction should be compensated for to the owners and replanting should take place,
- Roads should have facilities for drainage on both sides with cross drains to minimize flooding and water logging
- Sensitive structures and sites, e.g., schools, mosques, graveyards, markets, etc., should be avoided while undertaking road widening. The proposed alignment needs to bypass these structures and sites,
- Blockages should not be caused to local drainage system during the construction and operation.
- Road development as proposed in the meeting is strongly welcomed,
- Development work may necessitate removal or destruction of permanent and sensitive areas and structures like graveyards, madrassas, schools, mosques, e.g., those in the market area along the existing road. The proposed alignment needs to bypass these structures and sites,
- Underpasses, foot over bridges for pedestrians, etc. should be in adequate numbers and at appropriate locations (e.g., in vicinities of schools, madrassas, areas of bazars and hats etc.) in the detailed design,
- Private family/personal properties, if affected, should be adequately and appropriately compensated for.

2. Expectations of the People

522. The following expectations of the local people were raised during the consultations:

- Major expectation of the people is that the Local personnel should be employed in different activities of the project on a priority basis.
- Local businessmen/contractors should be engaged in different phases of the project for construction and development on a 'priority basis.
- Compensation payment in any form, if any, should be properly and promptly distributed so that the actual affected person gets his full share and in right time.

3. Overall Findings

523. The findings as recorded from public consultations have been presented in the Table-IX.3 indicating the critical issues. Details are attached in the Annex 3.

Table IX.3: Issues Raised in Public Consultation

Project Name	Issue Discussed	Issue Raised	Suggestion
Improvement of the Hatirjheel-Rampura-Bonoshree Ideal School and College Sheikherjaiga-Amulia-Demra Highway into 4-lanes (including link to Chattogram Road intersection and access to Tarabo) through Public Private Partnership	Impact of implementation of the project	Reduce unemployment	Labour should be taken from respective locality.
		Social and Economic developments	Living status will be high.
		Land and property damage	Due compensation to be paid according to the up-to-date price list.
		Crop damage	Due compensation to be paid on the spot
		Compensation assessment	Compensation assessment by DC office and local leader
		Impact on Fish breading and fish pass	Must avoid breeding season and breeding ground
		Pollution of air and surface water	Monitoring should be adopted
		Sanitary problem	Appropriate sanitary system should be developed during project execution.
		Noise Pollution	Appropriate noise mitigation measure will be adopted in drilling site

524. The nature of the project was explained at the start of the FGDs, and the outcomes and potential impacts of the project interventions were discussed. Concerns were also raised about the climatic conditions in the project areas. The attendees were then asked for their thoughts and comments on the project, whether it is environmentally and socially viable during the construction and operational phases, and how it will affect their lives. Several people have spoken up, and they have all stated that they will support this effort. The following are some of the most important issues and suggestions raised by the participants.

525. The participants claimed that the project's execution would not cause any environmental or social damage. Additionally, they stated that the project would open up new job opportunities and that its project will benefit the economy of the country. They endorsed the plan wholeheartedly and suggested that building work get started right away. They also demanded that the project authority give residents precedence when conducting project activities.

X. GRIEVANCE REDRESS MECHANISM

A. General

526. A Grievance Redress Mechanism (GRM) to address environmental, social, and construction-related issues and complaints from the project affected parties and other stakeholders will be established by the implementing agency e.g.; Dhaka RAD Elevated Expressway Company Limited in collaboration with RHD. GRM is a paralegal tool that allows anyone aggrieved with the project activities and implementation approach relevant to environmental and social measures to raise and communicate their voice.

527. The project will guarantee that grievance redress processes are in place and those procedures are monitored to ensure that grievances are addressed correctly. The PIU shall develop a system to respond to project-related questions and handle complaints, disputes, and grievances concerning any part of the project's operations, including conflicts over environmental and social impact assessment and mitigation. The following sections indicate the specifics of the institutional structures and procedures.

B. Formation and Operation of GRM

528. The GRMs will follow the principle of accessibility for potential users and accountability of the contractors and implementing agencies. As such, all information related to the GRM process will be available on bulletin boards at the project site and office. Brochures with related information will be distributed during consultations and public meetings, and posters will be displayed in public places such as in government offices, project offices, notice boards, etc.

529. A toll-free helpline will be established to receive complaints. RHD will desire to keep some of the GRC resolutions confidential as it may affect involved parties defaming their dignity. But the summary of outcomes of GRCs in periodical reports will be published on the RHD's project website without mentioning the name of complainer/ affected persons. The monitoring plan also will ensure that AIIB guidance/good practices are followed when handling complaints related to SEA/SH.

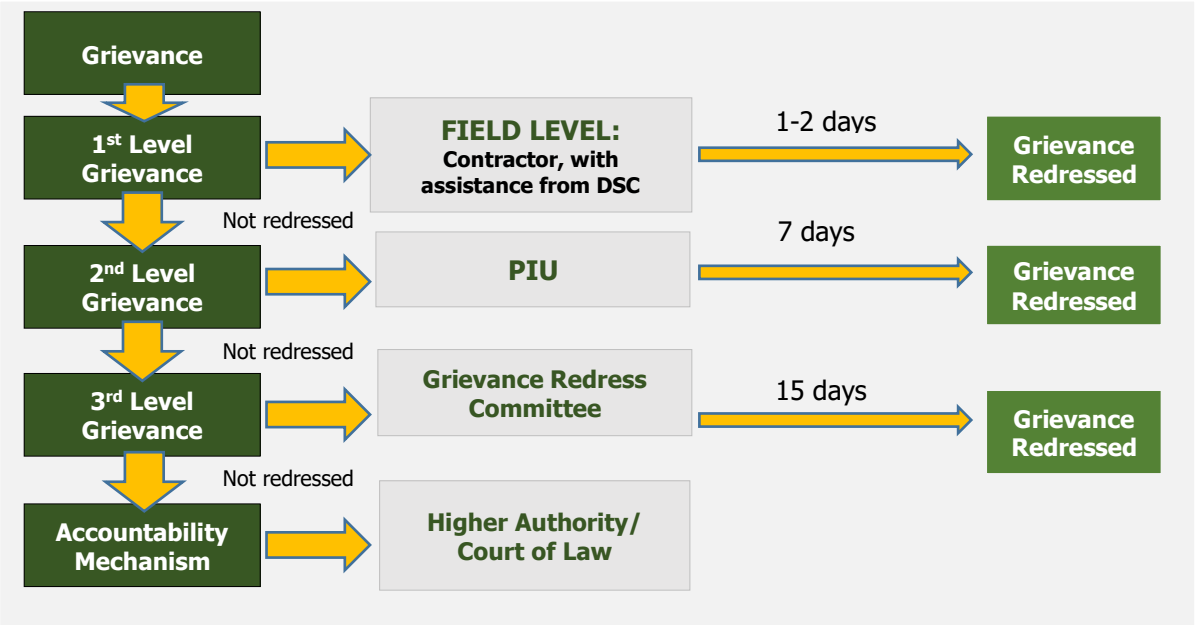

Figure X.1: Grievance Redress Mechanism of the Project

C. Steps to a Solution

530. **First Tier of GRM:** For grievance redressal, the Chief Engineer of the RHD should be responsible (1st tier). Within 7 working days, concerns will be resolved. Visits to the site and meetings with relevant stakeholders will be part of the grievance investigation process (e.g., affected persons, contractors, traffic police, etc.) In the event that anonymity is desired, grievances will be logged and personal information (name, address, date of complaint, etc.) will be provided. Each grievance should be issued a tracking number that includes the following elements:

- When the complaint is registered, the complainant receives an acknowledgment of receipt along with the initial grievance document (which includes the description of the issue);
- Grievance monitoring sheet, mentioning actions taken (investigation, corrective measures); and
- One copy of the closure sheet will be given to the complainant once he or she has signed off on the resolution.

531. The updated register of grievances and complaints will be available to the public at the project office, construction site, and other key public offices along the project area. Should the grievance remain unresolved, it will be elevated to the second tier.

532. **Second Tier of GRM:** Unresolved issues will be forwarded on to the second layer of GRM by the Additional Chief Engineer (ACE) of RHD (with written documentation). The PIU should establish the GRC before the start of site works. The GRC will consist of the following persons: (i) project director; (ii) representative of local administration; (iii) representative of the affected persons; (iv) representative of the local deputy commissioner's office (land); and (v) representative of the Department of Environment (DoE) for environmental-related grievances. A hearing will be called with the GRC, if necessary, where the affected person can present his or her concerns and issues. The process will facilitate resolution through mediation. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within 15 working days. The contractor will have observer status on the committee. If unsatisfied with the decision, the existence of the GRC shall not impede the complainant's access to the government's judicial or administrative remedies.

533. The functions of the local GRC are as follows: (i) resolve problems and provide support to affected persons arising from various environmental issues, including dust, noise, utilities, power and water supply, waste disposal, traffic interference, and public safety, as well as social issues such as land acquisition, asset acquisition, and eligibility for entitlements, compensation, and assistance; (ii) reconfirm grievances of displaced persons, categorize and prioritize them, and aim to provide solutions within a month; and (iii) report to the aggrieved parties about developments regarding their grievances and decisions of the GRC. The ACE, PIU will be responsible for processing and placing all papers before the GRC, maintaining the database of complaints, recording decisions, issuing minutes of the meetings, and monitoring to see that formal orders are issued and the decisions carried out.

534. **Third Tier of GRM:** In the event that a grievance cannot be resolved directly by the RHD (first tier) or GRC (second tier), the affected person can seek alternative redress through the city corporation (Dhaka North, Dhaka South and Narayanganj City Corporation) and Pourashava (Demra Pourashava) committees or in appropriate courts. The PIU or GRC will be kept informed by the city corporation authority. The monitoring reports of the EMP and the resettlement plan implementation

shall include the following aspects pertaining to progress on grievances: (i) number of cases registered with the GRC, level of the jurisdiction (first, second, and third tiers), number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon, which may be prepared with details such as name, identification (I.D.) with unique serial number, date of the notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance (i.e., open, closed, or pending).

D. Construction Workers Grievance

535. Laborers and other unskilled hired employees of the contractor have little recourse when their living circumstances deteriorate, they are not paid according to agreement, or basic necessities, such as drinking water, are not provided at construction sites, work camps, or on-the-job. The contract or letter of assignment for the job will contain the name and contact information of a RHD and/or the Contractor's employee for the worker to contact under this contract as part of the written agreement with each hiring. A second statement will be included in the letter/agreement, stating that the contractor will not penalize the worker for filing a complaint, and that if this happens, the contract will be fined an amount equal to the duration of the employee's contract from the time of the incident to the end of the contract period. The complainant will receive that sum. The contractor will provide a complaint box, which will be sealed and collected by the RHD, allowing construction workers to file complaints with the RHD directly.

E. Gender-based Violence, Sexual Exploitation and Workplace Sexual Harassment

536. RHD/PIU will, with support from consultants, identify institutions and services provides who are actively engaged in the prevention of gender-based violence, sexual exploitation and workplace sexual harassment to establish a manual for referencing any potential survivors. RHD/PIU, the project unit and the contractor are not equipped to handle complaints or provide relevant services to survivors but will refer any person to relevant service providers, including health facilities, law enforcement's gender unit or others, as relevant using the information on available services. Grievances related to gender-based violence be reported through the project/contractor, the nature of the complaint will be recorded along with the age of the complainant and relation to the project will be recorded but the issue will be referenced to relevant institutions. Also, the EIA may identify additional mitigation measures related to gender and such measures will be reflected in site-specific EMPs, including the contractors EMP or contractors specific Labour Management Plans, where required. This will include engagement with communities on gender-related risks, grievance and response measures available, as identified in the manual.

F. Communication & Awareness Raising on GRM

537. The final processes and procedures for the GRM will be translated into local language (i.e., Bangla) and disseminated at all project locations. These shall be made available (in both leaflet and poster format) to all project locations with the staff on site and in the offices at Upazila, District and Municipality. The affected persons and their communities will be informed of the project's grievance mechanism in open meetings at important locations and in PAP group meetings. Bangla translations of the RAP in the form of information brochures will be distributed among the affected persons. The PAPs will also be briefed on the scope of the GRC, the procedure for lodging grievances cases and the procedure of grievance resolution at the project level.

G. Project-Affected People's Mechanism on Grievance Redress Activity

538. When project-related concerns cannot be satisfactorily addressed through Project-level GRM or the Bank's management processes, people who believe they have been or will be adversely affected by the Bank's failure to implement the ESP may submit complaints to the Bank's PPM in accordance with the Policy on the project affected people's mechanism (PPM). The Bank requires all Clients to notify Project-affected individuals about the PPM's availability. The Client's (or beneficiary's) Project-related website includes information on the availability of the PPM in an accessible and understandable manner in locally appropriate language(s) (both Bangla and English in this case).

H. Monitoring & Reporting

539. ESS1 requires disclosure of the draft EIA, including documentation of the consultation process and the results of the social impact assessment in a timely manner in accordance with the applicable provisions of ESS 1. Adequate documented evidence of such engagement should be provided.

540. The SEP will be periodically revised and updated by the Social Specialists as necessary in the course of Modernization & Capacity Enhancement project planning and implementations in order to ensure that the information presented herein is consistent and is the most recent, and that the identified methods of engagement remain appropriate and effective in relation to the project context and specific phases of the development. Any major changes to the project related activities and to its schedule will be duly reflected in the SEP.

541. Monthly summaries and internal reports on public grievances, enquiries and related incidents, together with the status of implementation of associated corrective/preventative actions will be collated by responsible staff and referred to the senior management of the project(s). The monthly summaries will provide a mechanism for assessing both the number and the nature of complaints and requests for information, along with the Project's ability to address those in a timely and effective manner.

542. The project director with the support of social and environment specialist will share the progress and results of the stakeholder engagement activities to the AIIB quarterly and annually where Stakeholder related activities will be described broadly. These reports will also include detailed reports on the GRM effectiveness, including a list of grievances received, addressed and the pending ones.

XI. INSTITUTIONAL REQUIREMENTS

543. There are certain institutional requirements to ensure that the environmental aspects of the Project will be realized.

544. The Project has already obtained the Environmental Clearance Certificate from the Department of Environment (DoE) under the Ministry of Environment and Forest, according to Environmental Conservation Rules 1997 of Bangladesh. Beyond this requirement, Roads and Highways, the proponent of the Project, with the assistance of its Project Company, will also be responsible for ensuring that all environmental procedures and proposals are incorporated in the Detailed Engineering Design process and construction process, including the incorporation of appropriate provisions in the Project's Contract Documents.

545. The institutional requirement includes the following

- **Contract Preparation:** The environmental provisions recommended for inclusion in the Contracts for the Dhaka Bypass Road will be provided in the EMP. This is essential provisions to be incorporated and enforceable if the goals of the Project are to be fully achieved.
- **Environmental Management as an Integral Part of Construction Supervision:** Once Contract has been accepted and awarded, it will be necessary to monitor compliance with the environmental provisions of the Contract as an integral part of overall construction supervision. Supervision by the PIU will include the following requirements:
    - ✓ Ensure that asphalt plants, pilling equipment, construction camps and other facilities are properly sited and installed in accordance with the Contract.
    - ✓ Determine the timing and exact locations of both baseline and routine air quality and noise level monitoring and all other monitoring is in accordance with the Contract provisions.
    - ✓ Undertake critically important routine visual monitoring of construction, waste disposal and overall environmental management practices by the Contractors. Effective environmental management during construction will require frequent site visits and observation skills. Adequate staffing of in conjunction with the services provided by its PIU will be required.

A. Institutional Arrangements

546. Environmental management of the project requires a multidisciplinary approach with consolidated and coordinated efforts from a number of agencies. Various institutions will be involved during implementation of the Project. While contractor is responsible for implementation of EMP during construction works, Project Implementation Unit (PIU) of RHD is primarily responsible for supervision of monitoring of the implementation of the EMP with the assistants of Independent Engineers and also reporting the progress to RHD who is also the Executing Agency (EA). The RHD will be involved in the implementation and management of the works for which they are responsible by establishing a PIU. The Key organizations and people involved in environmental management of the project are as presented in Figure XI-1.

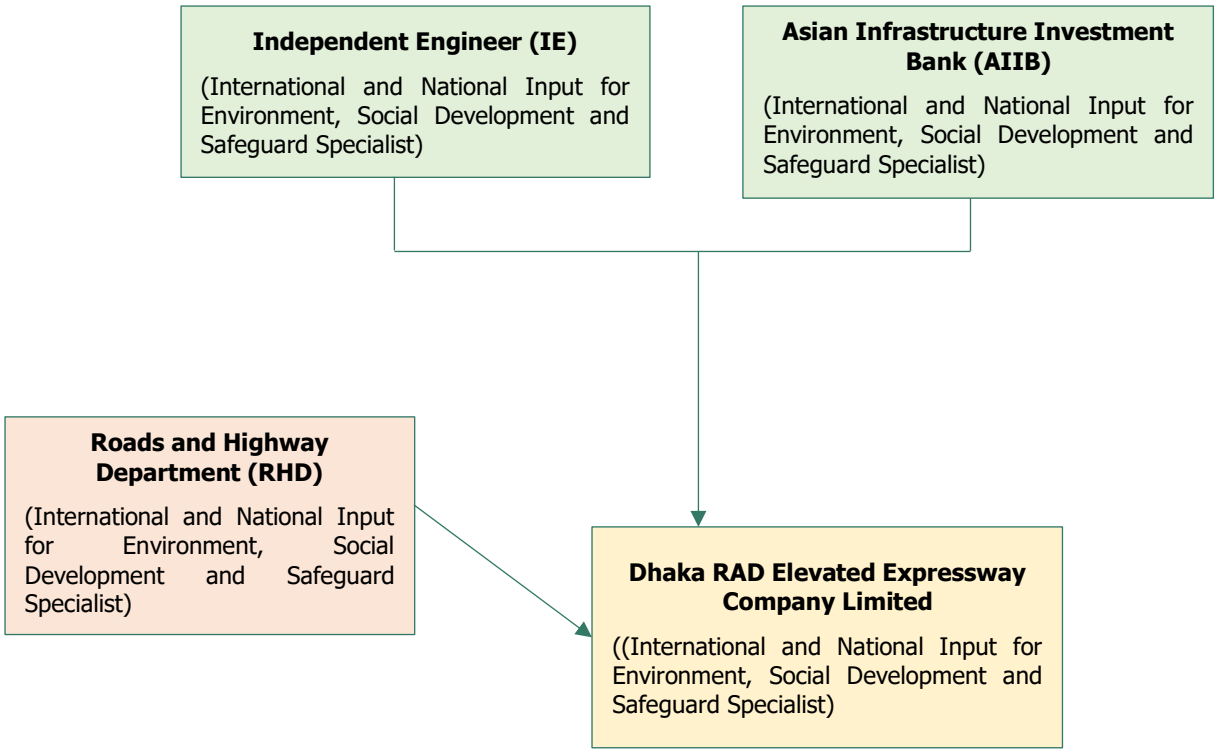

Figure XI-XI.1: Proposed Institutional Framework for EMP Implementation

B. Institutional Responsibilities

547. A number of institutions will be involved during construction and operation phase of the Project in order to achieve environmental compliance goal set by EMP. A proposed institutional framework for EMP implementation has been showed in Figure IX-1. These institutions will carry out following distinct but interrelated responsibilities:

1. Ministry of Road Transport and Bridges (MoRTB)

548. MoRTB as the highest authority of the Project will have the overall responsibility of ensuring that the environmental safeguard requirements of the project are fulfilled through the Road and Highways Department. The main responsibilities of the MoRTB are to:

- ✓ Ensure that the project, regardless of financing source, complies with the provisions of the EMP and AIIB's ESF 2021;
- ✓ Ensure that project implementation complies with government environmental policies and regulations;
- ✓ Ensure that project environmental management is implemented and reported to the Steering Committee and the financing agency as required.

2. Inter-ministerial Steering Committee

549. A Steering Committee with representatives from related Ministries and Government agencies covering will be established at the time of implementation of this project. This committee will facilitate the coordination of various agencies under the ministries in the environmental management and monitoring process.

3. Roads and Highways Department

550. The Roads and Highways Department (RHD), as the main project implementing agency, is responsible for the effective execution of the environmental safeguards. Although not directly involved in the day-to-day monitoring activities, RHD will have oversight on the monitoring activities carried out by the PIU and will report to MoRTB.

4. The Social and Environmental Circle

551. The Social and Environmental Circle of the RHD is headed by a Superintending Engineer (Resettlement and Environment). There is an Environmental Division under this circle staffed by one Executive Engineer, one Sub divisional Engineer, two Assistant Engineers and three Sub Assistant Engineers. The Environmental Division under the Social and Environmental circle will provide guidance to PIU staff for developing mechanisms for effective project supervision throughout the project construction and even in operation phase. They will also assist PIU and the Company in conducting subsequent monitoring and reporting and in undertaking corrective options and establishment and implementation of an environmental management system.

5. Project Implementation Unit

552. The Project Implementation Unit will be established under the RHD will include an environmental and social unit (EU). The EU will consist of one Executive engineer, one sub-divisional engineer and two assistant engineers to monitor environmental and social compliances. The EU will be responsible for overseeing of the monitoring activities conducted by the Project Company on its behalf. It will also be responsible for overseeing the activities of contractor through PIU. The main activities of the EU with regard to environmental safeguards are:

- Planning and implementation of EMP
- Ensuring that environmental protection and mitigation measures in the EMP are incorporated in the Construction Environmental Management Plan (CEMP);
- Supervision and monitoring of the progress of activities of the consultants and contractors for implementation of different components of EMP
- Provide guidance to PIU, and Company in conducting subsequent monitoring and reporting and in undertaking corrective options
- Responsible for modifications of the EMP when there were adaptation/changes during implementation.
- Ensure submission of periodical environmental management and monitoring reports to steering committee and co-financers through RHD;
- Submit semi-annual monitoring reports on EMP implementation for co-financers review through RHD;
- Ensure establishment and implementation of an environmental management system;
- Implementation of environmental monitoring measures (such as environmental quality monitoring, tree plantation, landscaping, wild life monitoring) during O/M stage of the Project.
- Promote improved social and environment performance through the effective use of management systems;

- External communications with other government, semi-government and non-government organizations, universities, research institutes in the country on the matters of mutual interest related to environmental management and filming of activities to be carried out under the project development.

6. Asian Infrastructure Investment Bank (AIIB)

553. AIIB will be primarily responsible to monitor the implementation status of AIIB's ESF. They will have both national and international expert to monitor the works.

7. Independent Engineers (IE)/Consultants

554. The Independent Engineers or Consulting Team functioning under the RHD will be directly responsible for contract administration and day-to-day project supervision including environmental management. The Engineers will consist of a Health, Safety, social and Environment unit with one environmental and one Social Development expert. The engineers will advise the RHD and the PIUs on EMP implementation, and monitor the work of the Company in the field. The Engineers will also help the PIUs prepare quarterly progress reports to be submitted to the RHD, who will submit semi-annual reports to the financing agency (AIIB) for review. The Engineers will, inter alia, be responsible for the following:

- Engage environmental and social development specialist to ensure proper implementation of EMP provisions;
- Undertake regular monitoring of the Company's environmental performance, as scheduled in the EMP;
- Conduct periodical environmental audits;
- Prior to construction, review and approve CEMP/method statements prepared by the Project Company;
- Supervise site environmental management system of the company, and provide corrective instructions;
- Monitor the implementation of the CEMP and review the environmental management and monitoring reports prepared by the Company;
- Review and report on CEMP implementation by the Company.

555. Overall, IE is responsible for ensuring proper and timely implementation of all their tasks specified in the EMP.

8. Project Company (Dhaka RAD Elevated Expressway Company Limited)

556. The Project Company will be primarily responsible for preparing an implementing the CEMP. The Project Company will be recommended to have one Environmental Specialist, one Social Development Specialist and one Occupational, Health and Safety (OHS) Specialist, who will be working in close coordination with the environmental staff of PIU. The main functions of the Company with regard to environmental management and monitoring are to:

- ☐ Prior to start of construction, prepare the CEMP and other method statements and management plans according to requirements of EMP and get them approved by PIU.

- Recruit qualified environmental and safety officers (ESO) to ensure compliance with environmental statutory and contractual obligations and proper implementation of CEMP;
- Provide sufficient funding and human resources for proper implementation of CEMP;
- Prepare monthly reports on environmental management and monitoring for review and verification by the PIU;
- Prepare and implement an Environmental Management system according to requirement specified in EIA/ ISO 14001.

XII. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusion

557. Several environmental effects of the project will be felt during its construction and operation. The Project is not anticipated to have major negative environmental effects, presuming that the mitigation strategies and monitoring guidelines described in the environmental management plan are implemented successfully. The environmental advantages should also be mentioned, as an all-weather transportation route will maximize connections between the capital city of Dhaka and Chattogram, Sylhet, Narayanganj, and other eastern districts. Due to higher and more consistent speeds, the likelihood of congestion will be reduced, which will result in lower vehicle emissions. The air quality next to the road should also improve.

558. The EMP has identified a number of mitigation measures that must be addressed before, during, and after the building of the road. An air, noise, vibration, soil, riverbed sediment, groundwater, and surface water quality monitoring program will be initiated throughout the building phase to monitor the mitigation efforts. Given that all construction would be closely limited to the existing right-of-way for the road, there is little likelihood that affects will spread much more than the 50 m to 100 m wide corridor of impact centered around the road.

559. The assessment concludes that this EIA is complete and addresses all relevant likely impacts and proposes a full set of time-bounded mitigative and monitoring actions, including the assignment of responsibilities. The application of the detailed EMP will ensure that the nature and socio-cultural environmental are not unduly affected by the work or the operation of the second line. Additionally, an environmental approval has been granted by DoE, and that no further studies be required except the renewal of the approval.

560. The major impacts are related to air quality, noise and vibration, traffic congestion and Occupational and community health and safety. Regular monitoring and quality test of all the environmental parameters, spraying water, plantation along the alignment and roundabouts, monitoring SEA/SH issues etc. can be a major mitigative measures. Maintaining MSDS for handling of chemicals has been suggested. Apart from these, labor management and stakeholder engagement plan have also been discussed throughout the EIA report.

B. Recommendation

561. The bidding documents for the project activities must include the EMP, along with its mitigation and monitoring strategies. According to the contract documents, the Company is in charge of carrying out the EMP's requirements through his own Site-Specific Environmental Management Plan, which will incorporate all of the EMP's requirements while also adding site-specific details that are currently unknown, like the locations of the borrow pits.

562. The EMP and all its requirements will then be included in the contract, making implementation of the EMP a contractual necessity. The contractor (Dhaka RAD Elevated Expressway Company Limited) will next create his CEMP, which the PIU/Environmental Specialist will accept and oversee. After being reviewed by the PIU, the completed CEMP will also be given to the funding agency/AIIB for their records and potential future inspection. Employing a national environmental specialist to track and report project activities during the project's construction period will help the company to ensure compliance with the CEMP.

563. RHD has a social and environmental network, but they require skill development and exposure to real-world situations. To improve the capabilities of the concerned EA personnel, enough training must be provided as recommended by the environmental management plan. It is advised to update environmental regulations that are centered on the efficient application of mitigation measures. As part of these recommendations, performance indicators may also be created to track and evaluate the efficiency of the mitigating measures.

APPENDICES

Appendix 1: Environmental Clearance Certificate

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Part B – Environmental Clearance Certificate

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

Memo No: DoE/Clearance/5764/2017/ 40 Date: 09 /02/2020

Subject: **Environmental Clearance for Improvement of the Hatirjheel-Rampura-Bonoshree Ideal School & College-Sheikherjaiga-Amulia-Demra Highway into 4 Lanes (including Link to Chittagong Road intersection and access to Tarabo) through Public Private Partnership (PPP).**

Ref: Your application on 30/01/2020.

Please refer to your letter of 30th January, 2020 on the captioned subject, I have the pleasure to convey the approval of Environmental Impact Assessment (EIA) Report as well as provide Environmental Clearance in favor of Improvement of the Hatirjheel-Rampura-Bonoshree Ideal School & College-Sheikherjaiga-Amulia-Demra Highway into 4 Lanes (including Link to Chittagong Road intersection and access to Tarabo) through Public Private Partnership (PPP).

A copy of the said Environmental Clearance Certificate is attached herewith for your kind information and necessary action at your end.

09.02.2020

(Syed Nazmul Ahsan)
Director (Environmental Clearance)
Phone # 8181673

Executive Engineer
Public Private Partnership Cell
Roads and Highways Department
132/4 New Bailey Road
Dhaka.

Copy Forwarded to :

1) The Secretary, Ministry of Environment, Forests and Climate Change, Bangladesh Secretariat, Dhaka.
2) The Secretary, Bridges Division, Ministry of Road Transport and Bridges, Shetu Bhaban, New Airport Road, Banani, Dhaka-1212.
3) Director, Department of Environment, Dhaka Metropolitan/ Dhaka Regional Office, Dhaka.
4) Assistant Director, Office of the Director General, Department of Environment, Head Office, Dhaka.

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

Environmental Clearance Certificate
Section 12 of the Environment Conservation Act, 1995 (Amended 2010)

Clearance Certificate Number: 40
File number: DoE/Clearance/5764/2017 . 40
Clearance Certificate Issue Date: 09 February 2020
Renewal date not later than: 08 February 2021

A. Clearance Certificate Type
Environmental Clearance Certificate

B. Clearance Certificate Holder
Executive Engineer
Public Private Partnership Cell
Roads and Highways Department
132/4 New Bailey Road
Dhaka.

C. Premises to which this Clearance Certificate Applies
The Project road starts at Chattogram Road of National Highway N1 meets the approach to Sultana Kamal Bridge Road (R201) near Demra Circle and ends at another intersection near Rampura Bridge Road.

D. Activities for which this Clearance Certificate Authorizes and Regulates
- Construction of approximately 13.50 km long and the width is 8.6 m in each direction (elevated portion, 9 km long) and 9.7 m in each direction (at- grade section, 4.5 km long)
- Construction of Service roads parallel to the tolled road portion having a minimum width of 4.8 m plus 1.0 m paved shoulder in each direction
- Construction of 2 Bridges, 2 Culverts, 1 toll plaza, 3 Underpass & 4 Intersection

E. Terms and Conditions for Environmental Clearance Certificate

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

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

In case of non-coverage of ECR 1997 the World Bank Environment, Health and Safety Guideline and JICA Guidelines for Environmental and Social Considerations, 2010 shall be adhered to.

3. **Operating conditions:**

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

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

3.3 Construction works shall be carried out with proper traffic management and control to avoid/mitigate the disturbance of local lives as well as implementation schedules of the works shall be notified in advance to nearby residents.

3.4 Environment friendly construction and development practices shall be followed that minimize the loss of habitats and biodiversity.

3.5 Storage area for construction materials shall be carefully selected to avoid disturbance of the natural drainage. To avoid soil contamination at labour camp and work site chemical, cement and petroleum derivatives shall be handled cautiously.

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

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

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

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

3.10 To control dust, spraying of water over the earthen materials should be carried out from time to time.

3.11 Adequate considerations should be given to facilitate drainage system for run off water from rain/flood.

3.12 Adequate facilities should be ensured for silt trap to avoid clogging of drain/canal/water bodies.

3.13 Full and adequate utilization of the system for mitigation of pollution and environmental damage as well as that for treatment of wastes shall be ensured.

3.14 Spent lubricating oil and oil filters shall be disposed off in environment friendly manner or can be sold to factories those have environmental Clearance Certificate from DOE.

3.15 Proper and adequate on-site precautionary measures and safety measures shall be ensured.

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

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

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

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3.19 Stringent control measures and procedures to be adopted to avoid traffic congestion during construction activities.

3.20 There should be provision of Elevator, Escalator, Tactile Road Tile, etc. in the stations for handicaps, disable and blind passengers.

3.21 Provision of traffic display panel, proper signs and announcement for the inhabitants shall be ensured.

3.22 A fully functional fire fighting equipment shall be kept on site through out the project period and at the project site at operation stage.

3.23 There should be proper environmental monitoring program and ensure proper implementation during construction of the project.

3.24 Online air and noise quality monitoring system should be made functional throughout the life of the project.

3.25 A full-fledged institutional setup for EHS and CSR must be put in place before construction and operation of the project.

3.26 The project authority shall extend active cooperation to DOE officials to facilitate their visit to the site as and when necessary.

3.27 The project authority should provide all sort of logistics support to DOE and other relevant agencies for monitoring environment related items/events.

3.28 All the required mitigation measures suggested in the Environmental Management Plan (EMP) included in the EIA report along with the emergency response plan are to be strictly implemented and kept operative/functioning on a continuous basis.

3.29 Comprehensive Environmental Performance report, upon completion of the project shall have to be submitted to the DOE Dhaka Metropolitan/Regional office and DOE Head Office describing actual intervention and rehabilitation at the project site.

4 **Monitoring and Recording conditions:**

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

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

4.2. Requirement to monitor concentration of pollutants discharged

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

5. **Reporting Conditions:** Environmental Monitoring Reports shall be made available simultaneously to Head Quarters and Dhaka Metropolitan/Regional office of the Department of Environment on a quarterly basis during the whole period of the project.

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

F. **Recording of pollution complaints**

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

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

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

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

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

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

09.02.2020

(Syed Nazmul Ahsan)
Director (Environmental Clearance)
Phone # 8181673

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Office of the Project Director (SE), RHD
Support to Rampura-Amulia-Demra
Highway PPP Project

PD (SE)

RECEIVED
No. 166 Date 19-08-2021

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

Memo No: DoE/Clearance/5764/2017/

Date: /08/2021

Subject: Renewal of Environmental Clearance for Improvement of the Hatirjheel-Rampura-Bonoshree Ideal School & College-Sheikherjaiga-Amulia-Demra Highway into 4 Lanes (including Link to Chittagong Road Intersection and access to Tarabo) through Public Private Partnership (PPP).

Ref: Your Application dated 24/06/2021.

With reference to your above application, the Department of Environment hereby renews the Environmental Clearance in favor of Improvement of the Hatirjheel-Rampura-Bonoshree Ideal School & College-Sheikherjaiga-Amulia-Demra Highway into 4 Lanes (including Link to Chittagong Road intersection and access to Tarabo) through Public Private Partnership (PPP) subject to fulfilling the terms and conditions stated in Environmental Clearance Certificate issued on 09.02.2020 vide memo no. DoE/Clearance/5764/2017/40.

2. This renewal is valid upto 08 February, 2022. An application for further renewal along with a) the renewal fees (as per the ECR, 1997) b) VAT on renewal fees (in separate Treasury Chalan) and c) all associated documents shall be submitted to the Dhaka Head Office of DoE with a copy to Dhaka Regional/Metropolitan Office at least 30 days ahead of expiry date.

11.08.2021

(Masud Iqbal Md. Shameem)
Director (Environmental Clearance)
Phone: 818 673

Project Director
Improvement of the Hatirjheel-Rampura-Bonoshree Ideal School & College-Sheikherjaiga-Amulia-Demra Highway into 4 Lanes (including Link to Chittagong Road intersection and access to Tarabo) through Public Private Partnership (PPP) Project
Roads and Highways Department
Room-09, Part-B, Level-02
Sharak Bhaban, Tejgaon, Dhaka.

Copy Forwarded to :

1) PS to the Hon'ble Secretary, Ministry of Environment, Forest and Climate Change, Bangladesh Secretariat, Dhaka.
2) Director, Department of Environment, Dhaka Regional/ Metropolitan Office, Dhaka.
3) Assistant Director, Office of the Director General, Department of Environment, Head Office, Dhaka.

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Appendix 2: Sample Analysis Results

Air Quality

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Name of the Project	Improvement of the Hatirjheel-Rampura-Bonoshree Ideal School and College Sheikherjaiga-Amulia-Demra Highway into 4-lanes {including link to Chittagong Road intersection and access to Tarabo) through PPP.
Location ID	AAQ_01
Description of Sample	Ambient Air Quality Test
Sample Collector	Collected by DSCL Personnel
Sampling Date	23 June 2022

Test Result of Ambient Air Quality Analysis

Parameter	Unit	RAD_AAQ_01 Meradia Bazar, Rampura, Dhaka 23.762032°N, 90.443609°E Concentration Present	Bangladesh Standard*	IFC Standard **	Duration (hours)	Method of Analysis
$PM_{2.5}$	µg/m³	73.17	65	75	24	AEROQUAL Series 500Perticulate matter monitor
PM_{10}	µg/m³	156.72	150	150	24	
SO_2	µg/m³	152	365	125	24	AEROQUAL Series SOx monitor
NO_x	µg/m³	18.3	100	40	Annual	AEROQUAL Series NOx monitor
O_3	µg/m³	0	NYS	160	8	AEROQUAL Series 500 O_3 monitor
CO	ppm	1	10	NYS	8	Lutron AQ 9901
CO_2	ppm	452	NYS	NYS	8	
Weather Condition		Sunny				
Monitoring Date		23/06/2022				

* The Bangladesh National Ambient Air Quality Standards have been taken from the Environment Conservation Rules, 1997 which was amended on 19 July 2005 vide S.R.O. No. 220-Law/2005.
** IFC Standard for Air Emissions and Ambient Air Quality, April 2007.

Description of the Surrounding Environment

Location	Sample Site Description
Meradia Bazar, Rampura, Dhaka **(RAD_AAQ_01)**	➢ High amount of vehicle was moving. ➢ High amount of dust particles was present in the project area. ➢ The weather was mostly sunny. ➢ People movement was high. ➢ This location was beside C/S No. -206 CH. 10+250 km. ➢ The location is 43m away from the road centreline. ➢ Nearest sensitive location, Famous Specialized Hospital is 23m away from the location. ➢ Closest water body, Rampura Khal is in 25m away from the location.

Test Performed By:
Md. Masud Rana
Junior Environmental Monitoring Officer

Development Solutions Consultant Limited ★ DSCL ★

Checked By:
Md. Mashiur Rahman
Deputy Manager

IAF INTERNATIONAL ACCREDITATION FORUM | BQSR | IAS ACCREDITED ISO 9001:2015 ISO 45001:2018

House# 734 (1-A), Road# 10, Avenue# 04, DOHS Mirpur Dhaka-1216, Bangladesh.
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DSCL Environmental Laboratory

Name of the Project	Improvement of the Hatirjheel-Rampura-Bonoshree Ideal School and College Sheikherjaiga-Amulia-Demra Highway into 4-lanes {including link to Chittagong Road intersection and access to Tarabo) through PPP.
Location ID	RAD_AAQ_02
Description of Sample	Ambient Air Quality Test
Sample Collector	Collected by DSCL Personnel
Sampling Date	24 June 2022

Test Result of Ambient Air Quality Analysis

Parameter	Unit	RAD_AAQ_02 Aichi Medical College, Mendipur, Amulia, Dhaka 23.739986°N, 90.479863°E Concentration Present	Bangladesh Standard*	IFC Standard **	Duration (hours)	Method of Analysis
$PM_{2.5}$	$\mu g/m^3$	68.21	65	75	24	AEROQUAL Series 500Perticulate matter monitor
PM_{10}	$\mu g/m^3$	153.71	150	150	24	
SO_2	$\mu g/m^3$	167.7	365	125	24	AEROQUAL Series SOx monitor
NO_x	$\mu g/m^3$	27.4	100	40	Annual	AEROQUAL Series NOx monitor
O_3	$\mu g/m^3$	0	NYS	160	8	AEROQUAL Series 500 O_3 monitor
CO	ppm	1	10	NYS	8	Lutron AQ 9901
CO_2	ppm	343	NYS	NYS	8	
Weather Condition		Sunny				
Monitoring Date		24/06/2022				

* The Bangladesh National Ambient Air Quality Standards have been taken from the Environment Conservation Rules, 1997 which was amended on 19 July 2005 vide S.R.O. No. 220-Law/2005.
** IFC Standard for Air Emissions and Ambient Air Quality, April 2007.

Description of the Surrounding Environment

Location	Sample Site Description
Aichi Medical College, Mendipur, Amulia, Dhaka **(RAD_AAQ_02)**	➢ Moderate amount of dust particles was present in the project area. ➢ The weather was sunny. ➢ People movement was moderate. ➢ High amount of vehicle was moving. ➢ This location was beside C/S No. -113 CH. 05+600 km. ➢ 8m away from Mendipur Aman Market. ➢ The location is 3m away from the road centreline ➢ The closest water body is in 34m south from the location

Test Performed By:
S.M. Sowaib Hossain
Jr. Environmental Specialist

Development Solutions Consultant Limited ★ DSCL ★

Checked By:
Md. Mashiur Rahman
Deputy Manager

House# 734 (1-A), Road# 10, Avenue# 04, DOHS Mirpur Dhaka-1216, Bangladesh.
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Name of the Project	Improvement of the Hatirjheel-Rampura-Bonoshree Ideal School and College Sheikherjaiga-Amulia-Demra Highway into 4-lanes {including link to Chittagong Road intersection and access to Tarabo) through PPP.
Location ID	RAD_AAQ_03
Description of Sample	Ambient Air Quality Test
Sample Collector	Collected by DSCL Personnel
Sampling Date	25 June 2022

Test Result of Ambient Air Quality Analysis

Parameter	Unit	RAD_AAQ_03 Bonoshree Central Jame Mosque, Bonoshree, Dhaka 23.763663°N, 90.431573°E Concentration Present	Bangladesh Standard*	IFC Standard **	Duration (hours)	Method of Analysis
$PM_{2.5}$	µg/m³	74.82	65	75	24	AEROQUAL Series 500Perticulate matter monitor
PM_{10}	µg/m³	154.88	150	150	24	
SO_2	µg/m³	167.7	365	125	24	AEROQUAL Series SOx monitor
NO_x	µg/m³	24.3	100	40	Annual	AEROQUAL Series NOx monitor
CO	ppm	2	10	160	8	Lutron AQ 9901
CO_2	ppm	413	NYS	NYS	8	
O_3	µg/m³	0	NYS	NYS	8	AEROQUAL Series 500 O3 monitor
Weather Condition		Sunny				
Monitoring Date		25/06/2022				

** The Bangladesh National Ambient Air Quality Standards have been taken from the Environment Conservation Rules, 1997 which was amended on 19thJuly 2005 vide S.R.O. No. 220-Law/2005.
** IFC Standard for Air Emissions and Ambient Air Quality, April 2007.

Description of the Surrounding Environment

Location	Sample Site Description
Bonoshree Central Jame Mosque, Bonoshree, Dhaka **(RAD_AAQ_03)**	➢ Moderate amount of dust particles was present in the project area. ➢ The weather was sunny. ➢ People movement was high. ➢ High amount of vehicle was moving. ➢ This location was near C/S No.-231 CH 11+500 Km ➢ 70m far from the nearest sensitive location, Ideal School & College. ➢ The location is 37m away from the road centreline. ➢ Closest water body, Rampura khal is in 27m far from the location.

Afia Ratri
Test Performed By:
Afia Ratri
Jr. Environmental Engineer

Development Solutions Consultant Limited ★ DSCL ★

Checked By:
Md. Mashiur Rahman
Deputy Manager

House# 734 (1-A), Road# 10, Avenue# 04, DOHS Mirpur Dhaka-1216, Bangladesh.
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Name of the Project	Improvement of the Hatirjheel-Rampura-Bonoshree Ideal School and College Sheikherjaiga-Amulia-Demra Highway into 4-lanes {including link to Chittagong Road intersection and access to Tarabo) through PPP.
Location ID	RAD_AAQ_04
Description of Sample	Ambient Air Quality Test
Sample Collector	Collected by DSCL Personnel
Sampling Date	26 June 2022

Test Result of Ambient Air Quality Analysis

Parameter	Unit	RAD_AAQ_04 Beside Rampura Bridge Police Box, Rampura, Dhaka 23.767401°N, 90.423261°E Concentration Present	Bangladesh Standard*	IFC Standard **	Duration (hours)	Method of Analysis
$PM_{2.5}$	µg/m³	89.5	65	75	24	AEROQUAL Series 500Perticulate matter monitor
PM_{10}	µg/m³	174.8	150	150	24	
SO_2	µg/m³	218.6	365	125	24	AEROQUAL Series SOx monitor
NO_x	µg/m³	30.9	100	40	Annual	AEROQUAL Series NOx monitor
CO	ppm	1	10	160	8	Lutron AQ 9901
CO_2	ppm	700	NYS	NYS	8	
O_3	µg/m³	0	NYS	NYS	8	AEROQUAL Series 500 O3 monitor
Weather Condition		Sunny				
Monitoring Date		26/06/2022				

* The Bangladesh National Ambient Air Quality Standards have been taken from the Environment Conservation Rules, 1997 which was amended on 19thJuly 2005 vide S.R.O. No. 220-Law/2005.
** IFC Standard for Air Emissions and Ambient Air Quality, April 2007.

Description of the Surrounding Environment

Location	Sample Site Description
Beside Rampura Bridge Police Box, Rampura, Dhaka **(RAD_AAQ_04)**	➢ High amount of vehicle was moving. ➢ High amount of dust particles was present in the project area. ➢ The weather was mostly sunny. ➢ People movement was high. ➢ This location was beside C/S No. -251 CH. 12+450 km. ➢ The location is in 22 m away from the centreline ➢ The closest water body, Rampura Khal is in 45m away from the location ➢ The closest sensitive location, Rampura Water pump is in 20 m away from the location.

Test Performed By:
Maliha Khatun
Jr. Environmental Engineer

Development Solutions Consultant Limited ★ DSCL ★

Checked By:
Md. Mashiur Rahman
Deputy Manager

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Name of the Project	Improvement of the Hatirjheel-Rampura-Bonoshree Ideal School and College Sheikherjaiga-Amulia-Demra Highway into 4-lanes {including link to Chittagong Road intersection and access to Tarabo) through PPP.
Location ID	RAD_AAQ_05
Description of Sample	Ambient Air Quality Test
Sample Collector	Collected by DSCL Personnel
Sampling Date	27 June 2022

Test Result of Ambient Air Quality Analysis

Parameter	Unit	RAD_AAQ_05 Nandipara Bridge, Rampura, Dhaka 23.749650°N, 90.460163°E Concentration Present	Bangladesh Standard*	IFC Standard ***	Duration (hours)	Method of Analysis
$PM_{2.5}$	µg/m³	78.82	65	75	24	AEROQUAL Series 500Perticulate matter monitor
PM_{10}	µg/m³	159.08	150	150	24	
SO_2	µg/m³	390	365	125	24	AEROQUAL Series SOx monitor
NO_x	µg/m³	38	100	40	Annual	AEROQUAL Series NOx monitor
CO	ppm	2	10	160	8	Lutron AQ 9901
CO_2	ppm	456	NYS	NYS	8	Lutron AQ 9901
O_3	µg/m³	0	NYS	NYS	8	AEROQUAL Series 500 O3 monitor
Weather Condition		Sunny				
Monitoring Date		27/06/2022				

* The Bangladesh National Ambient Air Quality Standards have been taken from the Environment Conservation Rules, 1997 which was amended on 19 July 2005 vide S.R.O. No. 220-Law/2005.
** IFC Standard for Air Emissions and Ambient Air Quality, April 2007.

Description of the Surrounding Environment

Location	Sample Site Description
Nagdarpar Bridge, Bonoshee, Dhaka **(RAD_AAQ_05)**	➢ Traffic volume is high. ➢ The movement of people is very low. ➢ The weather was sunny. ➢ Visual dust particle is high. ➢ The location is situated 12m far from the road centreline. ➢ This location was beside C/S No. -161 CH. 07+950 km. ➢ Closest water body, Nagdarpar pond is 77m from the location.

Test Performed By:
Sadia Sabrin
Jr. Environmental Engineer

Development Solutions Consultant Limited ★ DSCL ★

Checked By:
Md. Mashiur Rahman
Deputy Manager

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Development Solutions Consultant Limited

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DSCL Environmental Laboratory

Name of the Project	Improvement of the Hatirjheel-Rampura-Bonoshree Ideal School and College Sheikherjaiga-Amulia-Demra Highway into 4-lanes {including link to Chittagong Road intersection and access to Tarabo) through PPP.
Location ID	RAD_AAQ_06
Description of Sample	Ambient Air Quality Test
Sample Collector	Collected by DSCL Personnel
Sampling Date	28 June 2022

Test Result of Ambient Air Quality Analysis

Parameter	Unit	RAD_AAQ_06 Mostam Haji Mor, Rampura, Dhaka 23.746545°N, 90.472206°E Concentration Present	Bangladesh Standard*	IFC Standard **	Duration (hours)	Method of Analysis
$PM_{2.5}$	µg/m³	86.3	65	75	24	AEROQUAL Series 500Perticulate matter monitor
PM_{10}	µg/m³	179.8	150	150	24	
SO_2	µg/m³	206.3	365	125	24	AEROQUAL Series SOx monitor
NO_x	µg/m³	33.7	100	40	Annual	AEROQUAL Series NOx monitor
CO*	ppm	7	10	160	8	Lutron AQ 9901
CO_2*	ppm	413	NYS	NYS	8	
O_3	µg/m³	0	NYS	NYS	8	AEROQUAL Series 500 O3 monitor
Weather Condition		Sunny				
Monitoring Date		28/06/2022				

* The Bangladesh National Ambient Air Quality Standards have been taken from the Environment Conservation Rules, 1997 which was amended on 19thJuly 2005 vide S.R.O. No. 220-Law/2005.
** IFC Standard for Air Emissions and Ambient Air Quality, April 2007.

Description of the Surrounding Environment

Location	Sample Site Description
Mostam Haji Mor, Rampura, Dhaka **(RAD_AAQ_06)**	➢ Dust particle high. ➢ Vehicular movement is also high. ➢ Moderate people movement. ➢ The location is 7.02 m far from the centre line. ➢ This location was in between C/S No. -134 CH. 06+650 km. ➢ Sensitive location- Iram Chattar Bazar is 44 m far from the location. ➢ Closest Water body- Mostam Haji Pond is 178 m far from the location.

Maliha

Test Performed By:
Maliha Khatun
Jr. Environmental Engineer

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Rahman

Checked By:
Md. Mashiur Rahman
Deputy Manager

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Name of the Project	Improvement of the Hatirjheel-Rampura-Bonoshree Ideal School and College Sheikherjaiga-Amulia-Demra Highway into 4-lanes {including link to Chittagong Road intersection and access to Tarabo) through PPP.
Location ID	RAD_AAQ_07
Description of Sample	Ambient Air Quality Test
Sample Collector	Collected by DSCL Personnel
Sampling Date	29 June 2022

Test Result of Ambient Air Quality Analysis

Parameter	Unit	RAD_AAQ_07 Staff Quarter Jame Mosque, Demra, Dhaka 23.720360°N, 90.491715°E Concentration Present	Bangladesh Standard*	IFC Standard **	Duration (hours)	Method of Analysis
$PM_{2.5}$	µg/m³	95.81	65	75	24	AEROQUAL Series 500Perticulate matter monitor
PM_{10}	µg/m³	193.19	150	150	24	
SO_2	µg/m³	126.66	365	125	24	AEROQUAL Series SOx monitor
NO_x	µg/m³	25.3	100	40	Annual	AEROQUAL Series NOx monitor
CO	ppm	10	10	160	8	Lutron AQ 9901
CO_2	ppm	329	NYS	NYS	8	
O_3	µg/m³	0	NYS	NYS	8	AEROQUAL Series 500 O3 monitor
Weather Condition			Sunny			
Monitoring Date			29/06/2022			

* The Bangladesh National Ambient Air Quality Standards have been taken from the Environment Conservation Rules, 1997 which was amended on 19thJuly 2005 vide S.R.O. No. 220-Law/2005.
** IFC Standard for Air Emissions and Ambient Air Quality, April 2007.

Description of the Surrounding Environment

Location	Sample Site Description
Staff Quarter Jame Mosque, Demra, Dhaka **(RAD_AAQ_07)**	➢ Heavy traffic movement. ➢ Visible dust particle high. ➢ People movement high. ➢ The weather was cloudy and rainy. ➢ This location was beside C/S No. -62 CH. 03+050 km. ➢ The location is 113m far from the centre line of the road. ➢ Closest water body is in 78m far from the location. ➢ Nearest sensitive location-Staff quarter jam-e-masjid is 17m far from the location

Test Performed By:
S.M. Sowaib Hossain
Jr. Environmental Specialist

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Checked By:
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Name of the Project	Improvement of the Hatirjheel-Rampura-Bonoshree Ideal School and College Sheikherjaiga-Amulia-Demra Highway into 4-lanes {including link to Chittagong Road intersection and access to Tarabo) through PPP.
Location ID	RAD_AAQ_08
Description of Sample	Ambient Air Quality Test
Sample Collector	Collected by DSCL Personnel
Sampling Date	30 June 2022

Test Result of Ambient Air Quality Analysis

Parameter	Unit	RAD_AAQ_08 Near Sugandha Hospital, Chittagong Road, Dhaka 23.697662°N, 90.509537°E Concentration Present	Bangladesh Standard*	IFC Standard **	Duration (hours)	Method of Analysis
$PM_{2.5}$	$\mu g/m^3$	74.24	65	75	24	AEROQUAL Series 500Perticulate matter monitor
PM_{10}	$\mu g/m^3$	158.25	150	150	24	
SO_2	$\mu g/m^3$	190.10	365	125	24	AEROQUAL Series SOx monitor
NO_x	$\mu g/m^3$	29.98	100	40	Annual	AEROQUAL Series NOx monitor
CO	ppm	15.33	10	160	8	Lutron AQ 9901
CO_2	ppm	446	NYS	NYS	8	
O_3	$\mu g/m^3$	0	NYS	NYS	8	AEROQUAL Series 500 O3 monitor
Weather Condition		Sunny				
Monitoring Date		30/06/2022				

* The Bangladesh National Ambient Air Quality Standards have been taken from the Environment Conservation Rules, 1997 which was amended on 19thJuly 2005 vide S.R.O. No. 220-Law/2005.
** IFC Standard for Air Emissions and Ambient Air Quality, April 2007.

Description of the Surrounding Environment

Location	Sample Site Description
Near Sugandha Hospital, Chittagong Road, Dhaka **(RAD_AAQ_08)**	➢ Heavy traffic volume. ➢ People movement was very high. ➢ The weather was mostly rainy. ➢ Visible dust particle high. ➢ This location was in beside C/S No. -01 CH 00+000 km. ➢ The location is 6.30m far from the road centre line. ➢ Closest water body, Chittagong Road Lake is in 103m from the location.

Test Performed By:
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Jr. Environmental Engineer

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Noise Level Measurement

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Name of the Project	Improvement of the Hatirjheel-Rampura-Bonoshree Ideal School and College Sheikherjaiga-Amulia-Demra Highway into 4-lanes {including link to Chittagong Road intersection and access to Tarabo) through PPP.
Description of Sample	Noise Level Measurements
Sample Collector	Collected by DSCL Personnel
Sampling Date	23 June 2022 to 30 June 2022

Test Result of Noise Level Measurements

Location	Sample ID	GPS Location	Land Use Category	Time		Noise Level (dBA) (LAeq)		Bangladesh Standard (dB A) **	
				Day	Night	Day	Night	Day	Night
Meradia Bazar, Rampura, Dhaka	RAD_NM_01	23.762089^0 N 90.443466^0 E	Mixed	09:27am to 11:27am	8:00pm to 10:00pm	77.63	83.92	60	50
Beside National Ideal School and College, Bonoshree, Rampura, Dhaka	RAD_NM_02	23.762317^0 N 90.440339^0 E		12:50pm to 02:50pm	09:05pm to 11:05pm	77.5	94.15		
Aichi Medical College, Mendipur, Amulia, Dhaka	RAD_NM_03	23.739983^0 N 90.472190^0 E		08:53am to 10:53am	08:42pm to 10:42pm	57.19	77.63		
Amulia Baitunnahar Jame Mosque, Baitunnahar, Dhaka	RAD_NM_04	23.73769^0 N 90.48232^0 E		09:05am to 11:05am	09:00pm to 11:00pm	63.47	75.11		
Bonoshree Central Jame Mosque, Bonoshree, Dhaka	RAD_NM-05	23.763592^0 N 90.431749^0 E		08:34am to 10:34am	08:00pm to 10:00pm	69.15	63.91		
Academia Bonoshree, Dhaka	RAD_NM-06	23.762523^0 N 90.437947^0 E		11:45am to 01:45pm	09:20pm to 11:20pm	63.88	63.73		
Beside Rampura Bridge Police Box	RAD_NM_07*	23.767437°N 90.423241°E		10:24am to 10:24pm	10:24pm to 10:24pm	68.82	67.60		
Bonoshree Adarsha Bidda Niketon School and College, Bonoshree, Dhaka.	RAD_NM_08*	23.76306° N 90.43398° E		11:30am to 11:30pm	11:30pm to 11:301m	75.92	78.72		
Nandipara Bus Stop, Rampura, Dhaka	RAD_NM_09	23.751376°N 90.453586°E		11:08am to 01:08pm	07:30pm to 09:30pm	71.10	71.68		

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Location	Sample ID	GPS Location	Land Use Category	Time		Noise Level (dBA) (LAeq)		Bangladesh Standard (dB A) **	
				Day	Night	Day	Night	Day	Night
Sarulia Bazar Jame Mosque, Sarulia, Dhaka	RAD_NM_10	23.716238°N 90.496155°E		11:34am to 01:34pm	08:45pm to 10:45pm	67.79	66.90		
Mostam Haji Mor, Rampura, Dhaka	RAD_NM_11*	23.746594°N 90.472167°E		10:00am to 10:00pm	10:00pm to 10:00am	70.20	68.33		
Demra Fire Station, Demra, Dhaka	RAD_NM-12*	23.71393° N 90.49777° E		10:39am to 10:39pm	10:39pm to 10:39am	67.79	68.33		
Staff Quarter Jame Mosque, Demra, Dhaka	RAD_NM_13	23.720129°N 90.491336°E		11:20am to 01:20pm	08:00pm to 10:00pm	66.48	63.70		
Sarulia DPDC, Sarulia, Dhaka.	RAD_NM_14	23.717709°N 90.495160°E		11:30am to 01:30pm	08:05pm to 10:05pm	67.15	61.46		
Infront of Gas Transmission Company Limited, Demra, Dhaka	RAD_NM_15*	23.710745°N 90.500286°E		12:00pm to 12:00pm (24hours)	04:00am to 06:00am	74.29	77.73		
Near Sugandha Hospital, Chittagong Road, Dhaka	RAD_NM_16*	23.697620°N 90.509541°E		10:30am to 10:30am (24Hours)	11:45pm to 01:45am	81.66	80.24		

IFC Standards**		
Residential; Institutional; Educational	Day Time	55 dB
	Night Time	45 dB
Industrial; Commercial	Day Time	70 dB
	Night Time	70 dB

Notes

- The land use category is based on the classification provided in the Noise Pollution Control Rules (2006).
- The sound level standard for the commercial and industrial area is 70(Day) and 60(Night) & 75(Day) and 70(Night) dBA during the daytime respectively.
- Noise Level is the average noise recorded throughout the monitoring period.

*24 hours value is calculated for 12 hours day time and 12 hours night time.
** IFC Standards for Noise Level Guideline, April 2007.

Description of the Surrounding Environment

Sample Location and ID	Sample Site Description
Meradia Bazar, Rampura, Dhaka **(RAD_NM_01)**	➢ It was both residential and commercial area. ➢ High volume of traffic because it's situated beside the road. ➢ High people movement. ➢ Noise from vehicle and people is high. ➢ Heavy vehicle movement during night time.
Beside National Ideal School and College, Bonoshree, Rampura, Dhaka. **(RAD_NM_02)**	➢ It was both residential and commercial area. ➢ High volume of traffic. ➢ Very Low people movement. ➢ Four-wheeler specially trucks and buses movement are high.

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Sample Location and ID	Sample Site Description
Aichi Medical College, Mendipur, Amulia, Dhaka. **(RAD_NM_03)**	➢ It was a commercial area. ➢ High volume of traffic. ➢ Moderate people movement. ➢ Some small shops are present. ➢ Heavy vehicle movement during night time has been noticed.
Amulia Baitunnahar Jame Mosque, Baitunnahar, Dhaka. **(RAD_NM_04)**	➢ It was both residential and commercial area. ➢ High amount volume of traffic. ➢ High amount of people movement. ➢ Busy road. ➢ Heavy vehicle movement during night time.
Bonoshree Central Jame Mosque Bonoshree Central Jame Mosque, Bonoshree, Dhaka. **(RAD_NM_05)**	➢ High volume of traffic. ➢ High people movement. ➢ Many grocery shops are present. ➢ Comparatively less busy area.
Academia Bonoshree, Dhaka **(RAD_NM_06)**	➢ It was both commercial and residential areas. ➢ Traffic volume was moderate. ➢ Moderate amount of people movement. ➢ No construction work is going on.
Beside Rampura Bridge Police Box **(RAD_NM_07)**	➢ It was a commercial area. ➢ Traffic volume was high in the project area. ➢ High people movement was noticed. ➢ Busy road. ➢ Cars and motor vehicle movement was high.
Bonoshree Adarsha Bidda Niketon School and College, Bonoshree, Dhaka. **(RAD_NM_08)**	➢ It situated in both commercial and residential area. ➢ High people movement ➢ High volume of traffic because of beside the road. ➢ Busy road. ➢ School was open and noise from the institution was high.
Nandipara Bus Stop,Rampura, Dhaka. **(RAD_NM_09)**	➢ It was situated in both commercial and residential area. ➢ Moderate people movement was noticed. ➢ Moderate vehicle movement is present. ➢ Beside Bazar area. ➢ Mini buses and large buses movement was high.
Sarulia Bazar Jame Mosque, Sarulia, Dhaka. **(RAD_NM_10)**	➢ It was situated in both commercial and residential area. ➢ High volume of traffic. ➢ High people movement. ➢ Welding machine sound high. ➢ Very crowdy place. ➢ Weather was sunny.
Mostam Haji Mor, Rampura, Dhaka **(RAD_NM_11)**	➢ It was situated in both commercial and residential area. ➢ High volume of people movement ➢ High volume of traffic because of beside the road. ➢ Some shops are present.
Demra Fire Station, Demra, Dhaka. **(RAD_NM_12)**	➢ It was situated in both commercial and residential area. ➢ High people movement ➢ High volume of traffic because of beside the road. ➢ Commercial buildings are seen.
Staff Quarter Jame Mosque, Demra, Dhaka. **(RAD_NM_13)**	➢ It was situated in both commercial and residential area. ➢ Moderate amount of people movement. ➢ High volume of traffic movement. ➢ Bazar area.
Sarulia DPDC, Sarulia, Dhaka.	➢ It was both industrial and commercial area.

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Sample Location and ID	Sample Site Description
(RAD_NM_14)	➢ High amount of vehicle movement. ➢ Moderate people movement. ➢ Situated beside a canal and in open place.
Infront of Gas Transmission Company Limited, Demra, Dhaka. **(RAD_NM_15)**	➢ It was both industrial and commercial area. ➢ Low amount of people movement is visible. ➢ Moderate amount of vehicle movement. ➢ Dust particle is moderate.
Near Sugandha Hospital, Chittagong Road, Dhaka. **(RAD_NM_16)**	➢ It was both residential and commercial area. ➢ High amount of traffic movement. ➢ High volume of people. ➢ Beside a local Bazar.

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Vibration Level Measurement

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Name of the Project	Improvement of the Hatirjheel-Rampura-Bonoshree Ideal School and College Sheikherjaiga-Amulia-Demra Highway into 4-lanes {including link to Chittagong Road intersection and access to Tarabo) through PPP.
Description of Sample	Vibration Level Measurements
Sample Collector	Collected by DSCL Personnel
Sampling Date	23 June 2022 to 30 June 2022

Test Result of Vibration Level Measurements

Location	Sample ID	Velocity (mm/s)				Acceleration (m/s^2)				Displacement (mm)			
		Maximum	Minimum	Standard Deviation	Mean Value	Maximum	Minimum	Standard Deviation	Mean Value	Maximum	Minimum	Standard Deviation	Mean Value
Meradia Bazar, Rampura, Dhaka	VB_01 (Day)	37.71	0	1.160	0.475	18	0	0.727	0.261	2.462	0	0.127	0.030
	VB_01 (Night)	3.89	0	0.603	0.435	13	0	0.839	0.356	2.401	0	0.070	0.016
Aichi Medical College, Amulia, Dhaka	VB_02 (Day)	2.99	0	0.518	0.812	2.93	0.31	0.455	0.692	2.005	0.005	0.204	0.202
	VB_02 (Night)	15.07	0.31	3.108	3.392	3.63	0.33	0.700	1.518	3.055	0.005	0.654	0.593
Bonoshree Central Jame Mosque, Bonoshree, Dhaka	VB_03 (Day)	6.53	0.31	0.617	0.921	5.91	0.31	0.399	0.543	0.989	0.005	0.079	0.022
	VB_03 (Night)	5.05	0.31	0.681	0.886	2.83	0.31	0.474	0.837	0.661	0.005	0.066	0.041
Bonoshree Bus Stop, Bonoshree, Dhaka	VB_04 (Day)	30.01	0.31	1.974	1.429	6.71	0.31	0.748	0.883	3.675	0.005	0.397	0.154
	VB_04 (Night)	72.55	0.31	3.160	1.523	341.9	0.31	10.699	2.156	3.897	0.005	0.445	0.233
Nagdarpar Bridge, Bonoshree, Dhaka	VB_05 (Day)	2.41	0.31	0.412	0.740	1.87	0.31	0.335	0.660	0.965	0.005	0.084	0.041
	VB_05 (Night)	3.51	0.31	0.613	0.961	2.97	0.31	0.320	0.626	0.941	0.005	0.082	0.053
Mostam Haji Mor, Rampura, Dhaka	VB_06 (Day)	7.25	0.31	0.675	0.932	2.55	0.31	0.390	0.716	2.376	0.005	0.397	0.154
	VB_06 (Night)	30.01	0.31	1.974	1.429	6.71	0.31	0.748	0.883	3.675	0.005	0.008	0.003
Staff Quarter Jame Mosque,	VB_07 (Day)	9.21	0.31	0.733	0.808	1.91	0.31	0.354	0.634	0.486	0.005	0.036	0.028
	VB_07 (Night)	2.93	0.31	0.434	0.755	2.25	0.31	0.417	0.793	0.215	0.005	0.018	0.012

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Location	Sample ID	Velocity (mm/s)				Acceleration (m/s²)				Displacement (mm)			
		Maximum	Minimum	Standard Deviation	Mean Value	Maximum	Minimum	Standard Deviation	Mean Value	Maximum	Minimum	Standard Deviation	Mean Value
Demra, Dhaka													
Near Sugandha Hospital, Chittagong Road, Dhaka	VB_08 (Day)	7.27	0.31	0.997	1.398	2.09	0.31	0.376	0.611	2.510	0.005	0.133	0.085
	VB_08 (Night)	1.01	0.31	0.232	0.513	4.87	0.31	0.718	0.956	2.588	0.005	0.208	0.046

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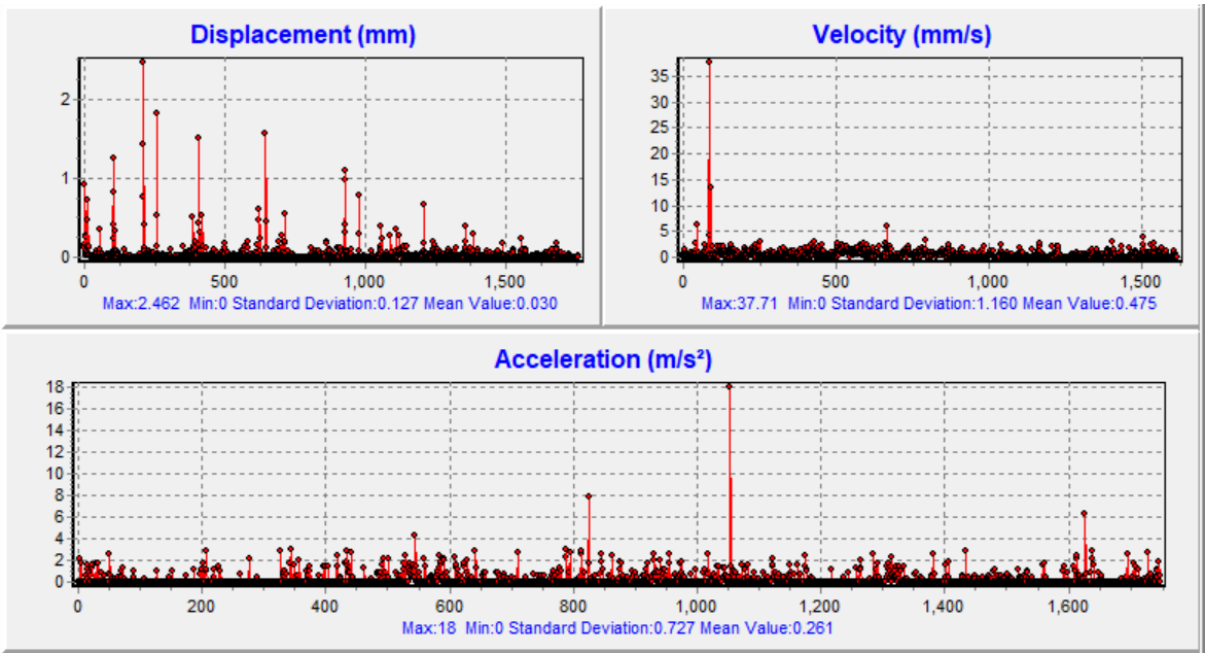
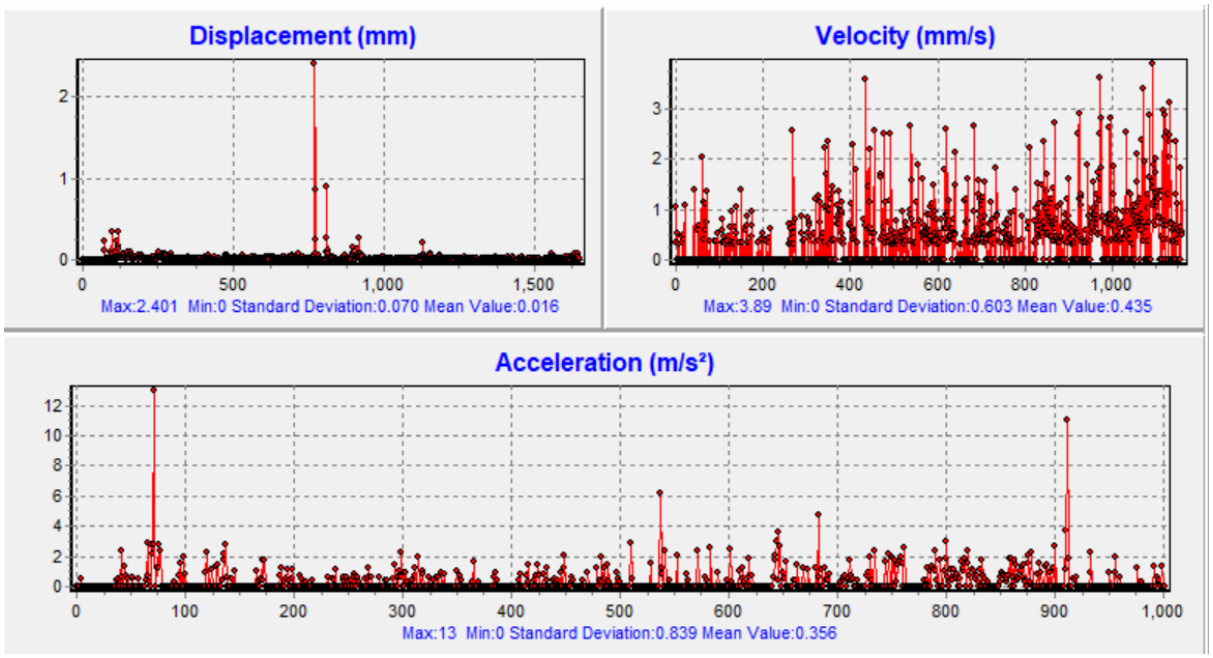
"RAD_VB_01" (02 Hours for both Day and Night Time)

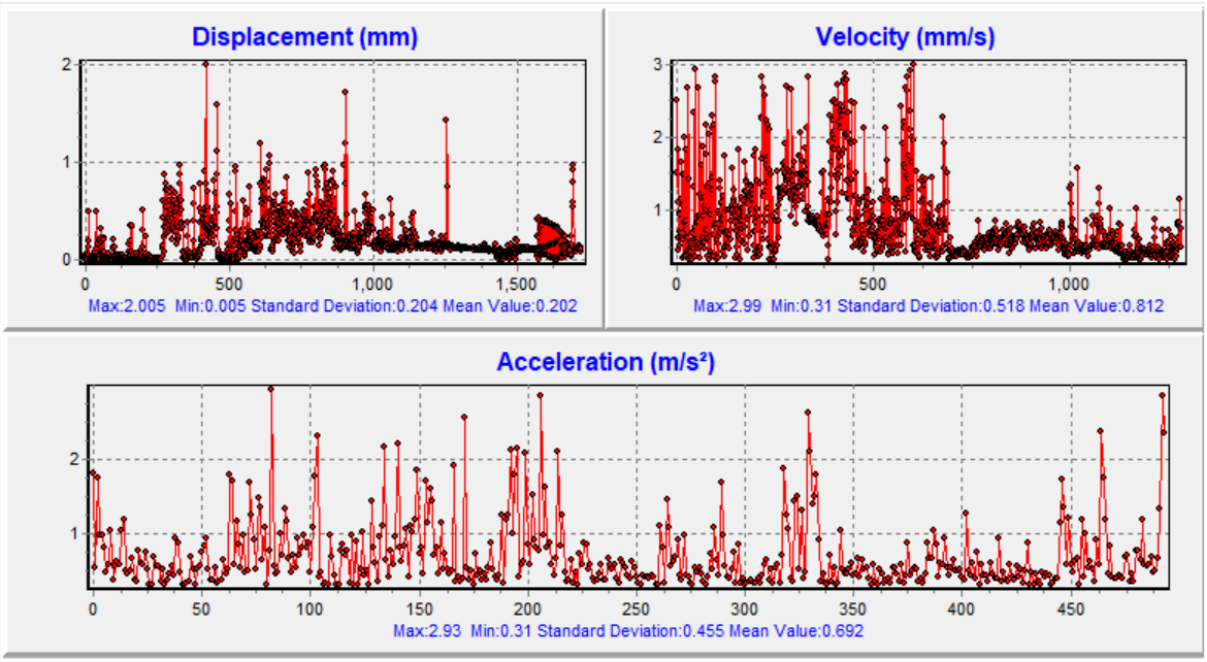


Daytime

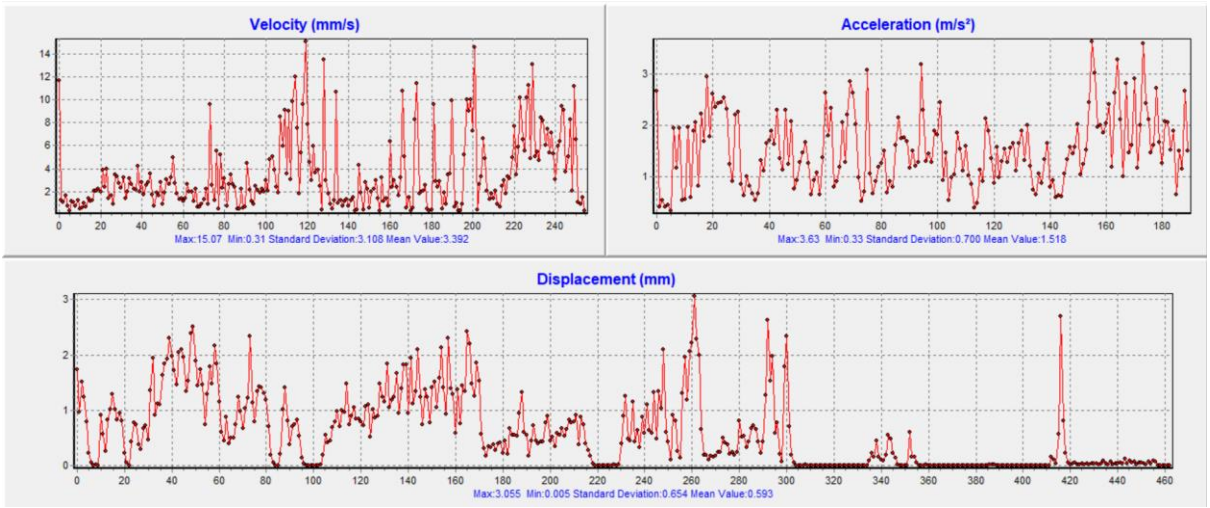


Night Time

"RAD_VB_02" (02 Hours for both Day and Night Time)

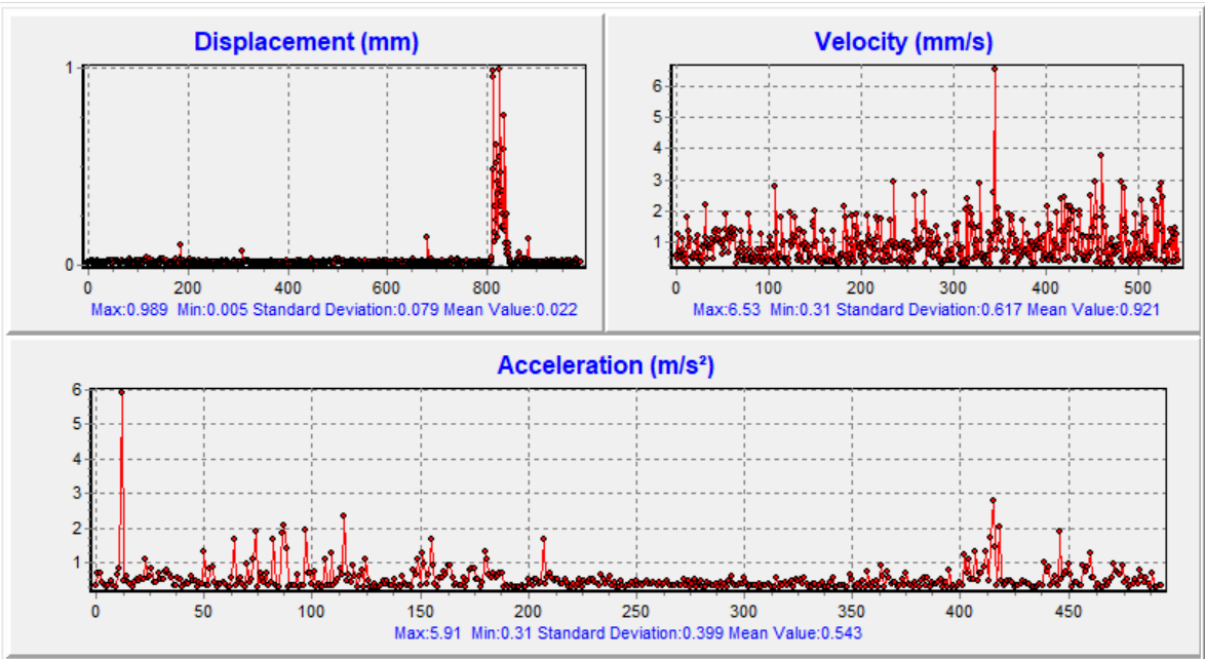


Daytime

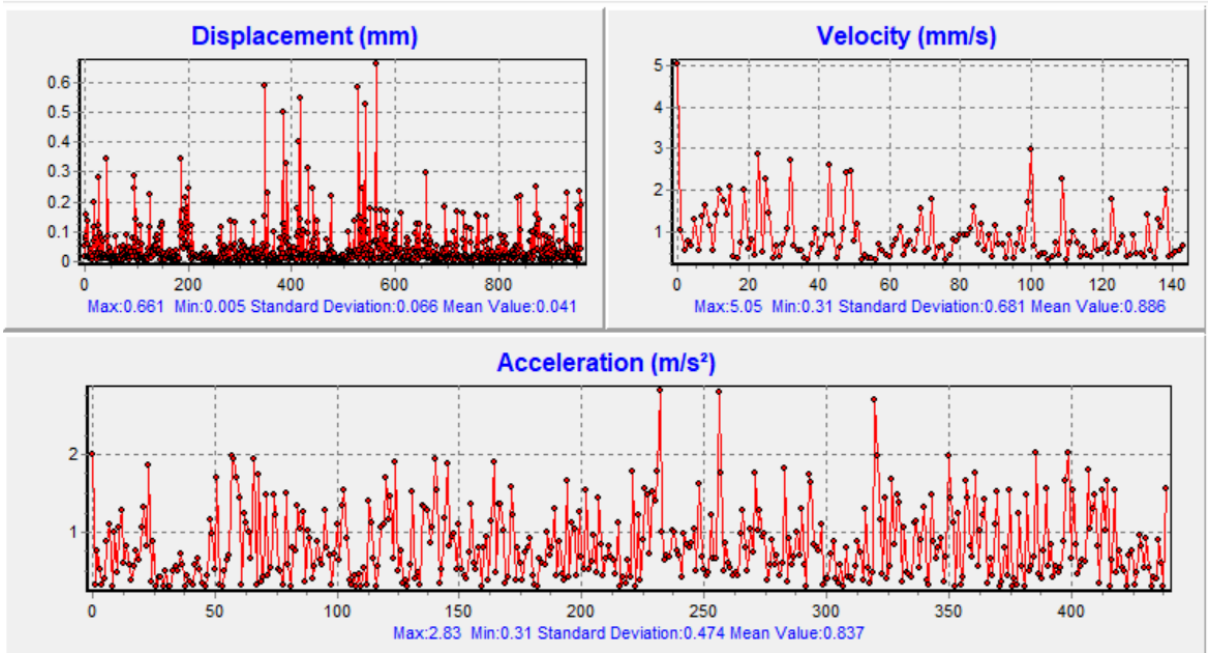


Night Time

"RAD_VB_03" (02 Hours for both Day and Night Time)

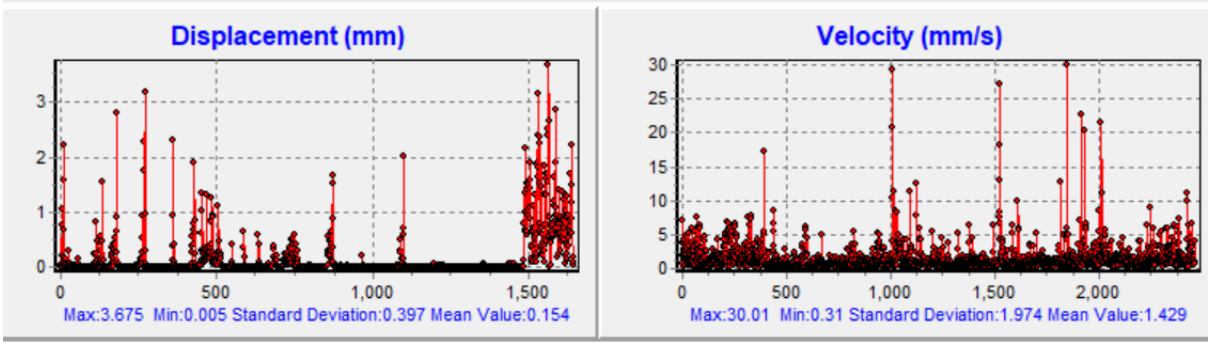


Daytime

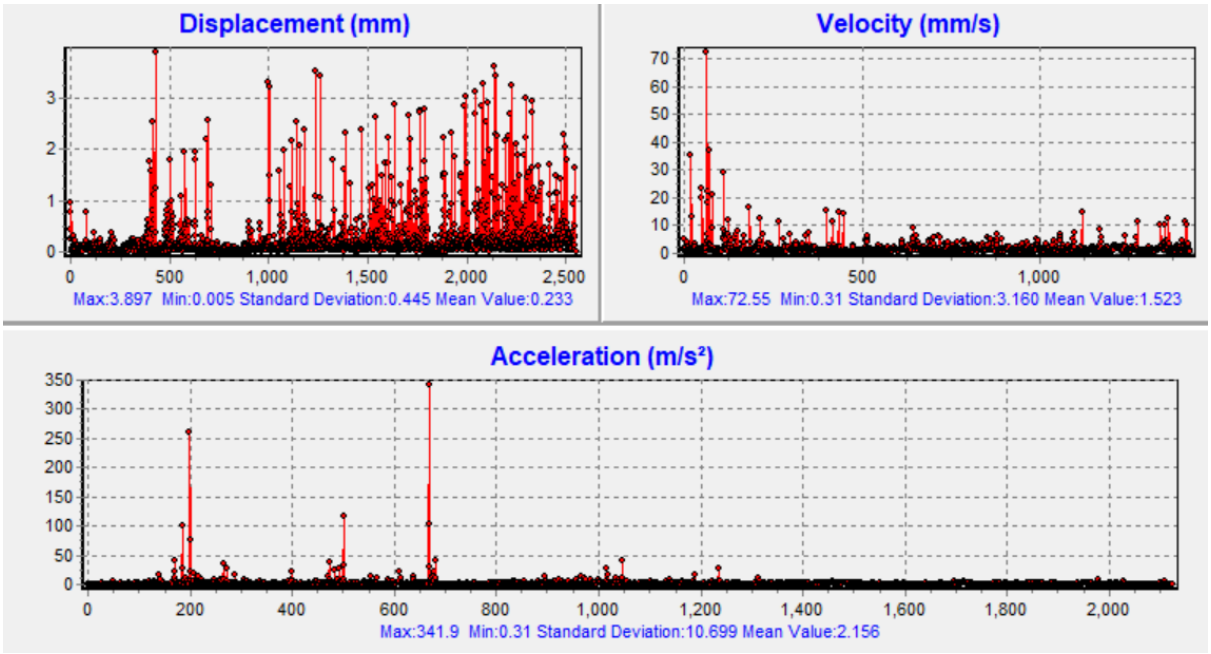


Night Time

"RAD_VB_04" (24 Hours)

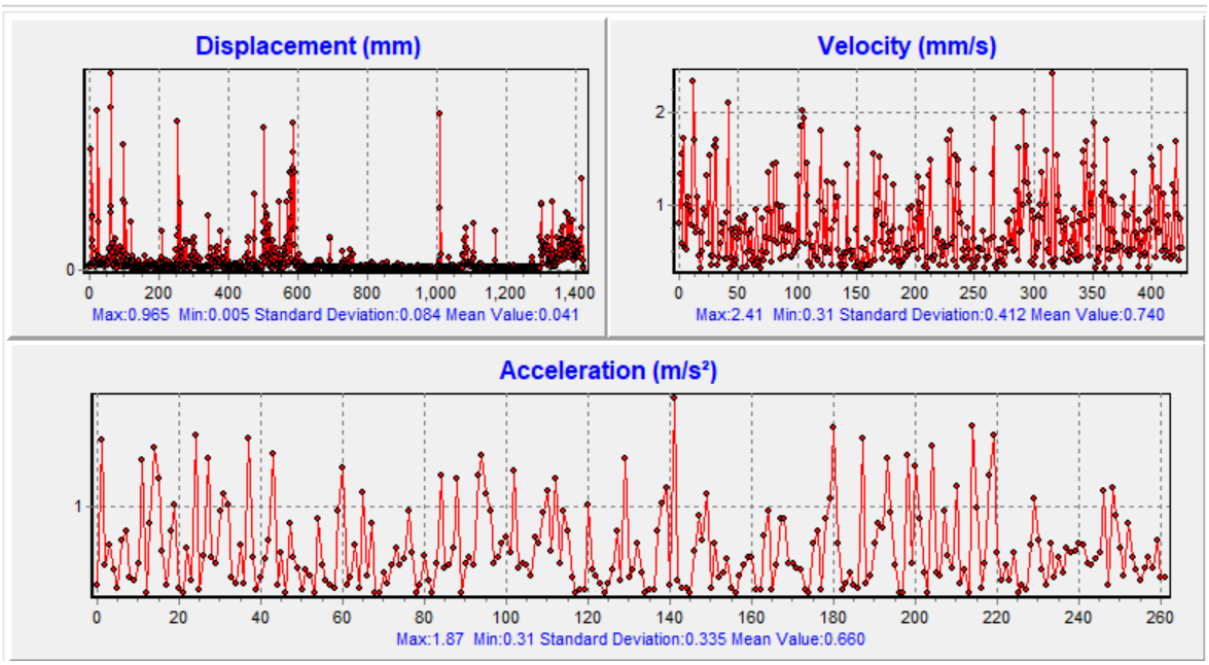


Daytime (12 hours)

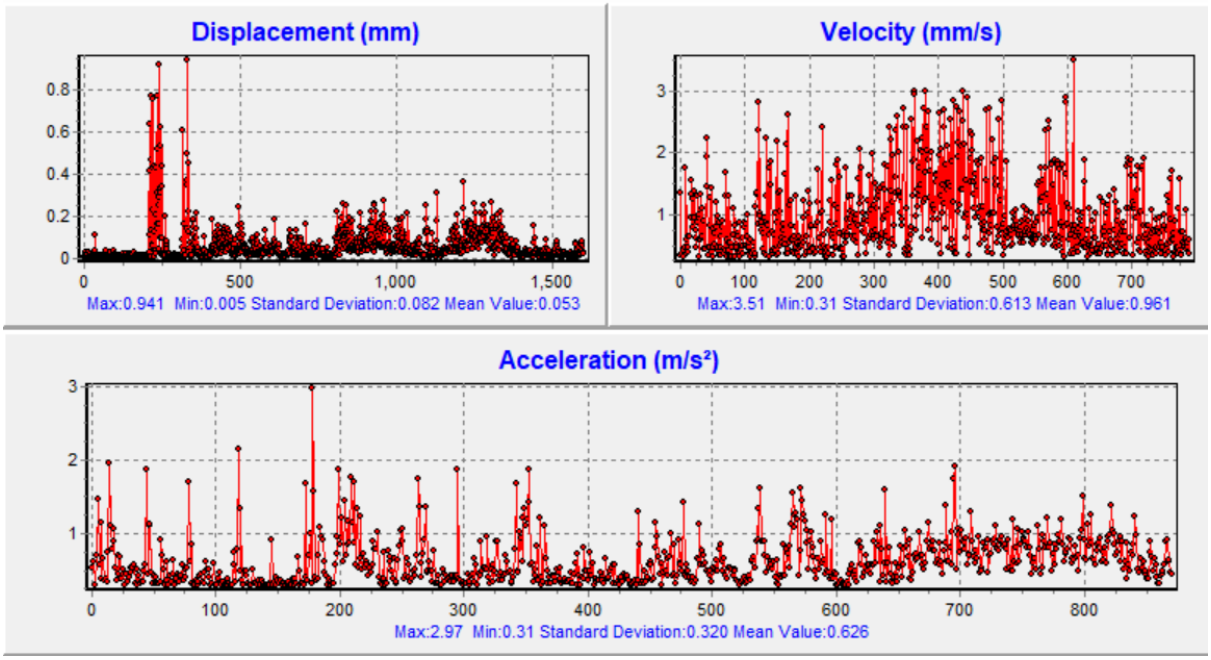


Night Time (12 hours)

"RAD_VB_05" (02 Hours for both Day and Night Time)

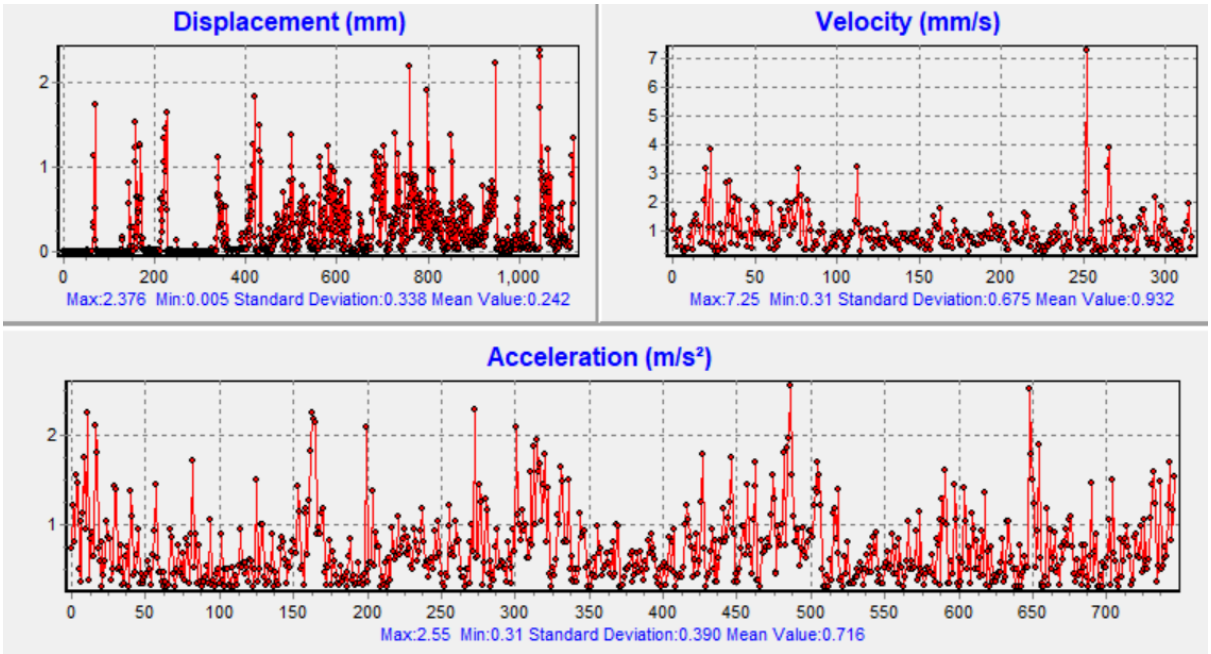


Daytime

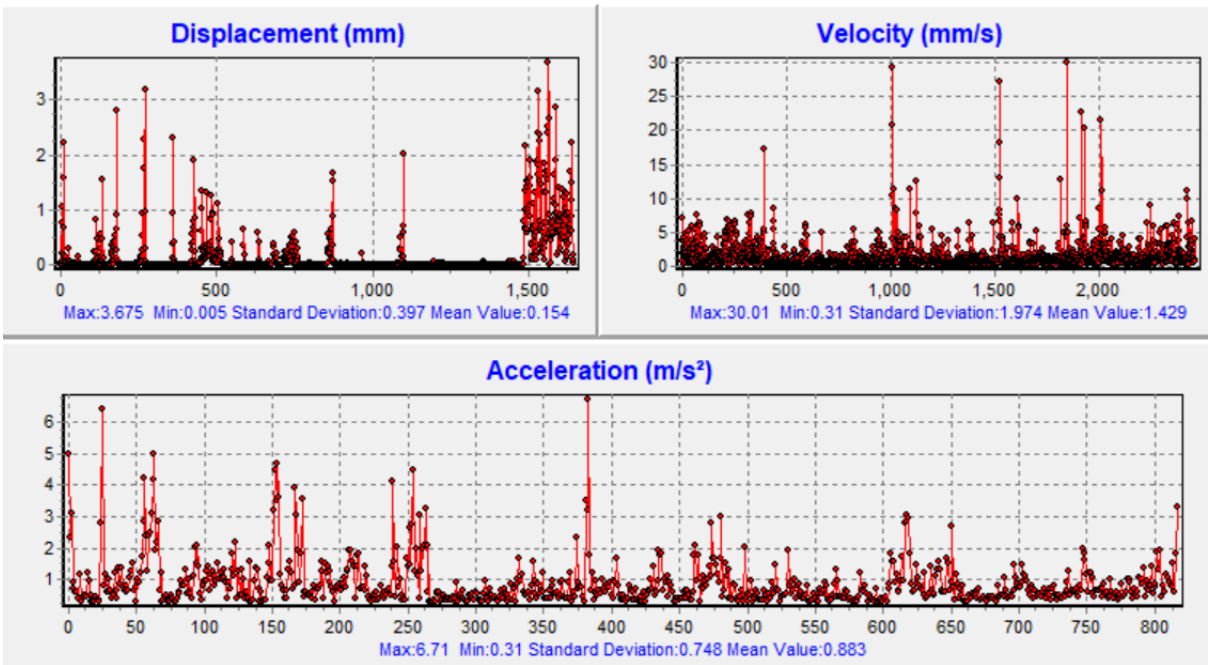


Night Time

"RAD_VB_06" (24 Hours)

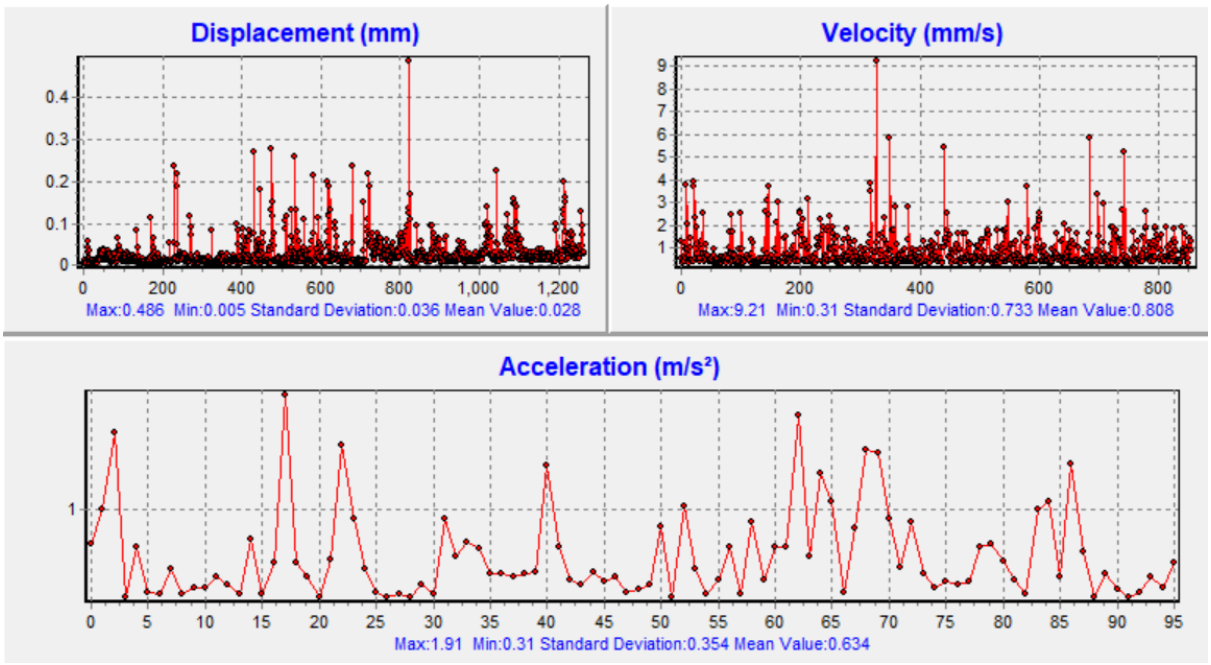


Daytime (12 hours)

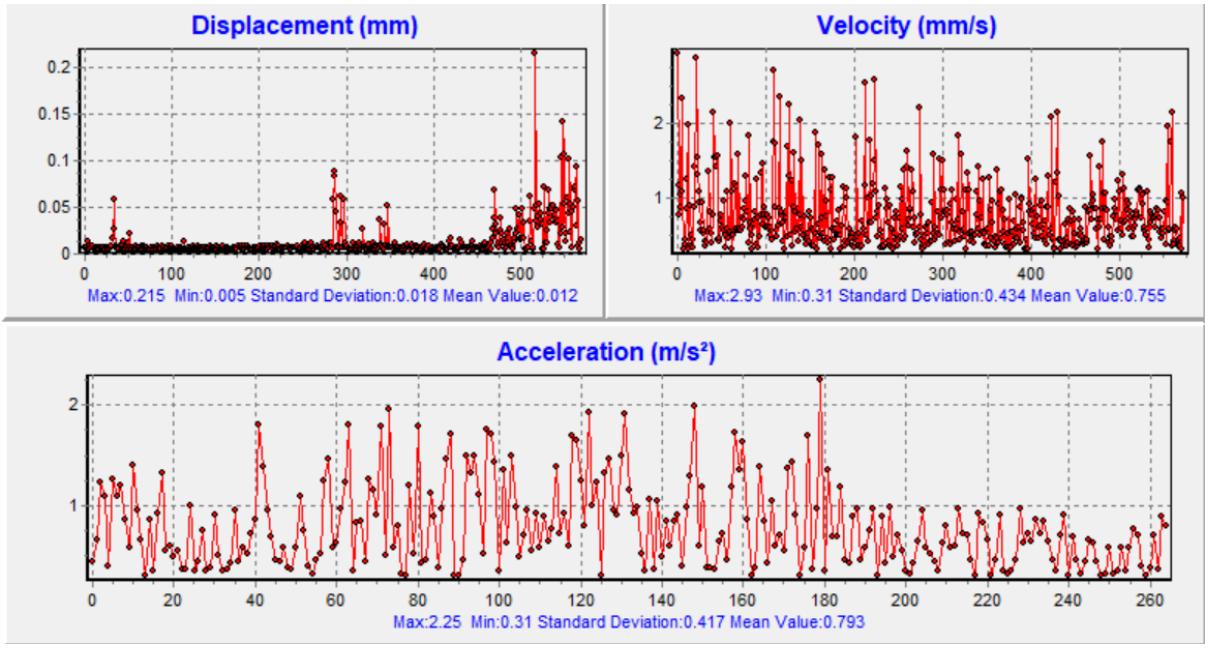


Night Time (12 hours)

"RAD_VB_07" (02 Hours for both Day and Night Time)

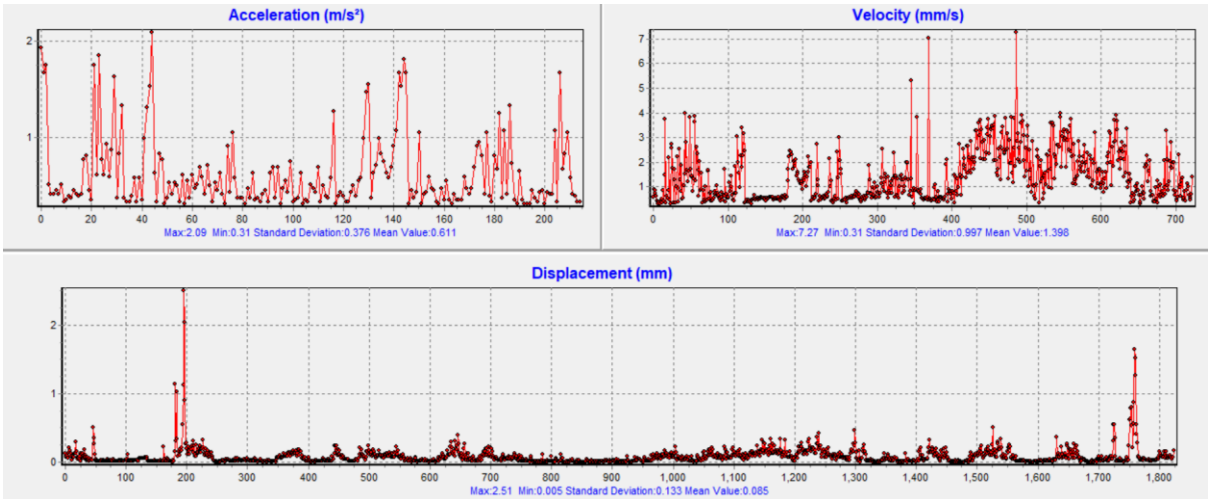


Daytime

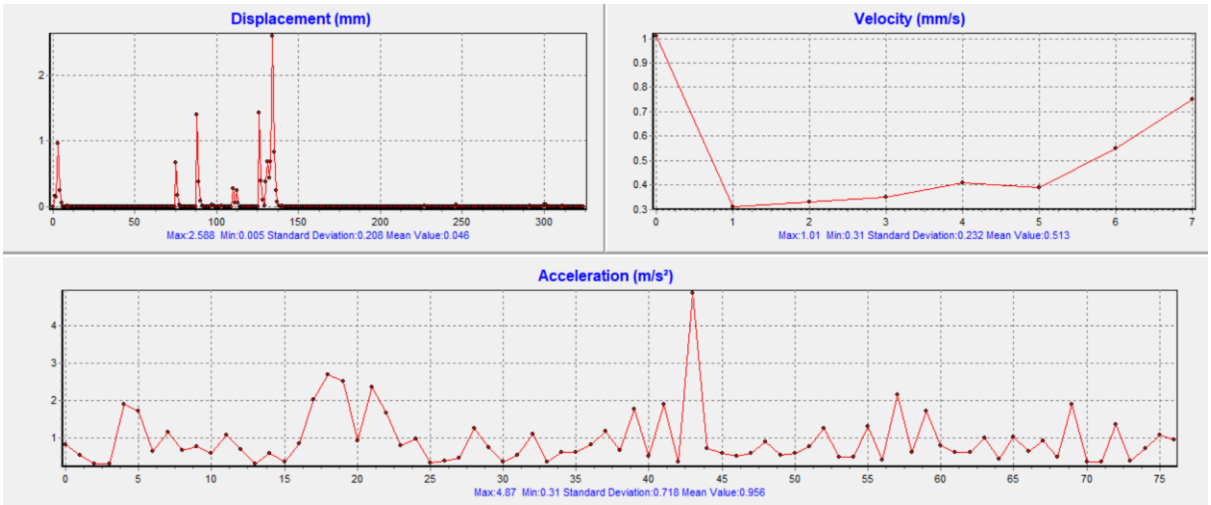


Night Time

"RAD_VB_08" (24 Hours)

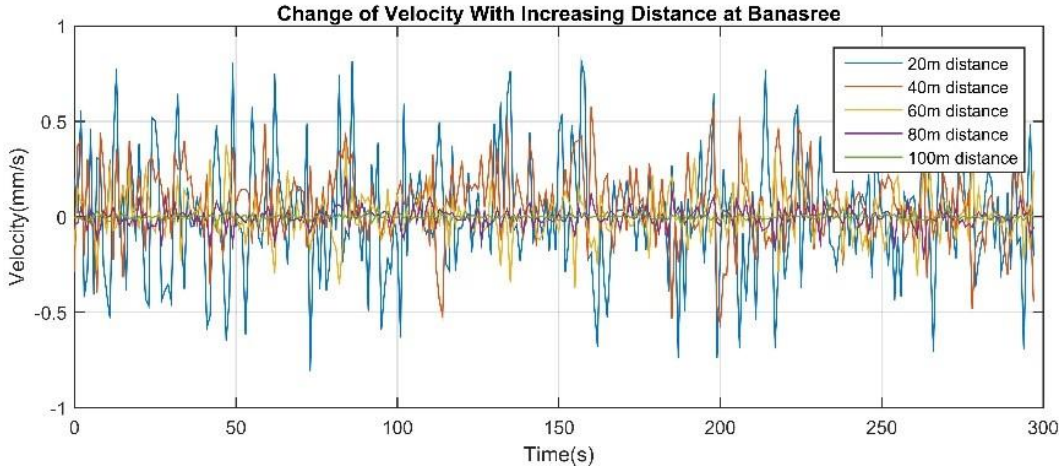


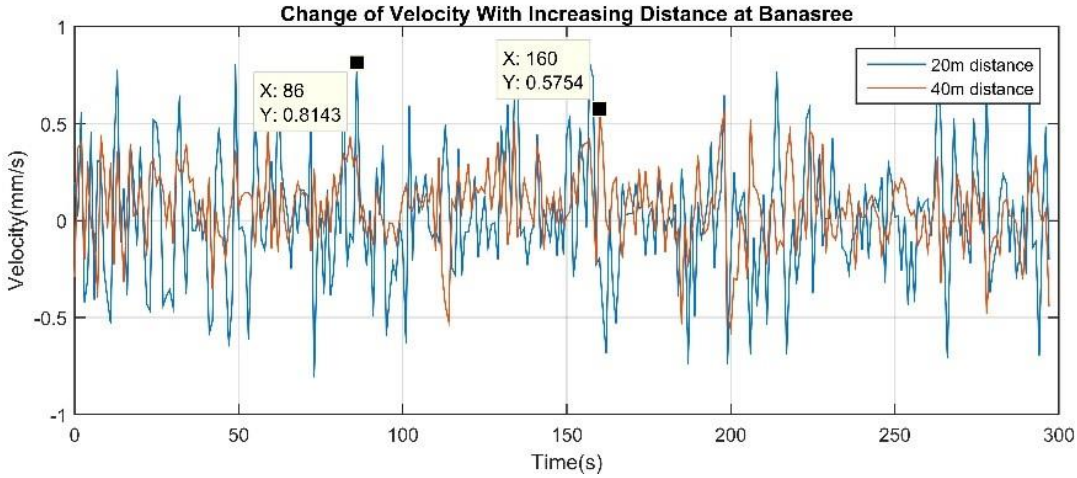
Daytime (12 hours)

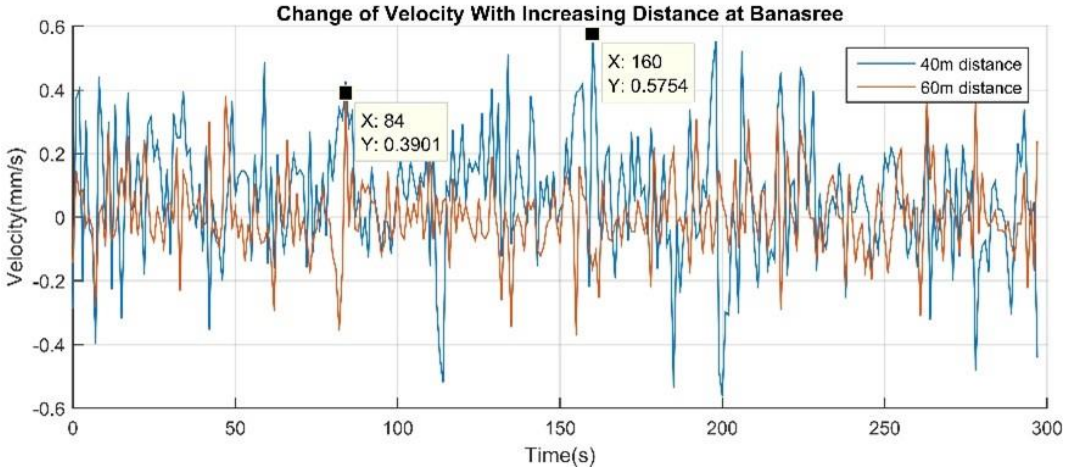


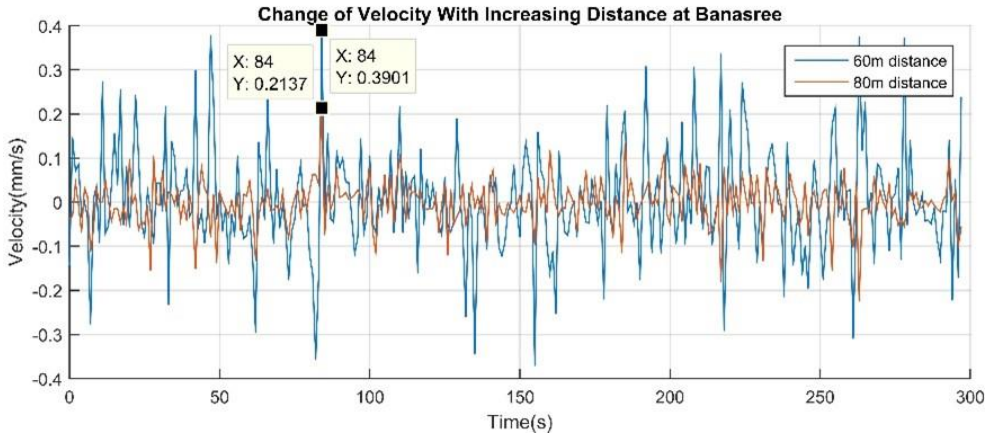
Night Time (12 hours)

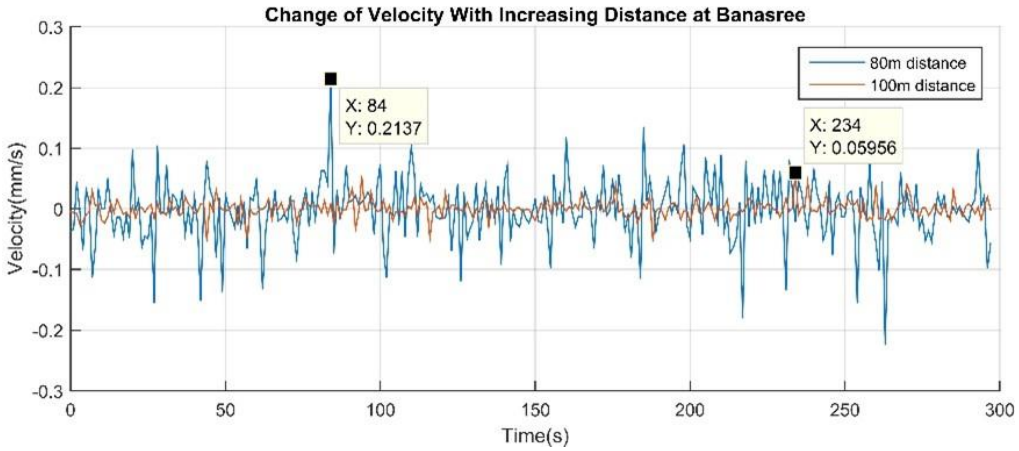
Vibration Level Modeling Graphs

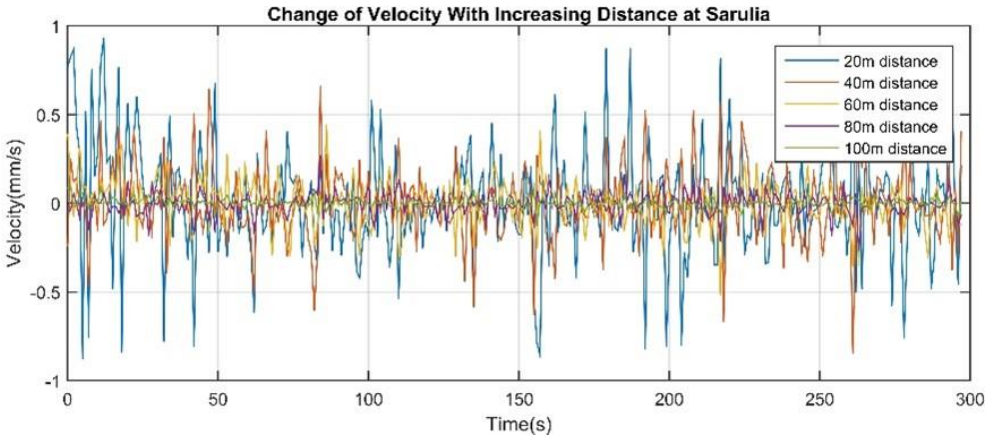


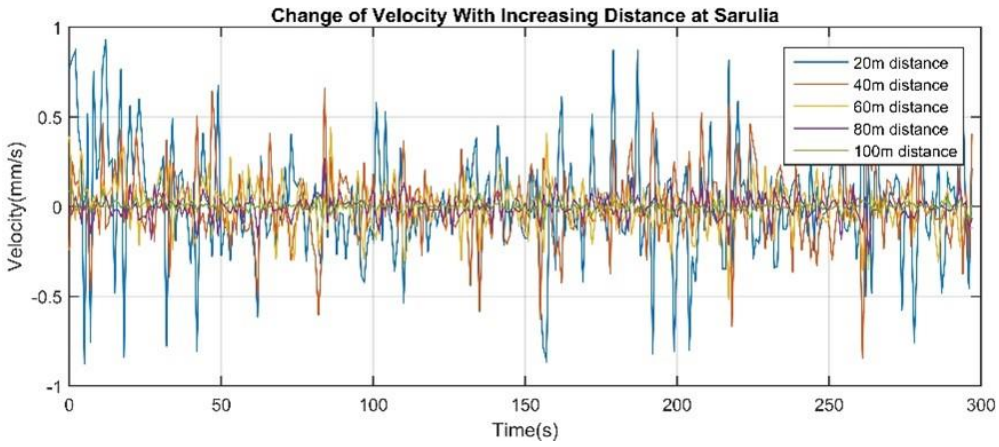


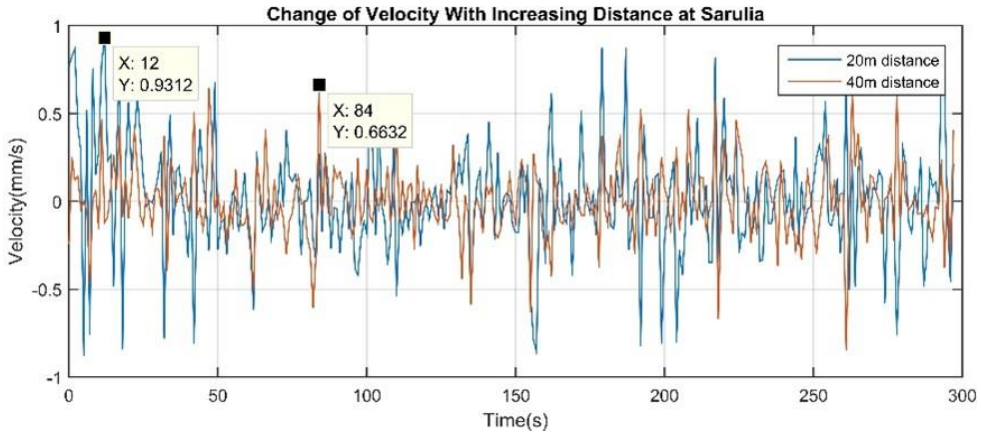


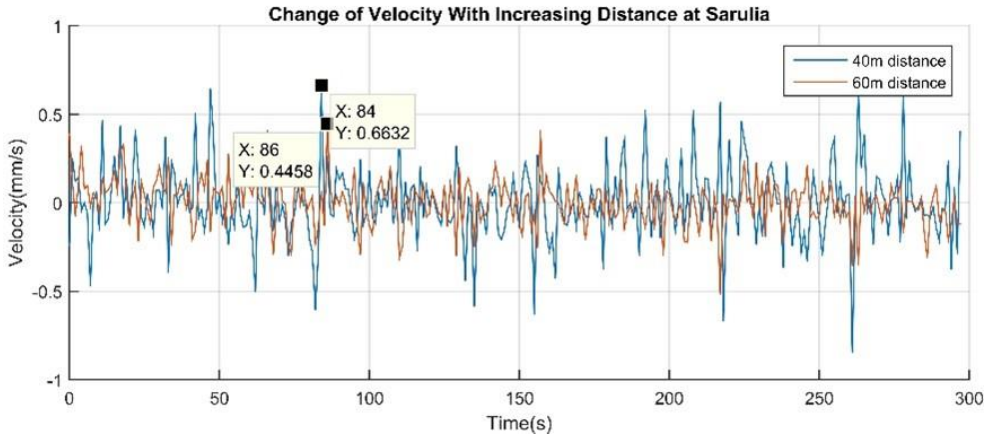

Change of Velocity With Increasing Distance at Banasree
X: 84
Y: 0.2137
X: 84
Y: 0.3901
60m distance
80m distance
Velocity(mm/s)
Time(s)

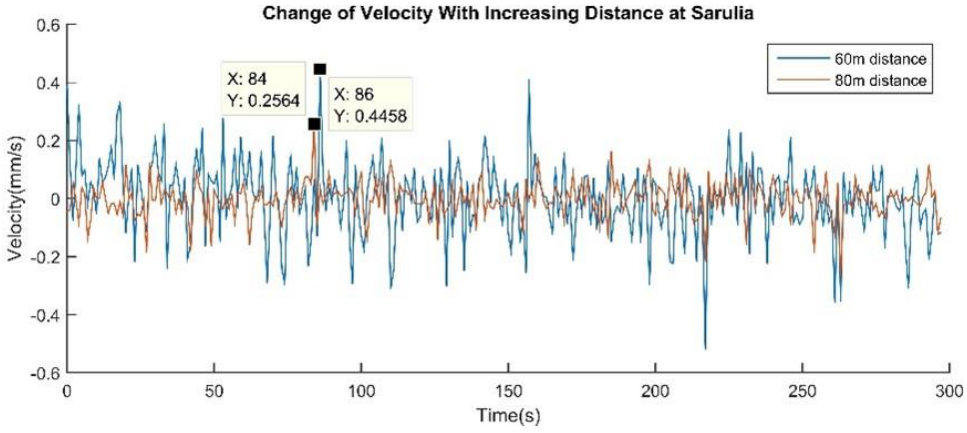

Change of Velocity With Increasing Distance at Banasree
80m distance
100m distance
X: 84
Y: 0.2137
X: 234
Y: 0.05956
Velocity(mm/s)
Time(s)

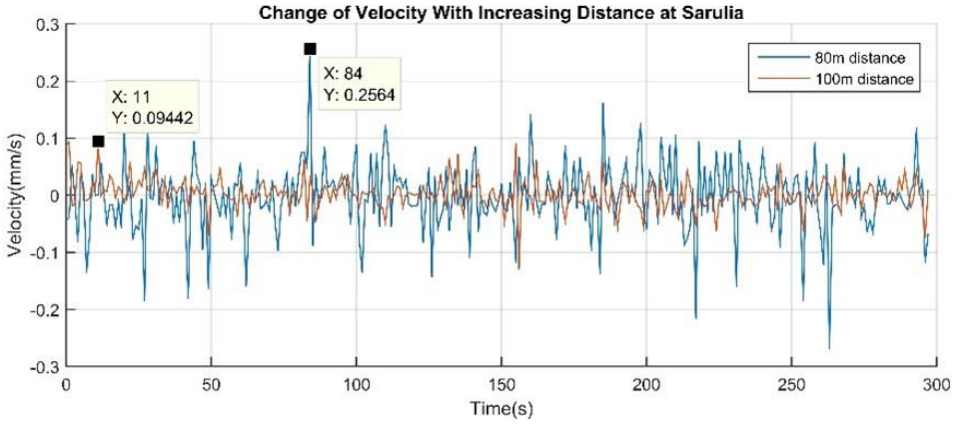

Change of Velocity With Increasing Distance at Sarulia
20m distance
40m distance
60m distance
80m distance
100m distance
Velocity(mm/s)
Time(s)

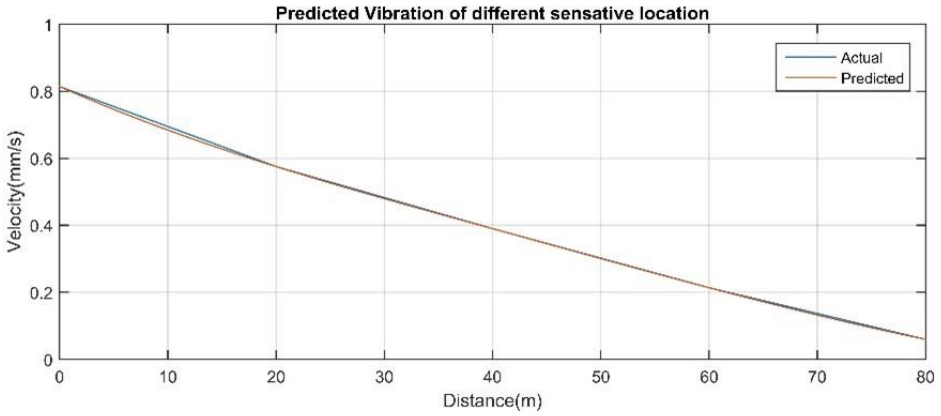

Change of Velocity With Increasing Distance at Sarulia
20m distance
40m distance
60m distance
80m distance
100m distance
Velocity(mm/s)
Time(s)

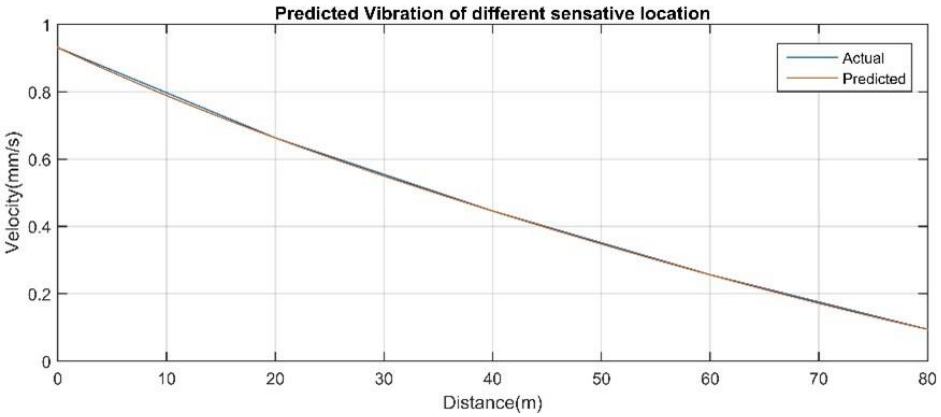

Change of Velocity With Increasing Distance at Sarulia
X: 12
Y: 0.9312
X: 84
Y: 0.6632
20m distance
40m distance
Velocity(mm/s)
Time(s)


Change of Velocity With Increasing Distance at Sarulia
X: 84
Y: 0.6632
X: 86
Y: 0.4458
40m distance
60m distance
Velocity(mm/s)
Time(s)


Change of Velocity With Increasing Distance at Sarulia
X: 84
Y: 0.2564
X: 86
Y: 0.4458
60m distance
80m distance
Velocity(mm/s)
Time(s)


Change of Velocity With Increasing Distance at Sarulia
X: 11
Y: 0.09442
X: 84
Y: 0.2564
80m distance
100m distance
Velocity(mm/s)
Time(s)


Predicted Vibration of different sensative location
Actual
Predicted
Velocity(mm/s)
Distance(m)
0
0.2
0.4
0.6
0.8
1
0
10
20
30
40
50
60
70
80


Predicted Vibration of different sensative location
Actual
Predicted
Velocity(mm/s)
Distance(m)
0
0.2
0.4
0.6
0.8
1
0
10
20
30
40
50
60
70
80

Groundwater Quality

DSCL

Development Solutions Consultant Limited

Multidisciplinary Development Consultants

DSCL Environmental Laboratory

Name of the Project	Improvement of the Hatirjheel-Rampura-Bonoshree Ideal School and College Sheikherjaiga-Amulia-Demra Highway into 4-lanes {including link to Chittagong Road intersection and access to Tarabo) through PPP.
Description of Sample	Groundwater Quality
Sample Collector	Collected by DSCL Personnel
Sampling Date	23 June 2022 to 30 June 2022

Test Results of Ground Water Quality

Parameters	Unit	Concentration Present					Standards for Portland Water**	WHO Standard***	Analysis Method
		RAD_GW_01	RAD_GW_02	RAD_GW_03	RAD_GW_04	RAD_GW_05			
		23.7616100° N 90.4443410° E	23.767484° N 90.423122° E	23.749514° N 90.459496° E	23.721610° N 90.489590° E	23.69726° N 90.50942° E			
Temperature*	°C	27.89	29.7	27.4	29.6	29.1	20-30	25	Multimeter
pH*	-	8.01	8.07	8.18	8.96	7.8	6.5-8.5	8	Multimeter
Electric Conductivity (EC)*	µS/cm	407	372	232	223	332	NYS	400	Multimeter
Total Dissolved Solids (TDS)*	mg/L	270	258	358	161	233	1000	1500	Multimeter
Salinity	mg/L	207	200	187	127	185	NYS	600	Multimeter

* On-Site Test Result
**Standards for Inland Surface Water is followed Environment Conservation Rules (ECR), 1997
***Guidelines for Drinking-water Quality, WHO,2021
NYS = Not Yet Standard

Description of the Surrounding Environment

Sample Location & ID	Description of Surrounding Environment
Yamagata Dhaka Friendship Hospital, Bonoshree, Dhaka **(RAD_GW_01)**	➢ Tube well was established in 2019/2020. ➢ Distance of the source from the nearest toilet is 20m. ➢ The depth of the tube well is 15m. ➢ Nearest agricultural land is far away from the source. ➢ Water is used for washing purpose.
Rampura Bridge Traffic Police Booth, Rampura, Dhaka **(RAD_GW_02)**	➢ Depth of the ground water source is 20ft. ➢ The source was established on 2012. ➢ Distance of the source from the nearest toilet is 3m. ➢ The water is used for washing purpose. ➢ Agricultural land is not visible nearly.
Nagdarpar, Bonoshree, Dhaka **(RAD_GW_03)**	➢ The depth of the tube well is 18ft. ➢ Distance of the source from septic tank is 20m. ➢ The nearest toilet from the source is 10m. ➢ Nearest agricultural land is about 15m away. ➢ Water is used for cleaning and washing purpose.
Near Demra Ideal College, Demra, Dhaka **(RAD_GW_04)**	➢ The depth of the source is 10m. ➢ Nearest toilet source is 18m. ➢ Distance of the source from septic tank is 25m. ➢ Water is used for washing purpose. ➢ No agricultural land was detected near.

Development Solutions Consultant Limited

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House# 734 (1-A), Road# 30, Avenue# 04, DOHS Mirpur Dhaka-1216, Bangladesh.
Tel: +8809617035444; +8801822[illegible], Email: dscl@dsclbd.com Web: www.dsclbd.com

Sample Location & ID	Description of Surrounding Environment
Beside Sugandha Hospital, Chittagong Road, Dhaka **(RAD_GW_05)**	➢ The depth of the source is 25m. ➢ Septic was located in 10m distance. ➢ Owner of the source is hospital authority. ➢ Nearest toilet source is in 10m distance. ➢ Water is used for washing purpose.

Test Performed By:
SK. Ekram Hossain Riyad
Jr. Environmental Engineer

Development Solutions Consultant Limited ★ DSCL ★

Checked By:
Md. Mashiur Rahman
Deputy Manager

TEST REPORT NO: 1001607439 **Jul.3,2022**

UL ORDER NO: 14390953

Applicant :	DEVELOPMENT SOLUTIONS CONSULTANT LIMITED	**Test Date :**	Jun.26 – Jul.3, 2022
Address :	HOUSE-734, 1-A, ROAD-10, AVENUE-4, DOHS MIRPUR, DHAKA-1216, BANGLADESH		
Contact Person :	MD. MASHIUR RAHMAN		

Sample Description:	GROUNDWATER
Testing Protocol:	Self-Reference
Project Name:	Environmental Quality Assessment of "Improvement of the Hatirjheel-Rampura-Bonoshree Ideal School and College Sheikherjaiga-Amulia-Demra Highway into 4-Lanes (Including link to Chittagong Road intersection and access to Tarabo) through Public Private Partnership"
Sample ID:	RAD_GW_01, RAD_GW_02, RAD_GW_03, RAD_GW_04, RAD_GW_05
Source:	Groundwater Samples from the site

Sample Information :

Sample ID	Description	Equivalent Code / Color
001	GROUNDWATER SAMPLE	RAD_GW_01
002	GROUNDWATER SAMPLE	RAD_GW_02
003	GROUNDWATER SAMPLE	RAD_GW_03
004	GROUNDWATER SAMPLE	RAD_GW_04
005	GROUNDWATER SAMPLE	RAD_GW_05

For and on behalf of
UL VS Bangladesh Ltd.

Md. Nur Alam – Lab Technical & Operations Manager

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TEST REPORT NO: 1001607439 **Jul.3,2022**

UL ORDER NO: 14390953

TEST	Sample ID				
	001	002	003	004	005
Total Suspended Solid (TSS)	NC	NC	NC	NC	NC
Chemical Oxygen Demand (COD)	NC	NC	NC	NC	NC
Biological Oxygen Demand (BOD) (5-day)	NC	NC	NC	NC	NC
Turbidity	NC	NC	NC	NC	NC
Sulphate (SO_4)	NC	NC	NC	NC	NC
Total Coliform (TC) ♦	NC	NC	NC	NC	NC
Faecal Coliform (FC) ♦	NC	NC	NC	NC	NC
Fluoride	NC	NC	NC	NC	NC
Total Alkalinity	NC	NC	NC	NC	NC
Total Arsenic (As)	NC	NC	NC	NC	NC
Total Cadmium (Cd)	NC	NC	NC	NC	NC
Total Copper (Cu)	NC	NC	NC	NC	NC
Total Iron (Fe)	NC	NC	NC	NC	NC
Total Lead (Pb)	NC	NC	NC	NC	NC
Total Magnesium (Mg)	NC	NC	NC	NC	NC
Total Zinc (Zn)	NC	NC	NC	NC	NC

Note: **P = Pass ; F = Fail ; NC = No Comment ; NA = Not Applicable ; ** = test result(s) will be added later**
♦ Marked test was subcontracted to an ISO 17025 accredited laboratory.

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TEST REPORT NO: 1001607439 **Jul.3,2022**

UL ORDER NO: 14390953

(01) Total Suspended Solid (TSS)

Test Method: With reference APHA/SM 2540D

Sample ID	Ref. Sample ID	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	RAD_GW_01	5	14	-	**NC**
002	RAD_GW_02	5	10	-	**NC**
003	RAD_GW_03	5	16	-	**NC**
004	RAD_GW_04	5	11	-	**NC**
005	RAD_GW_05	5	8	-	**NC**
"<" means "less than" ; "mg/L" means "milligram per litre;					

(02) Chemical Oxygen Demand (COD)

Test Method: With reference APHA/SM 5220D

Sample ID	Ref. Sample ID	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	RAD_GW_01	5	26	-	**NC**
002	RAD_GW_02	5	45	-	**NC**
003	RAD_GW_03	5	16	-	**NC**
004	RAD_GW_04	5	20	-	**NC**
005	RAD_GW_05	5	28	-	**NC**
"<" means "less than" ; "mg/L" means "milligram per litre;					

(03) Biological Oxygen Demand (BOD) (5-day)

Test Method: With reference APHA/SM 5210B

Sample ID	Ref. Sample ID	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	RAD_GW_01	2	10	-	**NC**
002	RAD_GW_02	2	15	-	**NC**
003	RAD_GW_03	2	5	-	**NC**
004	RAD_GW_04	2	6	-	**NC**
005	RAD_GW_05	2	13	-	**NC**
"<" means "less than" ; "mg/L" means "milligram per litre;					

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TEST REPORT NO: 1001607439 **Jul.3,2022**

UL ORDER NO: 14390953

(04) Turbidity

Test Method: With reference Nephelometric

Sample ID	Ref. Sample ID	Detection limit, NTU	Result, NTU	Requirement, NTU	Comment
001	RAD_GW_01	5	<5	-	**NC**
002	RAD_GW_02	5	<5	-	**NC**
003	RAD_GW_03	5	<5	-	**NC**
004	RAD_GW_04	5	<5	-	**NC**
005	RAD_GW_05	5	<5	-	**NC**

(05) Sulphate (SO_4)

Test Method: Analysis by Photometric Method

Sample ID	Ref. Sample ID	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	RAD_GW_01	10	<10	-	**NC**
002	RAD_GW_02	10	<10	-	**NC**
003	RAD_GW_03	10	<10	-	**NC**
004	RAD_GW_04	10	<10	-	**NC**
005	RAD_GW_05	10	<10	-	**NC**
"<" means "less than" ; "mg/L" means "milligram per litre;					

(06) Total Coliform (TC)

Test Method: With reference USEPA 9132

Sample ID	Ref. Sample ID	Result, CFU/100mL	Requirement, CFU/100mL	Comment
001	RAD_GW_01	65	-	**NC**
002	RAD_GW_02	3	-	**NC**
003	RAD_GW_03	0	-	**NC**
004	RAD_GW_04	5	-	**NC**
005	RAD_GW_05	700	-	**NC**
"<" means "less than" ; "CFU" means "colony forming units"				

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UL ORDER NO: 14390953

(07) Faecal Coliform (FC)

Test Method: Membrane Filtration

Sample ID	Ref. Sample ID	Result, CFU/100mL	Requirement, CFU/100mL	Comment
001	RAD_GW_01	45	-	**NC**
002	RAD_GW_02	0	-	**NC**
003	RAD_GW_03	0	-	**NC**
004	RAD_GW_04	2	-	**NC**
005	RAD_GW_05	520	-	**NC**
"<" means "less than" ; "CFU" means "colony forming units"				

(08) Fluoride

Test Method: Analysis by Photometric Method

Sample ID	Ref. Sample ID	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	RAD_GW_01	0.5	<0.5	-	**NC**
002	RAD_GW_02	0.5	<0.5	-	**NC**
003	RAD_GW_03	0.5	<0.5	-	**NC**
004	RAD_GW_04	0.5	<0.5	-	**NC**
005	RAD_GW_05	0.5	<0.5	-	**NC**
"<" means "less than" ; "mg/L" means "milligram per litre"					

(09) Total Alkalinity

Test Method: With reference APHA/SM 2320 B

Sample ID	Ref. Sample ID	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	RAD_GW_01	5	165	-	**NC**
002	RAD_GW_02	5	184	-	**NC**
003	RAD_GW_03	5	155	-	**NC**
004	RAD_GW_04	5	146	-	**NC**
005	RAD_GW_05	5	165	-	**NC**
"<" means "less than" ; "mg/L" means "milligram per litre"					

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TEST REPORT NO: 1001607439 **Jul.3,2022**

UL ORDER NO: 14390953

(10) Total Arsenic (As)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	RAD_GW_01	Arsenic (As)	7440-38-2	0.02	<0.02	-	**NC**
002	RAD_GW_02	Arsenic (As)	7440-38-2	0.02	<0.02	-	**NC**
003	RAD_GW_03	Arsenic (As)	7440-38-2	0.02	<0.02	-	**NC**
004	RAD_GW_04	Arsenic (As)	7440-38-2	0.02	<0.02	-	**NC**
005	RAD_GW_05	Arsenic (As)	7440-38-2	0.02	<0.02	-	**NC**
"<" means "less than" ; "mg/L" means "milligram per litre"							

(11) Total Cadmium (Cd)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_GW_01	Cadmium (Cd)	7440-43-9	0.1	<0.1	-	**NC**
002	RAD_GW_02	Cadmium (Cd)	7440-43-9	0.1	<0.1	-	**NC**
003	RAD_GW_03	Cadmium (Cd)	7440-43-9	0.1	<0.1	-	**NC**
004	RAD_GW_04	Cadmium (Cd)	7440-43-9	0.1	<0.1	-	**NC**
005	RAD_GW_05	Cadmium (Cd)	7440-43-9	0.1	<0.1	-	**NC**
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

(12) Total Copper (Cu)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_GW_01	Copper (Cu)	7440-50-8	0.25	<0.25	-	**NC**
002	RAD_GW_02	Copper (Cu)	7440-50-8	0.25	<0.25	-	**NC**
003	RAD_GW_03	Copper (Cu)	7440-50-8	0.25	<0.25	-	**NC**
004	RAD_GW_04	Copper (Cu)	7440-50-8	0.25	<0.25	-	**NC**
005	RAD_GW_05	Copper (Cu)	7440-50-8	0.25	<0.25	-	**NC**
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

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(13) Total Iron (Fe)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	RAD_GW_01	Iron (Fe)	7439-89-6	0.5	0.68	-	NC
002	RAD_GW_02	Iron (Fe)	7439-89-6	0.5	<0.5	-	NC
003	RAD_GW_03	Iron (Fe)	7439-89-6	0.5	<0.5	-	NC
004	RAD_GW_04	Iron (Fe)	7439-89-6	0.5	<0.5	-	NC
005	RAD_GW_05	Iron (Fe)	7439-89-6	0.5	0.88	-	NC
"<" means "less than" ; "mg/L" means "milligram per litre;							

(14) Total Lead (Pb)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_GW_01	Lead (Pb)	7439-92-1	0.05	<0.05	-	NC
002	RAD_GW_02	Lead (Pb)	7439-92-1	0.05	<0.05	-	NC
003	RAD_GW_03	Lead (Pb)	7439-92-1	0.05	<0.05	-	NC
004	RAD_GW_04	Lead (Pb)	7439-92-1	0.05	<0.05	-	NC
005	RAD_GW_05	Lead (Pb)	7439-92-1	0.05	<0.05	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

(15) Total Magnesium (Mg)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_GW_01	Total Magnesium (Mg)	7439-95-4	10	16	-	NC
002	RAD_GW_02	Total Magnesium (Mg)	7439-95-4	10	13	-	NC
003	RAD_GW_03	Total Magnesium (Mg)	7439-95-4	10	14	-	NC
004	RAD_GW_04	Total Magnesium (Mg)	7439-95-4	10	14	-	NC
005	RAD_GW_05	Total Magnesium (Mg)	7439-95-4	10	23	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

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TEST REPORT NO:	1001607439	Jul.3,2022
UL ORDER NO:	14390953	

(16) Total Zinc (Zn)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_GW_01	Zinc (Zn)	7440-66-6	0.5	<0.5	-	NC
002	RAD_GW_02	Zinc (Zn)	7440-66-6	0.5	<0.5	-	NC
003	RAD_GW_03	Zinc (Zn)	7440-66-6	0.5	<0.5	-	NC
004	RAD_GW_04	Zinc (Zn)	7440-66-6	0.5	<0.5	-	NC
005	RAD_GW_05	Zinc (Zn)	7440-66-6	0.5	<0.5	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

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TEST REPORT NO:	1001607439	Jul.3,2022
UL ORDER NO:	14390953	

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Surface Water Quality

DSCL

Development Solutions Consultant Limited

Multidisciplinary Development Consultants

DSCL Environmental Laboratory

Name of the Project	Improvement of the Hatirjheel-Rampura-Bonoshree Ideal School and College Sheikherjaiga-Amulia-Demra Highway into 4-lanes {including link to Chittagong Road intersection and access to Tarabo) through PPP.
Description of Sample	Surface Water Quality
Sample Collector	Collected by DSCL Personnel
Sampling Date	23 June 2022 to 30 June 2022

Test Results of Surface Water Quality

Parameters	Unit	Concentration Present					Standards for Inland Surface Water**	EU*** Standard	Analysis Method
		RAD_SW_01	RAD_SW_02	RAD_SW_03	RAD_SW_04	RAD_SW_05			
		23.767511° N 90.423707° E	23. 76063° N 90. 44588° E	23.749825° N 90.460082° E	23. 71991° N 90. 49303° E	23.722250°N 90.499085°E			
Temperature*	°C	30.3	29.5	27.9	29.9	30.6	20-30	NYS	Multimeter
pH*	-	8.06	8.89	8.74	8.55	8.05	6.5-8.5	6.5-8.5	Multimeter
Electric Conductivity (EC)*	µS/cm	746	549	649	268	307	NYS	500	Multimeter
Total Dissolved Solids (TDS)*	mg/L	479	479	542	178	214	1000	NYS	Multimeter
Salinity	mg/L	363	465	401	136	163	NYS	NYS	Multimeter

* On-Site Test Result
**Standards for Inland Surface Water is followed Environment Conservation Rules (ECR), 1997
*** EU Guidelines for Surface-water Quality.
NYS = Not Yet Standard

Description of the Surrounding Environment

Sample Location and ID	Sample Site Description
Rampura Khal, Rampura, Dhaka **(RAD_SW_01)**	➢ The pond is located beside C/S -209 CH. 10+400km. ➢ Fish is not cultured in the pond. ➢ Water remains in the khal off and on the whole year. ➢ Water is mostly polluted. ➢ There is a large dustbin beside the khal. ➢ Drainage wastes were noticed.
Meradia Bazar, Rampura, Dhaka **(RAD_SW_02)**	➢ The pond is beside C/S -205 CH. 10+200km. ➢ Fish is cultured in the pond. ➢ Water is constant in the pond all-round the year. ➢ Household water drains in the pond. ➢ Rain water and domestic sewage water drains in the pond.
Deb Dhoilai Khal, Nagdarpar, Bonoshree, Dhaka **(RAD_SW_03)**	➢ The Sample was collected from deb dholai khal near Nagdarpar Bridge. ➢ The khal is located between C/S -161 CH. 08+000km and C/S -160 CH. 07+950km. ➢ No drainage is attached. ➢ Situated beside household. ➢ Fish is not cultured here.
Demra khal, Demra, Dhaka **(RAD_SW_04)**	➢ The Sample was collected from Demra khal within the alignment. ➢ The water body is located beside C/S -60 CH. 02+950 km. ➢ Sand collection is going on. ➢ Water color is turning into black as the water is polluted. ➢ Sheola is seen in the water body.

Development Solutions Consultant Limited ★ DSCL ★

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DSCL

Development Solutions Consultant Limited

Multidisciplinary Development Consultants

Sample Location and ID	Sample Site Description
Shitalakshya river, Shiddhirganj, Dhaka **(RAD_SW_05)**	➢ The Sample was collected from Shitalakkhya River. ➢ The water body is located beside C/S -63 CH. 03+100km. ➢ The distance of the water body from the alignment is approximately 0.67km. ➢ The sample was collected during upstream. ➢ Commercial area was seen beside the river.

Riyad

Test Performed By:
SK. Ekram Hossain Riyad
Jr. Environmental Engineer

Development Solutions Consultant Limited ★ DSCL ★

Checked By:
Md. Mashiur Rahman
Deputy Manager

House# 734 (1-A), Road# 10, Avenue# 04, DOHS Mirpur Dhaka-1216, Bangladesh.
Tel: +8809617035444; +8801822758548; Email: dscl@dsclbd.com Web: www.dsclbd.com

TEST REPORT NO: 1001607419 **Jul.3,2022**

UL ORDER NO: 14390954

Applicant :	DEVELOPMENT SOLUTIONS CONSULTANT LIMITED	**Test Date :**	Jun.26 -Jul.3, 2022
Address :	HOUSE-734, 1-A, ROAD-10, AVENUE-4, DOHS MIRPUR, DHAKA-1216, BANGLADESH		
Contact Person :	MD. MASHIUR RAHMAN		
Sample Description:	SURFACE WATER		
Testing Protocol:	Self-Reference		
Project Name:	Environmental Quality Assessment of "Improvement of The Hatirjheel-Rampura-Bonoshree Ideal School and College Sheikherjaiga-Amulia-Demra Highway into 4-Lanes (Including link to Chittagong Road intersection and access to Tarabo) through Public Private Partnership"		
Sample ID:	RAD_SW_01, RAD_SW_02, RAD_SW_03, RAD_SW_04, RAD_SW_05		
Source:	Surface Water Samples from the site		

Sample Information :

Sample ID	Description	Equivalent Code / Color
001	SURFACE WATER SAMPLE	RAD_SW_01
002	SURFACE WATER SAMPLE	RAD_SW_02
003	SURFACE WATER SAMPLE	RAD_SW_03
004	SURFACE WATER SAMPLE	RAD_SW_04
005	SURFACE WATER SAMPLE	RAD_SW_05

For and on behalf of
UL VS Bangladesh Ltd.

Md. Nur Alam – Lab Technical & Operations Manager

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TEST REPORT NO: 1001607419 **Jul.3,2022**

UL ORDER NO: 14390954

TEST	Sample ID				
	001	002	003	004	005
Total Suspended Solid (TSS)	NC	NC	NC	NC	NC
Chemical Oxygen Demand (COD)	NC	NC	NC	NC	NC
Biological Oxygen Demand (BOD) (5-day)	NC	NC	NC	NC	NC
Turbidity	NC	NC	NC	NC	NC
Sulphate (SO_4)	NC	NC	NC	NC	NC
Total Coliform (TC) ♦	NC	NC	NC	NC	NC
Faecal Coliform (FC) ♦	NC	NC	NC	NC	NC
Fluoride	NC	NC	NC	NC	NC
Total Alkalinity	NC	NC	NC	NC	NC
Total Arsenic (As)	NC	NC	NC	NC	NC
Total Cadmium (Cd)	NC	NC	NC	NC	NC
Total Copper (Cu)	NC	NC	NC	NC	NC
Total Iron (Fe)	NC	NC	NC	NC	NC
Total Lead (Pb)	NC	NC	NC	NC	NC
Total Magnesium (Mg)	NC	NC	NC	NC	NC
Total Zinc (Zn)	NC	NC	NC	NC	NC

Note: **P = Pass ; F = Fail ; NC = No Comment ; NA = Not Applicable ; ** = test result(s) will be added later**
♦ Marked test was subcontracted to an ISO 17025 accredited laboratory.

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TEST REPORT NO: 1001607419 **Jul.3,2022**

UL ORDER NO: 14390954

(01) Total Suspended Solid (TSS)

Test Method: With reference APHA/SM 2540D

Sample ID	Ref. Sample ID	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	RAD_SW_01	5	43	-	**NC**
002	RAD_SW_02	5	140	-	**NC**
003	RAD_SW_03	5	25	-	**NC**
004	RAD_SW_04	5	20	-	**NC**
005	RAD_SW_05	5	81	-	**NC**
"<" means "less than" ; "mg/L" means "milligram per litre;					

(02) Chemical Oxygen Demand (COD)

Test Method: With reference APHA/SM 5220D

Sample ID	Ref. Sample ID	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	RAD_SW_01	5	76	-	**NC**
002	RAD_SW_02	5	205	-	**NC**
003	RAD_SW_03	5	73	-	**NC**
004	RAD_SW_04	5	42	-	**NC**
005	RAD_SW_05	5	46	-	**NC**
"<" means "less than" ; "mg/L" means "milligram per litre;					

(03) Biological Oxygen Demand (BOD) (5-day)

Test Method: With reference APHA/SM 5210B

Sample ID	Ref. Sample ID	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	RAD_SW_01	2	20	-	**NC**
002	RAD_SW_02	2	70	-	**NC**
003	RAD_SW_03	2	25	-	**NC**
004	RAD_SW_04	2	15	-	**NC**
005	RAD_SW_05	2	18	-	**NC**
"<" means "less than" ; "mg/L" means "milligram per litre;					

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TEST REPORT NO: 1001607419 **Jul.3,2022**

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(04) Turbidity

Test Method: With reference Nephelometric

Sample ID	Ref. Sample ID	Detection limit, NTU	Result, NTU	Requirement, NTU	Comment
001	RAD_SW_01	5	29.6	-	**NC**
002	RAD_SW_02	5	75.5	-	**NC**
003	RAD_SW_03	5	8.5	-	**NC**
004	RAD_SW_04	5	<5	-	**NC**
005	RAD_SW_05	5	45	-	**NC**

(05) Sulphate (SO_4)

Test Method: Analysis by Photometric Method

Sample ID	Ref. Sample ID	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	RAD_SW_01	10	16	-	**NC**
002	RAD_SW_02	10	20	-	**NC**
003	RAD_SW_03	10	21	-	**NC**
004	RAD_SW_04	10	22	-	**NC**
005	RAD_SW_05	10	21	-	**NC**
"<" means "less than" ; "mg/L" means "milligram per litre;					

(06) Total Coliform (TC)

Test Method: Membrane Filtration

Sample ID	Ref. Sample ID	Result, CFU/100mL	Requirement, CFU/100mL	Comment
001	RAD_SW_01	18200	-	**NC**
002	RAD_SW_02	22000	-	**NC**
003	RAD_SW_03	2500	-	**NC**
004	RAD_SW_04	140000	-	**NC**
005	RAD_SW_05	188	-	**NC**
"<" means "less than" ; "CFU" means "colony forming units"				

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(07) Faecal Coliform (FC)

Test Method: Membrane Filtration

Sample ID	Ref. Sample ID	Result, CFU/100mL	Requirement, CFU/100mL	Comment
001	RAD_SW_01	10900	-	**NC**
002	RAD_SW_02	16000	-	**NC**
003	RAD_SW_03	900	-	**NC**
004	RAD_SW_04	72000	-	**NC**
005	RAD_SW_05	140	-	**NC**
"<" means "less than" ; "CFU" means "colony forming units"				

(08) Fluoride

Test Method: Analysis by Photometric Method

Sample ID	Ref. Sample ID	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	RAD_SW_01	0.5	<0.5	-	**NC**
002	RAD_SW_02	0.5	<0.5	-	**NC**
003	RAD_SW_03	0.5	<0.5	-	**NC**
004	RAD_SW_04	0.5	<0.5	-	**NC**
005	RAD_SW_05	0.5	<0.5	-	**NC**
"<" means "less than" ; "mg/L" means "milligram per litre"					

(09) Total Alkalinity

Test Method: With reference APHA/SM 2320 B

Sample ID	Ref. Sample ID	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	RAD_SW_01	5	272	-	**NC**
002	RAD_SW_02	5	262	-	**NC**
003	RAD_SW_03	5	175	-	**NC**
004	RAD_SW_04	5	146	-	**NC**
005	RAD_SW_05	5	68	-	**NC**
"<" means "less than" ; "mg/L" means "milligram per litre;					

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(10) Total Arsenic (As)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_SW_01	Arsenic (As)	7440-38-2	0.02	<0.02	-	**NC**
002	RAD_SW_02	Arsenic (As)	7440-38-2	0.02	<0.02	-	**NC**
003	RAD_SW_03	Arsenic (As)	7440-38-2	0.02	<0.02	-	**NC**
004	RAD_SW_04	Arsenic (As)	7440-38-2	0.02	<0.02	-	**NC**
005	RAD_SW_05	Arsenic (As)	7440-38-2	0.02	<0.02	-	**NC**
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

(11) Total Cadmium (Cd)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_SW_01	Cadmium (Cd)	7440-43-9	0.1	<0.1	-	**NC**
002	RAD_SW_02	Cadmium (Cd)	7440-43-9	0.1	<0.1	-	**NC**
003	RAD_SW_03	Cadmium (Cd)	7440-43-9	0.1	<0.1	-	**NC**
004	RAD_SW_04	Cadmium (Cd)	7440-43-9	0.1	<0.1	-	**NC**
005	RAD_SW_05	Cadmium (Cd)	7440-43-9	0.1	<0.1	-	**NC**
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

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(12) Total Copper (Cu)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_SW_01	Copper (Cu)	7440-50-8	0.25	<0.25	-	NC
002	RAD_SW_02	Copper (Cu)	7440-50-8	0.25	<0.25	-	NC
003	RAD_SW_03	Copper (Cu)	7440-50-8	0.25	0.8	-	NC
004	RAD_SW_04	Copper (Cu)	7440-50-8	0.25	0.27	-	NC
005	RAD_SW_05	Copper (Cu)	7440-50-8	0.25	<0.25	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

(13) Total Iron (Fe)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/L	Result, mg/L	Requirement, mg/L	Comment
001	RAD_SW_01	Iron (Fe)	7439-89-6	0.5	0.5	-	NC
002	RAD_SW_02	Iron (Fe)	7439-89-6	0.5	1.7	-	NC
003	RAD_SW_03	Iron (Fe)	7439-89-6	0.5	<0.5	-	NC
004	RAD_SW_04	Iron (Fe)	7439-89-6	0.5	<0.5	-	NC
005	RAD_SW_05	Iron (Fe)	7439-89-6	0.5	4.58	-	NC
"<" means "less than" ; "mg/L" means "milligram per litre;							

(14) Total Lead (Pb)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_SW_01	Lead (Pb)	7439-92-1	0.05	<0.05	-	NC
002	RAD_SW_02	Lead (Pb)	7439-92-1	0.05	<0.05	-	NC
003	RAD_SW_03	Lead (Pb)	7439-92-1	0.05	<0.05	-	NC
004	RAD_SW_04	Lead (Pb)	7439-92-1	0.05	<0.05	-	NC
005	RAD_SW_05	Lead (Pb)	7439-92-1	0.05	<0.05	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

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(15) Total Magnesium (Mg)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_SW_01	Total Magnesium (Mg)	7439-95-4	10	12	-	**NC**
002	RAD_SW_02	Total Magnesium (Mg)	7439-95-4	10	11	-	**NC**
003	RAD_SW_03	Total Magnesium (Mg)	7439-95-4	10	<10	-	**NC**
004	RAD_SW_04	Total Magnesium (Mg)	7439-95-4	10	<10	-	**NC**
005	RAD_SW_05	Total Magnesium (Mg)	7439-95-4	10	<10	-	**NC**
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

(16) Total Zinc (Zn)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_SW_01	Zinc (Zn)	7440-66-6	0.5	<0.5	-	**NC**
002	RAD_SW_02	Zinc (Zn)	7440-66-6	0.5	<0.5	-	**NC**
003	RAD_SW_03	Zinc (Zn)	7440-66-6	0.5	<0.5	-	**NC**
004	RAD_SW_04	Zinc (Zn)	7440-66-6	0.5	<0.5	-	**NC**
005	RAD_SW_05	Zinc (Zn)	7440-66-6	0.5	<0.5	-	**NC**
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

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TEST REPORT NO:	**1001607419**	**Jul.3,2022**
UL ORDER NO:	**14390954**	

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Riverbed Sediment Quality

TEST REPORT NO: 1001607500 **Jul.3,2022**

UL ORDER NO: 14390955

Page : 1 of 6

Applicant :	DEVELOPMENT SOLUTIONS CONSULTANT LIMITED	**Test Date :**	Jun.26 – Jul.3,2022
Address :	HOUSE-734, 1-A, ROAD-10, AVENUE-4, DOHS MIRPUR, DHAKA-1216, BANGLADESH		
Contact Person :	MD. MASHIUR RAHMAN		

Sample Description:	Riverbed Sediments
Testing Protocol:	Self-Reference
Project Name:	Environmental Quality Assessment of "Improvement of The Hatirjheel-Rampura-Bonoshree Ideal School and College Sheikherjaiga-Amulia-Demra Highway into 4-Lanes (Including link to Chittagong Road intersection and access to Tarabo) through Public Private Partnership"
Sample ID:	RAD_RBS_01, RAD_RBS_02, RAD_RBS_03, RAD_RBS_04, RAD_RBS_05
Source:	Riverbed Sediment Samples from the Side

Sample Information :

Sample ID	Description	Equivalent Code / Color
001	Riverbed Sediment	RAD_RBS_01
002	Riverbed Sediment	RAD_RBS_02
003	Riverbed Sediment	RAD_RBS_03
004	Riverbed Sediment	RAD_RBS_04
005	Riverbed Sediment	RAD_RBS_05

For and on behalf of
UL VS Bangladesh Ltd.

Md. Nur Alam – Lab Technical & Operations Manager

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TEST	Sample ID				
	001	002	003	004	005
Total Iron (Fe)	NC	NC	NC	NC	NC
Total Copper (Cu)	NC	NC	NC	NC	NC
Total Lead (Pb)	NC	NC	NC	NC	NC
Total Zinc (Zn)	NC	NC	NC	NC	NC
Total Phosphorus	NC	NC	NC	NC	NC
Sulphate (SO4)	NC	NC	NC	NC	NC

Note: **P = Pass ; F = Fail ; NC = No Comment ; NA = Not Applicable ; ** = test result(s) will be added later**

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TEST REPORT NO: 1001607500 **Jul.3,2022**

UL ORDER NO: 14390955

(01) Total Iron (Fe)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_RBS_01	Iron (Fe)	7439-89-6	10	4619	-	**NC**
002	RAD_RBS_02	Iron (Fe)	7439-89-6	10	3935	-	**NC**
003	RAD_RBS_03	Iron (Fe)	7439-89-6	10	4320	-	**NC**
004	RAD_RBS_04	Iron (Fe)	7439-89-6	10	16347	-	**NC**
005	RAD_RBS_05	Iron (Fe)	7439-89-6	10	10982	-	**NC**
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

(02) Total Copper (Cu)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_RBS_01	Copper (Cu)	7440-50-8	10	<10	-	**NC**
002	RAD_RBS_02	Copper (Cu)	7440-50-8	10	11	-	**NC**
003	RAD_RBS_03	Copper (Cu)	7440-50-8	10	21	-	**NC**
004	RAD_RBS_04	Copper (Cu)	7440-50-8	10	13	-	**NC**
005	RAD_RBS_05	Copper (Cu)	7440-50-8	10	16	-	**NC**
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

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TEST REPORT NO:	1001607500	Jul.3,2022
UL ORDER NO:	14390955	

(03) Total Lead (Pb)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_RBS_01	Lead (Pb)	7439-92-1	5	18	-	NC
002	RAD_RBS_02	Lead (Pb)	7439-92-1	5	16	-	NC
003	RAD_RBS_03	Lead (Pb)	7439-92-1	5	17	-	NC
004	RAD_RBS_04	Lead (Pb)	7439-92-1	5	13	-	NC
005	RAD_RBS_05	Lead (Pb)	7439-92-1	5	11	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

(04) Total Zinc (Zn)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_RBS_01	Zinc (Zn)	7440-66-6	10	158	-	NC
002	RAD_RBS_02	Zinc (Zn)	7440-66-6	10	242	-	NC
003	RAD_RBS_03	Zinc (Zn)	7440-66-6	10	148	-	NC
004	RAD_RBS_04	Zinc (Zn)	7440-66-6	10	87	-	NC
005	RAD_RBS_05	Zinc (Zn)	7440-66-6	10	89	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

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TEST REPORT NO: 1001607500 **Jul.3,2022**

UL ORDER NO: 14390955

(05) Total Phosphorus

Test Method: Analysis by Photometric Method

Sample ID	Ref. Sample ID	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_RBS_01	0.1	<0.1	-	**NC**
002	RAD_RBS_02	0.1	<0.1	-	**NC**
003	RAD_RBS_03	0.1	<0.1	-	**NC**
004	RAD_RBS_04	0.1	<0.1	-	**NC**
005	RAD_RBS_05	0.1	<0.1	-	**NC**
"<" means "less than" ; "mg/kg" means "milligram per kilogram"					

(06) Sulphate (SO_4)

Test Method: Analysis by Photometric Method

Sample ID	Ref. Sample ID	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_RBS_01	20	768	-	**NC**
002	RAD_RBS_02	20	748	-	**NC**
003	RAD_RBS_03	20	770	-	**NC**
004	RAD_RBS_04	20	1559	-	**NC**
005	RAD_RBS_05	20	421	-	**NC**
"<" means "less than" ; "mg/kg" means "milligram per kilogram"					

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TEST REPORT NO:	1001607500	Jul.3,2022
UL ORDER NO:	14390955	

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Soil Quality

TEST REPORT NO: 1001607450 **Jul.3,2022**

UL ORDER NO: 14390956

Page : 1 of 8

Applicant :	DEVELOPMENT SOLUTIONS CONSULTANT LIMITED	**Test Date :**	Jun.26–Jul.3, 2022
Address :	HOUSE-734, 1-A, ROAD-10, AVENUE-4, DOHS MIRPUR, DHAKA-1216, BANGLADESH		
Contact Person :	MD. MASHIUR RAHMAN		
Sample Description:	SOIL SAMPLES		
Testing Protocol:	Self-Reference		
Project Name:	Environmental Quality Assessment of "Improvement of The Hatirjheel-Rampura-Bonoshree Ideal School and College Sheikherjaiga-Amulia-Demra Highway into 4-Lanes (Including link to Chittagong Road intersection and access to Tarabo) through Public Private Partnership"		
Sample ID:	RAD_SQ_01, RAD_SQ_02, RAD_SQ_03, RAD_SQ_04, RAD_SQ_05		
Source:	Soil Samples from the site		

Sample Information :

Sample ID	Description	Equivalent Code / Color
001	SOIL SAMPLE	RAD_SQ_01
002	SOIL SAMPLE	RAD_SQ_02
003	SOIL SAMPLE	RAD_SQ_03
004	SOIL SAMPLE	RAD_SQ_04
005	SOIL SAMPLE	RAD_SQ_05

For and on behalf of
UL VS Bangladesh Ltd.

Md. Nur Alam – Lab Technical & Operations Manager

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UL ORDER NO: 14390956

TEST	Sample ID				
	001	002	003	004	005
pH Value	NC	NC	NC	NC	NC
Total Organic Matter	NC	NC	NC	NC	NC
Soil Texture	NC	NC	NC	NC	NC
Total Lead (Pb)	NC	NC	NC	NC	NC
Total Chromium (Cr)	NC	NC	NC	NC	NC
Total Mercury (Hg)	NC	NC	NC	NC	NC
Total Cadmium (Cd)	NC	NC	NC	NC	NC
Total Zinc (Zn)	NC	NC	NC	NC	NC
Total Iron (Fe)	NC	NC	NC	NC	NC
Total Manganese (Mn)	NC	NC	NC	NC	NC
Total Arsenic (As)	NC	NC	NC	NC	NC
Total Copper (Cu)	NC	NC	NC	NC	NC
Electrical Conductivity (EC)	NC	NC	NC	NC	NC

Note: P = Pass ; F = Fail ; NC = No Comment ; NA = Not Applicable ; ** = test result(s) will be added later

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UL ORDER NO: 14390956

(01) pH Value

Test Method: With reference USEPA 9045 D

Sample ID	Ref. Sample ID	Result	Requirement	Comment
001	RAD_SQ_01	9.0	-	**NC**
002	RAD_SQ_02	8.2	-	**NC**
003	RAD_SQ_03	8.6	-	**NC**
004	RAD_SQ_04	8.9	-	**NC**
005	RAD_SQ_05	9.0	-	**NC**

(02) Total Organic Matter

Test Method: Ignition Method & result calculated based on “as received” sample

Sample ID	Ref. Sample ID	Result, (%)	Requirement, (%)	Comment
001	RAD_SQ_01	0.82	-	**NC**
002	RAD_SQ_02	1.5	-	**NC**
003	RAD_SQ_03	1.7	-	**NC**
004	RAD_SQ_04	1.5	-	**NC**
005	RAD_SQ_05	1.5	-	**NC**

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(03) Soil Texture

Test Method: With reference to Jar Test Method

Sample ID	Ref. Sample ID	Observation	Height of soil fractions in millimeters (mm)	Total height in millimeters (mm)	Portions expressed as percentage (%)	Soil Textural Class
001	RAD_SQ_01	Sand	25	35	72	Loamy Sand
		Silt	5		14	
		Clay	5		14	
002	RAD_SQ_02	Sand	29	38	76	Loamy Sand
		Silt	5		13	
		Clay	4		11	
003	RAD_SQ_03	Sand	20	36	56	Sandy Loam
		Silt	9		25	
		Clay	7		19	
004	RAD_SQ_04	Sand	12	88	14	Silt Loam
		Silt	66		75	
		Clay	10		11	
005	RAD_SQ_05	Sand	10	74	14	Silt Loam
		Silt	58		78	
		Clay	6		8	

(04) Total Lead (Pb)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_SQ_01	Lead (Pb)	7439-92-1	5	6	-	NC
002	RAD_SQ_02	Lead (Pb)	7439-92-1	5	9	-	NC
003	RAD_SQ_03	Lead (Pb)	7439-92-1	5	13	-	NC
004	RAD_SQ_04	Lead (Pb)	7439-92-1	5	21	-	NC
005	RAD_SQ_05	Lead (Pb)	7439-92-1	5	24	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

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(05) Total Chromium (Cr)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_SQ_01	Chromium (Cr)	7440-47-3	5	14	-	NC
002	RAD_SQ_02	Chromium (Cr)	7440-47-3	5	23	-	NC
003	RAD_SQ_03	Chromium (Cr)	7440-47-3	5	23	-	NC
004	RAD_SQ_04	Chromium (Cr)	7440-47-3	5	21	-	NC
005	RAD_SQ_05	Chromium (Cr)	7440-47-3	5	18	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

(06) Total Mercury (Hg)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_SQ_01	Mercury (Hg)	7439-97-6	0.1	<0. 1	-	NC
002	RAD_SQ_02	Mercury (Hg)	7439-97-6	0.1	<0.1	-	NC
003	RAD_SQ_03	Mercury (Hg)	7439-97-6	0.1	<0.1	-	NC
004	RAD_SQ_04	Mercury (Hg)	7439-97-6	0.1	<0.1	-	NC
005	RAD_SQ_05	Mercury (Hg)	7439-97-6	0.1	<0.1	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

(07) Total Cadmium (Cd)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_SQ_01	Cadmium (Cd)	7440-43-9	0.5	<0.5	-	NC
002	RAD_SQ_02	Cadmium (Cd)	7440-43-9	0.5	<0.5	-	NC
003	RAD_SQ_03	Cadmium (Cd)	7440-43-9	0.5	<0.5	-	NC
004	RAD_SQ_04	Cadmium (Cd)	7440-43-9	0.5	<0.5	-	NC
005	RAD_SQ_05	Cadmium (Cd)	7440-43-9	0.5	<0.5	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

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(08) Total Zinc (Zn)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_SQ_01	Zinc (Zn)	7440-66-6	10	82	-	NC
002	RAD_SQ_02	Zinc (Zn)	7440-66-6	10	88	-	NC
003	RAD_SQ_03	Zinc (Zn)	7440-66-6	10	70	-	NC
004	RAD_SQ_04	Zinc (Zn)	7440-66-6	10	73	-	NC
005	RAD_SQ_05	Zinc (Zn)	7440-66-6	10	81	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

(09) Total Iron (Fe)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_SQ_01	Iron (Fe)	7439-89-6	10	14163	-	NC
002	RAD_SQ_02	Iron (Fe)	7439-89-6	10	11431	-	NC
003	RAD_SQ_03	Iron (Fe)	7439-89-6	10	21487	-	NC
004	RAD_SQ_04	Iron (Fe)	7439-89-6	10	18581	-	NC
005	RAD_SQ_05	Iron (Fe)	7439-89-6	10	19110	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

(10) Total Manganese (Mn)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_SQ_01	Manganese (Mn)	7439-96-5	10	203	-	NC
002	RAD_SQ_02	Manganese (Mn)	7439-96-5	10	162	-	NC
003	RAD_SQ_03	Manganese (Mn)	7439-96-5	10	596	-	NC
004	RAD_SQ_04	Manganese (Mn)	7439-96-5	10	210	-	NC
005	RAD_SQ_05	Manganese (Mn)	7439-96-5	10	1136	-	NC
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

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(11) Total Arsenic (As)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_SQ_01	Arsenic (As)	7440-38-2	5	<5	-	**NC**
002	RAD_SQ_02	Arsenic (As)	7440-38-2	5	<5	-	**NC**
003	RAD_SQ_03	Arsenic (As)	7440-38-2	5	<5	-	**NC**
004	RAD_SQ_04	Arsenic (As)	7440-38-2	5	<5	-	**NC**
005	RAD_SQ_05	Arsenic (As)	7440-38-2	5	<5	-	**NC**
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

(12) Total Copper (Cu)

Test Method: Acid Digestion with ICP analysis

Sample ID	Ref. Sample ID	Substance name	CAS No.	Detection limit, mg/kg	Result, mg/kg	Requirement, mg/kg	Comment
001	RAD_SQ_01	Copper (Cu)	7440-50-8	10	<10	-	**NC**
002	RAD_SQ_02	Copper (Cu)	7440-50-8	10	30	-	**NC**
003	RAD_SQ_03	Copper (Cu)	7440-50-8	10	15	-	**NC**
004	RAD_SQ_04	Copper (Cu)	7440-50-8	10	22	-	**NC**
005	RAD_SQ_05	Copper (Cu)	7440-50-8	10	26	-	**NC**
"<" means "less than" ; "mg/kg" means "milligram per kilogram"							

(13) Electrical Conductivity (EC)

Test Method: In-house Method, Analysis by Conductivity Meter

Sample ID	Ref. Sample ID	Detection limit, µS/cm	Result, µS/cm	Requirement, µS/cm	Comment
001	RAD_SQ_01	10	248	-	**NC**
002	RAD_SQ_02	10	147.9	-	**NC**
003	RAD_SQ_03	10	176	-	**NC**
004	RAD_SQ_04	10	320	-	**NC**
005	RAD_SQ_05	10	326	-	**NC**
"<" means "less than" ; "µS/cm" means "micro Siemens per centimetre;					

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Appendix 3: Focus Group Discussion (FGD) Details

FGD-1 Location: Bonoshree Bus Stop (GPS: 23.76733°N, 90.42319°E) Date: 26.06.2022 Time: 5:40 pm to 6.10 pm

Table: Details of Focus of Discussions

Sl No.	Name	Occupation	Question/Comment	Response
01.	Md. Rahim	Service	▪ No problem in bridge construction if compensation is given properly. ▪ Construction of expressway will help and develop local economy. ▪ It will create employment opportunities during construction of the expressway.	Thank you for yourappreciation and positive feedback.
02.	Abdul Kader	Business	▪ Proper Land Compensation ▪ Discussion about the price of the land. ▪ Again, wants to engage the local people in this development work. ▪ How he will be benefited from the project.	The Land victim will get the proper land compensation by the government. This will bring more people to the area and people will be benefited as the business will grow and will have more earning.
03.	Mofajjal Hossain	Driver	▪ Very much thankful for the project as he thinks it will reduce the pressure of the traffic in the road. ▪ Current road condition is very tough and risky issue. ▪ Roads also needs to be smoothened for safely driving. ▪ Speed limit must be increased and ensure safety to the driver.	This point is very important. Thankingfor your feedback and it will be mentioned in the report.
04.	Ali Hosan	Business	▪ Thanking Government of Bangladesh ▪ We expect for 1 tree cutting = 3 tree plantation. ▪ Use local labor to solve the problem ofunemployment. ▪ Wish the implementation of this project as early as possible. ▪ Legal compensation to the victimize people due to this project activities.	This valuable comment will be shared with the management.
05.	Motiul	Business	▪ Some people will be landless due to project activities. ▪ How much compensation for the victimize authority? ▪ Concerns about environmental effect and social life.	The consultants discussed to the participants what environmental and social standards would be maintained throughout the project, like, preparing separate documents on Environmental Impact Assessment (EIA), Stakeholder Engagement Plan (SEP), Labor Management Procedure (LMP), Resettlement Action Plan (RAP).

UPDATING OF ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR IMPROVEMENT OF THE 'HATIRJHEEL-RAMPURA-BONOSHREE IDEAL SCHOOL AND COLLEGE SHEIKHERJAIGA-AMULIA-DEMRA' HIGHWAY INTO 4-LANES INCLUDING LINK TO CHITTAGONG ROAD INTERSECTION AND ACCESS TO TARABO) THROUGH PUBLIC PRIVATE PARTNERSHIP (PPP)

List of Participants in Public Consultation/FGD

Address: Banasree Bus Stop

GPS: 23.76733, 90.42319

Date: 26.06.2022 **Time** 5.40 pm

SL No.	Participant's Name	Age	Occupation	Mobile No.	Signature
১.	মো. রহিম	২৭	চাকুরি	01736928509	রহিম
২.	আব্দুল কাদের	৩৮	ব্যবসা	01523615028	Akader
৩.	সাখাওয়াত হোসেন	৩০	ড্রাইভার	01512861903	সাখাওয়াত
৪.	আলি হোসেন	৪৫	ব্যবসা	01711285231	আলি
৫.	মতিউল	৩৫	ব্যবসা	01521692113	মতিউল

Facilitated By Maliha Khatun

Signature

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FGD-2 Location: Nagdarpar Bridge Bus stand (GPS: 23.749163^{0}N, 90.462142^{0}E) Date: 27.06.2022 Time: 5:28 pm to 6.15 pm

Table: Details of Focus of Discussions

Sl No.	Name	Occupation	Question/Comment	Response
01	Md. Sofur	Business	▪ How is the price determined in the case of land acquisition? ▪ If business is affected, how will that person be paid compensation.	The affected persons will be paid land compensation. The Government is bound to pay land compensation as per the policy. Consultants informed that by evaluating the market survey and government rate land price, all affected person/s should get a fair price for their land parcel.
02.	Md. farid	Business	▪ Construction of Expressway will bring profit top the businessowners. ▪ It will improve the local transportation system. ▪ Is there any Loss of the agricultural land due to construction? ▪ It will create employment opportunities during construction of expressway.	Land compensation will be paid as per Government policy. Agricultural land will be given priority prior to the construction.
03.	Md. Moksad	Farmer	▪ Some Doubt about land compensation. ▪ Proper value of land. ▪ Compensation about physical disruption. ▪ Helping hand for this project. ▪ Is there any Loss of the agricultural land due to construction?	The Government will assure proper land compensation for the victimized people.
04.	Md. Taleb Ali	Business	▪ Happy with the decision to finally construction of the expressway. ▪ Business owners will be benefited. ▪ The education system and children's security should be considered.	This comment is much appreciated and the education sector will be given priority because without their improvement no development can be considered as good development.
05.	Fokruddin	Business	▪ We are happy because of the commencement of the expressway. ▪ Road communication will be improved from Rampura to Demra. ▪ Improvement of business sector. ▪ Compensation to the affected people. ▪ Local people are deprived from the compensation.	This point is very vital and it will be mentioned in report recommending the Government.

Sl No.	Name	Occupation	Question/Comment	Response
06.	HarunMia	Farmer	▪ Land acquisition must be as less as possible.	Priority to the farmer will be given first and compensation will be given as per government rules and will be given based on the current market value of that area for the land.
07.	Md. Aslam	Business	▪ Thanking for the project. ▪ Improve the facilities for local people ▪ Rehabilitation and Resettlement plan. ▪ Priority must be given to local people and the businessman.	Resettlement plan will be prepared very carefully based on the expert's advice and report. The cost will be considerable for upcoming future.
08.	Sobir Ali	Farmer	▪ Whether the project won't harm, it will help to improve the life of the local people ▪ Proper land compensation for the victimizedpeople. ▪ His farming land is under land acquisition how much he will get the price.	Priority to the farmer will be given first and compensation will be given as per government rules and will be given based on the current market value of that area for the land.

UPDATING OF ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR IMPROVEMENT OF THE 'HATIRJHEEL-RAMPURA-BONOSHREE IDEAL SCHOOL AND COLLEGE SHEIKHERJAIGA-AMULIA-DEMRA' HIGHWAY INTO 4-LANES INCLUDING LINK TO CHITTAGONG ROAD INTERSECTION AND ACCESS TO TARABO) THROUGH PUBLIC PRIVATE PARTNERSHIP (PPP)

List of Participants in Public Consultation/FGD

Address: Nagdarpar bridge. bus stand

GPS: 23.749163N 90.462142E

Date: 27-06-22 **Time** 5:18 pm

SL No.	Participant's Name	Age	Occupation	Mobile No.	Signature
1	মো: ওএস	51	ব্যবসা	01758322226	ওএস
2	মো: মতিউর	৬০	ব্যবসা	01829196931	মতিউর
3	মো: মোকসেদ	৬০	কৃষি		মোকসেদ
4	মো: আলেব আলি	৪৮	ব্যবসা	01913789601	আলি
5	আবদুল্লাহ	৫৮	ব্যবসা		আব্দুল্লাহ
6	আবুল মিয়া	৪০	কৃষি		আবুল
7	মো: আবদুল্লাহ	৬৮	ব্যবসা		আবদুল্লাহ
8	মতিউর রহমান	৬০	চাকরি		মতিউর

Facilitated By Sadia Sabrin

Signature Sadia

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FGD-3 Location: Beside Dhaka-Demra Highway (GPS: 23.719946^{0}N, 90.490493^{0}E) Date: 29.06.2022 Time: 6:50 pm to 7:50 pm

Table: Details of Focus of Discussions

Sl No.	Name	Occupation	Question/Comment	Response
01.	Kuddus Ali	Business	▪ Appreciation of the project. ▪ How is the price determined in the case of land acquisition? ▪ If business is affected, how will that person be paid compensation.	The affected persons will be paid land compensation. The Government is bound to pay land compensation as per the policy. Consultants informed that by evaluating the market survey and government rate land price, all affected person/s should get a fair price for their land parcel.
02.	Md. Shahrukh Khan	Business	▪ Construction of Expressway will bring profit top the businessowners. ▪ It will improve the local transportation system. ▪ It will create employment opportunities during construction of expressway.	Land compensation will be paid as per Government policy. Agricultural land will be given priority prior to the construction.
03.	Md. Rakib Hasan	Teacher	▪ Some Doubt about land compensation. ▪ Labor-related issues ▪ Compensation about physical disruption. ▪ The education system and children's security	Students will be given priority. All workers who come to the area to work on the project must ensure that they have the COVID-19 vaccine. The use of gloves, helmets, boots, etc., should be ensured to avoid the risk of accidents and the safety of those who will work as laborers.
04.	Pulok Mahmud	Service	▪ Happy with the decision to finally construction of the expressway. ▪ Road communication will be improved from Rampura to Demra. ▪ No problem in road construction if compensation is given properly.	This comment is much appreciated.
05.	Ahsan Ahmed	Business	▪ We are happy because of the commencement of the expressway. ▪ Improvement of business sector. ▪ Compensation to the affected people. ▪ Local people are deprived from the compensation.	This point is very vital and it will be mentioned in report recommending the Government.

Sl No.	Name	Occupation	Question/Comment	Response
06.	Nur Hossain	Imam	▪ Wanted to know how much will be paid for Mosque if it is affected during implementation of the project. ▪ How people will be benefited.	As the issue is about religious perspective and sensitive, consideration is given so that mosque does not get effected. Even if it is affected compensation will be given according to government rules.
07.	Sowab Khondokar	Engineer	▪ Thanking for the project. ▪ Improve the facilities for local people ▪ As a civil engineer the design of the project is much appreciated. ▪ Priority must be given to local people. ▪ This project must bring work opportunity for the engineers also.	Very much appreciation to the engineer for his valuable feedback about the project and priority will be given to the engineers for work purpose.
08.	Aslam Akter Mizan	Business	▪ Whether the project won't harm, it will help to improve the life of the local people ▪ Proper land compensation for the victimizedpeople. ▪ Land acquisition price is his main concern is his business and private land.	Priority to the business will be given and compensation will be given as per government rules and will be given based on the current market value of that area for the land.
09.	Khan Jahan Ali	Shopkeeper	▪ This project will bring good to the people. ▪ Business will get affected and the people must get proper compensation.	This comment will be considered and will mention it to the management.

UPDATING OF ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR IMPROVEMENT OF THE 'HATIRJHEEL-RAMPURA-BONOSHREE IDEAL SCHOOL AND COLLEGE SHEIKHERJAIGA-AMULIA-DEMRA' HIGHWAY INTO 4-LANES INCLUDING LINK TO CHITTAGONG ROAD INTERSECTION AND ACCESS TO TARABO) THROUGH PUBLIC PRIVATE PARTNERSHIP (PPP)

List of Participants in Public Consultation/FGD

Address: Staff Quarter Jame Masjid Bazar

GPS: 23.720483°N, 90.491620° E

Date: 29/06/2022 **Time** 05:45 pm

SL No.	Participant's Name	Age	Occupation	Mobile No.	Signature
1	মো: রুনি	35	Driver	01956323006	রুনি
2	মো: বুবেল মিয়া	35	ব্যবসা	01990569144	
3.	মো: শফিকুল ইসলাম	55	চাকুরী	0187665715	
4	লিয়াকত হোসেন	48	ব্যাবসা	01680553749	
5.	আফজাল আলী	41	ব্যাবসা	01709723956	
6	কামাল মিয়া	26	চা		

Facilitated By Sadia Sabnin

Signature Sadia

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FGD-4 Location: Staff Quarter Jame Masjid Bazar (GPS: 23.720483^0 N, 90.491620^0 E) Date: 29.06.2022 Time: 6:45 pm to 7:30 pm

Table: Details of Focus of Discussions

Sl No.	Name	Occupation	Question	Response
01	Md. Rony	Driver	▪ Very much thankful for the project as he thinks it will reduce the pressure of the traffic in the road. ▪ Current road condition is very tough and risky issue. ▪ Roads also needs to be smoothened for safely driving. ▪ Speed limit must be increased and ensure safety to the driver.	Consultants would try to provide all possible assistance in implementing the project.
02.	Md. Rubel Mia	Business	▪ Proper Land Compensation ▪ Discussion about the price of the land. ▪ Again, wants to engage the local people in this development work.	The Land victim will get the proper land compensation by the government.
03.	Md. Shafiqul Islam	Service	▪ Development project will bring prosperity. ▪ Use existing road to avoid loss. ▪ Increase land price along expressway. ▪ Changes in commercial, education and cultural values. ▪ Give priority of local people for the work	The elevated expressway will be constructed along with the existing approach road. So, no need to construct another approach road. We do believe in less loss, more benefit. Along with the expressway the prices of the land will be increased also.
04.	Liakot Hossain	Business	▪ How it will bring prosperity to the government and local people. ▪ Improvement of Transportation System. ▪ Development of mitigation plan for mitigating environmental pollution. ▪ Also wanted to know about the land acquisition.	The elevated expressway will be constructed along with the existing approach road. So, no need to construct another approach road. We do believe in less loss, more benefit. Along with the expressway the prices of the land will be increased also.
05.	Ajgor Ali	Business	▪ Very much happy because of the commencement of the expressway. ▪ Improvement of business sector. ▪ Compensation to the affected people. ▪ Local people are deprived from the compensation.	This point is very vital and it will be mentioned in report recommending the Government.
06.	Rasel Mia	Student	▪ Wanted to know how much this project will make time less to reach to the university nearest. ▪ How people will be benefited. ▪ How the transportation system will be developed. ▪ Is future plan for the project is sustainable.	Very much appreciation to the young student as he reflects the young generations thought. Thanking him for his valuable feedback about the project and priority will be given to the time because all will be done to reduce the time and make life more valuable.

UPDATING OF ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR IMPROVEMENT OF THE 'HATIRJHEEL-RAMPURA-BONOSHREE IDEAL SCHOOL AND COLLEGE SHEIKHERJAIGA-AMULIA-DEMRA' HIGHWAY INTO 4-LANES INCLUDING LINK TO CHITTAGONG ROAD INTERSECTION AND ACCESS TO TARABO) THROUGH PUBLIC PRIVATE PARTNERSHIP (PPP)

List of Participants in Public Consultation/FGD

Address: Beside Dhaka - Demra highway.

GPS: 23.719946 , 90.490493

Date: 29/6/22 **Time** 6:50 pm

SL No.	Participant's Name	Age	Occupation	Mobile No.	Signature
১.	[illegible]	৫৮	ব্যবসা		
2.	[illegible]	২৬	ব্যবসা		
৩.	Md. Rakib Hasan	32	Teacher		
৪.	[illegible]	৪২	চাকুরিজীবী		
৫.	[illegible]	৪৫	ব্যবসা		
৬.	[illegible]	৪৬	ইমাম		
৭.	[illegible]	৩৭	ইঞ্জি:		
৮.	Aslam Akter Mizan	57	Business		
৯.	[illegible]	৫৪	দোকানদার		
১০.	MOBARAK MIAH	60			

Facilitated By Sadia Sabrin

Signature Sadia

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FGD-5 Location: Near Sugandha Hospital (GPS: 23.69711^0 N, 90.50949^0 E) Date: 30.06.2022 Time: 5:25 pm to 6:50 pm

Table: Details of Focus of Discussions

Sl No.	Name	Occupation	Question/Comment	Response
01.	Liakot Mia	Service	▪ How much land will be acquired is the vital query. ▪ Now people have no enough land. ▪ How much they will get land compensation. ▪ We do not expect land acquisition and anyhouse loss for the project	Social consultants firstly said that, for the implementation of the project will acquire some land. The participant also wanted to know that if land acquisition takes place, compensation will be determined for the lands on the front side of the road, away from the main road. Consultants informed that by evaluating the market survey and government rate land price, all affected person/s should get a fair price for their land parcel.
02.	Mofazzol Hosen	Service	▪ We want development but no maximum loss. ▪ Use existing road to avoid loss. ▪ Increase land price along expressway. ▪ Changes in commercial, education andcultural values. ▪ Give priority of local people for the work	The elevated expressway will be constructed along with the existing approach road. So, no need to construct another approach road. We do believe in less loss, more benefit. Along with the expressway the prices of the land will be increased also.
03.	Mahmud hasan	Service	▪ We are grateful to the Government for this kind of development plan. ▪ Give proper compensation to the affected people. ▪ Expressway construction will give advantage, that'strue, but the promises which are being given, that should be kept. ▪ Give attention that the people are less affected and development of proper mitigation plan.	This project will definitely serve its purpose.
04.	Zamiul Islam	Driver	▪ Current road condition is very tough and risky issue. ▪ Roads also needs to be smoothened for safely driving. ▪ Speed limit must be increased and ensure safety to the driver.	This comment will be taken into consideration as there is issues with roads and safety.
05.	Lutfor Rahman	Driver	▪ This project will be welcomed if there are no vital issues with the existing traffic conditions. ▪ Safety of drivers and the car should be given priority.	This comment is much appreciated as they share their valuable thoughts. This will must be in the head prior to the construction.

Sl No.	Name	Occupation	Question/Comment	Response
06.	Hasan Mia	Shopmaker	▪ Wish that the expressway will be constructed by reducing the negative impact to the local people. ▪ The project will create a good investment to his business.	Project appreciation is very much welcomed and also said that this will add profit and will be beneficiary for all the businessman like him.
07.	Zaheerul Islam	Shopmaker	▪ Proper Land Compensation. ▪ Discussion about the price of the land. ▪ Again, wants to engage the local people in thisdevelopment work. ▪ Mostly important how much benefit will be brought to his business.	The Land victim will get the proper land compensation by the government. This will definitely bring prosperity to the economy of the people as well as to the local businessman.
08.	Nazmul Mia	Service	▪ Improvement of Transportation System. ▪ Development of mitigation plan for mitigating environmental pollution. ▪ Also wanted to know about the land acquisition.	Comments is really considerable as it is related to the traffic. This project will reduce the pressure of the vehicle in the existing road condition and people will be benefited because time will be saved and people can go to their destination soon.
09.	Maidul Islam	Service	▪ This expressway will be within his land. ▪ How much land will be acquired and how much is the compensation.	Consultants informed that by evaluating the market survey and government rate land price, all affected person/s should get a fair price for their land parcel.
10.	Zishan Mia	Student	▪ Implementation of the project to get rid of all obstruction. ▪ Create employment opportunities to the localpeople and especially for the poor population. ▪ The expressway should be connected to the main road. ▪ The construction should be in a specific manner so that it would create recreational facilities to the local people and create employment opportunities from the recreation sector.	The expressway will be connected to the main road and existing thus it is supposed to be minimize the traffic jam and will give priority to the local people to work.
11	Motin Mia	Day Laborer	▪Create employment opportunities to the local people and especially for the poor population. ▪The wages for the daily labor work must be a good amount.	This comment is taken into consideration as poor people will be benefited and they will be given number one priority to the construction work

UPDATING OF ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR IMPROVEMENT OF THE 'HATIRJHEEL-RAMPURA-BONOSHREE IDEAL SCHOOL AND COLLEGE SHEIKHERJAIGA-AMULIA-DEMRA' HIGHWAY INTO 4-LANES INCLUDING LINK TO CHITTAGONG ROAD INTERSECTION AND ACCESS TO TARABO) THROUGH PUBLIC PRIVATE PARTNERSHIP (PPP)

List of Participants in Public Consultation/FGD

Address: Near Sugondha Hospital

GPS: 23.69711, 90.50949

Date: 30.06.2022 **Time** 5.25 PM

SL No.	Participant's Name	Age	Occupation	Mobile No.	Signature
01	Liakot Mia	40	Service	01718200173	
02	Mofazzol Hosen	38	D	01725168209	
03	Mahmood Hasan	30	D	01825017628	
04	Zamiul Islam	28	Driver	01512861903	
05	Lutfor Rahman	26	D	01612018920	
06	Hasan Mia	30	Shopkeeper	01728501208	
07	Zaherul Islam	45	D	01700289203	
08	Nazmul Mia	36	Service	01730286021	
09	Maidul Islam	33	D	01741218904	
10	Ziaul Mia	24	Student	01822600201	
11	Motin Mia	40	Daily labourer	01780229203	

Facilitated By SM Sowaib Hossain

Signature

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Appendix 4: Important Environmental and Social Features around/within the Project Area

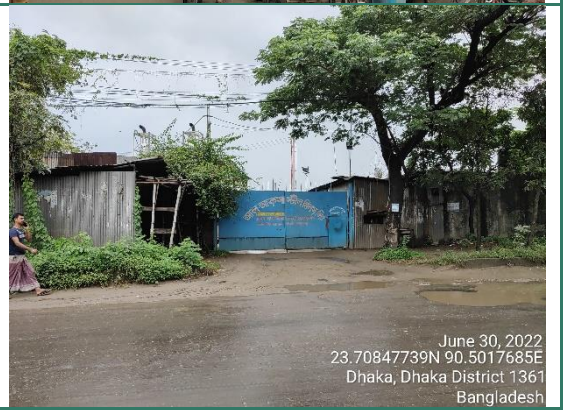
SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
1	Chattogram Road Mosque	23.697027	90.509129	Near CH. 00+000	68.46	
2	Chan Super Market	23.697254	90.508876	Near CH. 00+000	72.42	
3	Hirajhil Women's Madrasha	23.696878	90.507362	Near CH. 00+000	228	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
4	Lion Eye Service	23.697641	90.50817	CH. 00+050 – CH. 00+000	109	
5	Madina Eye Hospital	23.698262	90.509411	CH. 00+050 – CH. 00+000	34	
6	Tekpara Chairman Bari Jam-e Masjid	23.699255	90.508632	CH. 00+200 – CH. 00+150	25	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
7	Jibon Fish Farm	23.699386	90.508165	CH. 00+200 – CH. 00+150	8	
8	Shifa International School	23.700432	90.505504	CH. 00+450 – CH. 00+400	173.16	
9	ARBAB Group	23.704203	90.505896	CH. 00+800 – CH. 00+750	92.86	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
10	Apollo Ispat Complex LTD	23.704802	90.504403	CH. 00+950 – CH. 00+900	2	
11	Shitalakshya Fish Nursery	23.708235	90.50181	CH. 01+400 – CH. 01+350	11	
12	Sarulia Cattle Market	23.708413	90.501892	CH. 01+400 – CH. 01+350	7.54	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
13	Haque Construction	23.709747	90.500946	CH. 01+600 – CH. 01+550	8.28	
14	Gas Transmission Company Limited City Gate Station	23.710924	90.500289	CH. 01+750 – CH. 01+700	25.51	
15	Titas Gas Ideal High School	23.71203	90.500337	CH. 01+850 – CH. 01+800	98.19	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
16	Bangladesh Police UN Warehouse	23.710599	90.497427	CH. 01+850 – CH. 01+800	239.86	
17	Titas Gas Field	23.712122	90.49914	CH. 01+900 – CH. 01+850	1.48	
18	AL Aqsa Steel Mills LTD	23.71262	90.498616	CH. 02+000 – CH. 01+950	12.69	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
19	Demra Fire Station	23.714044	90.498056	CH. 02+150 – CH. 02+100	27.41	
20	Police Fari Pond	23.714404	90.49719	CH. 02+250 – CH. 02+200	23.58	
21	Bangladesh Police Demra Police Fari	23.714758	90.497522	CH. 02+250 – CH. 02+200	26.31	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
22	Baitun-nazat Jam-e-Masjid	23.714664	90.497199	CH. 02+250 – CH. 02+200	6.83	
23	Life and Care Medical Services	23.714738	90.496517	CH. 02+300 – CH. 02+250	60.26	
24	Shamsul Haque General Hospital	23.714878	90.496517	CH. 02+300 – CH. 02+250	51.40	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
25	68 no. Ward Awami League Office	23.71521	90.496911	CH. 02+300 – CH. 02+250	2.55	
26	Sarulia Bazar	23.716063	90.496279	CH. 02+350 – CH. 02+300	24.74	
27	Sarulia Pond	23.715261	90.496554	CH. 02+450 – CH. 02+400	5.32	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
28	Sarulia Bazar Jam-e-Masjid	23.716149	90.496559	CH. 02+450 – CH. 02+400	41.61	
29	M.A. Sattar High School	23.717454	90.498666	CH. 02+450 – CH. 02+400	12.09	
30	Fulmoti Islamia Alim Madrasha	23.716523	90.496422	CH. 02+450 – CH. 02+400	20.61	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
31	BTCL Telephone Building, Dhaka	23.716605	90.49602	CH. 02+500 – CH. 02+450	8.93	
32	DPDC Sarulia 33KV Substation	23.717665	90.495342	CH. 02+650 – CH. 02+600	20.23	
33	Karim Jute Mills Limited	23.71785	90.495074	CH. 02+650 – CH. 02+600	9.21	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
34	Karim Jute Mill Pond	23.719024	90.49447	CH. 02+800 – CH. 02+750	29.76	
35	Staff Quarter Pond	23.720642	90.492903	CH. 03+050 – CH. 03+000	0	
36	Staff Quarter Jam-e-Masjid	23.720484	90.49162	CH. 03+100 – CH. 03+050	114.04	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
37	Tropical Hospital	23.720055	90.490181	CH. 03+200 – CH. 03+150	260.53	
38	Akmol Shopping Complex	23.720779	90.490345	CH. 03+250 – CH. 03+200	196.56	
39	Demra Ideal College	23.72173	90.489535	CH. 03+350 – CH. 03+300	198.04	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
40	Baitun-Nur Jam-e-Masjid	23.721931	90.48949	CH. 03+400 – CH. 03+350	187.85	
41	Sajek Sami Timber & Saw Mill	23.723883	90.488585	CH. 03+600 – CH. 03+550	113.42	
42	Messrs Sharif Timber Saw Mill	23.724161	90.488832	CH. 03+600 – CH. 03+550	73.71	

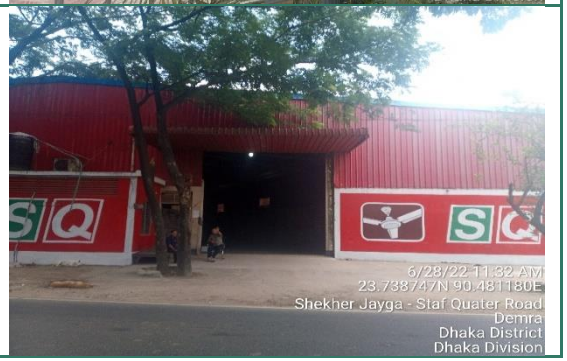
SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
43	Sheikher Jaiga Pond	23.724121	90.487747	CH. 03+700 – CH. 03+650	161.19	
44	Dominus Agro Industries Limited	23.725668	90.488135	CH. 03+800 – CH. 03+750	10.48	
45	ALLIED Group	23.726082	90.487877	CH. 03+850 – CH. 03+800	1.78	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
46	KKR Enterprise	23.725935	90.487748	CH. 03+850 – CH. 03+800	21.88	
47	SHIMU EPS Packaging Industries Industries Limited	23.727611	90.486939	CH. 04+050 – CH. 04+000	22.10	
48	Jamir Ali Super Market	23.728014	90.487171	CH. 04+050 – CH. 04+000	15.93	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
49	Chattogram VIP Timber And Saw Mill	23.730512	90.485931	CH. 04+350 – CH. 04+300	3.74	
50	Gouripur Timber Mill	23.73151	90.48569	CH. 04+500 – CH. 04+450	20.15	
51	Imtex Packaging	23.731854	90.485265	CH. 04+550 – CH. 04+500	7.51	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
52	Aligor Model University	23.732778	90.484709	CH. 04+650 – CH. 04+600	23.87	
53	Shonar Bangla Timber And Saw Mill	23.733565	90.484971	CH. 04+700 – CH. 04+650	31	
54	Snigdha Rajshahi Nursery	23.734502	90.484185	CH. 04+850 – CH. 04+800	10.40	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
55	Active Corporation	23.73555	90.484458	CH. 04+950 – CH. 04+900	53.42	
56	Haji Atik Market	23.736836	90.483493	CH. 05+100 – CH. 04+050	9.25	
57	E-Haque School and College	23.736653	90.483318	CH. 05+100 – CH. 04+050	16.56	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
58	Aranya Furniture Limited	23.737109	90.483125	CH. 05+150 – CH. 05+100	5.50	
59	Amulia Baitun-Nur Jam-e-Masjid	23.737626	90.482277	CH. 05+250 – CH. 05+200	16	
60	Panjeri Godown	23.738885	90.481154	CH. 05+450 – CH. 05+400	7.97	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
61	Amulia Mendipur Masjid and Madrasa	23.739455	90.479871	CH. 05+550 – CH. 05+500	43.27	
62	Haji Aman Market	23.740041	90.479908	CH. 05+600 – CH. 05+550	5.88	
63	Aichi Medical College & Hospital	23.740726	90.478854	CH. 05+750 – CH. 05+700	13.39	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
64	Maxim Group	23.743085	90.476404	CH. 06+100 – CH. 06+050	9.12	
65	Mostomajhi Pond	23.745182	90.473166	CH. 06+500 – CH. 06+450	39.43	
66	Iram Chottor Bazar	23.74631	90.472563	CH. 06+650 – CH. 06+600	12.19	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
67	Bismillah Timber Traders	23.74915	90.464493	CH. 07+550 – CH. 07+500	29	
68	Baitul Aman Jam-e-Masjid	23.749568	90.461226	CH. 07+900 – CH. 07+850	14.42	
69	Nagdarpar Sarkar Bari Graveyard	23.74967	90.461026	CH. 07+900 – CH. 07+850	25.50	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
70	Nagdarpar Pond	23.750185	90.459169	CH. 08+100 – CH. 08+050	45.81	
71	Samarai Cattle Farm	23.751489	90.453677	CH. 08+700 – CH. 08+650	10.56	
72	Messrs Rahim Afroz Gastec	23.751688	90.4535	CH. 08+700 – CH. 08+650	18.87	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
73	Imam Baag Jam-e-Masjid	23.752407	90.454209	CH. 08+700 – CH. 08+650	126.82	
74	Masjidul Akbar Jam-e-Masjid	23.751442	90.453277	CH. 08+750 – CH. 08+700	17.05	
75	Baitul Quran Madrasa	23.752363	90.453888	CH. 08+750 – CH. 08+700	102.43	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
76	Majumder Timber Furniture And Door	23.753645	90.450901	CH. 09+050 – CH. 09+000	11.97	
77	Liberty College	23.754399	90.450014	CH. 09+200 – CH. 09+150	16.65	
78	Central Warehouse	23.754839	90.449736	CH. 09+250 – CH. 09+200	4.54	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
79	Royal Ranch & Dairy	23.756417	90.448249	CH. 09+450 – CH. 09+400	11.96	
80	Messrs Quality Timber & Saw Mill	23.757508	90.447825	CH. 09+600 – CH. 09+550	7.55	
81	Tourist Police Headquater	23.760018	90.446414	CH. 09+900 – CH. 09+850	22.92	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
82	Yamagata Dhaka Friendship General Hospital	23.761464	90.443958	CH. 10+200 – CH. 10+150	86.48	
83	Dhaka Metropolitan Police, Rampura Thana	23.761305	90.443476	CH. 10+300 – CH. 10+250	125.83	
84	Famous Specialized Hospital	23.76195	90.443408	CH. 10+300 – CH. 10+250	54.83	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
85	Al Razi Islamia pvt Hospital	23.762244	90.439927	CH. 10+650 – CH. 10+600	39.75	
86	Bosuti Maa O Shishu Hospital	23.762461	90.438651	CH. 10+800 – CH. 10+750	27.50	
87	Academia	23.762445	90.437935	CH. 10+900 – CH. 10+850	35.82	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
88	Nur Majid Ayurbedic College	23.762511	90.437778	CH. 10+900 – CH. 10+850	29.16	
89	Intelligentsia School and College	23.762397	90.437495	CH. 10+900 – CH. 10+850	42.97	
90	Advanced Hospital	23.762545	90.436777	CH. 11+000 – CH. 10+950	35.10	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
91	Farazi Hospital Limited	23.762504	90.43626	CH. 11+050 – CH. 11+000	45.65	
92	DPDC Substation Bonoshree	23.762639	90.435631	CH. 11+100 – CH. 11+050	40.65	
93	Proper Health Care & Hospital	23.762713	90.435165	CH. 11+150 – CH. 11+100	41.39	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
94	Bangladesh Fertility Hospital LTD	23.762729	90.435056	CH. 11+150 – CH. 11+100	42.63	
95	National Ideal Girls' College	23.762754	90.434919	CH. 11+200 – CH. 11+150	42.35	
96	National Ideal English Version	23.762763	90.434837	CH. 11+200 – CH. 11+150	43.32	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
97	National Ideal School, Bonoshree	23.762794	90.434634	CH. 11+200 – CH. 11+150	43.26	
98	Bonoshree Adarsha Bidyaniketon School	23.762909	90.434168	CH. 11+250 – CH. 11+200	42.20	
99	Ideal School & College	23.76333	90.432153	CH. 11+450 – CH. 11+400	54.51	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
100	Bonoshree Central Jam-e-Masjid	23.763567	90.431472	CH. 11+550 – CH. 11+500	50.45	
101	Rajdhani Ideal School And College	23.764227	90.430001	CH. 11+700– CH. 11+650	37.17	
102	Holy Cresent School	23.764441	90.429426	CH. 11+750 – CH. 11+700	40.02	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
103	Rampura Khal	23.766348	90.426627	CH. 12+100 – CH. 12+050	11.07	
104	Oxford International School	23.766467	90.425843	CH. 12+200 – CH. 12+150	16.37	
105	East West University	23.768277	90.425361	CH. 12+350 – CH. 12+300	146.66	

SL No.	Name	Latitude (°N)	Longitude (°E)	Chainage	Distance (m)	Picture
106	Bangladesh Television Rampura	23.76714	90.424512	CH. 12+350 – CH. 12+300	2.54	
107	Rampura Water Pump	23.767555	90.423333	CH. 12+465 – CH. 12+450	4.68	

Appendix 5: Waste Management Plan

1. GENERAL

Considerable quantities of wastes (general & construction) will be generated due to the 3 years construction of the project road. Two types of wastes will be generated during construction:

a. General Waste:

- Organic waste (foods, fruits, tree leaves etc.); and
- Inorganic (such as papers, plastic and glass bottles & containers, polythene etc.); and

b. Construction Waste:

- Construction wastes are: construction materials such as sand, piece of rocks, bricks, rods, geotextiles, remaining concrete & bentonite waste.

2. OBJECTIVES

The main objective of the WMP is to organize disposal of all wastes generated during construction in an environmentally acceptable manner specially consider the following:

- Health hazards of the project personnel as well as community people should not be occurred;
- Manage the wastes in such a way that environment (specially air, soil, water etc.,) will not be polluted;
- Odor means bad smell should not be generated;
- Always friendly environment at the construction sites and construction camps;
- Any waste should not be disposed into the river and any water bodies to avoid water pollution;
- Any waste should not be burnt; and
- Any waste should not be placed in earth holes/chambers.

3. POTENTIAL ENVIRONMENTAL IMPACTS

Major potential environmental impacts due to the lack of waste management are:

- All types of environmental pollutions such as air, soils, water (surface & ground) pollutions;
- Generation of odor;
- Increase of flies, mosquitoes, insects etc.,
- Health hazards; and
- Environmental nuisance at the project sites

4. STRATEGIES TO ADOPT

The following strategies need to be adopted for appropriate soil waste collection system to be functioned properly:

a. Setting waste collection bins (not permanent structure, movable high-quality movable plastic bins; See Figure 1) in strategic points of the construction camp and work sites.

b. Introduce solid waste bins for organic and non-organic waste.

c. Coordinate with the municipalities waste collection system so that the waste can be collected at midnight when the road transports are minimum.

d. Wash liquids needs to be drained out though the functioning drains. The liquid waste needs to be treated with bleaching power every evening before draining so that the waste water cannot create nuisance and local pollution.

The other strategies that might be adopted are explained in later paragraphs.

Figure 1: High Quality Plastic Bins

5. METHOD OF DISPOSAL OF WASTES

The Project Company will collect the general wastes in separate waste bin at sources (means organic waste in one bin & inorganic waste in another bin) and dumped at the designated waste disposal site. The Company will construct concrete waste disposal site; means concrete floor and wall and covered by shed to avoid, air, bad smell, soil and ground water pollutions. Based on the quantity of general waste (organic & inorganic waste), the following two chambers (rooms) of the concrete disposal site will be constructed by Company:

Just after filling one chamber (say after 6 months) by organic waste through pocket gate, it should be covered by earth (soils) properly & keeps it for about 6 months for converting organic fertilizer for the agricultural lands. After filling 1st chamber by organic waste, disposing of waste will be started for 2nd chamber.

The inorganic waste will be collected in the waste collection bins. Just after filling, these inorganic wastes can be given to the vender free of cost.

The Company will collect construction waste as mentioned above separately and dump in to the designated room at the construction camp. Just after filling the room, Company will sale these waste to the vender for re-cyclic.

The Company will maintain log book for the measurement of quantity of the wastes (especially hazardous wastes) disposed every day.

6. INSTITUTIONAL ARRANGEMENT

Company is mainly responsible for design, construction, maintenance as well as environmental monitoring for the disposal of waste. Environmental Specialist of the PROJECT COMPANY is responsible for monitoring of the disposal. The PIU of the RHD will setup a 'Waste Management Committee' with the representatives of the PIU and Company to effectively disposing the wastes and distribution of organic fertilizer to the farmers and inorganic wastes to the venders. The committee is also responsible for monitoring procedure for the collection and carrying of wastes without causing any environmental hazards.

Appendix 6: Spill Prevention Procedure

GENERAL

A spill is the discharge of hazardous or regulated substances into the environment. Potential hazards created by a spill vary for humans, vegetation, water resources, fish and wildlife and depend on nature of the material, the amount spilled, the location of the release, weather conditions, and the time of year. The most common spills are small and easily contained. Spills of fuel and lubricants during construction can occur from fueling, hydraulic hose breaks, mechanical damage or vandalism.

Spill Prevention Procedure

Proper management, handling, and storage of the limited amount of hazardous or regulated materials to be used onsite will minimize the risk of a spill and mitigate potential effects to construction personnel and the environment if a spill does occur.

1) On-site Person in Charge

- Construction Site Manager, name and phone number to be determined.

2) Best Practices Regarding Use of Construction Equipment

- Store and maintain equipment in a designated area.
- Use secondary containment (drain pan) to catch spills when removing or changing fluids.
- Use proper equipment (pumps, funnels) to transfer fluids.
- Perform fueling in designated fueling areas.
- Do not “top-off” tanks
- Keep spill kits readily accessible
- Check incoming vehicles for leaking oil and fluids.
- Transfer used fluids and oil filters to waste or recycling drums.
- Inspect equipment routinely for leaks and spills.
- Repair equipment immediately, if necessary.
- Implement a preventative maintenance schedule for equipment and vehicles.

3) Best Practices Regarding Use and Storage of Regulated and Hazardous Wastes

RHD and Dhaka RAD Elevated Expressway Company Limited do not anticipate the Project will generate hazardous waste. Nonetheless, best practices to manage hazardous and regulated wastes are:

- Use entire volume before disposing of the container.
- Retain the original product label or MSDS.
- Recycle any useful material (used oil)
- Segregate wastes by waste type.
- Minimize the quantity of hazardous waste generated onsite and maintain storage quantities, times and disposal in compliance with national and international regulations.
- Arrange for disposal of hazardous waste at an approved waste facility.
- Train employees in proper hazardous/regulated material and waste management.

4) Spill Kits

Spill-containment and cleanup kits appropriate for the materials used throughout the construction phase should be well-marked, accessible and maintained onsite at the on-site Project construction office. A spill kit should include: Poly containment pail, oil absorbent pads, oil absorbent socks, heavy duty disposal bags, nitril gloves, all-purpose absorbent (such as sawdust or kitty litter), shovels, plugs and clamps to control a line breaks.

5) Training

Personnel working on the construction of the Project, its ancillary components and associated roadways will be briefed upon arrival to the Project site as to the nature of possible spill hazards, as well as the location, content, and usage of spill kits.

Appendix 7: Sample Material Safety Data Sheet (MSDS)

Date of issue:

Date of revision:

Version:

SECTION 1: IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE AUTHORITY

1.1. Product identifier:

1.2. Relevant identified uses of the substance or mixture and uses advised against:

1.3. Details of the supplier of the safety data sheet:

1.3.1. Responsible person:

1.4. Emergency telephone number:

SECTION 2: HAZARDS IDENTIFICATION

2.1. Classification of the substance or mixture:

2.2. Label elements:

2.3. Other hazards:

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1. Substances:

3.2. Mixtures:

Description	CAS number	EC number / ECHA list number	REACH registration number	Conc. (%)	Pictogram, signal word code(s)	Hazard class and category code(s)	Hazard statement code(s)
			-				
			-				
			-				

SECTION 4: FIRST AID MEASURES

4.1. Description of first aid measures:

4.2. Most important symptoms and effects, both acute and delayed:

4.3. Indication of any immediate medical attention and special treatment needed:

SECTION 5: FIREFIGHTING MEASURES

5.1. Extinguishing media:

5.1.1. Suitable extinguishing media:

5.1.2. Unsuitable extinguishing media:

5.2. Special hazards arising from the substance or mixture:

5.3. Advice for firefighters:

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1. Personal precautions, protective equipment and emergency procedures:

6.1.1. For non-emergency personnel:

6.1.2. For emergency responders:

6.2. Environmental precautions:

6.3. Methods and material for containment and cleaning up:

6.4. Reference to other sections:

SECTION 7: HANDLING AND STORAGE

7.1. Precautions for safe handling:

7.2. Conditions for safe storage, including any incompatibilities:

7.3. Specific end use(s):

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Control parameters:

DNEL values		Oral exposure		Dermal exposure		Inhalative exposure	
		Short term (acute)	Long term (chronic)	Short term (acute)	Long term (chronic)	Short term (acute)	Long term (chronic)
Consumer	Local	no data	no data	no data	no data	no data	no data
	Systemic	no data	no data	no data	no data	no data	no data
Worker	Local	no data	no data	no data	no data	no data	no data
	Systemic	no data	no data	no data	no data	no data	no data

8.2. Exposure controls:

8.2.1. Appropriate engineering controls:

8.2.2. Individual protection measures, such as personal protective equipment:

8.2.3. Environmental exposure controls:

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1. Information on basic physical and chemical properties:

Parameter	Value / Test method / Remarks
1. Physical state	no data*
2. Colour	no data*
3. Odour, odour threshold	no data*
4. Melting point/freezing point	no data*
5. Boiling point or initial boiling point and boiling range	no data*
6. Flammability	no data*
7. Lower and upper explosion limit	no data*
8. Flash point	no data*
9. Auto-ignition temperature	no data*
10. Decomposition temperature	no data*
11. pH	no data*
12. Kinematic viscosity	no data*
13. Solubility in water in other solvents	no data*
14. Partition coefficient n-octanol/water (log value)	no data*
15. Vapour pressure	no data*
16. Density and/or relative density	no data*
17. Relative vapour density	no data*
18. Particle characteristics	no data*

9.2. **Other information:**

9.2.1. **Information with regard to physical hazard classes:**

9.2.2. **Other safety characteristics:**

SECTION 10: STABILITY AND REACTIVITY

10.1. **Reactivity:**

10.2. **Chemical stability:**

10.3. **Possibility of hazardous reactions:**

10.4. **Conditions to avoid:**

10.5. **Incompatible materials:**

10.6. **Hazardous decomposition products:**

SECTION 11: TOXICOLOGICAL INFORMATION

11.1. **Information on hazard classes as defined in Regulation (EC) No 1272/2008:**

11.1.1. Summaries of the information derived from the test conducted:

11.1.2. Relevant toxicological properties:

11.1.3. Information on likely routes of exposure:

11.1.4. Symptoms related to the physical, chemical and toxicological characteristics:

11.1.5. Delayed and immediate effects as well as chronic effects from short and long-term exposure:

11.1.6. Interactive effects:

11.1.7. Absence of specific data:

11.2. **Information on other hazards:**

SECTION 12: ECOLOGICAL INFORMATION

12.1. **Toxicity:**

12.2. **Persistence and degradability:**

12.3. **Bio accumulative potential:**

12.4. **Mobility in soil:**

12.5. **Results of PBT and vPvB assessment:**

12.6. **Endocrine disrupting properties:**

12.7. **Other adverse effects:**

SECTION 13: DISPOSAL CONSIDERATIONS

13.1. **Waste treatment methods:**

13.1.1. Information regarding the disposal of the product:

13.1.2. Information regarding the disposal of the packaging:

13.1.3. Physical/chemical properties that may affect waste treatment options shall be specified:

13.1.4. Sewage disposal:

13.1.5. Special precautions for any recommended waste treatment:

SECTION 14: TRANSPORT INFORMATION

14.1. **Responsible Personnel's number or ID number:**

14.2. **Transport hazard class(es):**

14.3. **Packing group:**

14.4. **Environmental hazards:**

14.5. **Special precautions for user:**

SECTION 15: REGULATORY INFORMATION

15.1. **Safety, health and environmental regulations/legislation specific for the substance or mixture:**

15.2. **Chemical safety assessment:**

SECTION 16: OTHER INFORMATION

Prepared by	Checked by
Name:	Name:
Designation:	Designation:

Appendix 8: Safe Work Procedure during COVID-19

1. Introduction

A novel coronavirus (COVID-19) was identified in 2019 in Wuhan, China. This is a new coronavirus that has not been previously identified in humans. Coronaviruses are a large family of viruses that are known to cause illness ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS) and severe acute respiratory syndrome (SARS). (WHO) declared the Covid-19 outbreak a pandemic, as whole world is affected by this pandemic disease and have lost many of lives.

2. When staff/Construction Workers on travel to work

The contractor (The Company) needs to ensure they are protecting their workforce and minimizing the risk of spread of infection. This includes considering how personnel travel to and from sites. The personnel will travel to work site and shall keep minimum 2-meter distance maintaining social distancing. All workers technically be aware (not toolbox talk to be conducted) about this pandemic disease influence on health.

While travelling:

- Journeys should be shared informing with the team leader/project manager/supervisor and with the minimum number of people at any one time.
- Where social distancing is not feasible, use of Mask (Minimum Surgical) is mandatory in addition to protective goggles must be worn following with hand gloves.
- Temperature screening test must be conducted before entering the three project sites.
- Share with the minimum number of people at any one time
- Wherever possible maintain a distance of two meters and avoid touching your faces.
- Good ventilation (i.e., keeping the windows open) and facing away from each other may help to reduce the risk of transmission.
- The vehicle should be cleaned regularly using gloves and standard cleaning products, with particular emphasis on handles and other areas where passengers may touch surfaces.

3. Emergency Services

The health and safety requirements of the project sites; construction activity must not be compromised at this time. If an activity cannot be undertaken safely, it should not take place.

Emergency services are also under great pressure and may not be able to respond as quickly as usual. The PIU & Contractors (The Company) must take into consideration in the planning of work activities, first aid, fire and emergency responses. (The approved emergency response plan shall be applied)

Contractor (The Company) must have in place effective arrangements for monitoring and reviewing their compliance with Bangladesh government guidelines during this disaster. **In case emergency, please contact: IEDCR (IEDCR Hotlines are 333, 16263, 10655, and 01944333222.) Hotlines are 333, 16263, 10655, and 01944333222. See website: https://corona.gov.bd.** The site engineers/Supervisor must contact line management to control the situation though Bangladesh government authority's role is very important.

4. Site access and egress

- It is mandatory to do thermal screening of everyone entering and existing at the work sites. People with temperature above 37.3 ^{o}C or 99.14 ^{o}F, should not be allowed or asked to work either separately or in group. Thermal screening test records shall be maintained.

- Stop all non-essential visitors inside the project corridor.
- Consider introducing staggered start and finish times to reduce congestion and always contact
- Plan site access and egress points to enable social distancing may need to change the number of access points, either increase to reduce congestion or decrease to enable monitoring, including in the case of emergencies
- Allow plenty of space between people waiting to enter site
- Use signage at the project sites: if possible, such as floor markings, to ensure 2-meter distance is maintained between people when queuing
- reminding workers not to attend if they have symptoms of Coronavirus (COVID-19) and to follow guidelines
- Remove or disable entry systems that require skin contact (e.g., fingerprint scanners) unless they are cleaned between each individual use
- Require all workers to wash their hands for 20 seconds using soap and water when entering and leaving the site
- Regularly clean common contact surfaces in reception, office, access control and delivery areas e.g., scanners, turnstiles, screens, telephone handsets and desks, particularly during peak flow times
- Reduce the number of people in attendance at the sites inductions and consider holding them outdoors wherever possible
- Where loading and offloading arrangements on site will allow it, drivers should remain in their vehicles. Where drivers are required to exit their vehicle, they should wash or sanitize their hands before handling any materials
- Consider arrangements for monitoring compliance.

5. Control measures

- Educate/train workers about general precautions and regularly communicate plans to limit the spread of COVID-19.
- Reinforce good hygiene practices and take steps to make it easy for workers to frequently wash their hands.
- Institute policies and practices that maintain physical distance between workers.
- Identify, clean, and sanitize high-risk transmission areas regularly.
- Contractor (The Company) will Provide appropriate personal protective equipment (PPE). Workmen must use their own PPE's. PPE must not be exchanged.
- Require sick workers to stay home and send sick workers' home.
- Maintain a distance of at least ensure 2 meters distance from other workers, when possible, unless the task warrants otherwise (e.g., when performing a team lift). Limit large group interactions. Follow these same practices off the job.
- Instruct all employees/workers, cover their mouth and nose when they cough and sneeze into a tissue if possible or their upper sleeve or elbow, not their hands, when tissues aren't available. Dispose of tissues in the trash after use.
- Strictly warn to avoid touching eyes, nose, or mouth as much as possible.

6. Hand Washing

- Allow regular breaks to wash hands
- Provide additional hand washing facilities (e.g., pop ups) to the usual welfare facilities, particularly on a large spread-out site or where there are significant numbers of personnel on site, including plant operators
- Ensure adequate supplies of soap and fresh water are readily available at the project sites and kept always topped up
- Provide hand sanitizer (minimum 70% alcohol based) where hand washing facilities are

unavailable
- Regularly clean the hand washing facilities inside the project premises
- Provide suitable and sufficient rubbish bins inside the project corridor and hand towels with regular removal and disposal.

7. Toilet Facilities

- Restrict the number of people using toilet facilities at any one time (e.g., use a welfare attendant) and use signage, such as floor markings, to ensure 2 metre distance is maintained between people when queuing
- Wash or sanitize hands before and after using the facilities
- Enhance the cleaning regimes for toilet facilities, particularly door handles, locks, and the toilet flush
- Portable toilets should be avoided wherever possible, but where in use these should be cleaned and emptied more frequently
- Provide suitable and sufficient rubbish bins for hand towels with regular removal and disposal.

8. Rest Areas

- Where possible, workers should be encouraged to bring their own food. They should also be required to stay on site once they have entered it and avoid using local shops.
- Where there are no practical alternatives, workplace canteens may remain open to provide food to staff with appropriate adjustments for social distancing. Canteens should provide a takeaway service providing pre-prepared and wrapped food only.
- Consider increasing the number or size of facilities available on site if possible
- The capacity of each canteen or rest area should be clearly identified at the entry to each facility, and where necessary attendants provided to supervise compliance with social distancing measures
- Break times should be staggered to reduce congestion and always contact
- Drinking water should be provided with enhanced cleaning measures of the tap mechanism introduced
- Frequently clean surfaces that are touched regularly, using standard cleaning products e.g., kettles, refrigerators, microwaves
- Hand cleaning facilities or hand sanitizer should be available at the entrance to any room where people eat and should be used by workers when entering and leaving the area
- A distance of 2 meters should be maintained between users, wherever possible
- All rubbish should be put straight in the bin and not left for someone else to clear up
- Tables should be cleaned between each use
- Crockery, eating utensils, cups etc. should not be used unless they are disposable or are washed and dried between use
- Payments should be taken by contactless card wherever possible
- Canteen staff should wash their hands often with soap and water for at least 20 seconds before and after handling food
- Canteen staff and workers may use rest areas if they apply the same social distancing measures
- Consider arrangements for monitoring compliance.

9. Work Planning to Avoid Close Working

- Work planning should be done to avoid close working, if it's not possible, instruct all employees and workers should consider whether that activity needs to continue for the site to continue to operate, and, if so, take all the mitigating actions possible to reduce the risk of transmission.
- Sites and work need to be planned and organized to avoid crowding and minimize the risk of spread of infection by following the proper control measures of safe work procedures. In the

project Sites should remind the workforce (e.g., at daily briefings) of the specific control measures necessary to protect them, their colleagues, families, and others.

10. Hierarchy of Controls Covid-19 pandemic

If site workers are not able to work whilst maintaining a two-meter distance, worker should consider whether the activity should continue and, if so, risk assess it using the hierarchy of controls below:

Eliminate	• Workers who are unwell with symptoms of Coronavirus (COVID-19) at the project sites should not travel to or attend the workplace • Rearrange tasks to enable them to be done by one person, or by maintaining social distancing measures (2 meters) • Avoid skin to skin and face to face contact • Avoid Site Meetings
Reduce	Where the social distancing measures (2 meters) cannot be applied: • Where social distancing is not feasible, use of Mask (Minimum Surgical) is mandatory in addition to protective goggles must be worn following with hand gloves. • Temperature screening test must be conducted. • Minimize the frequency and time workers are within 2 meters of each other • Minimize the smaller number of workers involved in these tasks • Workers should work side by side, or facing away from each other, rather than face to face • Regularly clean common touch points, doors, buttons, handles, vehicle cabs, tools, equipment etc. • Increase ventilation in enclosed spaces. • Workers should wash their hands before and after using any equipment.
Isolate	Keep groups of workers that have to work within 2 meters: • Together in teams e.g. (do not change workers within teams) • As small as possible • Away from other workers where possible
Control	Where face to face working is essential to carry out a task when working within 2 meters: • Keep this to 15 minutes or less where possible • Consider introducing an enhanced authorization process for these activities • Provide additional supervision to monitor and manage compliance
PPE	At the project Sites workers need to wear mandatory PPE's maintaining 2-meter social distancing.
Behaviors	Contractor (The Company) should take measures necessary to minimize the risk of spread of infection rely on everyone construction workers for their actions and behaviors. Also encourage an open and collaborative approach between workers and employers on site where any issues can be openly discussed and addressed.

11. Proper Cleaning and housekeeping

Enhanced cleaning procedures should be in place across the project sites, particularly in communal areas and at touch points including:

- Taps and washing facilities
- Toilet flush and seats
- Door handles and push plates
- Handrails on staircases and corridors
- Lift and hoist controls
- Machinery and equipment controls

- All areas used for eating must be thoroughly cleaned at the end of each break and shift, including chairs, door handles, vending machines, and payment devices.
- Telephone equipment
- Keyboards, photocopiers, and other office equipment
- Rubbish collection and storage points should be increased and emptied regularly throughout and at the end of each day.

Appendix 9: Sample Table of Content for "Sexual Exploitation & Abuse (SEA)/Sexual Harassment (SH) Prevention Plan including Gender Based Violence (GBV)"

Appendix 10: Tree Plantation Plan

1. Objectives

The GOB, as policy encourages road side plantation for two decades past for environmental improvement, restoration of eco-balance and poverty alleviation through biomass energy, timber, food, fodder and other marketable biological products. Trees absorb carbon dioxide and release oxygen in daytime due to photosynthesis, thus clean air from noxious carbon-di-oxide gas. The timber, fruit, fuel, and medicine values of tree are immense. Roadside trees intercept dust with leaves and twigs keeping ambient air dust free. Tree plantation has other general advantages like improvement of environment, ecology and economy therefore, planting tree on road side slopes and other available spaces within the ROW would enhance environment, environment, economy and help alleviating rural poverty through work generation. In addition, dense tree plantation at both sides of the road embankment has special positive impact like protection of the coastal area from cyclonic storm.

The objective of the tree plantation and replacement programme is to compensate for the loss of trees due to the proposed implementation of road upgrading. Other major objectives of the programme are to protect the affected cultural/sensitive areas and to enhance the health of the existing ecosystem.

About 5820 of various trees of different sizes will be cut due to clearing of project road to be carried out under the Project.

A Tree Plantation Plan (TPP) is proposed to compensate the loss of these trees. To compensate 5820 trees and to improve the environmental and ecological status of the project area, a total of 17460 trees will be replanted.

The following areas have been identified for development of plantation sites in the Project areas:

- both side slopes of the constructed road embankment
- back side of the constructed bus stations
- along the affected cultural/sensitive areas

2. Selection and Planning of Tree Species

The species for the proposed tree plantation have been selected based on the statistics of the lost vegetation and in consultations with the concerned officials of the Arboriculture Department of RHD. In principal selection of species for the project should rather be on protection of the road embankment from slope erosion, aesthetic, and conservation than commercial. The list of tree species to be used for the plantation on the proposed locations along the road is as follows:

- At the roundabout, *Terminalia catappa* and *Ceiba speciosa St.Hih*. are used as the backbone trees in the design. The lower layer is matched with low shrubs such as *Hibiscus rosa-sinensis linn*. and *Bougainvillea glabra choisy* and the bottom layer is covered with *Schefflera heptaphylla* to create a road node landscape with flowers all year round and well-arranged.

The tree Plantation plan is shown in Figure 1.

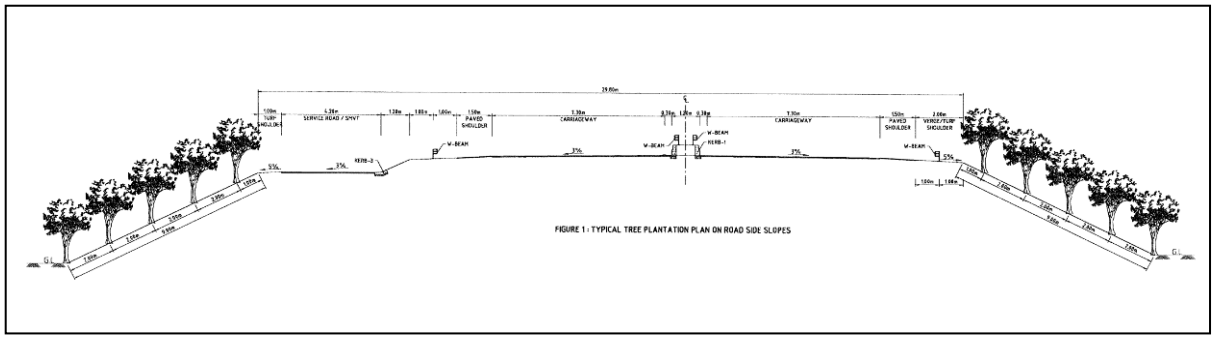


Figure 1: Road Cross Section Showing the Typical Tree Plantation Layout (sample design for at Grade Section)

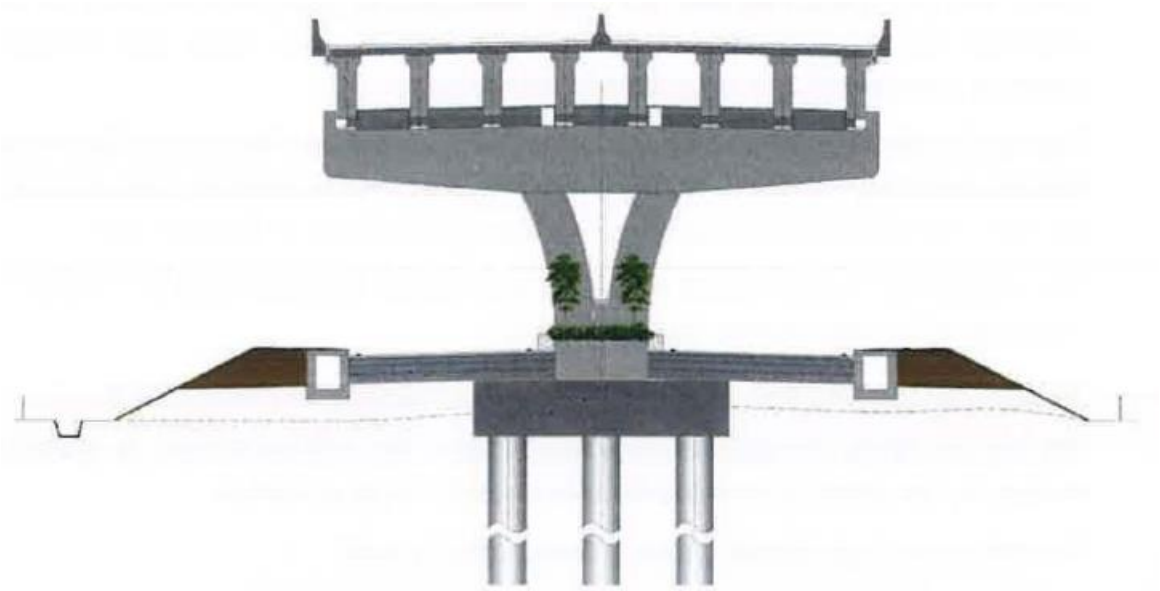


Figure 2: Cross Section of Greening Landscape (sample design for elevated section)

3. Quantities of Trees to be Planted

Minimum 3 trees need to be planted in case of cutting of 1 tree. Minimum 2m spacing is required for planting the trees as per plan shows in Table VIII-3. Since the project will cut very minimum number of trees thus the space required for tree replacement is also available along the road embankment. The distribution of these planted trees will be like -

- 50% timber
- 25% fruit
- 25% medicinal

4. Implementation Arrangement

The Arboriculture Department of RHD will be responsible for the plantation. However, they will involve the PAPs, especially vulnerable poor and women, in the plant replacement programme. They will provide all technical and other supports in planning and developing the plantations. However, the implementation arrangement for Project is unique than any other tree replacement programme in country that was agreed in consultation with AIIB, RHD and Company. It was decided that RHD will be responsible for the successful implementation of tree plantation and replacement programme without involving PAPs.

The tasks are as follows:

- training of the local RHD staff on tree maintenance
- preparation of the tree replacement programmes in accordance with this plan and get them approved by the Arboriculture Department, if necessary
- coordination of sapling procurement process of approved species prescribed above
- supervision of nurseries for raising saplings

5. Responsibility

It was decided that the Contractor (The Company) will be responsible for planting trees throughout the alignment and other areas as prescribed above. The Contractor (The Company) will need to procure and raise saplings until they survive. They can set up nurseries in consultation with RHD and the PIU at the early stage of the Project. Alternatively, the Company can purchase saplings from the local nursery.

The Environmental Officer of RHD/PIU will be responsible for overall coordination with the Arboriculture Department, PAPs, and supervision of the programme. Arboriculture Department will start the tree replacement programme in the pre-construction stage, so that setting up of nurseries can be done in the early stages of the Project.

6. Budget and Payment

The budget for the proposed tree replacement programme for the project road is provided in Table VIII-3 and this amount is added in the total environmental monitoring budget of Environmental Management Plan chapter of this EIA. The budget also includes maintenance for three years from the date of plantation to ensure that all planted saplings will survive and provision for an additional plantation is available. The plantation on the slopes of road embankment, roundabouts, intersections and along the affected cultural/sensitive areas will be taken up after completion of construction work. The budget also includes procurement and development of all facilities required to establish a nursery such as, collection of suitable soils, decomposing cow dung, procurement of fertilisers etc. The budget also includes measure required for maintenance of plantation, such as watering, weeding, fertiliser application, replacing of dead saplings (if any), etc. for the first year after planting.