FIRST DHAKA ELEVATED EXPRESSWAY (FDEE) CO. LTD.

Dhaka Elevated Expressway (DEE) Project

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

Bureau of Research, Testing and Consultation (BRTC)
Bangladesh University of Engineering and Technology (BUET) Dhaka – 1000, Bangladesh

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EXECUTIVE SUMMARY

The Government of Bangladesh has decided to build an elevated expressway stretching from Hazrat Shahjalal International Airport to Kutubkhali (connecting Dhaka-Chittagong Highway) to add additional capacity to the existing north-south routes as well as act as a bypass option in order to alleviate traffic congestion within Dhaka city. The proposed Dhaka Elevated Expressway (DEE) project will be implemented under Public-Private-Partnership (PPP) between the Government of Bangladesh, represented by the Bangladesh Bridge Authority (BBA), and the Italian-Thai Development Public Company Limited, represented by the First Dhaka Elevated Expressway (FDEE) Co. Ltd. (ITD Group).

Environmental Examination (EIA) of the proposed DEE Expressway project has been carried out following the guidelines of the Department of Environment (DoE) of GoB and the Environmental and Social Management Framework (ESMF) for Investment Promotion Financing Facility (IPFF) (IIFC, 2010), which is a safeguard instrument and compliance policy covering both IDA and GoB requirements. The overall objectives of the EIA were to identify potential significant impacts, both positive and negative, during pre-construction, construction and operation phases of the proposed project, and to develop and environmental management plan (EMP) including recommendation of mitigation measures to avoid or reduce adverse impacts and to enhance positive impacts.

Baseline Study

As a part of the EIA, a detailed baseline survey – including physical, ecological and socio-economic survey – of areas along and surrounding the preliminary alignment of the proposed Expressway have been carried out. The proposed Dhaka Elevated Expressway (DEE) will commence at Hazrat Shahjalal International Airport and end at Dhaka-Chittagong highway near Kutubkhali (Fig. 2.2). Besides the main four-lane dual carriageway and two suspended termini at its ends, it has five interchanges, two elevated links, 31 ramps (including 15 on-ramps and 16 off-ramps) and 8 toll plazas. The approximate total length of the main carriageway Expressway is about 46.73 km (including 19.73 km main flyover and 31 km ramps and elevated links). Thus, the alignment of the main carriageway shall be as follows:

> Hazrat Shahjalal International Airport- Kuril-Banani-Mohakhali-Tejgaon-Satrasta - Moghbazar Rail Corridor- Khilgaon – Kamalapur – Sayedabad – Jatrabari - Kutubkhali (near Dhaka-Chittagong highway)

The physical survey was carried out to identify the major features along and surrounding the preliminary alignment of the Expressway. From Airport to Kamlapur, the Expressway alignment passes primarily over/close to the alignment of the railway track, except for a short stretch in Khilkhet-Kuril-Joar Shahara area, where private land acquisition will be required. Along most of the alignment, the Expressway passes very close to human settlements, including hospitals, schools, and mosques. It also passes over and along a number of major roads, flyovers (President Zillur Rahman Flyover, Moghbazar-Mouchak Flyover, Mayor Mohammad Hanif Flyover), Banani Overpass, foot overpass (at Farmgate),

and level crossings. As a part of the baseline survey, noise level, water quality and air quality measurements were carried out at selected locations along the Expressway alignment.

According to the baseline ecological survey, most of the project areas have few biological resources. Most of floral species are cultivated or planted. Small number of wildlife species that exists in the project sites is common and found throughout the country. Only one threatened wildlife species (Yellow Monitor Lizard) was found in Tranche-1 of DEE. The baseline survey could not identify any threatened fish species within and surrounding the project areas; no threatened flora has been found in the project areas.

A baseline socio-economic study was carried out to understand the current situation of people living in and around the proposed project sites and to get feedback from them regarding different aspects of the proposed project. The study provided an understanding of people's background in the project areas and their lives and livelihood, as well as their attitude toward the proposed project.

Public Consultations

As a part of the baseline socio-economic study, five focus group discussions (FGDs) and several formal and informal meetings have been carried out at the project areas. The objectives of the FGDs and meeting were: (i) to understand people's socio-economic condition, (ii) to understand extent of people's access to current basic services, (iii) to understand people's perception regarding possible impacts of proposed project, and (iv) to get feedback from people regarding mitigation measures.

In the FGDs and meetings, people expressed their opinions regarding potential risk of the project and also suggested mitigation measures to reduce/eliminate the adverse impacts. The potential significant impacts from the project as identified in the FGDs and meetings included: (i) Land acquisition and dislocation; (ii) People's livelihood; (iii) Obstruction to movement (especially access to educational facilities, hospitals); (iv) Water and Sanitation problems; and (v) Increased social crimes

Impacts during Pre-construction Phase

The major activities to be carried out during the pre-construction phase include: (a) Finalization of the alignment of the proposed Dhaka Elevated Expressway (DEE), and (b) Acquisition of necessary land.

The major impacts related to the preliminary alignment of the Expressway include: (1) Conflict with future expansion of railway near Airport; (2) Conflict with Railway market in Khilkhet area; (3) Conflict with Shunting Operation near Cantonment Railway Station; (4) Conflict with Operation of Tejgaon Station; (5) Conflict with Banani Overpass and Zillur Rahman Flyover; (6) Conflict with the Proposed U-loops near Golf Course and Banani Graveyard; (7) Conflict with Tejgaon-Moghbazar-Malibagh Flyover of LGED; (8) Conflicts with MRT-6 and MRT-5; (9) Conflict with Hatirjheel Lowland behind Sonargaon Hotel and BGMEA building; (10) Conflict with Existing and Proposed Railway Track near Khilgaon; (11) Conflict with Inland Container Depot at Kamalapur; and (12) Conflict with Mayor

Mohammad Hanif Flyover (MMHF). Most of these conflicts have already been resolved by shifting/modifying the alignment of the DEE.

Land acquisition will be required for the proposed project and detailed land schedules have been prepared by BRTC, BUET, which is being used by the Bangladesh Bridge Authority (BBA) for acquisition of necessary land for the DEE project. For convenience, the Land Schedules have been prepared in three parts:

(a) LAP-Part 1 for Tranche 1 (stretching from Airport to Banani);
(b) LAP-Part 2 for Tranche 2 (stretching from Banani to Moghbazar); and
(c) LAP-Part 3 for Tranche 3 (stretching from Moghbazar to Kutubkhali).

According to LAP-Part-1, a total of 71.2350 acres of land needs to be acquired along Tranche-1 of the DEE, which includes 8.3008 acres of privately owned land. There are different kinds of built structures on both the private lands and lands under different Govt. agencies to be acquired for the project under LAP-Part 1. According to LAP-Part 2, a total of 87.6306 acres of land needs to be acquired along Tranche-2 of the DEE, which includes 13.6118 acres of privately owned land (located in 20 different Mouzas). There are different kinds of built structures on both the private lands and lands under different Govt. agencies to be acquired for the project under LAP-Part 2. According to LAP-Part-3, a total of 61.2863 acres of land needs to be acquired along Tranche-3 of the DEE, which includes 5.7306 acres of privately owned land (located in 21 Mouzas). There are different kinds of built structures on both the private lands and lands under different Govt. agencies to be acquired for the project under LAP-Part 3.

The socio-economic impacts related to land acquisition would be significant and could be categorized as: (i) loss of land and property; (ii) permanent dislocation/ displacement; (iii) loss of income. Figure E.1 shows the areas along the alignment of the Expressway where private land acquisition will be required.

Environmental Impacts during Construction Phase *Ecological Impacts:*

The project activities are likely to have minor impact on the ecological parameters. Areas along Tranche-1 of the Expressway have moderate number of planted trees beside the rail line (Kawla to Khilkhat and Banani area) that have economic and aesthetic values. In Tranche-2, there is a park a small park (on the western side of Pan Pacific Sonargaon Hotel / near Panthopath area) with varieties of planted floral species; this entire park will be used for construction of DEE infrastructure. In Tranche-3, notable number of planted trees also exists (Kamalapur Rail Station Area) In Tranche -1, fish culture is practiced in some ponds that have few native fish species; these ponds are likely to be filled up during construction phase of the DEE. Cutting of trees for clearing the right of way would be necessary in some sections of the DEE. However, construction of the DEE is not likely to affect the overall ecology of the area in any significant manner.

Figure E.1: Alignment of the Expressway showing areas where land acquisition will be required

Physicochemical Impacts:

Major physicochemical parameters considered for assessment of environmental impacts of project activities include: (i) Noise pollution, (ii) Air pollution, (iii) Vibration, (iv) Possible drainage congestion, and (v) Generation and disposal of wastes.

Noise and air pollution and vibration are important considerations, particularly where the Expressway alignment runs close to human habitations. Noise pollution and vibration during the construction phase may result from movement of vehicles carrying materials and equipment to and from the project sites, demolition works, operation of machines and equipment (e.g., concrete mixing machines, aggregate crushers), and different construction activities. A detailed assessment of noise levels generated from the major equipment to be used during construction phase has been made using a noise model. Localized and temporary air pollution may generate from earthworks (e.g., excavation, filling) during site preparation, movement of vehicles and demolition activities. However, the air pollution generated from these activities is likely to be localized (affecting immediate surroundings of the project sites).

Drainage congestion may result from possible obstruction to natural flow of drainage water during construction activities. During construction phase, problems related to sanitation and solid waste may result from improper/inappropriate facilities at the labor sheds. Demolition of the existing structures will also produce huge quantity of debris, which would have to be properly disposed of.

Socio-economic Impacts:

The major parameters considered for assessment of socio-economic impacts of project activities include: (i) Loss of income, (ii) Temporary dislocation/ displacement, (iii) Traffic congestion, (iv) Safety, and (v) Employment.

Loss of income could result from inability to perform certain income generating activities during construction operations, e.g., due to closing of markets/ shops/ offices located close to the Expressway alignment due to safety considerations. Apart from permanent displacement of people currently living on lands to be acquired for the project, some people living/working close to the Expressway alignment may have to move away temporarily during construction activities due to safety risks or other considerations (e.g., privacy, noise/ air/ vibration pollution).

The Expressway alignment passes over a number of major roads, level crossings, flyover/ elevated road and foot overpass. Besides, two Links of the Expressway are to be constructed over very busy roads of the city. There are 31 entry and exit ramps of the Expressway, which connect it with major existing roads of the city. Significant traffic disruption is likely during construction of Expressway over roads/ flyovers/foot overpasses, construction of the two elevated Links along busy roads, and construction of the entry and exit ramps on busy roads.

Temporary traffic congestion during the construction phase may result from increased movement of vehicles carrying materials and equipment to and from the site. Traffic congestion may be aggravated if materials (e.g., construction materials) are stored on the

street and equipment /machines/vehicles (e.g., mixing machines) are kept/parked on the street.

As noted earlier, the Expressway would passes over a number of major roads, level crossings, flyover/ elevated road and foot over-bridge. In addition to regular safety measures, special construction methodology would have to be followed to ensure safety during construction of Expressway over live railway tracks, over and along major busy roads. Occupational health and safety is an important issue during construction phase. General construction activities pose safety risks, which should be addressed as part of occupational health and safety plan. Chapter 6 presents guideline on occupational health and safety issues.

The construction of the Expressway will generate employment opportunities for both skilled manpower (e.g., engineers) as well as unskilled workforce (i.e., labor). This in turn would induce positive impacts on some other parameters including commercial activities in the project area. Table E.1 presents summary of physicochemical and socio-economic impacts during construction phase of the DEE project.

Table E.1: Summary of physicochemical and socio-economic impacts during pre-construction and construction phase

Project Activities	Important Physicochemical Impacts					
	1.					
Labor camp setting and its operation	0	0	-1S	-1S		
Demolition of existing structures	-2S	-1S	0	-1S		
Movement of project vehicles, equipment	-2S	-2S	0	0		
Earthworks, excavation	-1S	-2S	-2S	-1S		
General construction works (e.g., piling, RCC works)	-2S	-1S	-1S	-1S		
	Important Socio-economic Impacts					
Project Activities	2. 3	3		4	Safe ty	5
Land acquisition	-3S	-2S	0	0	0	0
General construction works	0	0	-1S	-2S	-2S	+2S

[Note: S = Short-term impact; L= Long-term impact; -3S = High negative impact; -2S = Moderate negative impact; -1S = Low negative impact; +3S = High positive impact; +2S = Moderate positive impact; +1S = Low positive impact]

Environmental Impacts during Operational Phase

Traffic impacts, vehicular air pollution, noise pollution and vibration from traffic movement are potential significant impacts during operational phase of the Expressway.

The primary objectives of the Expressway are to increase traffic capacity within and around the city and to reduce traffic times and provide travel comfort and convenience. During operational phase, the DEE will: (a) increase traffic capacity by improving north-south connectivity and linking important commercial and business centers; (b) reduce traffic times and provide travel comfort and convenience; (c) improve connectivity between North (N4) and South (N1) gateways; (d) provide truck access facility even during the daytime to the Dhaka's industrial belt comprising Savar, DEPZ, Dhamsona, Kaliakoir, Gazipur; and (e) establish better level of service (LOS) along the Asian Highway (AH2) corridor and thereby improve regional connectivity. At the same time, the Expressway may induce some undesirable effects, many of which could be minimized with appropriate mitigation measures. The main traffic impacts of DEE during its operational phase will be as follows:

- Congestion reduction in the existing North-South roads
- Increase in local congestion around the ramp touch-down points
- Increase in traffic volume in the long-run due to diverted and induced traffic

Mitigation Measures

Table E.2 shows the mitigation measures corresponding to specific adverse impacts, along with assignment of responsibilities for their implementation. These mitigation measures should be implemented as a part of the Environmental Management Plan (EMP). The measures presented in Table E.2 are aimed at minimizing the effects of the possible adverse impacts and enhancing the positive impacts. Table E.2 shows that most of the adverse impacts during construction phase could be minimized if appropriate mitigation measures are taken. Apart from the mitigation measures presented in Table E.2, occupational health and safety guidelines have also been developed for the proposed project.

Table E.2: Environmental impact during construction phase and mitigation measures

Activity/Issues	Potential Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
Pre-Construction Phase			
Alignment of the Expressway	• Conflicts with future expansion of rail lines and operation of some rail stations • Conflicts with three flyovers, Banani overpass, proposed U-loops • Conflicts with Hatirjheel, built structures (e.g. Khilkhet railway market), Kamalapur Container depot, etc • Possible conflict with MRT-6 and MRT-5	• Conflicts of Expressway alignment with future expansion of rail lines at some locations (e.g. near Airport, Khilgaon), and operation of some Rail Stations (Cantonment and Tejgaon); conflicts with flyover (President Zillur Rahman flyover; MMHF, Moghbazar-Mouchak flyover) and overpass (Banani) projects; proposed U-loops (near Golf Course and Banani graveyard; Kamalapur Container depot, Hatirjheel low lands; and conflicts with MRT-6 and MRT-5 have been largely resolved by modifying/shifting alignment of DEE Expressway, as explained in Table 4.1.	BBA, GoB and FDEE (ITD Group)
Land acquisition	• Loss of land / property	• Raise awareness of PAPs through public consultation process prior to actual land acquisition. • Avoid acquisition of private land as much as possible • Serve land acquisition notices to actual land owners. • Provide adequate (considering present market value), fair, and quick compensation to real land owners, in accordance with applicable laws of GoB, and the Environmental and Social Management Framework (ESMF) for Investment Promotion Financing Facility (IPFF). • Provide appropriate and quick compensation for loss of land, property and income to all project affected people (PAPs) following the entitlement matrix in **Table 6.2**. • Involve local people and peoples' representatives in settling social tension related to land acquisition and those that may develop during the progress of work from the very beginning of project implementation.	BBA, GoB
	• Permanent Dislocation/ displacement (mainly slum population)	• Giving time to residents for shifting to new places • Temporary accommodation for displaced population • Provision of compensation (according to entitlement matrix presented in **Table 6.2**).	BBA, GoB

Activity/Issues	Potential Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
	• Loss of Income	• Provide adequate compensation according to the entitlement matrix presented in **Table 6.2**. • Provide alternative job opportunities for PAPs, give priority to PAPs having requisite skills for jobs in the proposed project. • Avoid important festival times (e.g., Eid) for possible dismantling activities to minimize loss.	BBA, GoB
Construction Phase			
Mobilization project site	• Generation of sewage and solid waste at	• Construction of sanitary latrine and septic tank system • Erection of "no litter" sign, provision of waste bins/cans, where appropriate • Waste minimization, recycle and reuse principles to be followed • Proper disposal of solid waste	FDEE (ITD) (Monitoring by BBA)
	• Health of workers	• Clean bill of health a condition for employment • Provision of water supply with acceptable water quality • Raising awareness about hygiene practices among workers • Regular medical monitoring of workers	
	• Possible development of labor camp into permanent settlement	• Contractor to remove labor camp at the completion of contract	
	• Outside labor force causing negative impact on health and social well-being of local people	• Contractor to employ local work force, where appropriate; promote health, sanitation and road safety awareness	
• Construction of Expressway	• Noise pollution and Vibration	• Use of noise suppressors and mufflers in heavy construction equipment. • Avoid using of construction equipment producing excessive noise during school hours and also at night • Avoid prolonged exposure to noise (produced by equipment) by workers. • Regulate use of horns and avoiding use of hydraulic horns in project vehicles.	FDEE (ITD) (Monitoring by BBA)

Activity/Issues	Potential Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
	• Air pollution	• Ensure that all project vehicles are in good operating condition • Spray water on dry surfaces/ unpaved roads regularly reduce dust generation • Pave access roads • Maintain adequate moisture content of soil during transportation, compaction and handling • Sprinkle and cover stockpiles of loose materials (e.g., fine aggregates). • Not using equipment such as stone crushers at site, which produce significant amount of particulate matter	
	• Disruption of local drainage	• Provision for adequate drainage of storm water • Provide adequate diversion channel, if required • Provide facilities for pumping of congested water, if needed • Ensure adequate monitoring of drainage effects, especially if construction works are carried out during the wet season.	
	• Water and soil pollution	• Prevent discharge of fuel, lubricants, chemicals, and wastes into surface waters or on land. • Install sediment basins to trap sediments in storm water prior to discharge to surface water. • Replant vegetation when soils have been exposed or disturbed.	
	• Traffic congestion, communication problems	• Implementing suggestions, to the extent possible, presented in Section 6.2.1.2. • Adequate traffic lights, signals, personnel for controlling traffic during construction along/ over existing roads, level crossings • Schedule deliveries of material/ equipment during non-school hours and after regular working hours • Depute flagman for traffic control • Arrange for signal light at night	
	• Safety	• Follow occupation health and safety guidelines presented in Section 6.2.1.3. • Ensuring safety during demolition of existing structures • Ensuring safety of trains and rail lines during construction of Expressway above rail tracks through proper design of formwork/ centering • Ensuring safety of pedestrians and vehicles during construction of Expressway above roads, level crossing through proper design of formwork/ centering • Erection of signs (with lights) advising people/vehicle to avoid certain areas during overhead construction	

Activity/Issues	Potential Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
	• Accidents	• Following standard safety protocol while erecting poles and stretching cables. • Environmental health and safety briefing • Provision of protective gear	
	• Spills and leaks of oil, toxic chemicals	• Good house keeping • Proper handling of lubricating oil and fuel • Collection, proper treatment, and disposal of spills.	
	• Temporary dislocation and loss of income	• Avoid important festival times (e.g., Eid) for stoppage of commercial activities to minimize loss. • Provide alternative job opportunities for PAPs; employ such people in project works where possible	
	• Employment of work/labor force	• Employ local people in the project activities as much as possible. • Give priority to poor people living in slums within project area in project related works (e.g., excavation and other works, which do not require skilled manpower).	

Traffic impacts, vehicular air pollution, noise pollution and vibration from traffic movement are potential significant impacts during operational phase of the Expressway. Table E.3 shows the mitigation measures for these possible adverse impacts.

Table E.3: Environmental impact during operational phase and mitigation measures

Issue/Impact	Mitigation Measures
• Air Pollution	• Making sure, e.g., through regular inspection by traffic police, that vehicles are in good operating condition
• Noise Pollution	• Restriction on use of horn on Expressway, especially in sensitive areas (where households, hospitals, schools, etc. are located nearby). • Implementation of noise barrier, where appropriate
• Traffic Impacts: (i) Congestion reduction in the existing North-South roads; (ii) Increased local congestion around ramp touch-down points; and (iii) Long-term increase in traffic volume	• Adequate ramp lengths and appropriate tolling facilities to be provided to contain queue spillbacks (if any) and ensure that local traffic congestion is not aggravated due to DEE. • Proper geometric treatment and channelization at the vicinity of the ramps to ensure smooth flow of traffic. • Measures to be taken to recover lost capacities at intersections due to on-street parking, boarding-alighting and loading-unloading activities and ensure smooth traffic circulation. • DEE is likely to lead to increased traffic volumes and higher average speeds. This is likely to pose safety concerns, particularly for pedestrians. Improved pedestrian facilities should therefore be provided to ensure their safety. • A major project like DEE is likely to result significant changes in accessibility to certain areas leading to the risk of densification near the ramp locations. Strict land-use restrictions should therefore be imposed to avoid further densification in these locations and thus prevent the corresponding increase in traffic. • Implementing suggestions presented in Section 4.4.1 and Section 6.2.2.1.

Environmental Management Plan

The environmental management program should be carried out as an integrated part of the project planning and execution. For this purpose, it is recommended that the Project Director (PD) from BBA takes the overall responsibility of environmental management and monitoring. The PD will form a team with required manpower and expertise to ensure proper environmental monitoring, and to take appropriate measures (as outlined in Tables E.2 and E.3) to mitigate any adverse impact and to enhance beneficial impacts, resulting from the project activities.

The environmental management during the pre-construction phase should focus on addressing the possible impacts arising from: (i) Alignment of the Expressway (i.e., conflicts with rail line expansion, flyovers, overpass, ongoing and committed projects, and important installations), and (ii) Acquisition of land, especially private land, for the Expressway.

The environmental management during the construction phase should focus on addressing the following issues: (i) Air and Noise pollution, (ii) Possible drainage congestion, (iii) Generation and disposal of wastes, (iv) Loss of income, (v) Temporary dislocation/ displacement, (vi) Traffic congestion, (vii) Safety, and (viii) Employment.

The environmental management during the operational phase should primarily focus on addressing the following issues: (i) Air and Noise pollution and (ii) Traffic impacts.

Monitoring Program

The primary objective of the environmental monitoring is to record environmental impacts resulting from the project activities and to ensure implementation of the "mitigation measures" to reduce adverse impacts from project activities. Table E.4 presents a plan for monitoring noise and air quality during construction phase of the project. Besides, the Project Engineer should also make necessary arrangements to test water quality, if any pollution is suspected. In addition, the Project Engineer should also monitor possible drainage congestion (especially during wet season), and disruption of traffic during construction activities. An inventory of the trees to be cut during the construction phase should be maintained by the Project Engineer, so that proper compensation could be provided and plantation of similar trees at suitable location could be done.

Table E.4: Monitoring of air quality and noise level

Parameters	Monitoring Frequency	Resource Required and Responsibility	Comment
Particulate Matter (PM_{10}, $PM_{2.5}$)	Once every 3 months, and as directed by the Project Engineer	PM_{10} and $PM_{2.5}$ measuring equipment; Contractor's responsibility	Results to be verified by a monitoring team, lead by the Project Engineer
Noise Level	Once every month, and as directed by the Project Engineer	Noise level meter; Contractor's responsibility	

Note: Actual monitoring time and location should be decided by the Project Engineer depending on the location of specific activities.

During operational phase, monitoring of air quality and noise level at selected locations could be carried out following the monitoring plan presented in Table E.3

Recommendations

As a part of the EIA, mitigation and abatement measures to reduce or eliminate potential adverse impacts and to enhance beneficial impacts have been suggested. Mitigation and abatement measures for pre-construction, construction and operation phases of the project have been outlined in the EIA. An environment management plan (EMP), including a monitoring program has been developed. The EIA report should now be submitted to the Department of Environment (DoE) for getting necessary environmental clearance.

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Acronyms and Abbreviations

ADB	Asian Development Bank
BBA	Bangladesh Bridge Authority
BRTC	Bureau of Research Testing and Consultation
BUET	Bangladesh University of Engineering and Technology
DGPS	Digital Global Positioning System
DEE	Dhaka Elevated Expressway
DEEP	Dhaka Elevated Expressway Project
DGHS	Director General Health Services
DoE	Department of Environment
DOT	Department of Transportation
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ESMF	Environmental and Social Management Framework
FDEE	First Dhaka Elevated Expressway
FGD	Focus Group Discussion
GIS	Geographic Information System
GPS	Global Positioning System
GoB	Government of Bangladesh
IEE	Initial Environmental Examination
IPFF	Investment Promotion Financing Facility
NGO	Non Government Organization
PAP	Potentially Affected People
PPP	Public-Private-Partnership
RAP	Resettlement Action Plan
SI	Significant Impact
SIA	Social Impact Assessment
WB	World Bank

Chapter 1

Introduction

1.1 BACKGROUND

Dhaka, the capital of Bangladesh, is the administrative and commercial centre of the country. It has a population of over 16 million, accounting for about one-tenth of the total population of the country. With about 15 million people living in just 325 square kilometers, Dhaka is undoubtedly the most densely populated megacity in the world. The population of Dhaka is increasing rapidly and is expected to double over the next 20 years.

The transport sector in Dhaka is composed of many different modes – both motorized and non-motorized that uses the same right of way, often resulting in operational disorder. Dhaka is perhaps the only mega city with no well -organized and properly scheduled public transport system and one of the very few ones that are yet to introduce a Mass Rapid Transit (MRT) system. The deteriorating traffic conditions are causing increasing delays and worsening air pollution, and seriously compromising the ability of the transport sector to serve and sustain economic growth and quality of life. Traffic congestion is an issue of great concern for the inhabitants of the city resulting in commuter's frustration, longer travel times, lost productivity, increased accidents, more fuel consumption, and deterioration in air quality.

Dhaka city is oriented on a predominantly north-south alignment. Main north- south transport routes through the city include Mirpur Road, Begum Rokeya Sarani, Airport Road and Pragati Sarani (DIT Road). All these roads are currently heavily congested in peak hours. The Government of Bangladesh has approved the decision to build an elevated expressway stretching from Hazrat Shahjalal International Airport to Kutubkhali (connecting Dhaka-Chittagong Highway) to add additional capacity to the existing north-south routes as well as act as bypass option in order to alleviate traffic congestion within Dhaka city. Moreover, it is expected that the expressway would act as a flush out system during the peak hours and would help in construction of other Mega projects (viz. MRT5 & 6) within the core area of Dhaka City by providing diversion alternative.

The Expressway has been conceived as a part of a larger expressway network from Joydebpur to Narayanganj. The original alignment of the Expressway, approved in January 2011, passed through Hazrat Shahjalal International Airport- Kuril-Banani-Mohakhali-Tejgaon-Satrasta-Moghbazar Rail Corridor-Khilgaon-Kamalapur-Golapbagh-Kutubkhali (near Dhaka-Chittagong highway). However, this alignment was revised in October 2013 due to complications related to land acquisition (see **Appendix A**). In order to reduce land acquisition requirements, the alignment was revised primarily from the Kamalapur to Kutubkhali section; a number of ramps in Mohakhali and Farmgate areas were also discontinued/re-aligned. The revised approved alignment now passes through Hazrat Shahjalal International Airport- Kuril-Banani-Mohakhali-Tejgaon-Satrasta - Moghbazar Rail

Corridor- Khilgaon – Kamalapur – Sayedabad – Jatrabari - Kutubkhali (near Dhaka-Chittagong highway).

According to the revised alignment (approved in October 2013), initially the expressway will be about 21 km long, single free expressway with a design speed of 80 kph, a four- lane carriageway and having at least five major interchanges. The major objectives of the Expressway are:

- To increase traffic capacity within and around the city by improving north-south connectivity and linking important commercial and business centers;
- To reduce traffic times and provide travel comfort and convenience;
- To make improved connectivity between North (N4) and South (N1) gateways;
- To provide truck access facility even during the daytime to the Dhaka's industrial belt comprising Savar, DEPZ, Dhamsona, Kaliakoir, Gazipur etc. and thereby giving better backward linkage for export-import in international market; and
- To establish better level of service (LOS) along the Asian Highway (AH2) corridor and thereby to improve regional connectivity.

The Expressway project will be implemented under Public-Private-Partnership (PPP) between the Government of Bangladesh, represented by the Bangladesh Bridge Authority (BBA), and the Italian-Thai Development Public Company Limited, represented by the First Dhaka Elevated Expressway (FDEE) Co. Ltd. (ITD Group).

The proposed Dhaka Elevated Expressway (PPP) Project falls under the "red category" project according to the Environment Conservation Rules 1997, and require carrying out of an Initial Environmental Examination followed by (IEE) Environmental Impact Assessment (EIA) including social impact assessment. The Bureau of Research Testing and Consultation (BRCT) of Bangladesh University of Engineering and Technology (BUET) prepared the IEE report of the proposed project (BRTC-BUET, 2011) on behalf of the Bangladesh Bridge Authority (BBA). The report was duly submitted to the Department of Environment (DoE) for obtaining necessary clearance, and the site clearance was issues by the DoE on 12 June 2011 (see **Appendix B**).

This report presents the EIA of the proposed Dhaka Elevated Expressway (DEE) PPP Project. The EIA report has been prepared following the guidelines provided by the Department of Environment (DoE) (while issuing site clearance for the project). The Environmental and Social Management Framework (ESMF) for Investment Promotion Financing Facility (IPFF) (IIFC, 2010), which is a safeguard instrument and compliance policy covering both IDA and GoB requirements, was also consulted extensively. In addition, relevant safeguard policies and operational guidelines of the World Bank [e.g., Environmental Assessment, OP 4.01; World Bank (1997; 1999a, 1999b; 2003; 2004a; 2004b)] and the Asian Development Bank [e.g., ADB Safeguard Policy Statement, 2009)] were also consulted. It should be noted that the FDEE Co. Ltd. (ITD Group) has made separate arrangements for carrying out social impact assessment (SIA) and resettlement plan of the proposed project by separate Consultants. Hence, this report does not cover detail assessment of social impacts (particularly those related to acquisition of land) and resettlement plan for the proposed Elevated Expressway Project.

1.2 OBJECTIVES

The proposed project involves construction of about 21 km elevated expressway stretching from Hazrat Shahjalal International Airport to Kutubkhali (connecting Dhaka-Chittagong Highway), with a design speed of 80 kph, a four-lane carriageway and having at least five major interchanges. It also has two elevated links, and a number of interchanges and entry/exit ramps.

The overall objectives of the EIA of the proposed project were to identify potential significant impacts during construction and operational phases of the project, recommend mitigation measures to reduce/ eliminate adverse impacts and to enhance positive impacts, and to develop an environmental management plan (EMP), for both construction and operational phases of the project. The specific objectives of the EIA were:

(i) to assess the existing environmental conditions along the route of the proposed Dhaka Elevated Expressway (DEE) and its surrounding areas in order to establish a baseline, against which potential social and environmental impacts due to the implementation of the project would be predicted and assessed.

(ii) to identify and evaluate environmental impacts, both positive and negative, resulting from the project activities during both construction and operational phases of the project, and to suggest appropriate mitigation measures;

(iii) to carry out detailed assessment/ evaluation of the most significant impacts resulting from the proposed project (including those identified during the IEE, but excluding socio-economic impacts)

(iv) to develop a comprehensive environmental management plan (EMP), including monitoring plans, for both construction and operational phases of the proposed project.

1.3 OUTLINE OF METHODOLOGY

This study used multiple data collection technique to collect various primary as well as secondary information for conducting the EIA. Relevant information about the project areas along the alignment of the proposed expressway and its surroundings were gathered from detailed physical survey. Bangladesh Bridge Authority (BBA) provided the maps showing the route of the proposed elevated expressway alignment including the links, up and down ramps, and major interchange locations. Additional information were collected from published literature. In addition, data and information were also collected from different government and non-government organizations.

Field visits were carried out by the study team to obtain first hand information on environmental conditions along and surrounding the route of the proposed elevated expressway. During these field visits, informal discussions were carried out with people living in and around the project areas. A detailed reconnaissance survey was conducted to

gather route specific information. Together with reconnaissance, a detailed survey along the route of the proposed expressway was also carried out for mapping the site with specific details. In addition, a detailed route survey was carried out along the proposed route of the expressway, covering areas on either side of the route.

In the field surveys, GPS has been extensively used for: (i) identifying route of proposed elevated expressway; (iii) geo-coding and geo-referencing of the route; (iv) merging of GPS data with images and geo-referenced secondary information; and (v) identifying vulnerable entities with geo-references.

An environmental baseline survey has been carried out to gather information on the existing physical and biological environment of areas surrounding the proposed route of proposed Elevated Expressway; the baseline survey carried out during conducting IEE was updated by collecting additional data on physic-chemical and ecological parameters. Subsequently, the possible environmental impacts of the project activities have been evaluated against these baseline environmental conditions. For identification of potential environmental impacts, the major project activities during both construction and operational phases have been identified. Impacts of these activities on the existing physical and biological environments have been assessed both for construction and operation phases of the proposed project. This exercise has been followed by prediction and evaluation of the most significant impacts, including those identified in the IEE report (e.g., traffic impacts, air and noise pollution).

After evaluation of impacts, mitigation measures have been devised for all potential adverse impacts that could result from the proposed project activities. Mitigation measures have been developed separately for adverse impacts during construction and operation phases. Finally, an environmental management plan has been developed, incorporating the mitigation measures and monitoring requirements.

1.4 THE EIA TEAM

Keeping in view the multidisciplinary nature of the work, a 7 (seven) member team of experts drawn from all relevant disciplines, has been formed (see **Appendix C**) for carrying out the EIA. In addition, a survey team, led by a surveyor, and a field engineer assisted the study team (see **Appendix C**).

1.5 THE EIA REPORT

The EIA report has been prepared and presented following the structure suggested by the Department of Environment (DoE), with some modifications to suit the needs of the present study. The first Chapter of this EIA report describes the background and objectives of the project; it also presents an outline of the methodology followed for carrying out EIA. Chapter 1 also briefly describes the policy and legal framework following which the EIA has been prepared. Chapter 2 describes the project and the major activities to be carried out during both construction and operation phases of the project, along with project schedule

and utility demand. Chapter 2 also presents the relevant maps showing alignment of the Expressway and its surroundings. Chapter 3 describes the existing background environment along the proposed route of the elevated expressway and its surrounding areas; it includes detail description of physical and biological environment. It also presents a brief description of socio-economic environment along the surrounding the project areas. Chapter 4 presents an assessment of the potential environmental impacts (excluding socio-economic impacts) of the proposed project, both during construction and operation phases. This Chapter also presents an evaluation of the possible impact and suggests mitigation measures for enhancement of positive impact and for reducing or eliminating the negative impacts. Chapter 5 presents the outcome of public consultations carried out as a part of environmental assessment. Chapter 6 presents the environmental management plan (EMP), including the monitoring plans, for both construction and operational phases. The final Chapter (Chapter 7) of the EIA report presents the conclusions of the environmental study and recommendations based on the study.

Chapter 2

Project Description

2.1 INTRODUCTION

The Government of Bangladesh has approved the decision to build an elevated expressway stretching from Hazrat Shahjalal International Airport to Kutubkhali (connecting Dhaka-Chittagong Highway) to add additional capacity to the existing north-south routes as well as act as bypass option in order to alleviate traffic congestion within Dhaka city. The Expressway project will be implemented under Public-Private-Partnership (PPP) between the Government of Bangladesh, represented by the Bangladesh Bridge Authority (BBA), and the Italian-Thai Development Public Company Limited, represented by the First Dhaka Elevated Expressway (FDEE) Co. Ltd. (ITD Group).

Initially five alignments were considered, as suggested by AECOM in their prefeasibility report, for the route of the Expressway; Figure 2.1 shows the five alignments (Option 1 through Option 5) considered. In January 2011, in consideration of minimum land acquisition Option 5 (see Fig. 2.1, which basically follows existing railway corridor) with some modifications was selected for the Dhaka Elevated Expressway. The original alignment of the Expressway, approved in January 2011, passed through Hazrat Shahjalal International Airport- Kuril-Banani-Mohakhali-Tejgaon-Satrasta-Moghbazar Rail Corridor-Khilgaon-Kamalapur-Golapbagh-Kutubkhali (near Dhaka-Chittagong highway). However, this alignment was further revised in October 2013 due to complications related to land acquisition (see **Appendix A**). In order to reduce land acquisition requirements, the alignment was revised primarily from the Kamalapur to Kutubkhali section; a number of ramps in Mohakhali and Farmgate areas were also discontinued/re-aligned. According to the revised alignment, initially the expressway will be about 21 km long, single free expressway with a design speed of 80 kph, a four-lane carriageway and having at least five major interchanges.

This Chapter provides a description of the proposed elevated expressway project and its route. It also identifies the major activities to be carried out during the construction and operational phases of the project, the environmental impacts of which have been assessed in the subsequent Chapters.

2.2 DHAKA ELEVATED EXPRESSWAY (DEE)

2.2.1 Expressway Alignment

The proposed Dhaka Elevated Expressway (DEE) will commence at Hazrat Shahjalal International Airport and end at Dhaka-Chittagong highway near Kutubkhali (Fig. 2.2). Besides the main four-lane dual carriageway and two suspended termini at its ends, it has 31 Ramps (including 15 entry ramps and 16 exit ramps) with a total length of 27 kilometres (1-Lane Carriageway), main line of Approx. 19.73 kilometre of Elevated 4 Lane Dual Carriageways, 8 Toll Plaza and 43 Toll Booths.

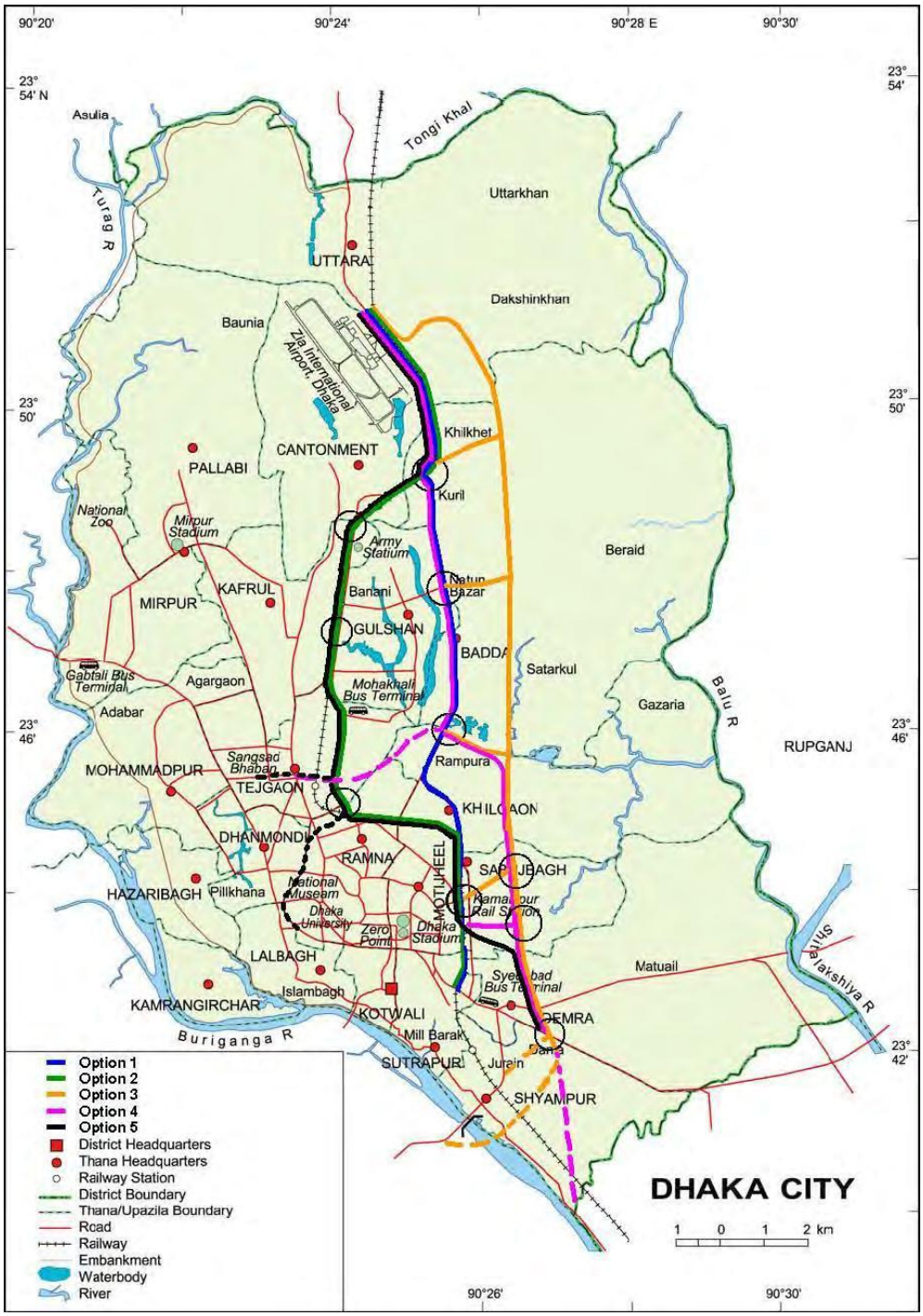


Figure 2.1: Five alignments considered for the proposed Alignments of DEE (Source: Pre-Feasibility Study by AECOM)

The major components of the Expressway are as follows.

Main Carriageway/Line:

The DEE will primarily follow the rail line alignment. From the Airport up to Kamalapur Railway Station, the Expressway follows the alignment of the railway track, except for a short stretch in Khilkhet-Kuril-Joar Shahara area. In the revised alignment, new ramps have been added at Banani (close to BBA office), Mohakhali, and Kamalapur; and an interchange

has been added at the Bijoy Sarani intersection. From Kamalapur Station, the revised expressway alignment will follow the Atish Dipankar Road passing through Sayedabad and Jatrabari and then connecting with Dhaka-Chittagong Highway at Kutubkhali, running directly over the Mayor Mohammad Hanif Flyover. From Saidabad to Jatrabari, the revised alignment has been set avoiding private land. Detail description of alignment of the Expressway, identifying important entities along and surrounding the alignment has been presented in Chapter 3 of this Report. Thus, the alignment of the main carriageway shall be as follows:

> Hazrat Shahjalal International Airport- Kuril-Banani-Mohakhali-Tejgaon-Satrasta - Moghbazar Rail Corridor- Khilgaon – Kamalapur – Sayedabad – Jatrabari - Kutubkhali (near Dhaka-Chittagong highway)

Elevated Link 1: About 1.8 km long, starting at a Chainage of about 11+800 (i.e., at 11.8 km), connecting the DEE at Tejgaon Crossing to Holy Cross College-Farmgate-Manik Mia Avenue.

Elevated Link 2: About 3.5 km long, starting at a Chainage of about 12+700, connecting the DEE (close to Moghbazar Rail Crossing) to Hotel Sonargaon (back side)-Hatirpool-Katabon-Polashi.

Interchange and major entry/exit ramps: In addition to the start and end termini near the Airport and Kutubkhali, the following major on-ramp/off-ramp ramps and interchange have been proposed:

(1) Interchange at Kuril Flyover/Interchange at the intersection of Airport Road and Progati Sarani to provide entry/exit facilities to all confluenceing roads at the Kuril intersection;
(2) Interchange at the mid-point of Tejgaon-Bijoy Sarani Link Road, to provide access to/from Mirpur, Mohammadpur, Shamoli, Lamatia, Dhanmondi, Kalabagan, etc;
(3) Ramp at Cantonment, overpass over Airport Road near railway crossing;
(4) Ramp at Banani, south of Kemal Ataturk Avenue and north of the Mohakhali Flyover on Airport Road to provide access to/from Banani, Cantontment, Gulshan and Mohakhali;
(5) Interchange at Farmgate to provide exit facility for Farmgagte and Manik Mia Avenue bound traffic;
(6) Interchange at Pantha Path/Moghbazar to provide access to/from Karwanbazar, Ramna, Tejgaon, Eskaton and Shaheed Tazuddin Ahmed Road;
(7) Interchange at Panthakunja to provide access to/from Banglamotor, Panthapath,; and Hatirpool Roads; and
(8) Interchange at Kamalapur to provide access to/from Motijheel Central Business District (CBD).

Toll Plazas: A total of 8 toll plazas has been proposed along the Expressway. The toll plazas will be composed of toll canopy with toll booths, toll surveillance building and weigh station. The facility requires widening of pavement areas for locating toll booths. General location of toll plazas is on entrance ramps, which conforms to the requirement of an “open” toll collection system.

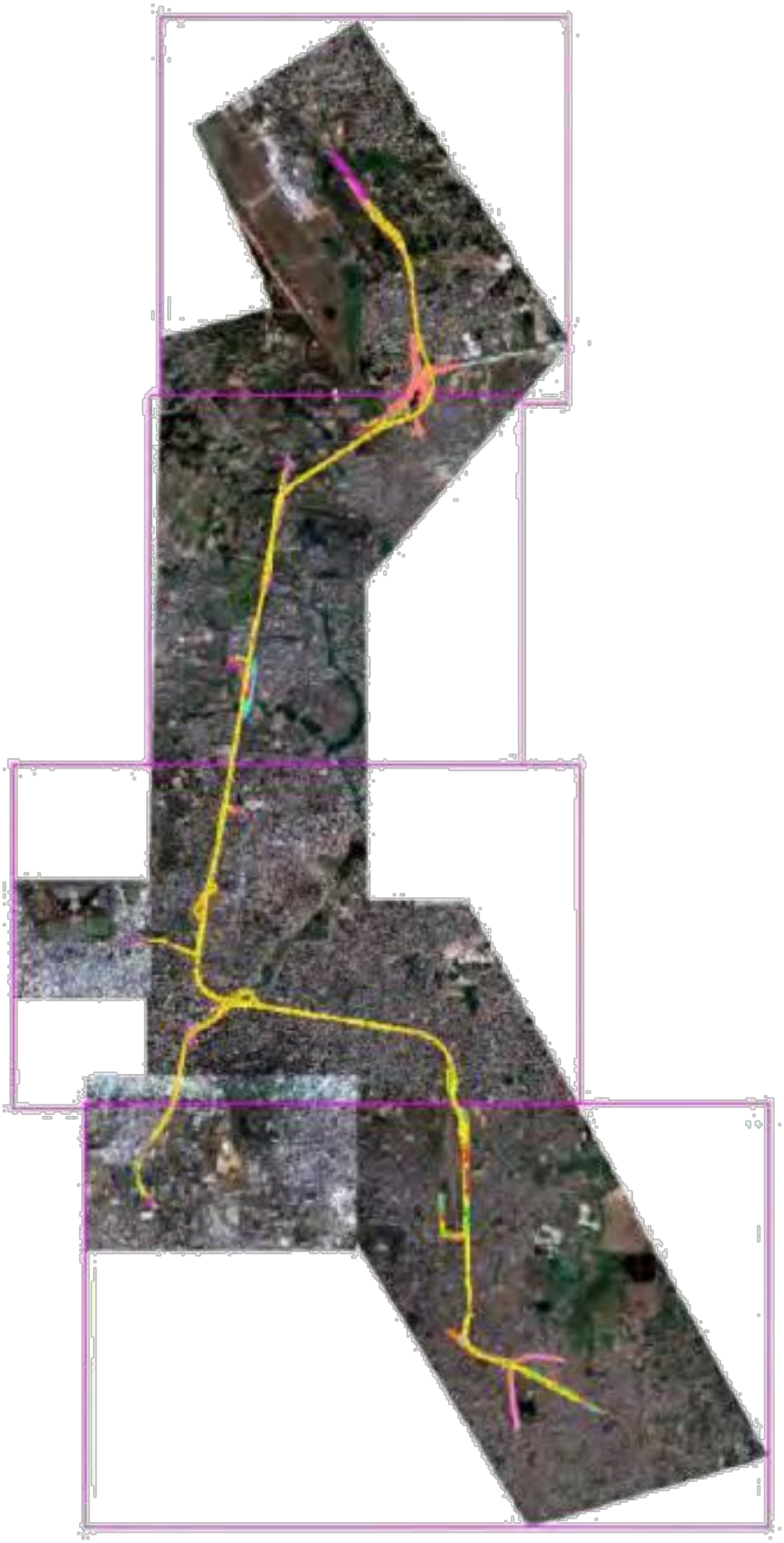


Figure 2.2: Layout of the proposed DEE on a map of Dhaka city

2.2.2 Geometric Requirements

General and Main Line:

In order to achieve the design speed of 80 km/hr on the main carriageway, the minimum horizontal radius of the Expressway has been proposed to be at 230m. At this radius, there are no major limitations on the structural forms for the superstructure. If straight beam and slab solutions are adopted, it may be necessary to reduce the span lengths through these tighter curves. The proposed maximum approach grade has been set at 4% and maximum departure grade at 6%.

It has been proposed that the typical bridge cross-section of the main carriageway follows the Geometric Design Standards of the Roads and Highways Department (RHD) and AASHTO, and as such comprises two dual lanes of 7.3m each, inner shoulder of 0.3 m width, outer shoulders of 0.5m width, outer shoulder of 1.8 m width, median barrier of 0.76 m width, and side barriers of 0.5m width. Thus, the total width of a typical roadway section (shown in Fig. 2.3) is 20.56 m. Cross slope of 2% has been recommended to facilitate roadway drainage.

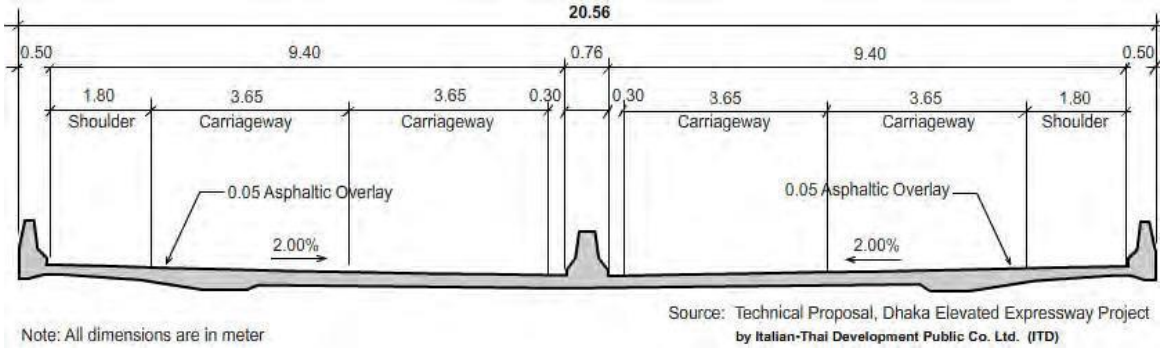


Figure 2.3: Typical roadway section of main line

Along some part of the route, the typical roadway section cannot be applied due to space constraint. In these areas a reduced typical section, with outer shoulder width of 0.3 m and a total width of 17.56 m will be utilized.

The cross-section of double lane ramps comprises of a 7.3m carriageway with a 0.3m wider inner and outer shoulder (Fig. 2.4). The overall width of the ramps would be 8.9m. The cross-section of single lane ramps comprises of 5.5m carriageway with 0.3m wide inner and outer shoulders, giving an overall width of 7.1m (Fig. 2.4).

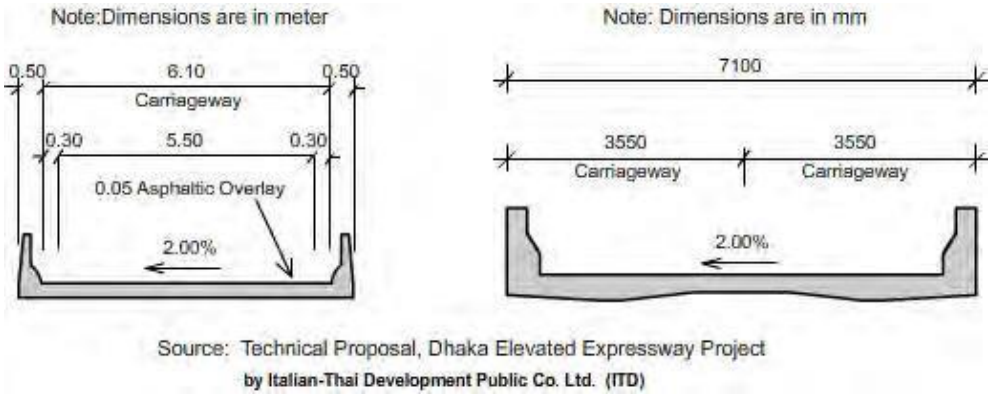


Figure 2.4: Typical sections of ramps single- and double-lane ramps

Links:

The Elevated Links (Link 1 and Link 2) would be dual-lane 2-way, with carriageway width of 6.5 m (2*3.35m), inner and outer shoulders of 0.3m width, median barrier of 0.76 m width, and side barriers of 0.5m width. Cross slope of 2% has been recommended to facilitate roadway drainage. Typical roadway section of links is shown in Fig. 2.5.

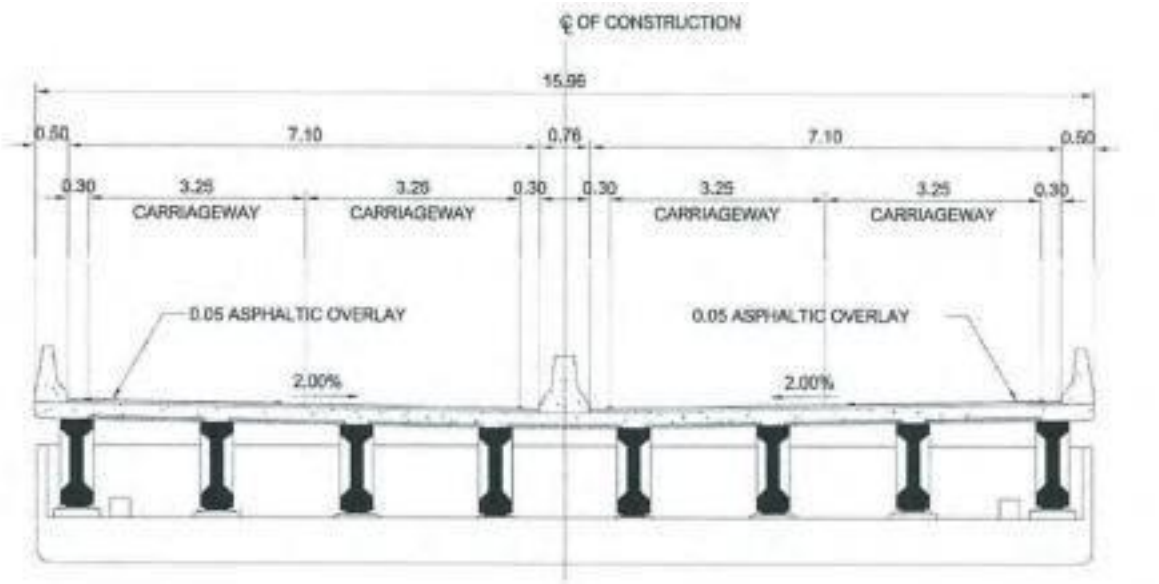


Figure 2.5: Typical roadway section of Links
(Source: Technical Proposal of Italian-Thai Development Private Company Limited)

Clearances:

The Roads and Highways Department's design standard suggests a minimum vertical clearance to existing roads of 5.7m. This value would apply to clearances to the elevated roadway permanent works, superstructure soffit and for the soffit of overhanging pier headstocks, if applicable. Where the elevated expressway is located over a rail corridor, the minimum vertical clearance from the top of rail to structure would be 7.4m. Consideration should be given to raising the vertical clearance of the Expressway to allow suitable vertical clearance to major temporary works, such as formwork and erection trusses.

Horizontal clearances from the edge of the pier columns to existing traffic lanes and from the outer edges of the elevated Expressway to existing building will apply. From the edge of the pier columns, the required minimum lateral clearance has been set at 1,000mm, which can be narrowed to 600mm in extreme circumstances; assuming that a shoulder exists on the edge of the road in question. Along the rail corridor, the minimum lateral clearance is 3,050 mm from track center to edge of structure.

2.2.3 Structural System

The elevated Expressway main line and Link structures will be designed based on AASHTO-LRFD Method. The vehicle live load of HL-93 will be adopted. Pre-stressed concrete girder is generally used for reducing structural size, which also reduces disruption to existing traffic. The major structural components of main line/carriageway are as follows:

- Girder: Precast I-girder. Typical span 30.0 m. Typically 10 girder for each span with girder spacing of 1.90m.
- Pier: Two types of piers are to be considered
    - Single Column Pier
    - Portal Frame Pier

The single column pier is typically used where the center area beneath the expressway has no constraints. The pile size is bored pile with diameter 1.0m with allowable load capacity of 550 ton/pile. Figure 2.6 shows overall structural section using single column pier.

The portal frame pier is typically used where the area beneath the Expressway is restricted by existing facilities such as railway tracks, roadways, etc. The pile size and capacity are the same as those for single column pier. The overall structural section using portal frame pier is shown in Fig. 2.7.

The major structural components of the Links are as follows:

- Girder: Precast I-girder. Typical span 20.0 m.
- Pier: Single column pier

The pile size is bored pile with diameter 1.2m with allowable load capacity of 750 ton/pile.

2.3 PROJECT ACTIVITIES DURING PRE-CONSTRUCTION AND CONSTRUCTION PHASE

2.3.1 Major Project Activities

The major activities to be carried out during the pre-construction and construction phases can be broadly categorized as follows:

a) Finalization of the alignment of the proposed Dhaka Elevated Expressway (DEE).
b) Acquisition of necessary land (to be carried out in phases)
c) Mobilization
d) Finalization of engineering design
e) Procurement of necessary materials and equipment
f) Construction of Elevated Expressway (main carriageway, Links, ramps, and toll plazas)

For carrying out EIA, the environmental impacts of the above major project activities on the “baseline environment” have been evaluated. Typical impacts during construction phase include air pollution, noise pollution, vibration, traffic congestion, drainage congestion, and impacts related to waste management. Health and safety issues and important considerations during construction phase.

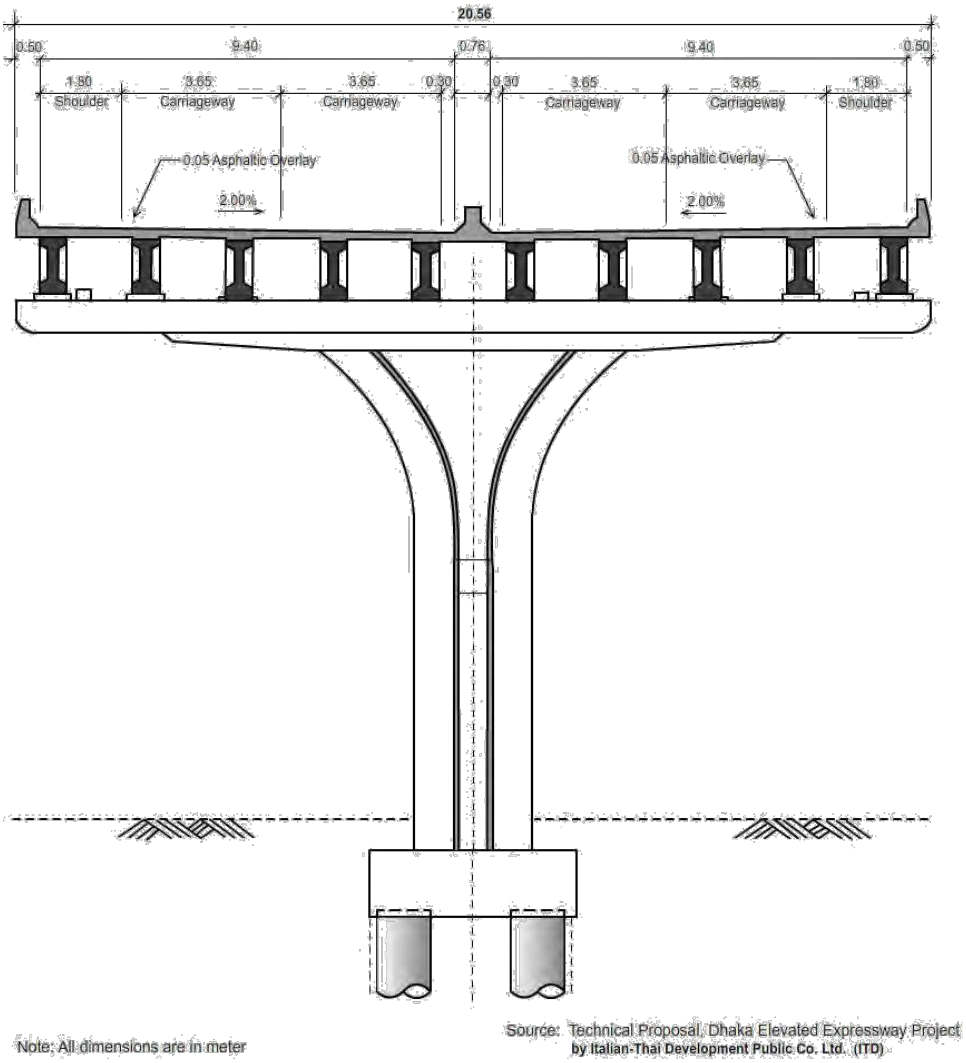


Figure 2.7: Overall structural section of main line with I-girder on single column pier (Source: Technical Proposal of Italian-Thai Development Private Company Limited, 2010)

2.3.2 Plants and Equipment to be employed for Construction

A wide range of plants and equipment will be used for construction works. These include bull dozer, hydraulic excavator, vibrating roller, vibratory compactor, concrete batching plant, asphaltic concrete plant, rough terrain crane, crawler crane, tower crane, flat-bed trailer, dump truck, etc. The complete list of plant and equipment proposed to be used by the FDEE Co. Ltd. (ITD Group) is presented in **Appendix D**. Access/ movement of these plants/ equipment at the project sites, and noise generated by these plants/ equipment are important considerations for assessment of environmental impacts during the construction phase.

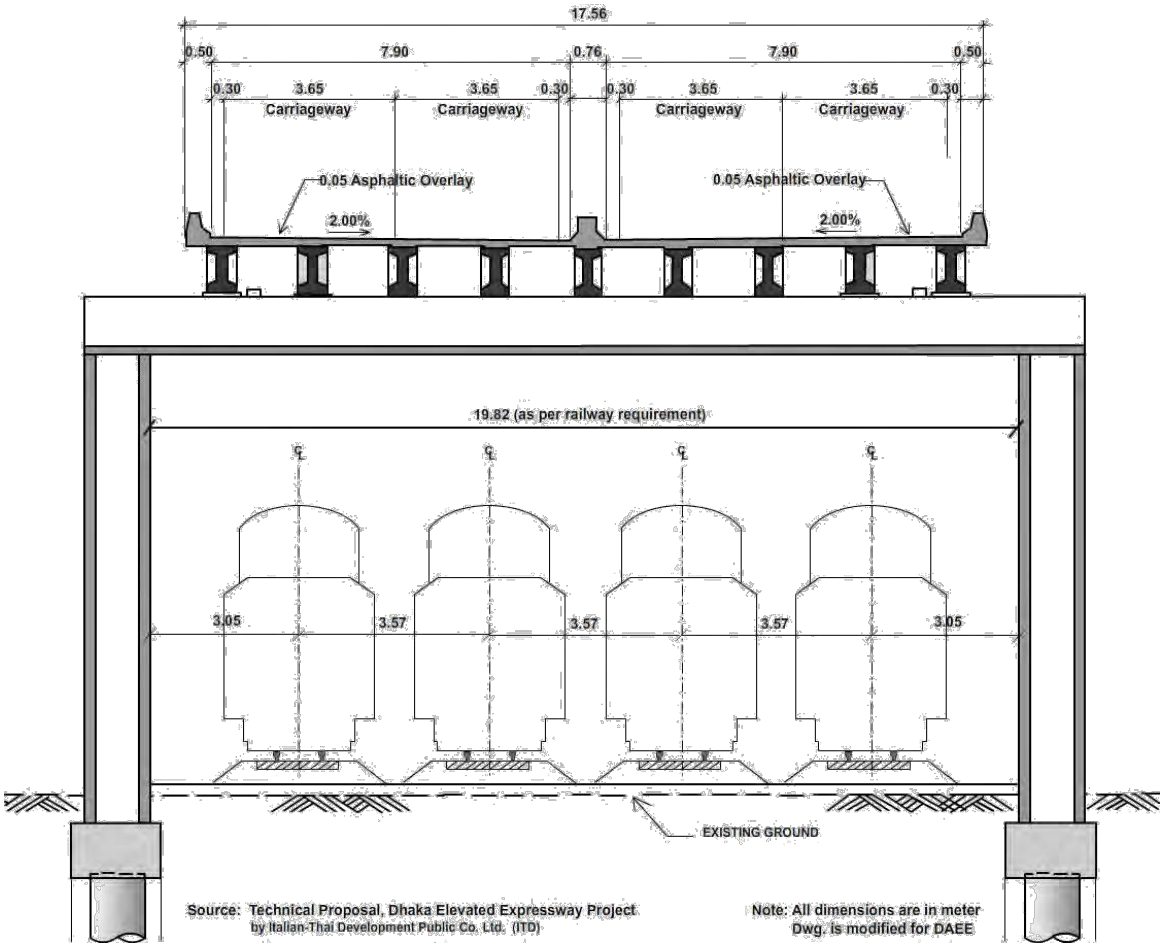


Figure 2.8: Main Viaduct – I-girder System along Railway Corridor (accommodating 3rd & 4th railway tracks)

2.3.3 Safety Issues

Major portion of the main carriageway of the Expressway (from Airport to Kamalapur Railway Station) would be constructed over/close to the existing railway tracks. The Links (Link 1 and Link 2) and some of the ramps would have to be constructed directly over existing busy roads. Besides, along its route, the Expressway would also pass over a number of major roads, flyover/ elevated road and foot over-bridge. The major crossings are listed below:

- Airport road near Hazarat Shahajalal International Airport
- Kuril Bishwa Road near Kuril Interchange
- Airport Road at Banani Level Crossing
- Banani DOHS road at DOHS Level Crossing
- Cantonment Road at Cantonment Level Crossing/Overpass
- Banani Road 11 near BBA Building
- Mohakhali Intersection over Mohakhali Flyover/overpass
- Elevated Road connecting Bijoy Sarani and Shahid Tajuddin Ahmed Sarani
- Farmgate Intersection over Farmgate Foot Over-bridge (Link-1)

- Sonargaon Road at Karwan Bazar Rail Crossing (Chainage: 12+600)
- VIP road connecting Sonargain intersection with Banglamotor Intersection (Link-2)
- Tongi Diversion Road at Moghbazar Rail Crossing over Moghbazar-Mouchak Flyover
- Road at Boro Moghbazar Rail Crossing over Moghbazar-Mouchak Flyover
- Road at Wireless Gate Rail Crossing
- Road at Rampura Rail Crossing
- Bishwa Raod at Malibagh Rail Crossing
- Khilgaon Flyover
- Over MMHF (parallel to the flyover)

Special construction methodology and safety measures would have to be strictly followed to ensure safety during construction of Expressway over live railway tracks and major busy roads and intersections.

2.4 PROJECT ACTIVITIES DURING OPERATIONAL PHASE

As noted in Chapter 1, the objectives of the Expressway are to increase traffic capacity within and around the city by improving north-south connectivity and linking important commercial and business centers, and to reduce traffic times and provide travel comfort and convenience. It is important to assess the possible impact of the Expressway on the traffic capacity and traffic time after commissioning of the Expressway.

Vehicular air pollution, noise pollution and vibration from traffic movement along the Expressway are also important considerations. Shadow/aesthetic issues/considerations are also important.

2.5 PROJECT SCHEDULE AND UTILITY REQUIREMENT

The commencement of actual project work is tied to handover of project land to FDEE by the BBA. Utility relocation works within Tranche-1 is expected to be completed by September 2014. Handover of land for Tranche-1 was expected to be completed in October 2014. However, some early works (primarily in Government-owned land in Tranche-1) has commenced in May 2014.

Major resources and utilities required during construction of the proposed project include:

- Fuel and Lubricants for the different equipment such as Excavator, Dump trucks, Tractors and pilling works etc.
- Electricity for electrical equipment, which will be used for construction purposes such as base plants, vibrators, contractor site office, etc.; electricity supplied by different entities (e.g. DESCO, DESA, DPDC) are available in areas throughout the alignment of the Expressway.
- Water for construction of Expressway and for project personnel and laborer; water supplied by DWASA is available in areas throughout the alignment of the Expressway.

Chapter 3

Existing Background Environment

3.1 INTRODUCTION

The proposed "Dhaka Elevated Expressway Project" has been conceived as a part of a larger expressway network from Joydebpur to Narayanganj. According to the revised alignment (approved in October 2013), initially the expressway will be about 21 km long, single free expressway with a design speed of 80 kph, a four -lane carriageway and having at least five major interchanges. The primary objectives of the Expressway are:

- To increase traffic capacity within and around the city by improving north-south connectivity and linking important commercial and business centers; and
- To reduce traffic times and provide travel comfort and convenience.

The Expressway project will be implemented under a Public-Private-Partnership (PPP) between the Government of Bangladesh, represented by the Bangladesh Bridge Authority (BBA), and the Italian-Thai Development Public Company Limited, represented by the First Dhaka Elevated Expressway Co. Ltd. (ITD Group).In the revised approved plan of the project the alignment passes through Hazrat Shahjalal International Airport- Kuril-Banani-Mohakhali-Tejgaon-Satrasta - Moghbazar Rail Corridor- Khilgaon – Kamalapur – Sayedabad – Jatrabari - Kutubkhali (near Dhaka-Chittagong highway).

Implementation of the Dhaka Elevated Expressway Project (DEEP) will have some impacts on the surrounding environment and socio-economic conditions of the project influence area. Hence an environmental and social impact assessment (ESIA, with appropriate environmental and social management plans) is needed to reduce the detrimental impacts and to enhance the positive impacts of the project. Implementation of the DEEP in the densely populated Dhaka city with high concentration of permanent structures is a challenging issue. In order to address this challenging issue in a manner and that is transparent and acceptable to all, the Government also decided, in October 2013, to follow the guidelines contained in the Environmental and Social Management Framework (ESMF) for "Investment Promotion and Financing Facility (IPFF)", prepared by the Bangladesh Bank (Bangladesh Bank, 2011).

As a part of the Environmental Impact Assessment (EIA) of the proposed project an overall project baseline survey was carried out along and around the proposed routes of the elevated expressway in the Dhaka Metropolitan City. In addition, a social survey was also carried out along and around the project route in order to gather and document baseline socio-economic conditions of the project areas.

The specific objectives of the baseline study were:

- To document the existing condition of physicochemical, ecological, and prevailing socio-economic condition of the study area;
- To identify the significant environmental and social aspects that are likely to be affected by the proposed development activities; and
- Setting of baseline parameters in order to identify possible adverse and beneficial impacts due to the proposed project activities.

This Chapter summarizes existing physical, ecological, and socio-economic environment around and along the proposed Dhaka Elevated Expressway Project based on the baseline physical, ecological and social surveys and other studies (e.g., physical infrastructure, soil quality, water quality, and noise level measurements) carried out as part of the present study. Relevant information on climate, geology, soils, hydrology and water resources, noise level, air quality, and water quality has been described in this Chapter. The possible environmental impacts of the proposed project have been evaluated against these baseline environmental conditions.

3.2 PHYSICAL ENVIRONMENT

3.2.1 Physical Infrastructure

As a part of preparing Environmental Impact Assessment (EIA), detail field surveys have been carried out along the routes of the Expressway. Considering the geographical extent of the proposed Expressway, satellite image based survey and analysis have been carried out. Field survey using DGPS has also been carried out for supplementary details. Field surveys have been conducted with the objectives of (i) verifying the final alignment of the proposed Expressway, (ii) identifying positions of important physical features along the alignment of the proposed Expressway and its surrounding areas, and (iii) Identifying the possible affected entities. The survey was carried out along approximately a 300m corridor along the proposed alignment of the Expressway.

The survey data have been used to prepare maps identifying the land types and major physical features in the vicinity of the proposed alignment of the Expressway. For example, road and railway networks, urban centers, canals/ wetlands, historical monuments and major human settlements along the alignment of the Expressway have been identified on the maps. As part of the EIA, baseline air quality, noise level and water quality around the proposed route of the Expressway have been determined through actual measurements at selected locations or collection of secondary data from reliable secondary sources. This Section provides a description of the physical environment of the project areas along the proposed route of the Expressway. The entire project has been divided into three separate tranches and the baseline physical description provided in this section has been arranged according to these tranches. Subsequently, the possible impacts of the proposed project activities have been evaluated against the baseline condition.

3.2.1.1 Expressway Alignment

The proposed Dhaka Elevated Expressway (DEE) will commence at HazratShahjalal International Airport and end at Dhaka-Chittagong highway near Kutubkhali (Fig. 2.2). Besides the main four-lane dual carriageway and two suspendedtermini at its ends, it has five interchanges, two elevated links, 31 ramps (including 15 entry-ramps and 16 exit-ramps) and 8 toll plazas. The approximate total length of the main carriageway Expressway is about

46.73 km (including 19.73 km main flyover and 27 km ramps and elevated links). The major components of the Expressway are as follows.

Main Carriageway/Line:
The DEE will primarily follow the rail line alignment. From the Airport up to Kamalapur Railway Station, the Expressway follow the alignment of the railway track, except for a short stretch in Khilkhet-Kuril-JoarShahara area. In the revised alignment, new ramps have been added at Banani (close to BBA office), Mohakhali, and Kamalapur; and an interchange has been added at the BijoySarani intersection. From Kamalapur Station, the revised expressway alignment will follow the AtishDipankar Road passing through Sayedabad and Jatrabari and then connecting with Dhaka-Chittagong Highway at Kutubkhali, running directly over the Mayor Mohammad Hanif Flyover. From Saidabad to Jatrabari, the revised alignment has been set avoiding private land. Detail description of alignment of the Expressway, identifying important entities along and surrounding the alignment has been presented in Chapter 3 of this Report.Thus, the alignment of the main carriageway shall be as follows:

> HazratShahjalal International Airport- Kuril- Banani-Mohakhali-Tejgaon-Satrasta-Moghbazar Rail Corridor-Khilgaon – Kamalapur – Sayedabad – Jatrabari-Kutubkhali (near Dhaka-Chittagong highway)

Elevated Link 1: About 1.8 km long, starting at a Chainage of about 11+800 (i.e., at 11.8 km), connecting the DEE at Tejgaon Crossing to Holy Cross College-Farmgate-Manik Mia Avenue.

Elevated Link 2: About 3.5 km long, starting at a Chainage of about 12+700, connecting the DEE (close to Moghbazar Rail Crossing) to Hotel Sonargaon (back side)-Hatirpool-Katabon-Polashi.

Interchange and major entry/exit ramps:In addition to the start and end termini near the Airport and Kutubkhali, the following major on-ramp/off-ramp ramps and interchange have been proposed:

(1) Interchange at Kuril Flyover/Interchange at the intersection of Airport Road and ProgatiSarani to provide entry/exit facilities to all confluenceing roads at the Kuril intersection;
(2) Interchange at the mid-point of Tejgaon-BijoySarani Link Road, to provide access to/from Mirpur, Mohammadpur, Shamoli, Lamatia, Dhanmondi, Kalabagan, etc;
(3) Ramp at Cantonment, overpass over Airport Road near railway crossing;
(4) Ramp at Banani, south of Kemal Ataturk Avenue and north of the Mohakhali Flyover on Airport Road to provide access to/from Banani, Cantontment, Gulshan and Mohakhali;
(5) Interchange at Farmgate to provide exit facility for Farmgagte and Manik Mia Avenue bound traffic;
(6) Interchange at Pantha Path/Moghbazar to provide access to/from Karwanbazar, Ramna, Tejgaon, Eskaton and ShaheedTazuddin Ahmed Road;
(7) Interchange at Panthakunja to provide access to/from Banglamotor, Panthapath,; and Hatirpool Roads; and

(8) Interchange at Kamalapur to provide access to/from Motijheel Central Business District (CBD).

The DEE will primarily follow the rail line alignment with piers offset from the railway. From the Airport up to Kamalapur Railway Station, the Expressway follow the alignment of the railway track, except for a short stretch in Khilkhet-Kuril-JoarShahara area. From Kamalapur Station, the expressway follows the AtishDipankar Road, passes through Sayedabad and Jatrabari and connects with Dhaka-Chittagong Highway at Kutubkhali, running parallel to Mayor Hanif Flyover. Figure 3.1 shows the alignment of the entire Dhaka Elevated Expressway.

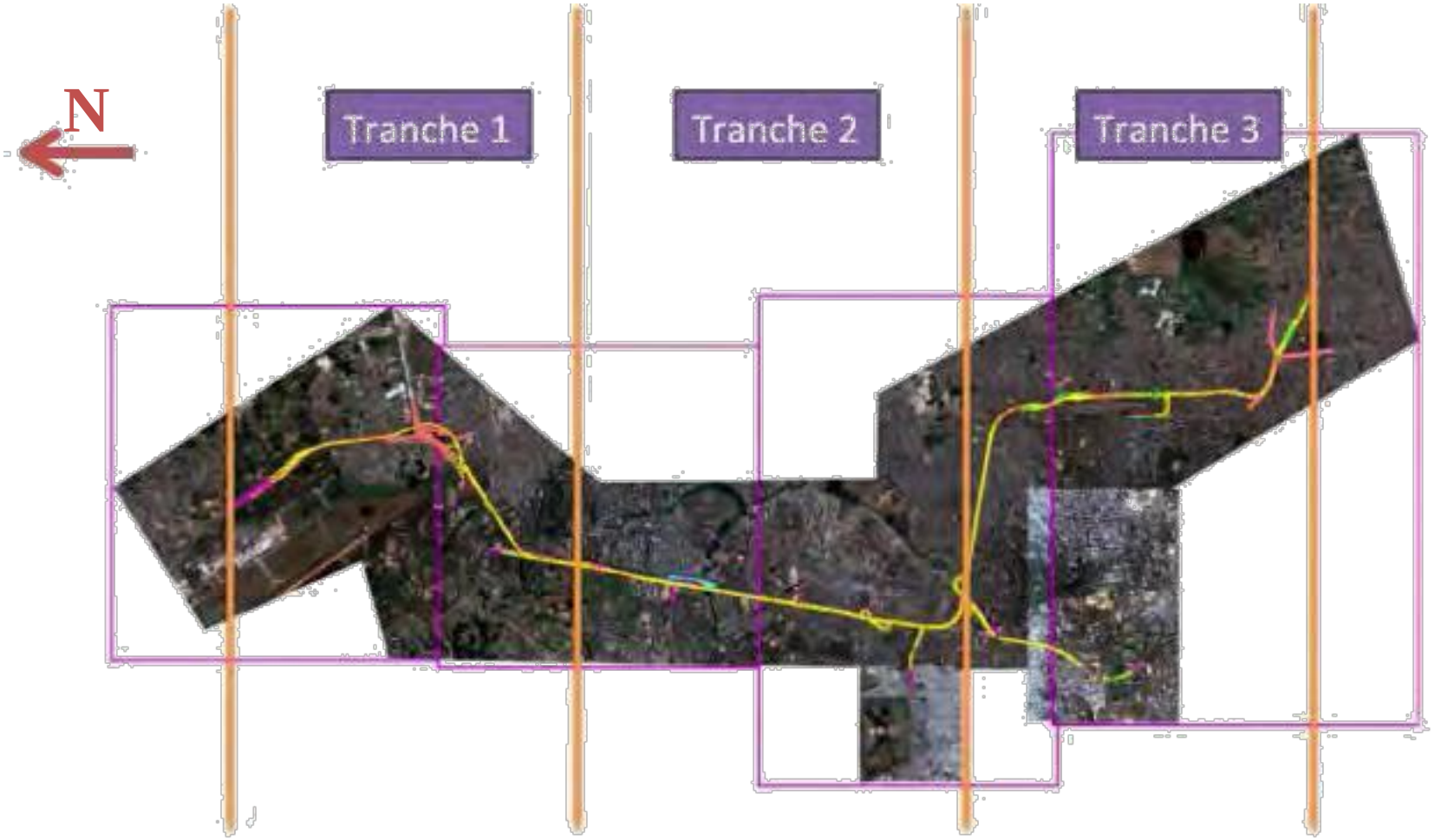


Figure 3.1: Proposed route of Dhaka Elevated Expressway

3.2.1.2 Tranche-1

Figure 3.2 shows the route of Tranche-1 of the Expressway (stretching from HazratShahjalal International Airport to Kakoli Bus Stand at Banani). Tranche-1 has been divided into 5 segments to study and present different physical entities along and around the proposed routes of the DEE.

The DEE commences at HazratShahjalal International Airport and continues over/close the railway track up to Khilkhet area, parallel to and on the eastern side of the Airport Road. Since the Expressway will follow the railway track or Bangladesh Railway owned land, no private land acquisition will be required within this stretch. A number of physical entities are located close to the alignment of the Expressway within this stretch. These include the Civil Aviation Staff Quarter, the Civil Aviation High School, Hazi Camp, Kaula Foot Over Bridge etc. (see Figure. 3.3). The Balaka office, and flying academy are also located close to the alignment of the Expressway (see Figure. 3.3).

The Civil Aviation Transmission office (a two-storied building) and a graveyard are also located close to the Expressway alignment (see Figure. 3.3). As shown in Figure 3.4, up to Khaa Para area in Khilkhet, three mosques, a school, a residential area, and a housing project (Banarupa housing project) are located close to the alignment of the Expressway. A five star hotel (Dhaka Regency Hotel) is located on the western side of the Airport Road (Figure. 3.4). Important physical infrastructures like DESCO Office, PalliBidyut Office, and Lotus Kamal Tower are located on the western side of the Airport Road (Figure. 3.4).

At a Chainage of about 2+600, the Expressway alignment turns eastward, crossing the railway tract from west to east, to avoid the Kuril flyover (see Figure. 3.5). The Expressway makes almost a semi-circular turn over Khilkhet area, Kuril area, the ProgatiSarani and JoarShahara area. Acquisition of private land will be required in these areas for the construction of the Expressway. In the Khilkhet and JoarShahara areas, a number of residential buildings (including three 5-storied buildings), a number of markets (including single-storied railway market), and a tin-shed bazaar are located along and close to the alignment of the Expressway (see Figure. 3.6). Three mosques, one madrasa are also located in this area.

In the Kuril area, there are a number of residential buildings (including tin-shed and multi-storied buildings), a multi-storied apartment building, three primary schools and five mosques located along and close to the alignment of the Expressway. A number of important establishments are located on the western side of the Airport road. These include the Armed Force Medical College, Army Golf Course etc. In the Kuril area, the Kuril flyover is located on the western side of the DEE. Some water bodies and slum area are also located in this area. The Expressway follows the railway track after crossing the ProgatiSarani and JoarShahara; the DOHS Baridhara is located on the eastern side of the alignment, while the Radisson Hotel on the western side (see Figure. 3.7). The alignment passes very close to the Cantonment railway station. The Expressway alignment continues over/close the rail track, crosses the Airport Road at Banani level crossing, and then continues alongside the Airport Road toward Kakoli-Mohakhali. Close to the Banani level crossing, some land acquisition will be required for ramps.

Figure 3.2: Route of Elevated Expressway in the Tranche-1.

Figure 3.3: A segment of Tranche-1 of the Dhaka Elevated Expressway project near HazratShahjalal International Airport showing important physical features

Figure 3.4: A segment of Tranche-1 of the Dhaka Elevated Expressway project near Khilkhet area showing important physical features.

Figure 3.5: A segment of Tranche-1 of the Dhaka Elevated Expressway project from Kuril Intersection to Cantonment Rail Station showing important physical features.

(a)

(b)

(c)

Figure 3.6: (a) A tin shed bazaar, (b) single-storied railway market, (c) a madrasa located on the route of the elevated expressway

Figure 3.7: A segment of Tranche-1 of the Dhaka Elevated Expressway project near Baridhara DOHS area showing important physical features.

Figure 3.8: A segment of Tranche-1 of the Dhaka Elevated Expressway project from Dhaka Cantonment to Banani area showing important physical features.

(a) (b)

(c)

Figure 3.9: Affected entities in areas under Tranche-1: (a) tress along rail track, (b) retail shop, (c) pond

The Expressway after crossing the Banani overpass continues towards Kakoli. Important physical entities like Dhaka Cantonment Gate, Navy Head Quarter, Army stadium, Govt. staff quarters, Kurmitola Golf Club, Banani Railway Station, Banani Overpass, Kakoli Bus Stand are located close to the alignment of the expressway within this stretch (see Figure. 3.7 and 3.8). The affected entities along the route of the DEE within the Tranche-1 are shown in Figure 3.9. These includes trees and ponds along the route of the expressway, retail shops located close to the alignment etc.

3.2.1.3 Tranche-2

Figure 3.10 shows the route of Tranche-2 of the Expressway (stretching from Kakoli Bus Stand at Banani to Polashi). The Tranche-2 has been divided into 6 sections (Figure 3.11 to Figure 3.16) to study and present different physical entities along and around the proposed routes of the DEE.

The DEE at Tranche- 2 commences from Kakoli Bus Stand at Banani and continues over/close the railway track up to Hatirjheel area, as shown (Figure 3.10). A number of physical entities are located close to the alignment of the Expressway within this stretch. These include the Shikder Plaza, NAM Village, Bridge Building Authority Office, Mohakhali Flyover, DGHS Office, BATB Factory, Transtec Factory, National Institute of Preventive and Social Medicine, Tejgaon Rail Station, Tejgaon Truck Terminal, Mohakhali DOHS, Channel I and

InceptaPharmaceuticals, Ayesha memorial Hospital, TCB Building, Janata Tower etc. Details locations of these entities are shown in enlarged satellite images in Figures 3.11, 3.12, 3.13, 3.14, and 3.15. Educational institutes like AIUB, NakhalparaHossain Ali School, and Government Science College are also located close to the alignment of the Expressway. In this Tranche the elevated expressway will cross the Bijoy-SharaniTejgaon Link Road and will have an interchange with this link road. The end of the Tranche-2 is over the Hatirjheel area near the BGMEA office building (Figure 3.14). Most of the main expressway within the Tranche-2 follows the alignment of the railway track. It should be mentioned that a large number of floating population of the capital city Dhaka lives in the slum areas located on both sides of the rail line within Tranche-2 (Figure 3.13).

At a Chainage of about 12+700, the elevate link starts from the main expressway and turns westward towards the Pan Pacific Sonargaon Hotel running over the Hatirjheel area (Figure 3.15). The elevated link connecting the main carriage way of the DEE to Polashi will run through the back side of Hotel Pan Pacific Sonargaon, Hatirpool and Katabon. Important physical infrastructure located close or on the route of the elevated link are shown in Figure 3.15 and 3.16. These include the BGMEA Office Building, Hotel Pan Pacific Sonargaon, Katabon Mosque, Hatirpool Market, BANBEIS, ICMA Building, Abul Barkat Museum (Figure 3.15, 3.16). A few shopping complexes like Eastern Plaza, Motaleb Plaza are locate close to the route of the elevated link (Figure 3.15). Educational institutes like Dhaka University and BUET are located at the end of the elevated link near Polashi (Figure 3.16). The elevated link will have an interchange at Pantha-Kunja (Figure 3.15) near Pantha Path to provide access to/from Ramna, Tejgaon and Shaheed Tazuddin Ahmed Road

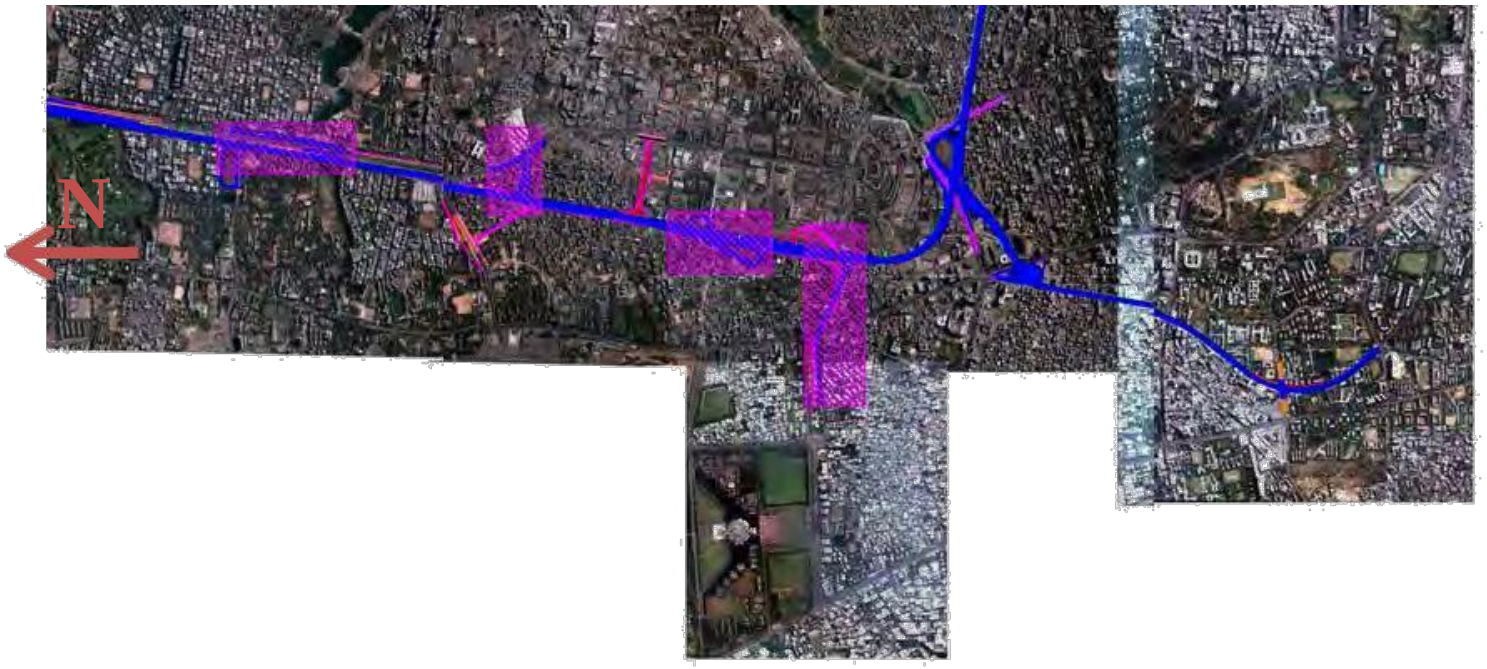


Figure 3.10: Routes of Elevated Expressway in the Tranche-2 segment.

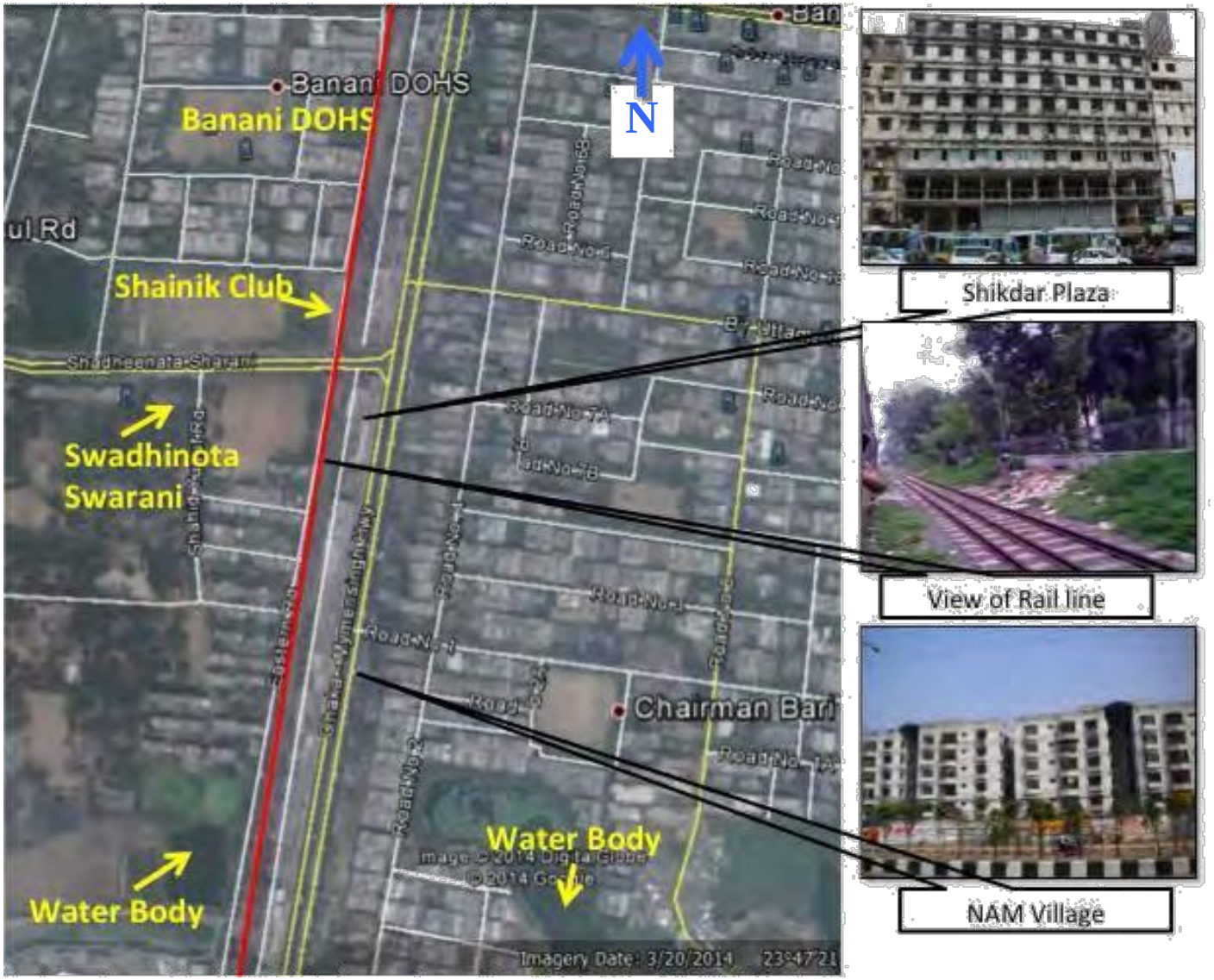


Figure 3.11: A segment of Tranche-2 of the Dhaka Elevated Expressway project near Banani area showing important physical features.

Figure 3.12: A segment of Tranche-2 of the Dhaka Elevated Expressway project near Mohakhali area showing important physical features.

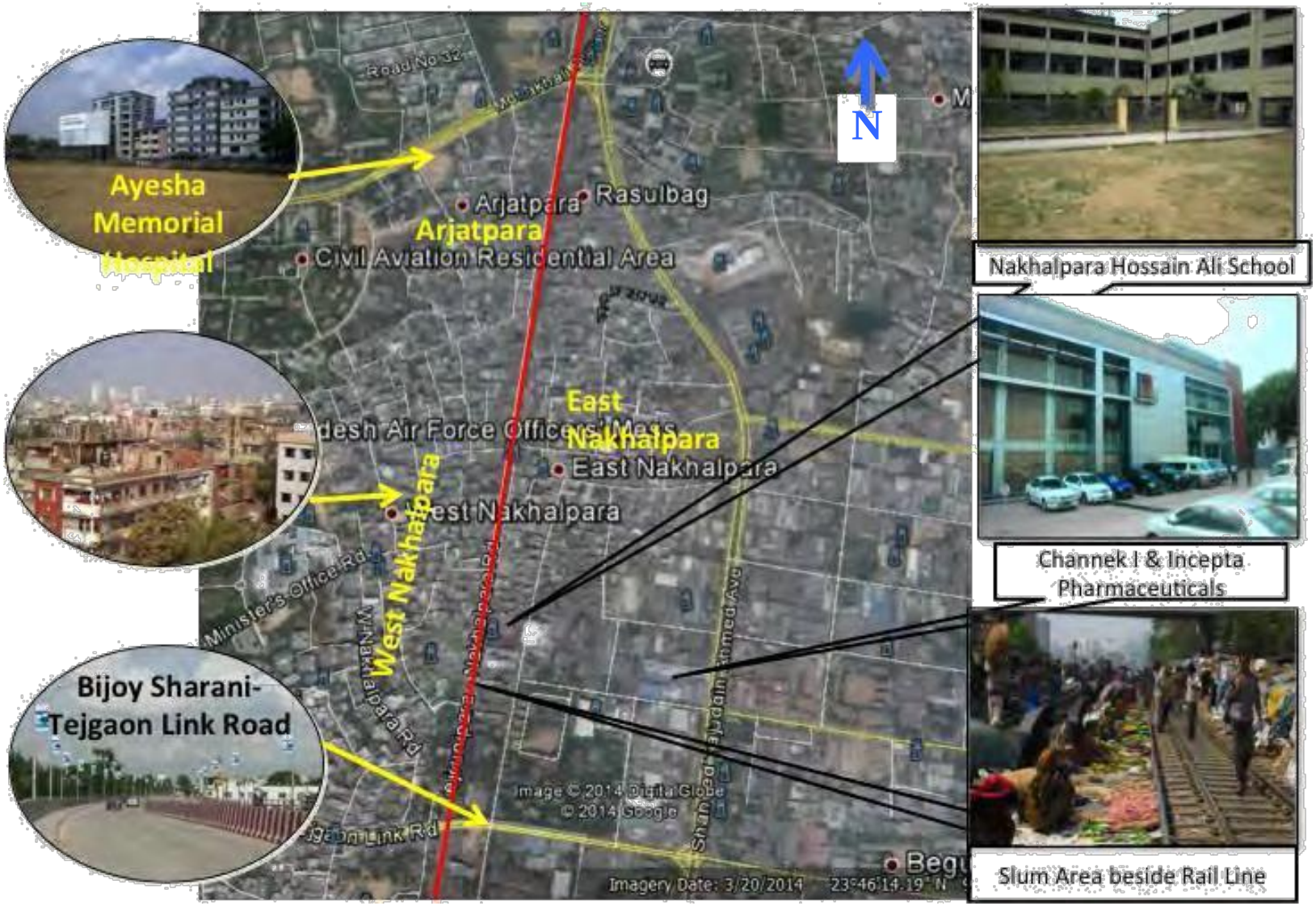


Figure 3.13: A segment of Tranche-2 of the Dhaka Elevated Expressway project through Arjatpara, Rasulbag, Nakhalpara and Tejgaon areas showing important physical features.

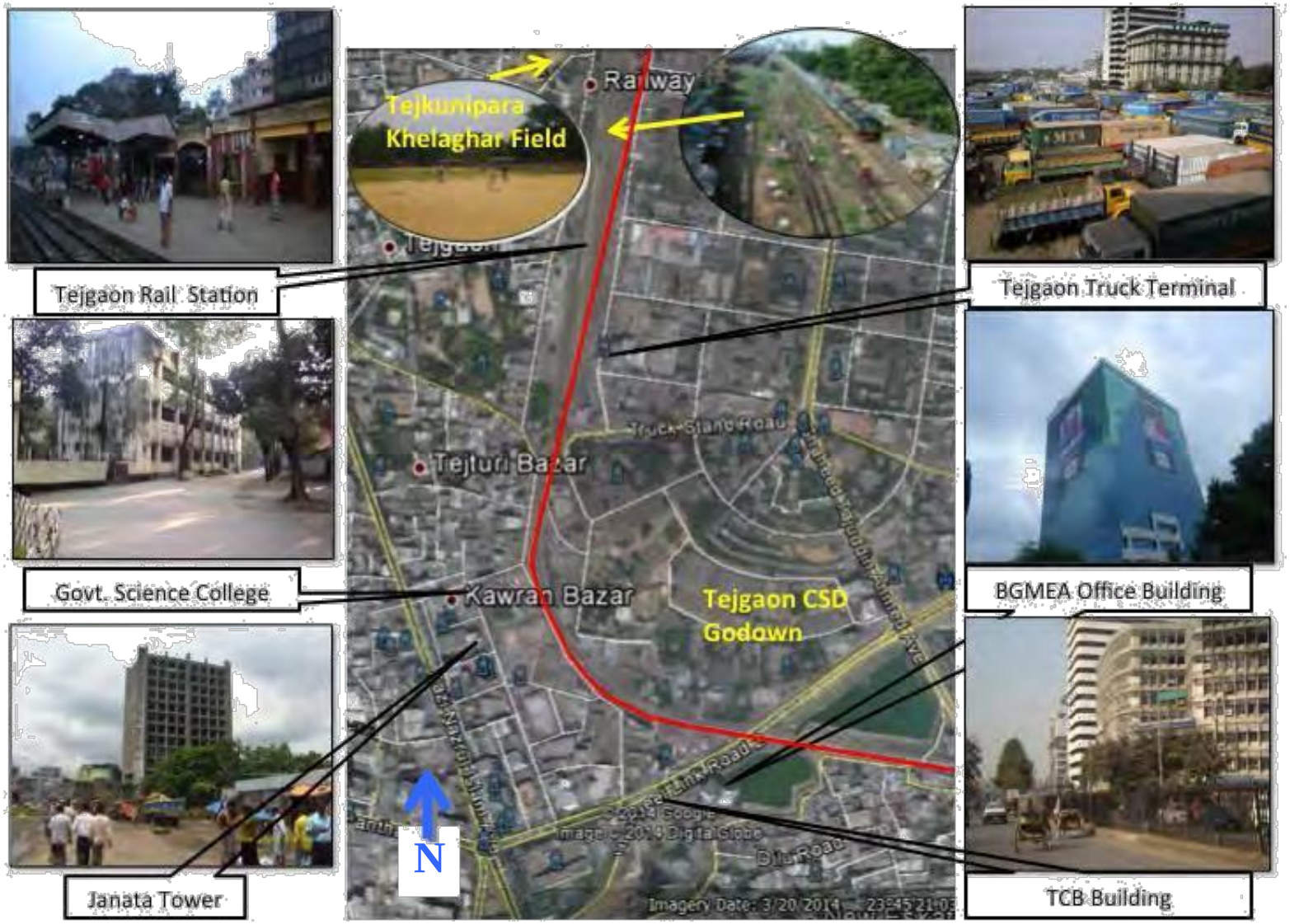


Figure 3.14: A segment of Tranche-2 of the Dhaka Elevated Expressway project from Tejgaon to Hatirjheel area showing important physical features.

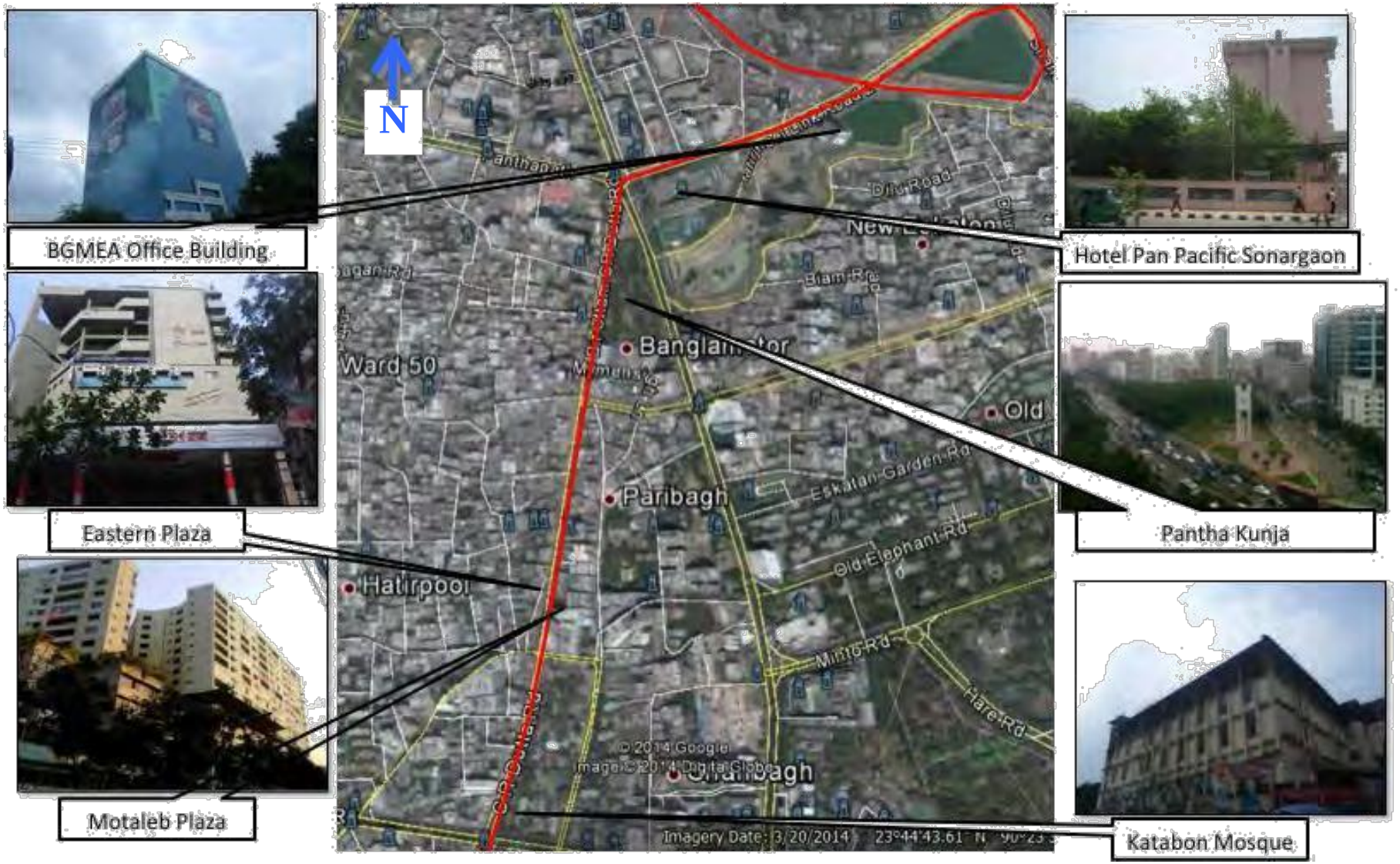


Figure 3.15: A segment of Tranche-2 of the Dhaka Elevated Expressway project near Hatirjheel area showing the beginning of the elevate link from the main expressway and important physical features surrounding the elevated link segment.

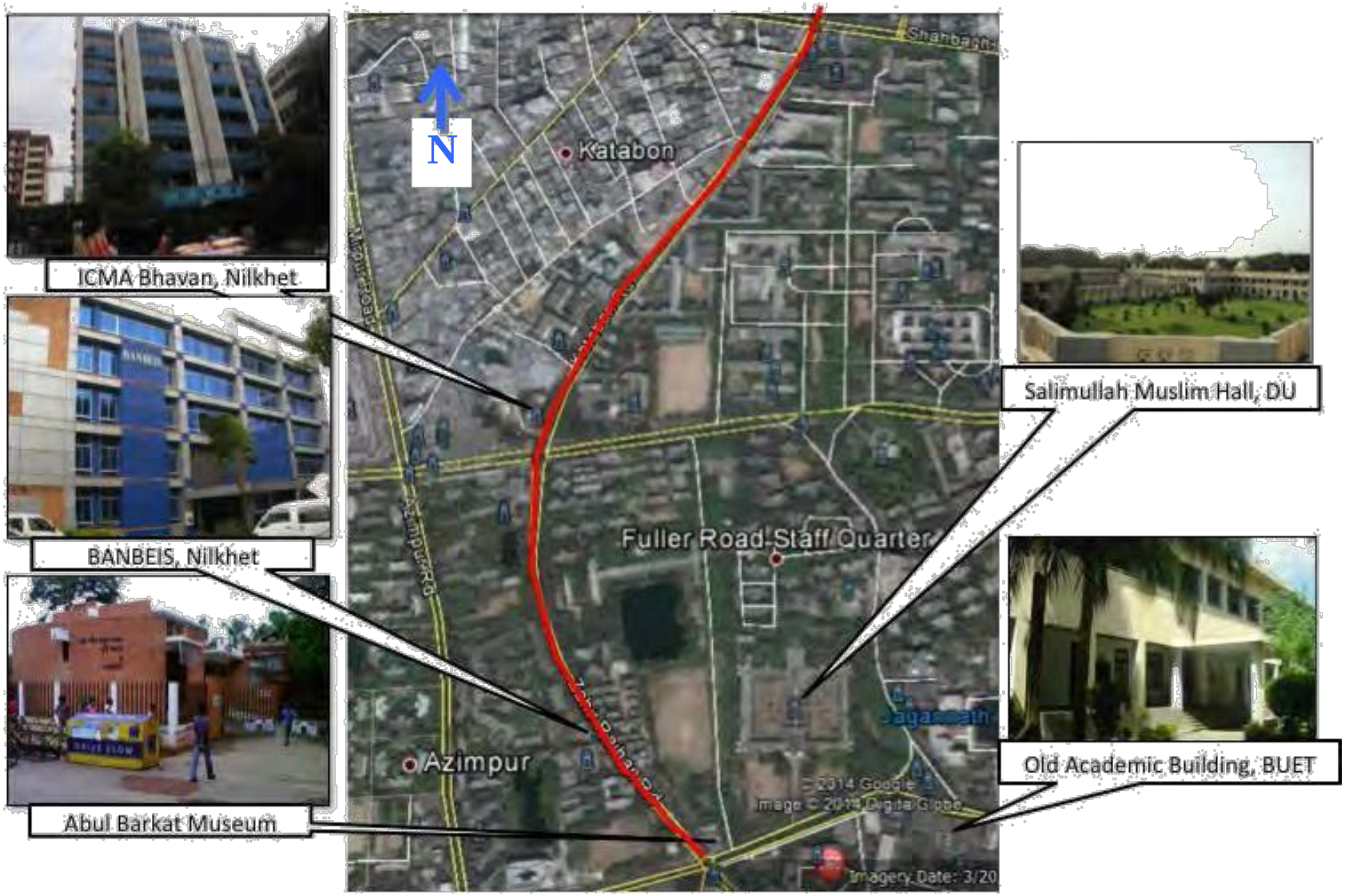


Figure 3.16: A segment of Tranche-2 of the Dhaka Elevated Expressway project near Palashi area showing the end of the elevate link from the main expressway and important physical features surrounding the elevated link segment.

3.2.1.4 Tranche-3

Figure 3.17 shows the route of Tranche-3 of the Expressway (stretching from Harijheel area to Kutubkhali). The Tranche- 3 has been divided into 7 sections (Figure 3.18 to Figure 3.24) to study and present different physical entities along and around the proposed routes of the DEE.

The DEE at Tranche-3 commences from Hatirjheel area near Moghbazar Rail Crossing and continues over/close the railway track up to Kamlapur Railway Station (up to Chainage: about 15+000), as shown in Figure 3.18 to 3.21). From Kamlapur Station, the expressway follows the Atish Dipankar Road as shown in Figure 3.21. The expressway continues over AtishDipankar Road and establishes an interchange after crossing the Kamalapur Railway Station. The ramps of the interchange are located over the Kamalapur Road and Outer Circular Road (Figure 3.21). The main carriageway continues towards Saidabad until it reaches the Mohammad Hanif Flyover (MMHF) (Figure 3.23). After reaching the MMHF, the expressway will run above the MMHF. The down ramp (towards Chittagong side) will be located on the main roadside adjacent to the Mayor Hanif Flyover, while the up ramp (from Chittagong side) will start downstream of the MMHF.

A number of physical entities are located close to the alignment of the Expressway within Tranche-3. These include Rajdhani Super Market, Shah Nuri Model High School, Khidmah Hospital, Khilgaon Bagicha Mosque, few RMG Industries, educational institutes (like Kamlapur School), Kamlapur stadium, Kamlapur Railway Station, Khilgaon Flyover, Religion institutes like Darbar Sharif, Sayadabad Darbar Sharif Mosque etc. Important physical entities near the end of Tranche-3 include Mayor Hanif Flyover, Markatuz Tahfiz Cadet Madrasa, Sufia Plaza, Jatrabari Thana, Telephone Office, and Mosque near Sayedabad, etc. (Figure 3.24).

Figure 3.17: Routes of Elevated Expressway in the Tranche-3 segment.

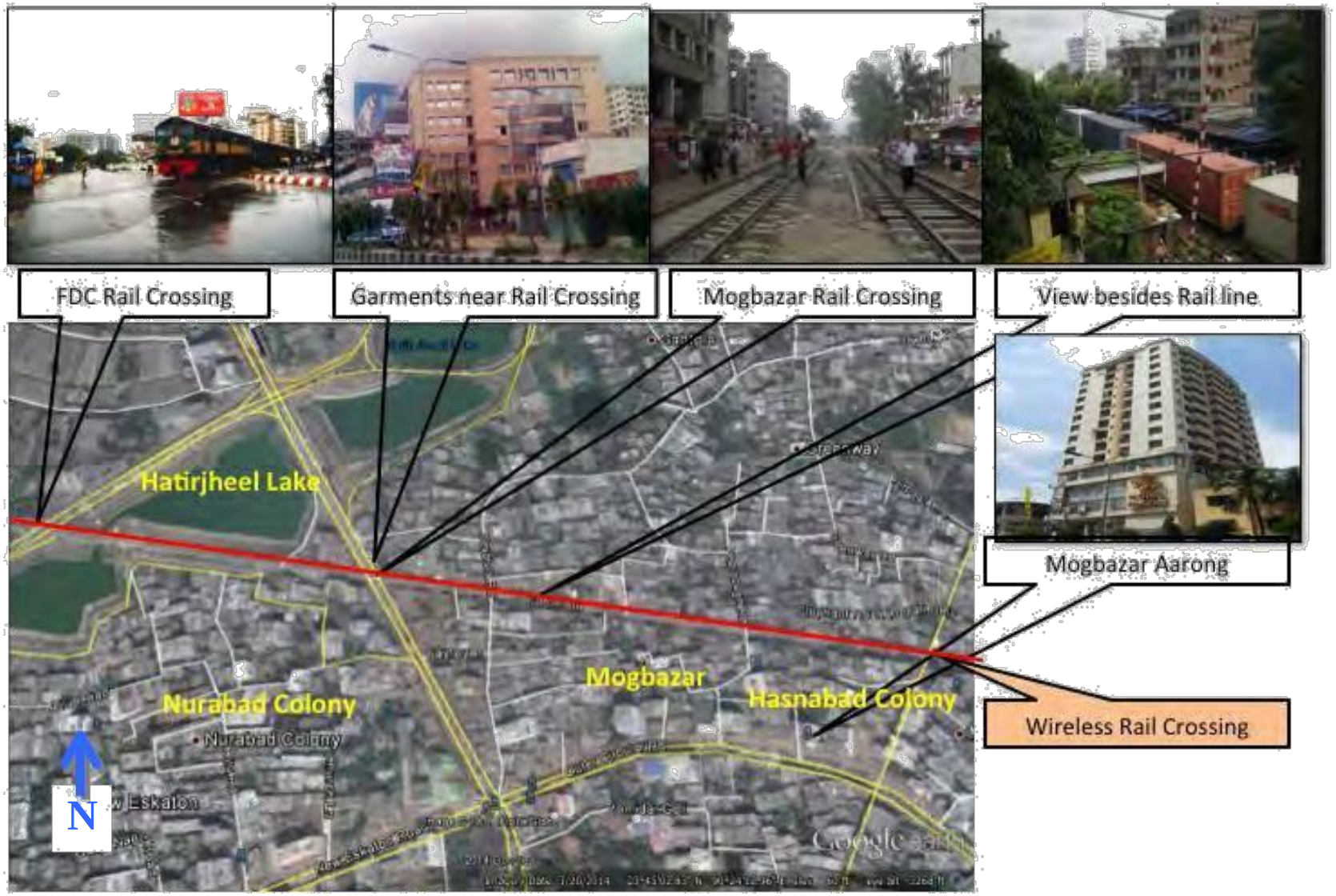


Figure 3.18: A segment of Tranche-3 of the Dhaka Elevated Expressway project near Hatirjheel and Mogbazar area showing important physical features.

Figure 3.19: A segment of Tranche-3 of the Dhaka Elevated Expressway project near Malibag, Gulbag, Khilgaon and Shahjahanpur area showing important physical features.

Figure 3.20: A segment of Tranche-3 of the Dhaka Elevated Expressway project near Shahjahanpur, Khilgaon and Central Bashabo area showing important physical features.

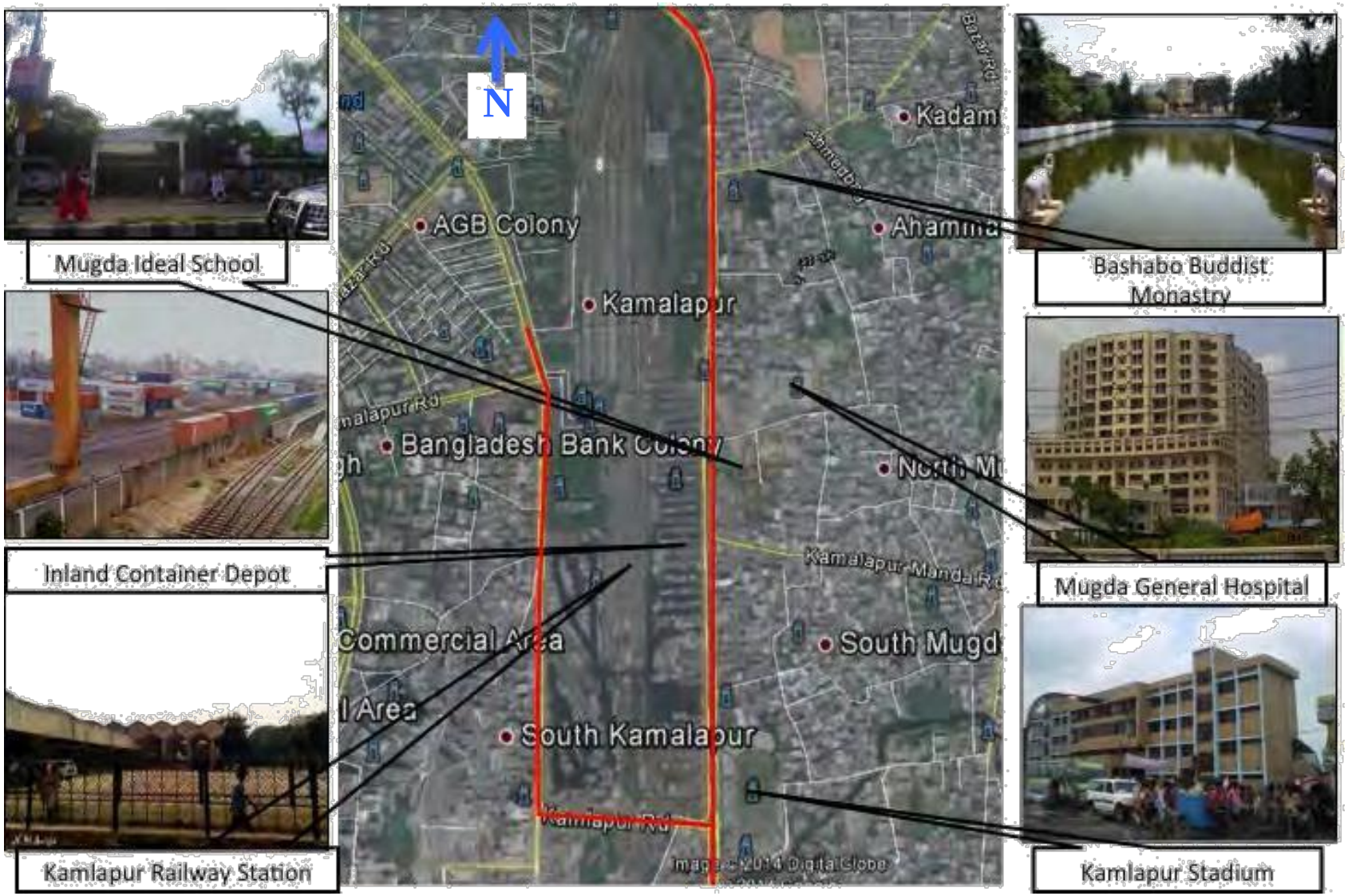


Figure 3.21: A segment of Tranche-3 of the Dhaka Elevated Expressway project near Bashabo, Mugda, Kamlapur area showing important physical features.

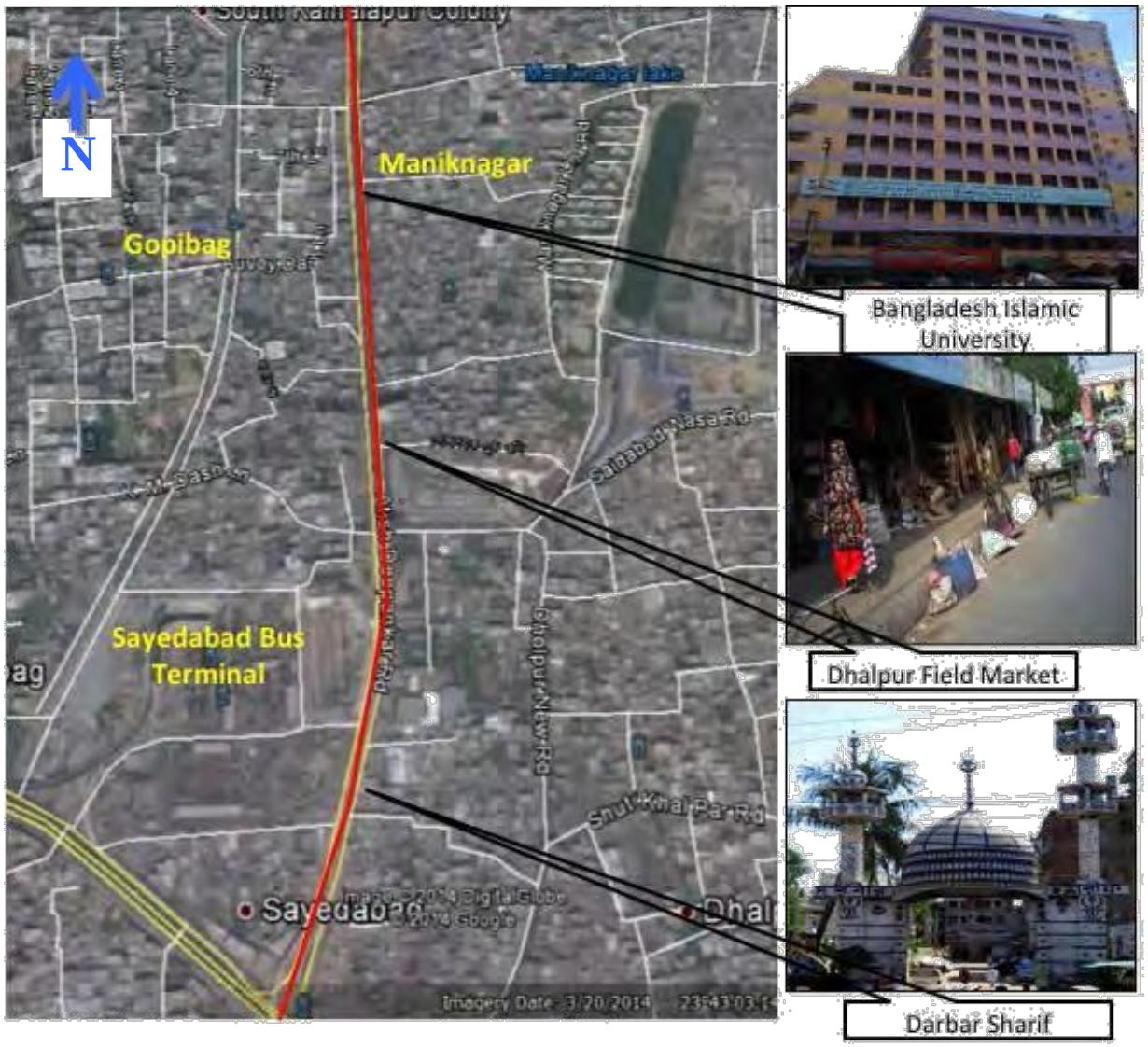


Figure 3.22: A segment of Tranche-3 of the Dhaka Elevated Expressway project near Maniknagar, Gopibag, Sayedabad area showing important physical features.

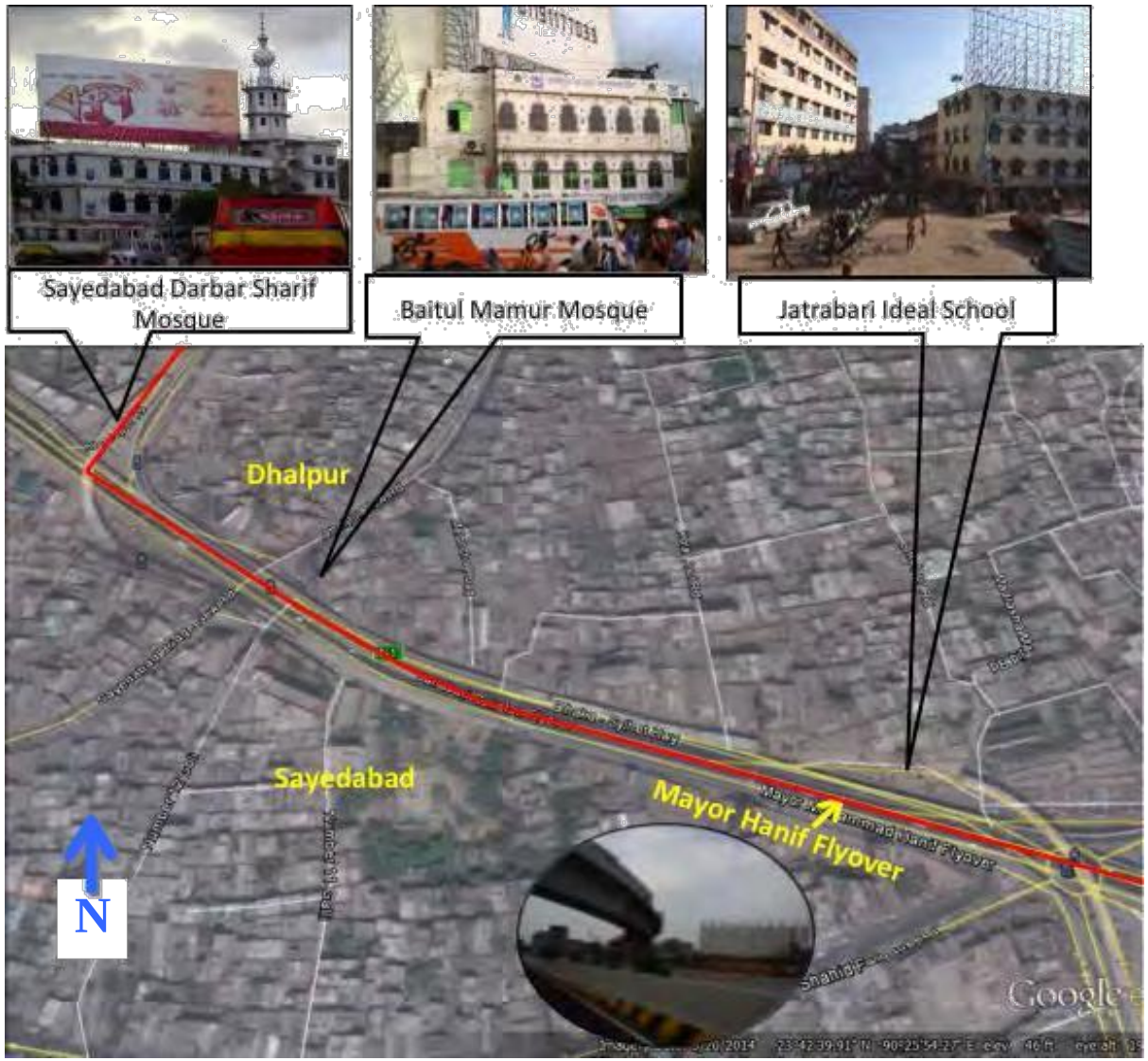


Figure 3.23: A segment of Tranche-3 of the Dhaka Elevated Expressway project near Dhalpur and Sayedabad area showing important physical features.

Figure 3.24: A segment of Tranche-3 of the Dhaka Elevated Expressway project near Jatrabari area showing important physical features.

3.2.2 Climate

Bangladesh is located at the central part within the Asiatic monsoon region where the climate is tropical. Relatively small size of the country and generally low-lying area cause moderate spatial variation of temperature, precipitation, relative humidity, wind speeds and other climatic variables. However, the climate of Bangladesh exhibits pronounced temporal variability. This is because of the moisture-laden monsoon wind flowing predominantly from the southwest during summer and the comparatively dry and colder northwestern winds during winter.

Three seasons are generally recognized: a hot, muggy summer from March to June; a hot, humid and rainy monsoon season from June to November during which more than 85% of the total annual rainfall occurs; and a moderately cold, dry winter from December to February. The beginning of the rainy season vary from year to year; heavy rains may commence anywhere between mid-April and early June and may end anywhere between the end of September and mid-November. Usually winter season is dry with occasional rains. The early summer season is considered from March-April. During summer the air becomes hot with very low humidity. Baishaki cyclone and rains also dominate the early summer.

The Bangladesh Meteorological Department monitors different climatic variables from 35 stations in Bangladesh. Among them the BMD station located at Dhaka city can represent the climatic condition around the proposed project area. Different meteorological data like rainfall, temperature, relative humidity, evaporation, and solar radiation measured in this station during the period 2001 – 2012 are summarized in Table3.1.

Precipitation

The general pattern of precipitation (which consists entirely of rain) follows the monsoon pattern with the cooler, drier months of November to March, increasing rains in April and May and highest rainfall in the summer months of June to September when the prevailing wind direction from the southwest brings moisture-laden air from the Bay of Bengal. The winter period (November to February) is dry with very little rainfall. Even though the temporal pattern of rainfall is pretty much similar throughout the country, there is pronounced spatial variation. Dhaka metropolitan city experiences the minimum rainfall during monsoon compared to the other metropolitan cities. Figure 3.25 shows the location of the Dhaka metropolitan city on the rainfall map of Bangladesh.

Relative Humidity

The spatial and temporal variation of Relative Humidity throughout the year is very low in Bangladesh. The relative humidity in the Dhaka city varies from 59% to 81%.

Ambient Air Temperature

The temperature of the country is related to the period of rainfall. In general, cool seasons coincide with the period of lowest rainfall. Table 3.1 shows the monthly average mean, maximum and minimum temperature in the Dhaka metropolitan cities. Maximum average temperature over the year is usually observed in May - September and minimum average temperature in January.

Table 3.1: Monthly averages of climatic variables at the Dhaka BMD Station, 2001-2012

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	5	14	29	111	212	326	350	290	316	155	19	11
Mean Temp (°C)	18.0	21.9	26.0	28.1	28.5	28.4	28.3	28.5	28.2	27.1	23.7	19.9
Max Temp (°C)	28.3	32.3	36.0	36.7	36.5	35.7	34.8	34.8	35.0	34.8	32.3	29.2
Min Temp (°C)	10.1	12.4	16.5	19.3	20.6	22.7	23.9	24.0	23.7	20.6	15.8	11.8
Humidity (%)	69	60	59	68	72	80	81	80	80	76	70	71
Sunshine (Hours)	5.7	7.3	7.5	7.7	6.8	3.4	4.0	4.5	4.2	5.7	6.8	5.8
Solar Radiation (Cal/cm2/min)	166	207	231	244	229	175	189	192	172	183	174	146
Evaporation (mm/d)	2.6	4.0	5.0	5.5	5.3	4.1	3.8	3.8	3.6	3.5	3.3	2.5

Source: Bangladesh Meteorological Department

Solar Radiation and Evaporation

The average incident solar radiation is comparatively higher during the period between February – May than the other months of the year. Consequently the amount of evaporation is also higher during that period.

3.2.3 Geology, Soils and Seismicity

Geology

Geology of Bangladesh is generally dominated by poorly consolidated sediments deposit over the past 10,000 to 15,000 years (Holocene age). It is mostly characterized by the rapid subsidence and filling of a basin in which a huge thickness of deltaic sediments were deposited as a mega-delta out built and progressed towards the south. The delta building is still continuing into the present Bay of Bengal and a broad fluvial front of the Ganges-Brahmaputra-Meghna river system gradually follows it from behind.

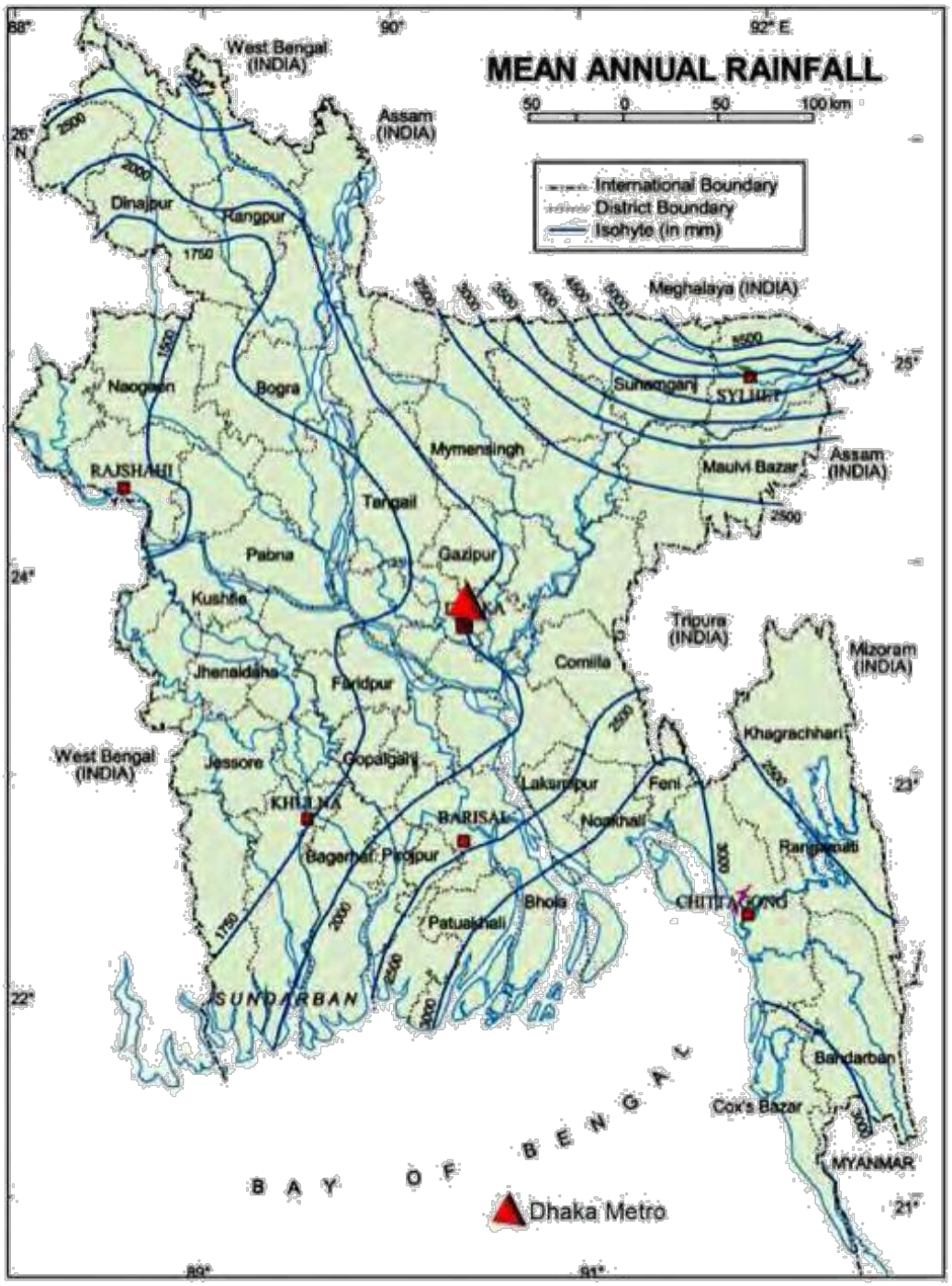


Figure 3.25: The location of Dhaka metropolitan city on the mean annual rainfall map of Bangladesh (map source: www.banglapedia.org)

Soil Characteristics

The soil formation in Bangladesh is remarkably homogeneous in appearance, both vertically and laterally. It comprises layer of unconsolidated clay, about 10m thick near Dhaka, but apparently thinner to the east and possibly much thicker in the west of the Rajshahi district. The sand mineralogy in this area is broadly similar to that of the tertiary hill sediments. Mineral contents of the soil are high in quartz, relatively low in feldspar and mica, and with zircon, tourmaline, kyanite, staurolite, sillimanite, and epidote dominating the heavy mineral fractions. The content of easily weatherable minerals ranges from 4 to 9%. The soil of Bangladesh can broadly be classified into seven tracts: (1) Madhupur Tract or Red Soil Tract, (2) Barind Tract, (3) Tista Silt, (4) Brahmaputra Alluvium, (5) Gangetic Alluvium, (6) Coastal Saline Tract, and (7) Hill Tracts. Figure 3.26 shows the position of the Dhaka metropolitan city on the soil tract map of Bangladesh.

The soil formation of Dhaka metropolitan city underlies Madhupur and Barind tracts. This tract represents the red lateritic soils of Madhupur area, a highland tract above flood level intersected by numerous large and small depressions, locally known as 'BAID'. The soils of this tract have clayey texture and contain large quantity of iron and aluminium, which are highly aggregated. The pH value ranges from 5.5 to 6.0 in the topsoil. The cation exchange capacity is low and the soils have the high phosphate fixing capacity. The soils are deficient in organic matter, nitrogen, phosphate and lime.

To assess the pH, organic content, chloride and sulfide levels of the natural soil in the study area several soil samples were collected from Dhaka metropolitan city (see Table 3.2 for sampling locations) from about 0.15 m below the top of the original soil layer, using a split spoon. Analysis was done using standard methods and the values of the parameters are given in Table 3.3. The results indicate that the pH of the first soil sample was in the acidic range, while that of the other two samples were close to the neutral value. Sulphate and chloride content of the three samples are very small. All the three samples registered similar organic content (Table 3.3).

Table 3.2: Geo-coordinates of three locations from where soil samples were collected from the project surrounding areas

Sample ID	GPS Location		Location
	Longitude	**Latitude**	
SS1	90°25'19.09"E	23°49'32.67"N	Tranche 1: Near Kuril Flyover
SS2	90°23'51.54"E	23°46'40.75"N	Tranche 2: Mohakhali Rail Crossing
SS3	90°25'42.80"E	23°43'35.35"N	Tranche 3: Near Kamlapur Rail Station

Table 3.3: Laboratory results of tested parameters of the soil samples collected from project surrounding areas

Sl. No.	**Parameters**	**Unit**	**Concentration Present**		
			SS1	**SS2**	**SS3**
1	pH	--	5.8	6.7	6.7
2	Sulphate, SO_4	%	0.0109	0.0	0.0756
3	Chloride, Cl^-	%	0.0026	0.0044	0.062
4	Organic Matter	%	0.217	0.211	0.224

Seismicity

In the north and northeast of Bangladesh, there are areas of high seismic activity and some of the major earthquakes originating in these areas have affected the adjacent regions of the country. The whole of Bangladesh is divided into three seismic zones (Figure 3.27). The northern part of the country that includes the greater districts of Rangpur, Mymensingh, and Sylhet are in the Zone-I where earthquake shock of maximum intensity of IX of the Modified Mercalli Scale is possible. The Zone-II includes the greater districts of Dinajpur, Bogra, Dhaka and Chittagong and the shocks of intensity of VIII are possible. The southern part of the country, the least active region, where the maximum intensity is not likely to exceed VII, is in the Zone-III. The experts suggest not constructing normal buildings with more than 60m of height. Dhaka metropolitan cityis located in zone II. Figure 3.27 shows the locations of the Dhaka metropolitan city in the seismic map of Bangladesh.

3.2.4 Flood-prone Areas

Bangladesh is prone to flooding; the coastal flooding as well as the bursting of Bangladesh's riverbanks is common and severely affects the landscape of the country. 75% of Bangladesh is less than 10m above sea level and 80% is flood plain, therefore rendering Bangladesh a nation very much at risk of further widespread damage. Flooding normally occurs during the monsoon season from June to September during the monsoon. The convectional rainfall of the monsoon is added to by relief rainfall caused by the Himalayas. Melt-water from the Himalayas is also a significant input and flood every year. Figure 3.28 shows the positions of Dhaka metropolitan city over the flood risk map of Bangladesh. It can be observed that Dhaka metropolitan city is not located in the flood-prone areas.

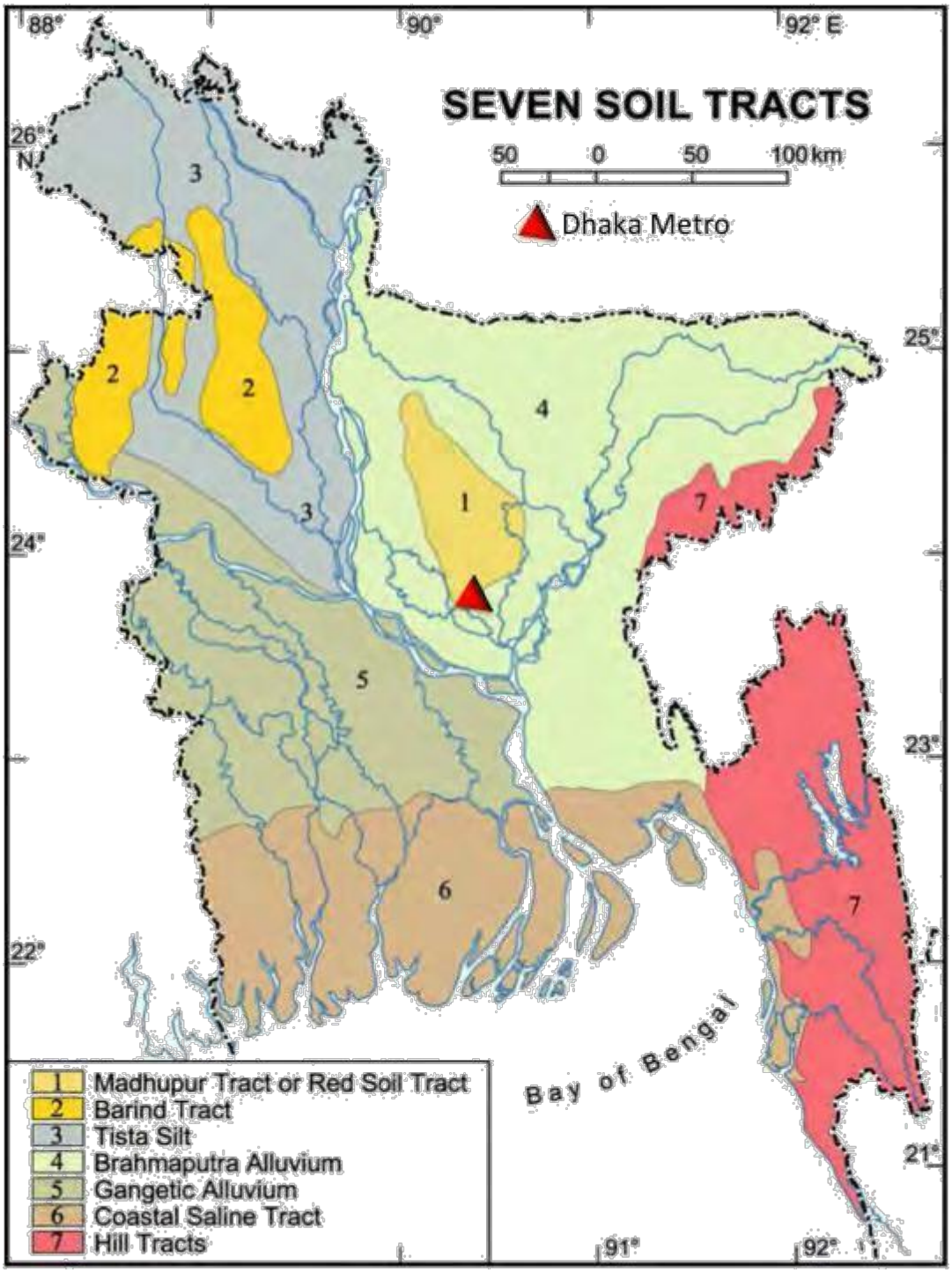


Figure 3.26: Map showing the Dhaka Metropolitan City area on the seven soil tracts of Bangladesh (map source: www.banglapedia.org)

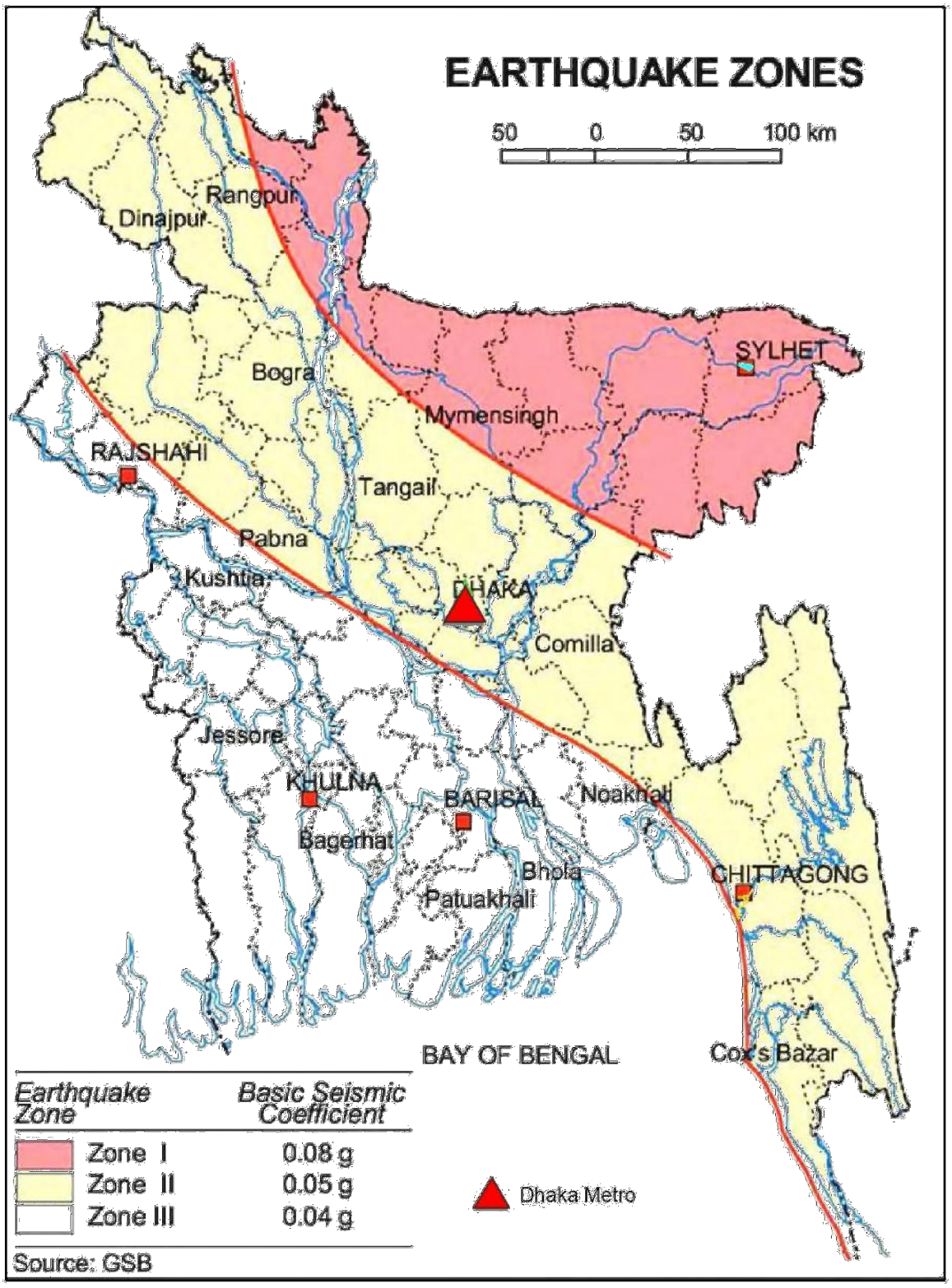


Figure 3.27: Location of Dhaka Metropolitan City on the seismic map of Bangladesh (map source: www.banglapedia.org)

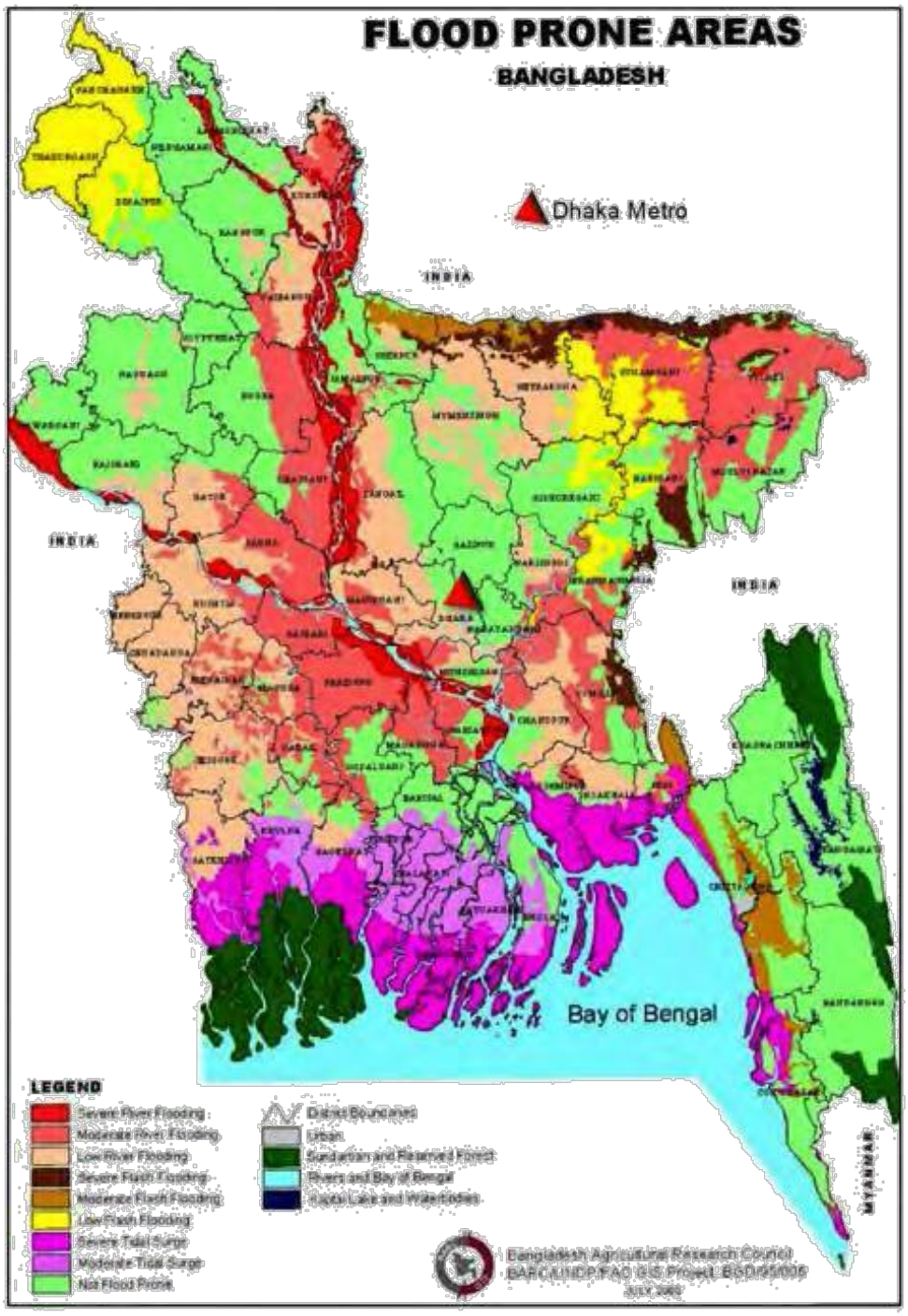


Figure 3.28: Location of the Dhaka metropolitan city on the flood risk map of Bangladesh (map source: BARC)

3.2.5 Air Quality Assessment

The Clean Air and Sustainable Environment (CASE) Project, under the Ministry of Environment and Forest, Government of the People's Republic of Bangladesh, monitors different ambient air quality parameters from 11 fixed continuous air monitoring stations (CAMS) located in different parts of the country. Among these CAMS, 3 stations located in Dhaka can represent the air quality of the surrounding area of the project and at a distant location from the project site (shown in Table 3.4). Different ambient air quality data like PM_{10}, $PM_{2.5}$, CO, SO_2, NO_X, O_3 measured monthly in these CAMS during the period of April, 2013 – June, 2014 are summarized in Figures 3.29 (a) – (h).

The air quality monitoring data is compared with the Bangladesh Ambient Air Quality Standards, as adopted in 2005 and WHO Ambient Air Quality Guidelines Global Update in 2005, for assessing the overall situation of the ambient air quality. Table 3.5 and 3.6 outlines the National Ambient Air Quality Standards for Bangladesh and WHO Ambient Air Quality Guideline values (Environmental, Health, and Safety General Guidelines, IFC, 2007), respectively.

Table 3.4: The continuous air monitoring stations (CAMS) representing the locations visited in this study

Locations	CAMS				
	ID	**Feature**	**Latitude**	**Longitude**	**Monitoring Capacity**
ShangshadBhabhan, Sher-e-Bangla Nagar	CAMS-1	Located close to the DEE alignment	N 23° 45' 36"	E 90° 23' 24"	PM_{10}, $PM_{2.5}$, CO, SO_2, NO_x, O_3 with meteorological parameters
Farmgate	CAMS-2	Located close to the DEE alignment	N 23° 45' 36"	E 90° 23' 24"	
Darus Salam	CAMS-3	Located away from the DEE alignment	N 23° 46' 48"	E 90° 21' 36"	

Table 3.5: National Ambient Air Quality Standards for Bangladesh

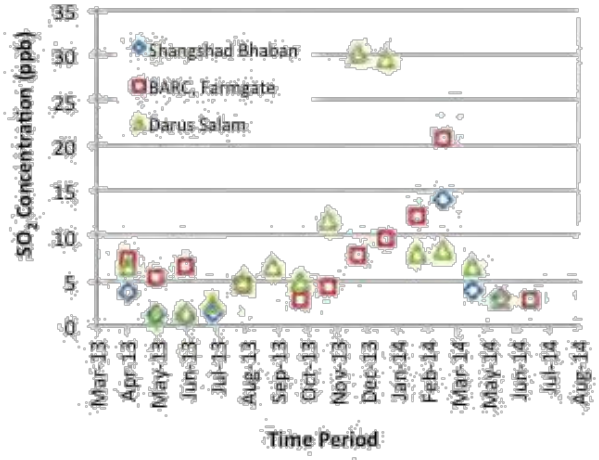
Pollutant	Standard	Average
CO	10 mg/m^3 (9 ppm)	8 hours [(a)]
	40 mg/m^3 (35 ppm)	1 hour [(a)]
NO_x	100 µg/m^3 (0.053 ppm)	Annual
SO_2	80 µg/m^3 (0.03 ppm)	Annual
	365 µg/m^3 (0.14 ppm)	24 hours [(a)]
O_3	235 µg/m^3 (0.12 ppm)	1 hour [(b)]
	157 µg/m^3 (0.08 ppm)	8 hours
$PM_{2.5}$	15 µg/m^3	Annual
	65 µg/m^3	24 hours
PM_{10}	50 µg/m^3	Annual [(c)]
	150 µg/m^3	24 hours [(d)]

Notes:
(a) Not to be exceeded more than once per year.
(b) The objective is attained when the expected number of days per calendar year with the maximum hourly average of 0.12 ppm is equal to or less than 1 (Source: AQMP, DOE)
(c) The objective is attained when the annual arithmetic mean is less than or equal to 50 µg/m3
(d) The objective is attained when the expected number of days per calendar year with a 24- hour average of 150 µg/m3 is equal to or less than 1

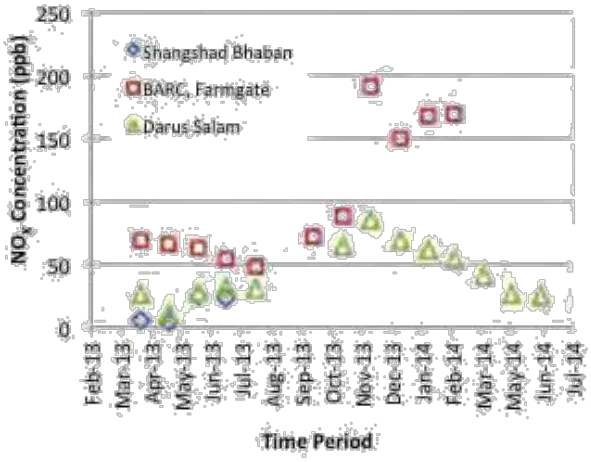
Table 3.6: WHO Ambient Air Quality Guidelines.

Pollutant	Averaging Period	Guideline value in µg/m^3
Sulfur dioxide (SO_2)	24-hour	125 (Interim target – 1) 50 (Interim target – 2) 20 (guideline)
	10 minutes	500 (guideline)
Nitrogen dioxide (NO_2)	1-year	40 (guideline)
	1-hour	200 (guideline)
Particulate Matter (PM_{10})	1-year	70 (Interim target – 1) 50 (Interim target – 2) 30 (Interim target – 3) 20 (guideline)
	24-hour	150 (Interim target – 1) 100 (Interim target – 2) 75 (Interim target – 3) 50 (guideline)
Particular Matter ($PM_{2.5}$)	1-year	35 (Interim target – 1) 25 (Interim target – 2) 15 (Interim target – 3) 10 (guideline)
	24-hour	75 (Interim target – 1) 50 (Interim target – 2) 37.5 (Interim target – 3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target – 1) 100 (guideline)

Note: WHO. Air Quality Guidelines Global Update, 2005. PM 24-hour value is the 99^{th} percentile. Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines. (*Ref*: Environmental, Health, and Safety General Guidelines, IFC, 2007)


Shangshad Bhaban
BARC, Farmgate
Darus Salam
SO2 Concentration (ppb)
Time Period

(a)


Shangshad Bhaban
BARC, Farmgate
Darus Salam
NOx Concentration (ppb)
Time Period

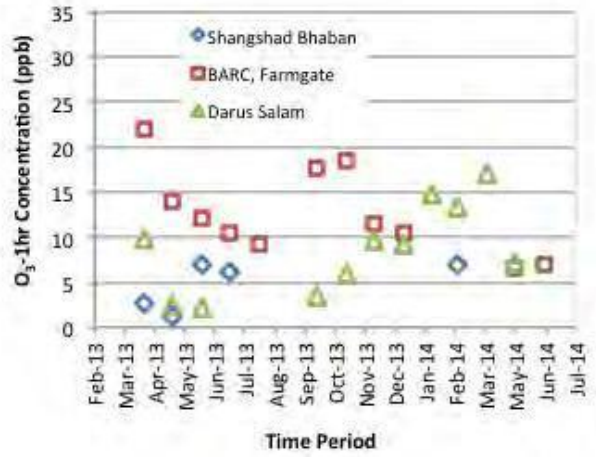
(b)


Shangshad Bhaban
BARC, Farmgate
Darus Salam
CO-1hr Concentration (ppm)
Time Period

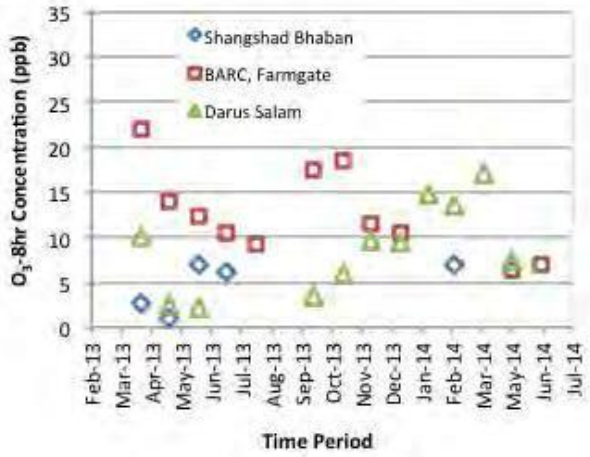
(c)


Shangshad Bhaban
BARC, Farmgate
Darus Salam
CO-8hr Concentration (ppm)
Time Period

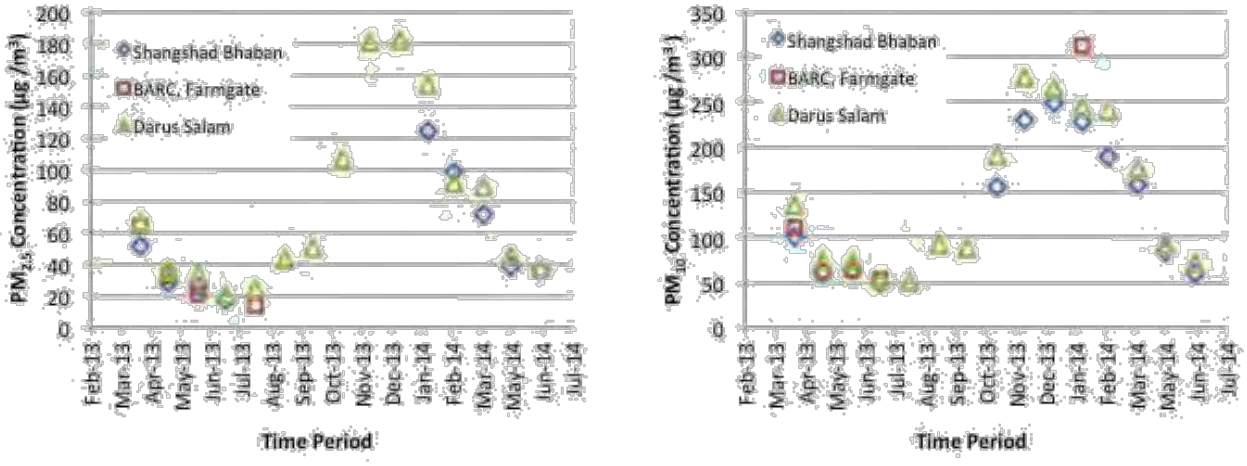
(d)


Shangshad Bhaban
BARC, Farmgate
Darus Salam
O3-1hr Concentration (ppb)
Time Period

(e)


Shangshad Bhaban
BARC, Farmgate
Darus Salam
O3-8hr Concentration (ppb)
Time Period

(f)



(g) (h)

Figure 3.29: Monthly air quality monitoring data from the CAMS located at Dhaka, Chittagong and Sylhet Metropolitan Cities for the time period of March 2013 - January 2014. The air quality parameters monitored are (a) SO_2, (b) NO_x, (c) CO-1hr, (d) CO-8hr, (e) O_3-1hr, (f) O_3-8hr, (g) $PM_{2.5}$, (h) PM_{10}.

The salient features of the monthly air quality monitoring data represented in Figure 3.29 are as follows:

- Concentrations of SO_2 and NO_x are higher from November to January. From the observed data set, the average concentrations of SO_2 and NO_x in Dhaka Metropolitan City are 0.006 ppm and 0.080 ppm respectively in the two areas adjacent to the expressway alignment. The average NO_x concentrations higher than the National Ambient Air Quality Standard value.
- The concentrations of Carbon monoxide, CO (both 1hr and 8hr) and Ozone, O_3 (both 1hr and 8hr) in the areas adjacent to the expressway varied throughout the year and fall within the National Ambient Air Quality Standard value.
- Particulate matter concentrations in the areas adjacent to the expressway alignment varied throughout the year with the maximum concentration of $PM_{2.5}$ and PM_{10} recorded during the period of November to February. The average concentration of $PM_{2.5}$ and PM_{10} was higher than the annual national ambient air quality standard value for all the three metropolitan cities.

3.2.6 Noise Level

As a part of the baseline study, noise level measurements were made at different locations around the proposed expressway alignment. Noise measurements were performed during daytime with a calibrated noise level meter (CEM-DT-8850). 5-minute continuous noise level measurements were carried out at the selected locations, and the equivalent noise levels (L_{eq}) as well as the maximum noise levels (L_{max}) were determined. Table 3.7 shows the summary of noise level measurements carried out in different metropolitan cities. Table 3.8 and Table 3.9 shows the Bangladesh noise level standards and the World Health Organization noise level guidelines for community noise (Environmental, Health, and Safety General Guidelines, IFC, 2007), respectively, during daytime and nighttime for various types of areas. Table 3.10 and 3.11 shows the noise limits for various working environments according to Environmental, Health, and Safety General Guidelines (IFC, 2007) and OSHA, respectively.

Table 3.7 shows that noise levels at different locations adjacent and along the alignment of the expressway are often high during daytime with Leq exceeding 70dBA, with the maximum noise level exceeding 85-90 dBA. This is due to noise associated with vehicular movement and dense gathering of people.

Table 3.7: Noise level measurements during daytime at selected locations close to the alignment of the Dhaka Elevated Expressway

Tranche No.	Noise level measurement locations	Latitude	Longitude	Equivalent Noise level (dBA), L_{eq}	Maximum Noise leve (dBA), L_{max}
Tranche - 1	Near Airport Gate	23°51.043'	90°24.521'	76.5	84.2
	Kuril Flyover	23°49.569'	90°25.242'	72.8	82.6
	Kuril Foot overbridge	23°49.145'	90°24.913'	73.3	85.5
	Cantonment Overpass	23°48.892'	90°24.279'	75.3	85.8
	In front of Army Stadium	23°48.342'	90°24.172'	75.8	86.1
	Kakoli Bus Stand	23°47.752'	90°24.073'	74.6	87.1
	Banani Rail Station	23°47.450'	90°24.039'	72.1	81.4
Tranche - 2	In front of Sainik Club	23°47.415'	90°24.010'	76.2	87.6
	Mohakhali Rail Crossing	23°46.689'	90°23.887'	79.8	87.2
	BijoySarani-Tejgaon Link road	23°45.856'	90°23.758'	71.4	79.5
	Near Tejgaon Rail Station	23°45.632'	90°23.683'	72.3	78.8
	FDC Rail Gate	23°45.098'	90°23.878'	74.5	81.8
Tranche - 3	Mogbazar Rail Crossing	23°45.057'	90°24.142'	76.4	94.2
	Wireless Rail Crossing	23°45.010'	90°24.529'	72.9	87.2
	Malibag Rail Crossing	23°44.982'	90°24.759'	74.9	92.4
	Khilgaon Rail Crossing	23°44.649'	90°25.582'	75.3	89.8
	Middle Bashabo	23°44.535'	90°25.610'	72.1	84.2
	Mugda	23°43.767'	90°25.713'	73.2	83.9
	In front of Kamlapur Stadium	23°43.509'	90°25.867'	73.4	85.2
	Jatrabari Intersection	23°42.597'	90°26.096'	76.5	88.6

[Note: The equivalent level is the level (L_{eq}) of a hypothetical steady sound that would have the same energy (i.e., the same time-averaged mean square sound pressure) as the actual fluctuating sound observed. The equivalent level represents the time average of the fluctuating sound pressure and is close to the maximum level observed during the measurement period. For the fluctuating noise scenario the equivalent noise level (L_{eq}) is generally used for more complete noise sample and is calculated as follows:

$$L_{eq} = 10\log_{10} \sum_{i=1}^{n} P_i \, 10^{L_i/10}$$

where P_i is the probability of the noise level lying in the i-th measurement interval and L_i is the mid-point of that interval.]

Table 3.8: Bangladesh standards for sound level (GoB, 2006)

Locations	Noise level (dBA) at day	Noise level (dBA) at night
Silent zone	50	40
Residential area	55	45
Mixed area	60	50
Commercial area	70	60
Industrial area	75	70

(Ref: Noise Pollution Control Rules, 2006)

Table 3.9: Noise Level Guidelines Measure Out of Doors. (Guidelines for Community Noise, WHO, 1999)

Receptor	One Hour L_{Aeq} (dBA)	
	Daytime 07:00 – 22:00	Nighttime 22:00 – 7:00
Residential, institutional, educational	55	45
Industrial, commercial	70	70

Note: For acceptable indoor noise levels for residential, institutional, and education settings refer to WHO (1999); (*Ref*: Environmental, Health, and Safety General Guidelines, IFC, 2007)

Table 3.10: Noise Limits for Various Working Environments.

Location/ activity	Equivalent Level LA_{eq}, 8h	Maximum LA_{max}, fast
Heavy Industry (no demand for oral communication)	85 dB(A)	110 dB(A)
Light Industry (decreasing demand for oral communication)	50 – 65 dB(A)	110 dB(A)
Open offices, control rooms, service counters or similar	45 – 50 dB(A)	--
Individual offices (no disturbing noises)	40 – 45 dB(A)	--
Classrooms, lecture halls	35 – 40 dB(A)	--
Hospitals	30 – 35 dB(A)	40 dB(A)

Note: For acceptable indoor noise levels for residential, institutional, and education settings refer to WHO (1999); (*Ref*: Environmental, Health, and Safety General Guidelines, IFC, 2007)

Table 3.11: OSHA Noise Exposure Limits for the Work Environment (Noise Exposure in dBA)

Noise Levels	Permissible Exposure (hours and minutes)
85	16 hrs
87	12 hrs 6 min.
90	8 hrs
93	5 hrs 18 min
96	3 hrs 30 min

Noise Levels	Permissible Exposure (hours and minutes)
99	2 hrs 13 min
102	1 hr 30 min
105	1 hr
108	40 min
111	26 min
114	17 min
115	15 min
118	10 min
121	6.6 min
124	4 min
127	3 min
130	1 min

Note: Exposure above or below the 90 dBA limit have been time weighted to give what OSHA believes are equivalent risks to a 90 dBA 8 hr. exposure (Marsh, 1991, p.322).

3.2.7 Water Quality

3.2.7.1 Surface Water Quality

Water is supplied using piped network system in the area surrounding the proposed alignment of the Dhaka Elevated Expressway project by DWASA. The project area is located along the railway or busy roadway alignment of the Dhaka metropolitan city, hence only a few surface water bodies exist nearby the main alignment. In order to assess the surface water quality of ponds, lowlands and lakes in the study area, two surface water samples were collected from the tranche – 1 and one other sample was collected close to the end of tranche – 2 for laboratory analysis. Surface water can be a good indicator to assess any domestic or industrial pollution in nearby areas. The sample collection locations are summarized in Table 3.12 and the results of the laboratory analysis are presented in Table 3.13. The results indicate that there is no significant organic pollution in the first two surface water samples as the BOD, COD. Ammonia and Nitrate values are relatively low, except for the samples collected from Hatirjheel area. The sample collected from Hatirjheel area registered high concentration of COD, BOD, and Ammonia. The sampling of SW-1 and SW-2 was carried out following a rainy day, which may be another reason for better quality of surface water in these two locations. The Bangladesh Standards for inland surface water bodies are given in Table 3.14 (ECR, 1997).

Table 3.12: Surface water sampling locations

Sampling Location	Sample ID	SW Sampling Location	Latitude	Longitude
Tranche - 1	SW-1	Water Body near Kuril Flyover	23°49'19.33"N	90° 25'13.75"E
	SW-2	Water Body in front of Army Stadium	23°48'20.27"N	90° 24'11.18"E
Tranche - 2	SW-3	Hatirjheel	23°45'11.9" N	90°24'05.1"E

Table 3.13: Analysis of surface water samples collected at different metropolitan city areas

Location	pH	Color	Turbidity	Chloride	Electrical Conductivity	Chemical Oxygen Demand (COD)	Biochemical Oxygen Demand (BOD_5)	Ammonia-Nitrogen (NH_3-N)	Phosphate (PO_4)	Total Dissolved Solids, TDS	Sulphate (SO_4)
Units	--	Pt. Co Unit	NTU	mg/L	mS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	µs/cm
SW-1	8.25	39	22.1	39.5	0.32	22	0.4	0.398	0.097	194	31.2
SW-2	8.21	86	9.89	41.3	0.17	25	3.6	0.221	0.021	111	6.3
SW-3	7.46	90	50.0	57.0	6.40	103	19.2	20.28	7.87	386	ND

Note: ND = Not Determined

Table 3.14: Bangladesh Standards for Inland Surface Water Bodies (ECR, 1997)

Best Practice Based Classification	**Parameter**			
	pH	**BOD (mg/L)**	**DO (mg/L)**	**Total Coliform (CFU/100ml)**
a. Source of drinking water for supply only after disinfecting	6.5-8.5	2 or less	6 or above	50 or less
b. Water usable for recreational activity	6.5-8.5	3 or less	5 or more	200 or less
c. Source of drinking water for supply after conventional treatment	6.5-8.5	6 or less	6 or more	5000 or less
d. Water usable by fisheries	6.5-8.5	6 or less	5 or more	---
e. Water usable by various process and cooling industries	6.5-8.5	10 or less	5 or more	5000 or less
f. Water usable for irrigation	6.5-8.5	10 or less	5 or more	1000 or less

3.2.7.2 Ground Water Quality

Groundwater samples were collected from different locations (the sample collection locations are shown in Table 3.15) close to the alignment of the expressway. Samples were collected from deep tubewells of the localities and tested for selected water quality parameters. Table 3.16 shows the characteristics of the groundwater at the different locations tested. The groundwater samples collected from Dhaka Metropolitan Cityis contaminated with Manganese, Iron, Fecal Coliform, and Total Coliform. Iron concentration has been found high in the locations GW2, and Manganese concentration has been found to exceed the Bangladesh drinking water standard limits in the locations GW1. Coliform contamination was observed in the groundwater samples GW2 collected from Farmgate, Dhaka Metropolitan City Area. Any kind of arrangement of drinking water using groundwater in these regions would require treatment for any one or more than one of the parameters like Iron, Manganese, Turbidity and Coliforms.

Table 3.15: Groundwater sampling locations

Location	Sample ID	GW Sampling Location	Latitude	Longitude
Dhaka Metropolitan City	GW 1	Deep tubewell Tejgaon	N 23°45'39.6"	E 90°23'59.8"
	GW 2	Deep tubewell Farmgate	N 23°45'28.4"	E 90°22'57.4"

Table 3.16: Analysis of drinking water samples collected at different locations in the study areas

Sampling locations	pH	Color	Turbidity	Total Hardness as $CaCO_3$	Iron, Fe	Manganese, Mn	Arsenic, As	Chloride, Cl	Total Coliform	Fecal Coliform	Total Dissolved Solids, TDS
Units	--	Pt. Co Unit	NTU	mg/L	mg/L	mg/L	ppb	mg/L			mg/L
Dhaka Metropolitan City (GW1)	7.25	8	1.90	122	0.26	**0.103**	2.9	8.0	0	0	247
Dhaka Metropolitan City (GW2)	6.89	9	0.23	206	**20.02**	0.046	1.9	81.0	**TNTC**	**TNTC**	421
WHO drinking water guidelines	6.5 – 8.5	15	5	500	0.3	0.4	10	250	0	0	1000
Bangladesh drinking water standards (ECR '97)	6.5 – 8.5	15	10	200 - 500	0.3 – 1.0	0.1	50	150 - 600	0	0	1000

Note: TNTC = Too Numerous To Count.

3.2.8 Water Supply and Drainage

The expressway project area is covered under the piped water supply network system provided by DWASA. Piped drainage system exists in the form of combined sewer network in major parts of the project area. In some areas located within tranche-1, surrounding low-lying water bodies serve as temporary drainage basins. The Hatirjheel area located between tranche-2 and tranche-3 serves as a water retention basin in the event of heavy rainfall. Heavy rainfall causes temporary waterlogging in some parts of the project area. Sedimentation of solid waste in the sewer network is responsible for such waterlogging inside the project area.

3.2.9 Baseline Traffic Condition

This particular segment emphasizes on the existing traffic congestion scenarios and safety issues surrounding the proposed DEE corridor, more specifically of intersections adjacent to the touch down points of DEE ramps and elevated link locations. The traffic situation at most of those intersections is complex where a mixed road user environment prevails and greater perceptual and cognitive demands are warranted from the road users accumulated with the heterogeneity of traffic, plying of modes with speed differential and maneuvering time. Prevalent congestion in the intersections have been substantially affecting functional performance of the existing roadway network, progressively deteriorating the entire social and physical milieu causing suffering and inconveniences to the road user. In addition, the concerned intersections adjacent to the DEE ramps and elevated link locations namely Jatrabari at-grade intersection, Kamlapur and Outer circular road intersection, Sonargaon intersection, Mohakhali intersection, Indira road and Kazi Nazrul Islam Avenue intersection and Polashi intersection are addressed as accident prone hazardous locations. A numerical hierarchy has been developed at the Accident Research Institute (ARI), BUET for all the hazardous intersections in Dhaka city to address the alarming safety issues. Among these hierarchy, Jatrabari intersection ranks at top, Sonargaon intersection ranks at three, Shonir Akhra Crossing ranks at seven, Manik Mia Av-Indira Rd. (Rajabazar) ranks at twenty-three and Mohakhali intersection ranks at thirty two. The congestion and safety issues as mentioned above has been further investigated though a field reconnaissance survey.

Jatrabari intersection, which is a round-about facilitates high volume non-motorized transport and higher speed differential among the heterogeneous transport modes consequential to safety issues and congestion scenarios; whereas at Kamlapur and Outer circular road intersection road side parking of non-motorized vehicles, boarding-alighting activities of buses and high volume of pedestrian activities engenders congestion scenarios as well as safety issues. The Sonargaon intersection which incorporates a roundabout accommodates a major portion of the Public transport coupled with the land use of adjacent area, attracts high volume of traffic, engendering congestion and safety issues at weekdays as well as weekends. Mohakhali Tee intersection incorporates three major at-grade approaches, where the important traffic activity is complement to the Mohakhali inter-city bus terminal, Mohakhali Kitchen Market, ICDDRB hospital and other establishments attracting trips for commercial activities and educational purposes; inducing high volume of traffic and pedestrians at the concerned location augmenting at-grade congestion and safety concerns. Furthermore, boarding alighting activities of buses aggravate this situation even more. Indira road and Kazi Nazrul Islam Avenue intersection accommodates high volume of public transport, boarding-alighting activities and on-street

parking accumulated with non-lane based heterogeneous traffic composition; engendering congestion scenarios coupled with safety concerns. The congestion and safety scenario at Polashi intersection is more severe as the intersection facilitates high volume of traffic from five approach legs coupled with non-motorized transports, high pedestrian activities and road side frictions, rendering a complex network of intertwined traffic and pedestrian.

3.3 ECOLOGICAL ENVIRONMENT

An assessment of floral and faunal diversity was carried out along the alignment of the proposed elevated expressway covering more than 450 m corridor along the route. The main purposes of the biological/ecological surveys were:

(i) to enlist the plant and wildlife species with their national and international status,
(ii) to enlist keystone, rare and threatened flora and fauna including fish species,
(iii) to investigate the distribution and abundance of flora and fauna including fish species, and
(iv) to make an assessment of the impacts for the proposed project activities on the existing ecological environment.

This updated survey was conducted in between May to August 2014 during daytime (previous surveys were conducted in January and in August 2011). The Ecologist of the EIA team visited all project sites to collect first -hand information on floral and faunal diversity. Literature review and interviews were also conducted as a part of the study. Ornithological, herpeto-faunal and mammalian surveys were done through visual and aural search and also by interviewing local people. Floral survey was conducted through visual and rapid field surveys. Fish and fishery information was collected through field study, fishermen interview as well as local fish market survey. Literature review was carried out to collect secondary information and to cross-check the primary data.

Detailed list of floral and faunal diversities surrounding the project areas have been previously documented in the IEE report (BRTC-BUET, 2011). For describing floral and faunal diversities in the IEE report, the project site were divided into five sections: (a) Hazrat Shahjalal Internatinal Airport to Kuril intersection; (b) Kuril intersection to Mohakhali flyover; (c) Mohakhali flyover to Moghbazar rail crossing; (d) Moghbazar rail crossing to Kamalapur railway station; and (e) Kamalapur railway station to Kutubkhali. The floral and faunal diversities identified at each of these five sections have been presented separately in the IEE report. However, to keep consistency with the updated LAP Map (Tranche – 1 to 3), the ecological assessment was also reorganized and updated. In this new assessment, the floral and faunal diversity has been described by dividing the project area into three sections viz. (a) Hazrat Shahjalal Internatinal Airport to Banani Rail Crossing, (b) Banani Rail Corssing to Moghbazar Rail Crossing and (c) Moghbazar rail crossing to Kutubkhali near Chittagong Highway. The following sections summarize the updated overall floral and faunal diversities.

3.3.1 Ecological Perspective of Project Areas

Bio-ecologically the project site remains under Brahmaputra-Jamuna Floodplain (IUCN -BD, 2002). Most of the proposed project areas are densely populated urban areas along rail line and major roads; there are also some open agricultural lands. Previous development activities have already changed the natural habitat of most of the floral and faunal species in

the proposed project areas. The remaining open agricultural lands are also changing rapidly due to various development activities. Some trees exist near the rail lines and roads that provide food, shelter and nesting habitat for certain faunal species for a certain period. Most of the project sites are predominantly surrounded by firm urban structures i.e. building, roads, shops, infrastructure, settlements, etc. On the other hand, agricultural land of the proposed project site supports seasonal aquatic land, which serves as the grazing ground for fish and other aquatic animals in the rainy season.

3.3.2 Floral and Faunal Diversity at the Project Areas

The proposed project site supports diversified floral and faunal species, though the abundance of faunal species is quite limited. Most of the floral species, specially the trees beside the rail-lines, are planted. Adaptive urban faunal species are still common in and around the proposed project sites. Floral and faunal diversity falls into the following broad categories, namely (i) aquatic fauna, (ii) aquatic flora, (iii) terrestrial fauna, and (iv) terrestrial flora. These major divisions have also several subdivisions.

Aquatic Flora

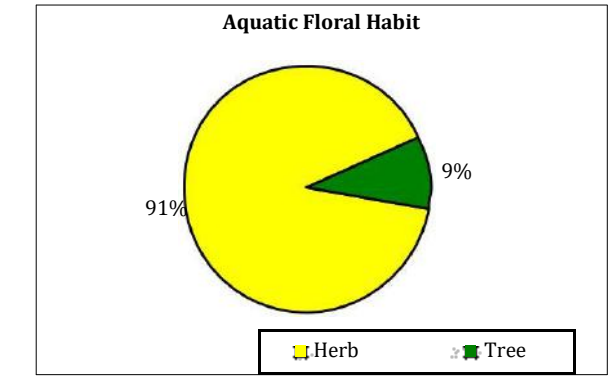
Aquatic environment of the project site provides habitat for aquatic floral species (Fig. 3.30). Percentage distribution of identified aquatic floral habit and their botanical family is shown in Fig. 3.31, which is indicative of the richness of aquatic floral diversity in the study area; Table 3.17 shows the complete list of identified floral species.

Table 3.17: Identified aquatic flora at or near the study site

Family (Botanical)	English / Native Name	Scientific Name	Habit	O	PR	LI	VC	FC	C	R	T
Amaranthaceae	Helencha	*Philoxeroidessp*	Herb	Y				Y			
Amaranthaceae	Haicha	*Alternantherasesilis*	Herb	Y							
Aponogetonaceae	Ghenchu	*Aponogetonnatans*	Herb	Y					Y		
Araceae	Topapana	*Pistiastrateotes*	Herb	Y					Y		
Capparidaceae	Barun/Panibajj	*Crataevanurvala*	Tree			Y		Y			
Convolvulaceae	Kalmi	*Ipomoea aquatica*	Herb			Y					
Compositae	Helencha	*Enhydrafluctuans*	Herb	Y					Y		
Hydrocharitaceae	Patajhangi	*Vallisneriaspiralis*	Herb			Y					
Limnaceae	Khudipana	*Lemnaperpusilla*	Herb	Y				Y			
Pontederiaceae	Kachuripana	*Eichhorniacrassipes*	Herb	Y			Y				
Salviniaceae	Indurkanipana	*Salviniacuculata*	Herb			Y			Y		

[Legend: O = Observed, PR = Previous Record, LI = Local Information, VC = Very common, FC = Fairly Common, C = Common, R = Rare, T = Threatened, Y = Yes]

Figure 3.30: Aquatic flora / habitat at or near the proposed alignment of DEE .



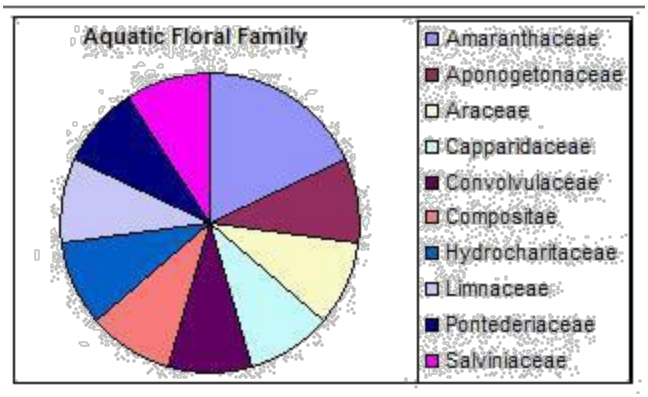


Figure 3.31: Distribution of aquatic floral habit (%) and family in project areas

Terrestrial Flora

Terrestrial environment of the project sites provide habitat for a range of terrestrial floral species (Fig. 3.32). Percentage distribution of identified terrestrial floral habit and their botanical family is shown in Fig. 3.33, which is indicative of the richness of aquatic floral diversity in the study area; Table 3.18 shows the complete list of identified floral species.

Figure 3.32: Terrestrial flora / habitat at or near the proposed alignment of DEE.

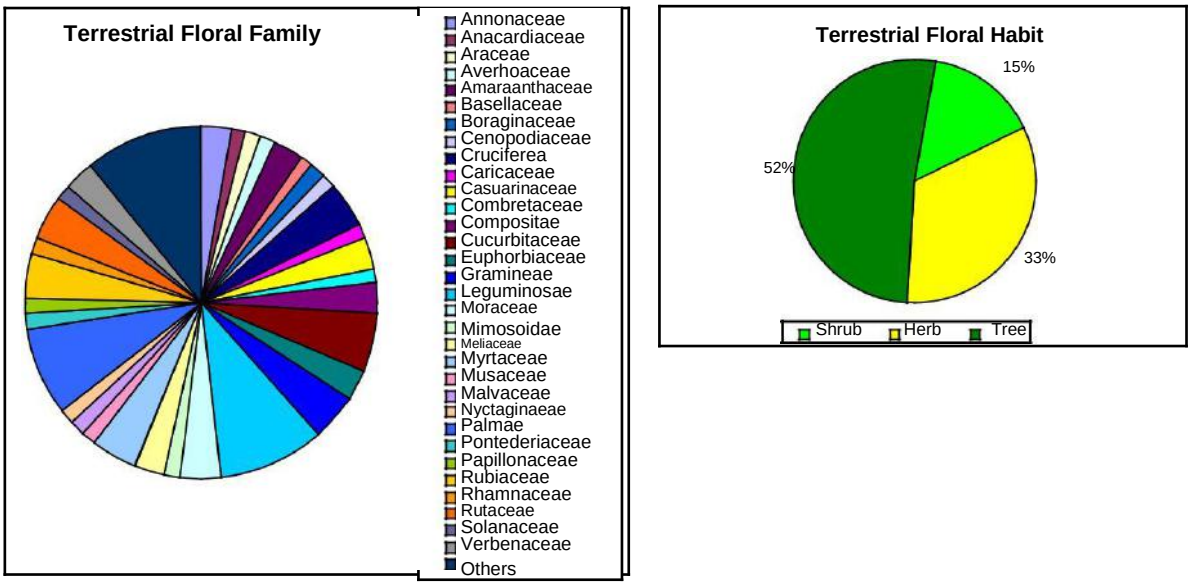


Figure 3.33: Distribution of terrestrial floral family and habit (%) and family in project areas

Table 3.18: Identified terrestrial flora in project areas

Family (Botanical)	English / Native Name	Scientific Name	Habit	O	PR	LI	VC	FC	C	R	T
Annonaceae	Debdaru	*Polyalthialongifolia*	Tree	Y					Y		
Annonaceae	Bullocks heart/Sharifa	*Annonareticulata*	Tree	Y							
Anacardiaceae	Mango Tree/Am	*Mangiferaindica*	Tree	Y				Y			
Araceae	Katchu	*Colocasiaesculenta*	Herb	Y					Y		
Apocynaceae	Chettim	*Atstoniascholaris*	Tree	Y					Y		
Averhoaceae	Kamranga	*Averrhoacarambala*	Tree	Y							
Amaraanthaceae	Kantanotey	*Amaranthusspinosus*	Herb	Y							
Amaraanthaceae	Data shak	*Amaranthusgangeticus*	Herb	Y					Y		
Basellaceae	PuiShak	*Basellarubra*	Shrub	Y					Y		
Boraginaceae	Hatisur	*Heliotropiumindicum*	Herb	Y				Y			
Cenopodiaceae	Palongshak	*Spinaceaaleracea*	Shrub	Y							
Cruciferea	Sharisa	*Brassica napus*	Herb	Y					Y		
Cruciferea	Kalosharisha	*Brassica nigra*	Herb	Y					Y		
Cruciferea	Mula	*Raphanus sativa*	Herb	Y					Y		
Caricaceae	Papaya	*Carica papaya*	Tree	Y					Y		
Casuarinaceae	Jhau	*Casuarinaequisetifolia*	Tree	Y					Y		
Combretaceae	Kath badam	*Terminaliacatapa*	Tree	Y					Y		
Compositae	Sheyalmutra	*Blumealacera*	Herb	Y					Y		
Compositae	Assamlata	*Mikaniacordata*	Herb	Y					Y		
Cucurbitaceae	Dhundul	*Luffaaegypticea*	Herb	Y							
Cucaurbitaceae	Korolla	*Momordicacharantia*	Shrub	Y							
Cucurbitaceae	Lau	*Lagenaria vulgaris*	Herb	Y					Y		
Cucurbitaceae	Telakucha	*Coeciniaindica*	Shrub	Y							
Euphorbiaceae	Reri / Venna	*Ricinuscommunis*	Herb	Y					Y		
Euphorbiaceae	Patabahar	Codiaeumvareigatum	Tree	Y				Y			
Gramineae	Durbaghas	*Cynodondactylon*	Herb	Y			Y				
Gramineae	Bamboo / Muli	*Melacanabambusoides*	Tree	Y							
Gramineae	Turfgrass	*Axonopuscompresus*	Herb	Y					Y		
Leguminosae	Acacia/Mangium	*Acacia mangium*	Tree	Y					Y		
Leguminosae	Krisnochura	*Delonixregia*	Tree	Y					Y		
Leguminosae	Madar	*Erythrina variegate*	Tree	Y							
Leguminosae	Koroi	*Albiziaprocera*	Tree	Y					Y		
Leguminosae	Tamarind /Tetul	*Tamarindusindica*	Tree	Y							
Leguminosae	Zostimodhu	*Glycerrhizaglara*	Herb	Y							
Leguminosae	Rendi / Raintree	*Samaneasaman*	Tree	Y							
Moraceae	Kakdumur	*Ficushispida*	Shrub	Y					Y		
Moraceae	Jackfruit / Kathal	*Artocarpusheterophyllus*	Tree	Y					Y		
Moraceae	Fig / Bot	*Ficusbenghalensis*	Tree	Y					Y		
Mimosoidae	Lazzaboti	*Mimosa pudica*	Shrub	Y							
Meliaceae	Mehagini	*Swieteniamahagoni*	Tree	Y					Y		
Meliaceae	Neem	*Azadirachtaindica*	Tree	Y					Y		
Myrtaceae	Black berry/Jam	*Syzygiumcumini*	Tree	Y					Y		
Myrtaceae	Eucalyptus	*Eucalyptus citriodora*	Tree	Y					Y		
Myrtaceae	Guava tree/ Payara	*Psidiumguayava*	Tree	Y					Y		
Musaceae	Banana / Kola	*Musa sapientum*	Herb	Y					Y		
Malvaceae	Joba	*Hibiscus rosa-sinensis*	Herb	Y							
Nyctaginaeae	Baganbilash	*Bouganvilleaspeciailis*	Herb	Y					Y		
Palmae	Coconut/Narikel	*Coccosnucifera*	Tree	Y					Y		
Palmae	Date Palm/	*Phoenix sylvestris*	Tree	Y				Y			

Family (Botanical)	English / Native Name	Scientific Name	Habit	O	PR	LI	VC	FC	C	R	T
	Khejur										
Palmae	Palm / Tal	*Borassusfiabellifer*	Tree	Y			Y				
Palmea	Bet	*Calamusviminalis*	Herb	Y					Y		
Plamae	Supari	*Areca catechu*	Tree	Y							
Palmea	Oil palm	*Elaeisguineensis*	Tree	Y				C			
Pontederiaceae	Sarkachu	*Monochoriavaginalis*	Herb	Y					Y		
Papillonaceae	Sim	*Lablab niger*	Shrub	Y					Y		
Rubiaceae	Kadom	*Anthocephaluscadamba*	Tree	Y					Y		
Rubiaceae	Rangon (red)	*Ixoracoccinea*	Herb	Y							
Rubiaceae	Rangon (golapi)	*Ixorarosea*	Herb	Y							
Rhamnaceae	Boroi, Kul	*Zizyphusmauritiana*	Tree	Y				Y			
Rutaceae	Bel	*Aeglemarmelos*	Tree	Y					Y		
Rutaceae	Jambura	*Citrus grandis*	Tree	Y							
Rutaceae	Lemon /Lebu	*Citrus limmon*	Tree	Y							
Solanaceae	Dhutra	*Daturametol*	Herb	Y							
Verbenaceae	Teak / Segun	*Tectonagrandis*	Tree	Y					Y		
Verbinaceae	Mehedi	Durantarepens	Shrub	Y							
	Bokul		Tree	Y							
	Sajna		Tree	Y							
	Hasnahena		Shrub	Y							
	Aloklata		Shrub	Y							
	Chalta		Tree	Y							
	Sweet Pototo		Shrub	Y							
	Sajna		Tree	Y							
	Hasnahena		Herb	Y							

[Legend: O = Observed, PR = Previous Record, LI = Local Information, VC = Very common, FC = Fairly Common, C = Common, R = Rare, T = Threatened, Y = Yes]

Aquatic Fauna

Aquatic environment of proposed project areas provide habitat for aquatic faunal species (See Fig. 3.34). Percentage of identified aquatic faunal habit is shown in Figure 3.35, which indicates richness of aquatic faunal diversity in the study area. The complete faunal list is presented in Table 3.19.

Table 3.19: Identified aquatic fauna and fish in project areas

Family (Zoological)	English / Native Name	Scientific Name	O	PR	LI	VC	FC	C	R	T
Amphibia	Bull Frog	*Hoplobatrachustigerinus*			Y		Y			
	Skipper Frog	*Euphlyctiscyanophlyctis*	Y			Y				
Reptilia	Common Skink	*Mabuyacarinata*			Y					
Osteichthyes	Spotted Snakehead	*Channapunctatus*			Y			Y		
	Asiatic Snakehead	*Channaorientalis*								
	Rohu	*Labeorohita*			Y			Y		
	Mrigal	*Cirrhinusmrigala*			Y			Y		
	Catla	*Catlacatla*			Y			Y		
	Silver carp				Y			Y		
	Grass Carp				Y					

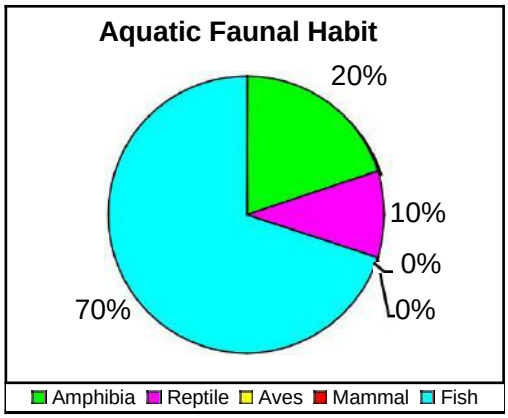


Figure 3.34: Distribution of aquatic faunal habit (%) in project areas

Figure 3.35: Aquatic fauna / habitat at or near the proposed alignment of DEE

Terrestrial Fauna

Terrestrial environment of proposed project areas provide habitat for terrestrial faunal species (Fig. 3.36). Percentage of identified aquatic faunal habit is shown in Figure 3.37. The complete list of identified fauna is presented in Table 3.20.

Table 3.20: Identified terrestrial fauna in project areas

Class (Zoological)	English Name	Scientific Name	O	PR	LI	VC	FC	C	R		T
Amphibia	Common Toad	*Bufomelanostictus*	Y								
	Cricket frog	*Lemnonecteslimnocharis*			Y						
Reptilia	Common House Lizard	*Hemidactylusbrooki*	Y						Y		
	Yellow Monitor Lizard	*Varanusflavescens*	Y							Y	Y
Aves	Pariah Kite	*Milvusmigrans*	Y						Y		
	Brahminy Kite	*Haliaeetur Indus*	Y						Y		
	Rose Ring Parakeet	*Psittaculakrameri*	Y								
	Black Headed Oriole	*Oriolusxanthornus*	Y								
	Asian Pied Starling	*Starnus contra*	Y						Y		
	White-throated Kingfisher	*Halcyon smyrnensis*	Y				Y				
	Indian Pond heron	*Ardeolagrayii*	Y						Y		
	Black Drongo	*Dicrurusmacrocercus*	Y			Y					
	House Crow	*Corvusspeldens*	Y			Y					
	Red Vented Bulbul	*Pycnonotuscafer*	Y						Y		
	Asian Palm Swift	*Cypriirusparvus*	Y						Y		
	Oriental Magpie Robin	*Copsychussaularis*	Y						Y		
	Common Myna	*Acridotherestristis*	Y						Y		
	House Sparrow	*Passer domisticus*	Y			Y					
	Common Tailor Bird	*Orthotomussutorius*	Y						Y		
	Jungle Crow	*Corvusmacrorhynchos*	Y								
	Small Kingfisher	*Alcedoatthis*	Y								
	Little Egret	*Egrettagarzetta*	Y								
Mammalia	Indian pipistrelle	*Pipistrelluscoromandra*			Y				Y		
	Grey musk shrew	*Suncusmurinus*			Y		Y				
	Common house Rat	*Rattusrattus*			Y				Y		
	Indian Mole Rat	*Bendicotabengalensis*			Y				Y		
	Small Indian Mongoose	*Hervestedauropunctatus*			Y						

[Legend: O = Observed, PR = Previous Record, LI = Local Information, VC = Very common, FC = Fairly Common, C = Common, R = Rare, T = Threatened, Y = Yes]

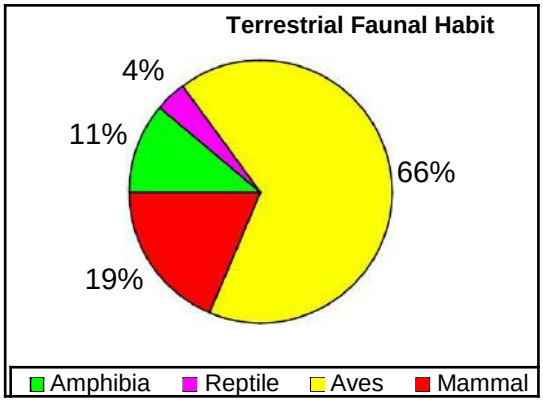


Figure 3.36: Distribution of terrestrial faunal habit (%) in project areas

Figure 3.37: Terrestrial fauna at or near the proposed alignment of DEE

3.3.3 Threatened Flora and Fauna

Floral and faunal species that exist as threatened (endangered, critically endangered, etc) condition are known as threatened species. There are specific criteria to declare a species as threatened species. A total of 54 freshwater fish and 147 inland wildlife species are threatened species in Bangladesh (IUCN, 2000a; 2000b; 2000c; 2000d; 2002). The present study found only one threatened wildlife in Tranche – 1 (Figure 3.38) of DEE. No threatened fish species were identified within and surrounding the project areas. A systematic research work in different seasons may provide a more complete status of flora and fauna within the project areas. A tentative list of 40 plant species is threatened in Bangladesh. No threatened flora has been found in the project areas during the baseline survey.

Figure 3.38: A dead Yellow Monitor Lizard observed on the rail line of Tranche -1 of DEE project areas

Chapter 4

Potential Significant Impacts

4.1 INTRODUCTION

As a part of the EIA, environmental impacts of the project activities on different ecological, physicochemical and socio-economic parameters, both during the construction phase and the operation phase, have been identified and evaluated. Impacts related to acquisition of lands will be covered in more under social impact assessment (SIA), which is being carried out separately.

The proposed Dhaka Elevated Expressway (DEE) will commence at Hazrat Shahjalal International Airport and end at Dhaka-Chittagong near Kutubkhali. Besides the 19.73 km main four-lane dual carriageway and suspended termini at each end, it has five interchanges, and 8 toll plazas. According to the layout of DEE, there are total 31 ramps including entry (on) and exit (off) ramps along the DEE with a total length of about 27 km. Thus, the total length of the DEE, including the Links and ramps, is about 46.73 km. The major project activities, described in Chapter 2, can be summarized as follows:

- Pre-construction Phase: - Finalization of alignment of the Expressway
  - Finalization of the engineering design of the Expressway
  - Acquisition of necessary land
- Construction Phase: - Construction of elevated Expressway (e.g., main carriage way, Links, ramps, toll plazas)
- Operational Phase: - Commissioning of the Expressway

The environmental impacts of the project activities associated with these project phases have been considered separately. The impacts of the project activities have been assessed separately for selected ecological, physicochemical and socio-economic parameters.

4.2 ENVIRONMENTAL IMPACTS DURING PRE-CONSTRUCTION PHASE

The major pre-construction activities include finalization of Expressway alignment and acquisition of necessary land. Expressway alignment has significant impact on the requirement of private land acquisition, possible impact on ongoing projects (e.g. Moghbazar-Mouchak flyover) or planned projects (e.g., expansion of railway). Land acquisition has significant socio-economic impacts (e.g., loss of land and income, displacement). As noted earlier, a separate report is being prepared for social impact

assessment (SIA) (including RAP) of the proposed project. Therefore, this Section covers the socio-economic impacts briefly.

4.2.1 Impacts Related to Alignment of Expressway

As described in Chapter 2, the alignment of the Expressway, including the Links and ramps, passes through the heart of Dhaka city. Though the major portion of the main line/ carriageway passes over or close to the railway corridor, parts of the main carriageway, the Links and many entry/exit ramps pass over private land and existing built structures/ installations.

During IEE, possible impacts of the DEE alignment (approved in January 2011) on ongoing projects and planned projects, as well as existing structures/installations were carefully assessed. For this purpose, the alignment of the Expressway has been carefully reviewed in relation to important existing/ planned projects/ installations. In the IEE report, a total of 11 conflicts of the proposed DEE alignment with ongoing/ planned projects/ structures were identified. Subsequently, as described in Chapter 2, this alignment was revised in October 2013 due to complications related to land acquisition; the most significant changes have been made in the stretch of the alignment from Kamalapur to Kutubkhali. During EIA, the data gathered from field visits and the detailed survey along the revised Expressway alignment were carefully studied to see if the identified adverse impacts related to Expressway alignment could be reduced or eliminated. Subsequently, BBA, BRTC-BUET and the ITD Group worked together to resolve these conflicts and almost all the conflicts have been successfully resolved with minor modifications/ adjustments of the Expressway alignment. Table 4.1 summarizes the conflicts (as identified in the IEE report) and the ways these have been resolved.

Table 4.1: Conflicts of DEE alignment with ongoing/ planned projects/ structures and actions taken to resolve the conflicts

Sl. No.	Conflicts	Resolution of Conflicts
1	***Conflict with future expansion of railway near Airport*** Near the starting point of the Expressway at Hazrat Shahjal al International Airport, the preliminary Expressway alignment crosses the railway tracks at Khilkhet from west to east and enters into Kuril area to comply with the ICAO (International Civil Aviation Authority) height restriction for the Airport (HSIA) runway funnel. The preliminary alignment at this crossing point (i.e., positions of the piers on either side of the existing rail lines) was such that it would have created direct conflict with Railway's proposed third and fourth lines, to be constructed parallel to the existing lines.	This has been resolved by slightly shifting the alignment of the DEE and increasing the span of the portal frame (of DEE) at this location
2	***Conflict with Railway market in Khilkhet area*** Near the Khilkhet, the preliminary Expressway alignment directly passed over northern and southern blocks of the railway market (a series of single-storey shops built parallel to railway track). Demolition of the market would have generated significant social impacts.	By realigning of the DEE, the entire northern block of the railway market has been fully saved; however, the southern block still needs to be demolished for the construction of the DEE.
3	***Conflict with Shunting Operation near Cantonment Railway Station*** After crossing Kuril intersection and Joar Shahara, the alignment of the preliminary Expressway ran very close to the Cantonment Railway Station, which could have caused significant problems with safe shunting operation at the Station.	This has been resolved by realigning the DEE (shifting it toward the east) bypassing the Cantonment Station.
4	***Conflict with Operation of Tejgaon Station*** The preliminary alignment of the Expressway virtually bifurcated the Tejgaon Rail Station, an important rail station, which would have made it almost non-functional.	This has been resolved by realigning the DEE (shifting it toward the west).
5	***Conflict with Banani Overpass and Zillur Rahman Flyover*** After crossing Cantonment Railway Station, the preliminary Expressway alignment passed over/close to the rail track, crossed the Airport Road at Banani level crossing, and then continued alongside the Airport Road toward Kakoli-Mohakhali. Close to the Banani level crossing, the Exit Ramp of the Expressway allowed north-bound traffic to get off to at-grade Airport Road. At this location, there were serious conflicts between the Expressway/ramp alignments and the Banani overpass and the Trumpet Interchange of Zillur Rahman flyover (near Radisson Hotel).	Instead of releasing traffic at at-grade Airport Road, now the Exit Ramp will merge with the Ramp of the Zillur Rahman flyover bound for Mirpur.
6	***Conflict with the Proposed U-loops near Golf Course and Banani Graveyard*** The up-ramp of the DEE near Golf Course conflicted with the proposed U-loop at this location (not enough room for both). Similarly the preliminary DEE alignment also conflicted with the proposed U-loop near Banani Graveyard.	The conflict near Golf Course has been resolved by merging the proposed U-loop with the up-ramp of DEE. After implementation of Banani flyover with two at-grade U-loops underneath it, there is now no

Sl. No.	Conflicts	Resolution of Conflicts
		need for the proposed U-loop near Banani Graveyard.
7	***Conflict with Tejgaon-Moghbazar-Malibagh Flyover of LGED*** At Moghbazar, Malibagh and FDC level crossings, the preliminary alignment of the Expressway conflicted with the alignment of the Tejgaon-Moghbazar-Malibagh Flyover, which is being implemented by the LGED.	This DEE will now pass over the Moghbazar-Mouchak flyover in order to avoid the conflict.
8	***Conflicts with MRT-6 and MRT-5*** The preliminary alignment of the Expressway conflicted with the proposed MRT-6 at Farmgate and Sonargaon Intersection (near Sonargoan Hotel); while it conflicted with the proposed MRT-5 at Kakoli point on Airport Road.	This has been resolved by keeping provision for necessary head-room for MRT-5/6 at the "conflict locations", such that the DEE could safely pass below these metro lines.
9	***Conflict with Hatirjheel Lowland behind Sonargaon Hotel and BGMEA building*** The preliminary Expressway alignment passed over Hatirjheel-Begunbari lowlands behind Sonargaon Hotel. There is a major Interchange Loop at this location, which connects the Expressway with Hotel Sonargaon (back side)-Hatirpool-Katabon- Polashi area. A couple of entry and exit ramps at this location would have induced visual intrusion and shadow problems in the lowland areas just behind Sonargaon Hotel.	It may be possible to address this issue to some extent by realigning the DEE. It may be possible to shift the DEE alignment more toward the north and taking it through between Sonargaon Hotel and BGMEA building (parallel to/ over Sonargaon road), rather than over/behind BGMEA building and Hatirjheel.
10	***Conflict with Existing and Proposed Railway Track near Khilgaon*** The preliminary alignment of the Expressway ran very close to the existing railway track in Khilgaon area, near Khilgaon flyover, which would conflict with the future expansion of rail lines by Bangladesh Railway.	This has been resolved by slight shifting of the alignment of the DEE.
11	***Conflict with Inland Container Depot at Kamalapur*** After crossing Kamalapur Railway station, the preliminary Expressway alignment passedmainly through privately owned land in Shabujbagh-Kamalapur-Bashaboo-Mugdapara areas. The Expressway alignment passed over a part of the Inland Container Deport at Kamalapur.	In order to avoid significant acquisition of private land, the originally proposed DEE alignment from Mostafa Kamal Stadium to Kutubkhali (~3 km) has been dropped. The revised alignment now passes over Atish Dipankar Road avoiding private land.
12	***Conflict with Mayor Mohammad Hanif Flyover (MMHF)*** The DEE alignment conflicted with the MMHF at Kutubkhali	Instead of intersecting the MMHF, the DEE will now vertically bypass the MMHF, requiring it (i.e. DEE) to rise to third level above ground. As MMHF is a PPP project, this resolution needs approval from the MMHF investor.

4.2.2 Impact Related to Land Acquisition

Construction of the proposed Expressway would require acquisition of land. Detailed Land Schedules (LAPs) have been prepared by BRTC, BUET, which will be used by the Bangladesh Bridge Authority (BBA) for acquisition of necessary land for the Expressway project. For convenience, the Land Schedules have been prepared in three parts:

(a) LAP-Part 1 for Tranche 1 (stretching from Airport to Banani);
(b) LAP-Part 2 for Tranche 2 (stretching from Banani to Moghbazar); and
(c) LAP-Part 3 for Tranche 3 (stretching from Moghbazar to Kutubkhali).

According to LAP-Part-1, a total of 71.2350 acres of land needs to be acquired along Tranche-1 of the DEE, which includes 8.3008 acres of privately owned land. Areas to be acquired along Tranche-1 are as follows:

(1) Private land	: 8.3008 acres
(2) Bangladesh Railway	: 31.8220 acres
(3) RHD (including C&B)	: 8.8816 acres
(4) Cantonment, Cantonment Board, Dhaka Cantonment	: 0.0758 acre
(5) Deputy Commissioner	: 19.2380 acres
(6) City Corporation	: 0.8760 acre
(7) Civil Aviation Authority	: 2.0408 acres
Total land area to be acquired (LAP-Part 1)	: 71.2350 acres

There are different kinds of built structures on both the private lands and lands under different Govt. agencies to be acquired for the project under LAP-Part 1. These include tin-shed houses, semi-pucca buildings, buildings ranging from single storied to seven storied, Madrassa, and under construction market. For rehabilitation of Madrassa/ school, small pieces of vacant land (where available) adjacent to the school has been included in the LAP-Part-1.

According to LAP-Part 2, a total of 87.6306 acres of land needs to be acquired along Tranche-2 of the DEE, which includes 13.6118 acres of privately owned land (located in 20 different Mouzas). Areas to be acquired along Tranche-2 are as follows:

(1)	Private land	: 13.6118 acres
(2)	Bangladesh Railway	: 43.8797 acres
(3)	RHD	: 2.3324 acres
(4)	Housing and Public Works	: 1.2004 acres
(5)	Rajuk	: 2.1622 acres
(6)	Bangladesh Parjatan Corporation	: 0.0035 acre
(7)	Deputy Commissioner	: 10.9181 acres
(8)	Education Deparment	: 1.0733 acres
(9)	Ministry of Defense	: 3.1170 acres
(10)	Dhaka City Development Authority	: 9.3189 acres
(11)	Masjid	: 0.0133 acre
Total land area to be acquired (LAP-Part 2)		: 87.6306 acres

There are different kinds of built structures on both the private lands and lands under different Govt. agencies to be acquired for the project under LAP-Part 2. These include tin-

shed houses, semi-pucca buildings, buildings ranging from single storied to seven storied, Masjids, Madrassas, School, and under construction market. For rehabilitation of Masjids/ Madrassas/ School, small pieces of vacant lands (where available) adjacent to these establishments have been included in the LAP-Part-2 for acquisition.

According to LAP-Part-3, a total of 61.2863 acres of land needs to be acquired along Tranche-3 of the DEE, which includes 5.7306 acres of privately owned land (located in 21 Mouzas). Areas to be acquired along Tranche-3 are as follows:

(1)	Private land	: 5.7306 acres
(2)	Bangladesh Railway	: 33.6137 acres
(3)	RHD	: 14.1318 acres
(4)	Housing and Pubic Works	: 1.4955 acres
(5)	Rajuk	: 0.0210 acre
(6)	Bangladesh Power Development Board (BPDB)	: 0.1797 acre
(7)	Deputy Commissioner	: 1.0092 acres
(8)	Education Department	: 0.0695 acre
(9)	Bangladesh Police	: 0.0551 acre
(10)	Dhaka City Development Authority	: 4.9802 acres
Total land area to be acquired (LAP-Part 3)		: 61.2863 acres

There are different kinds of built structures on both the private lands and lands under different Govt. agencies to be acquired for the project under LAP-Part 3. These include tin-shed houses, semi-pucca buildings, buildings ranging from single storied to seven storied, Madrassa, and under construction market.

The socio-economic impacts related to land acquisition would be significant and could be categorized as: (i) loss of land and property; (ii) permanent dislocation/ displacement; (iii) loss of income.

Loss of Land and Property:

Although land acquisition requirement has been reduced significantly by revising the alignment, implementation of the Dhaka Elevated Expressway Project (DEEP) still requires substantial land acquisition (see Fig. 4.1); a total of 27.6432 acres of private land needs to be acquired for the proposed project. Hence, a resettlement plan for the Project Affected Persons (PAPs) is needed. Land acquisition in the densely populated Dhaka city with high concentration of permanent structures is a challenging issue. The most significant socio-economic impact of the proposed project is the loss of land and property located within the heart of Dhaka city, where land is scarce and land price is ever increasing. In order to address this challenging issue in a manner and that is transparent and acceptable to all, the Government also decided, in October 2013, to follow the guidelines contained in the Environmental and Social Management Framework (ESMF) for "Investment Promotion and Financing Facility (IPFF)", prepared by the Bangladesh Bank (Bangladesh Bank, 2011).

Permanent Dislocation/ displacement:

During baseline survey it was revealed that there are slums at many locations along the railway track from Airport to Kamalapur. Figure 4.2 shows the areas along the alignment of

the railway track/ Expressway with significant slum population. As shown in Fig. 4.2, there is significant slum population along railway track at Mohakhali, Tejgaon, Karwan Bazar, and Moghbazar-Malibagh. These slums have been built mainly on Railway-owned land along the railway track. Most of these slum dwellers, living close to the railway tracks, are likely to be displaced permanently during construction of the Expressway. These slum dwellers do not have any right on the land they live; this puts them in a difficult position in terms of getting compensation or space for resettlement, according to existing Govt. rules and regulations. However, in order to minimize social impacts related to such issues, the Government has decided (in October 2013), to follow the guidelines contained in the Environmental and Social Management Framework (ESMF) for "Investment Promotion and Financing Facility (IPFF)", prepared by the Bangladesh Bank (Bangladesh Bank, 2011).

Loss of Income:

Loss of land and permanent displacement would definitely lead to loss of income for the affected people. Loss of income could result from demolition of business establishments (e.g., offices, shops, bazaars), inability to live close to the working places, and so on. As noted above, adequate compensation against loss of income should be provided following the guidelines contained in the Environmental and Social Management Framework (ESMF) for "Investment Promotion. The "resettlement principles and approaches" (BBA-BRTC-BUET, 2014) provides guideline for providing compensation against loss of income.

Figure 4.1: Alignment of the Expressway showing areas where land acquisition will be required

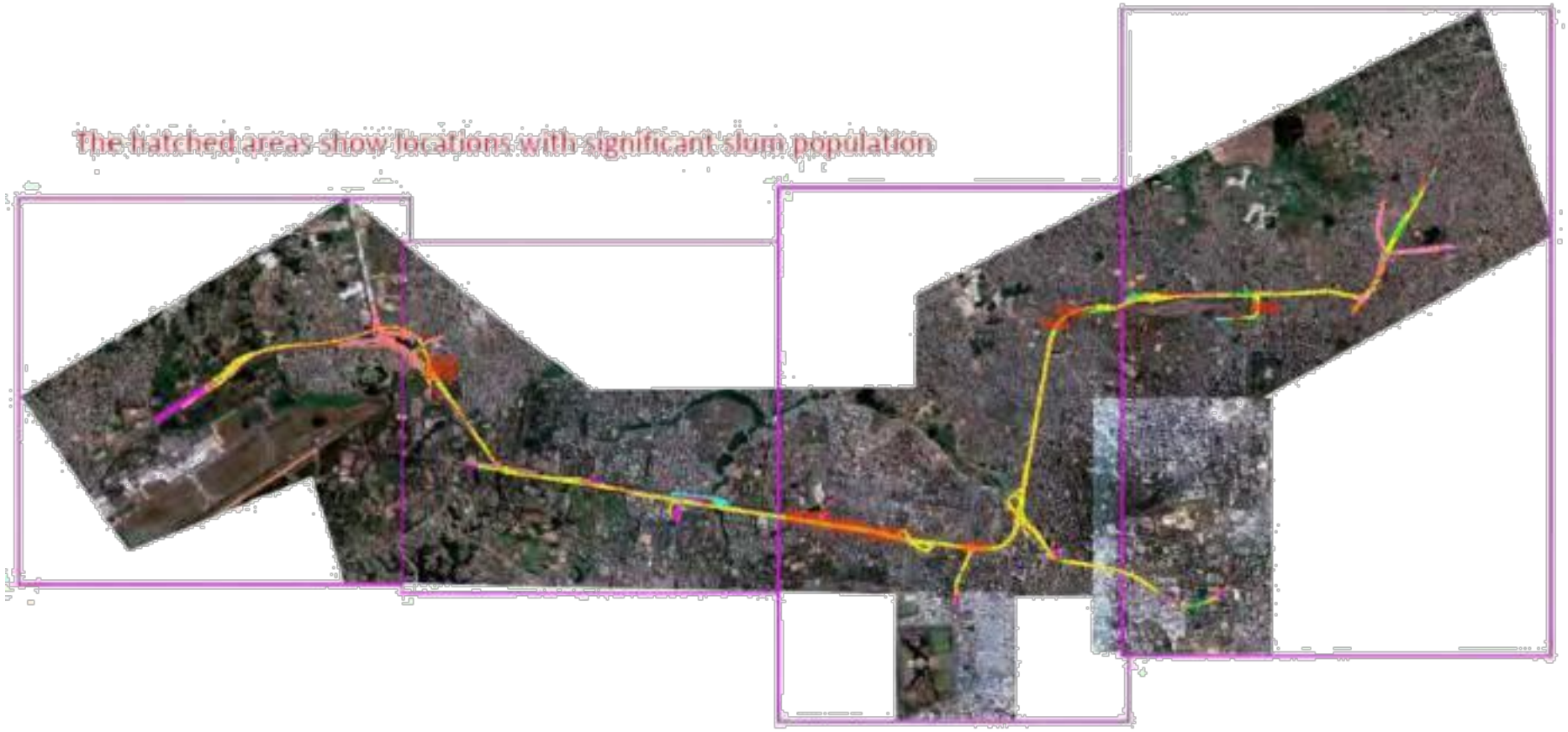


Figure 4.2: Areas along the alignment of the railway track/ Expressway with significant slum population

4.3 ENVIRONMENTAL IMPACTS DURING CONSTRUCTION PHASE

4.3.1 Ecological Impacts

The baseline ecological survey revealed that most of the floral species present along and surrounding the proposed alignment of the Expressway are cultivated or planted. Small number of wildlife species present at the project sites is common and found throughout the country. Some project sites have moderate biological resources that are fully or partially utilized by the associated fauna. As a result, project activities (land acquisition and civil works) are likely to have minor ecological impact. However, a small park (on the western side of Sonargaon Hotel) will be totally lost due construction of DEE infrastructure.

Areas along Tranche-1 of the Expressway have moderate number of planted trees beside the rail line (Kawla to Khilkhat and Banani area) (Fig. 4.3) that have economic and aesthetic values; and these are also fully or partially used by certain type of wildlife species through their ecological niche. In Tranche-2, there is a park a small park (on the western side of Pan Pacific Sonargaon Hotel / near Panthopath area) with varieties of planted floral species (Fig. 4.4) that are also used by urban adaptive fauna for their livelihood. In Tranche-3, notable number of planted trees also exists (Kamalapur Rail Station Area) (Fig. 4.5) that are also used as habitat by certain type of urban habitat adapted faunal species. Moreover, floral species exist in a scattered way throughout the alignment route of DEE. In Tranche -1, fish culture is practiced in some ponds that have few native fish species (Fig. 4.6). These ponds are likely to be filled up during construction phase of the DEE.

Figure 4.3: Trees beside rail line in Tranche -1 of DEE that are likely to be cleared

Figure 4.4: Trees in park on the western side of Sonargaon Hotel; this park will be lost due to the construction of the DEE

Figure 4.5: Trees along rail track in Tranche -3 of DEE that are likely to be cleared

Figure 4.6: Ponds located in Tranche-1 beside the rail track

Cutting of trees for clearing the right of way would be necessary in some sections of proposed elevated expressway. Loss of vegetation for construction is likely to be minor, except for the project stretches mentioned above. However, since the project areas to be affected are relatively small, construction of the proposed elevated Expressway is not likely to affect the overall ecology of the area in any significant manner.

4.3.2 Physicochemical Impacts

Major physicochemical parameters considered for assessment of environmental impacts of project activities include:

- Noise pollution,
- Air pollution,
- Vibration,
- Possible drainage congestion, and
- Generation and disposal of wastes.

4.3.2.1 Noise, Air Pollution and Vibration

Noise and air pollution and vibration are important considerations, particularly where the Expressway alignment runs close to human habitations. Figure 4.7 shows areas susceptible to such pollution. Noise pollution and vibration may result from movement of vehicles carrying materials and equipment to and from the project sites, operation of machines and equipment (e.g., concrete mixing machines, aggregate crushers, generators), and different construction activities (e.g. demolition of existing structures).

Figure 4.7: Alignment of the Expressway showing areas susceptible to air and noise pollution and vibration

Localized and temporary air pollution may generate from earthworks (e.g., excavation, filling) during site preparation, movement of vehicles and demolition activities. However, the air pollution generated from these activities is likely to be localized (affecting immediate surroundings of the project sites). Such construction related air pollution is of particular concern at locations where residences or offices are present at close proximity to the Expressway alignment (see Fig. 4.7).

In the present study, a detailed assessment of noise levels generated from the major equipment to be used during construction phase has been made using a noise model. Existing noise levels have been presented and described in Chapter 3. Results from noise level modeling are presented below.

Noise Model:

To assess the noise generated by different activities, it is essential to identify the equipment to be used at various stages of the work. Appendix D lists the major equipment proposed to be used in the project activities. These equipment will be used for a wide range of activities including transportation of material and equipment, pile driving, preparation of aggregate and mixing of concrete.

A screening model has been used to predict sound levels as a function of distance from the construction operations. The screening modeling is based on sound level reduction over distance only. Given the relatively short distances between the construction operations and receptors (households, offices, etc.) in most cases, this is a reasonable assumption. The noise assessment was made following the New York State Department of Environmental Conservation (NYSDEC) screening-level noise analyses. This methodology uses the principle of hemispherical spreading of sound waves so that every doubling of distance produces a 6 dBA reduction of sound for a point source. Thus, the sound levels were calculated using equation below:

$$L_{eq}(h) = L_{\max} + E.F. + 10\log U.F. - 20\log(D/D_0) \quad (4.1)$$

Where,

$L_{eq}(h)$	A-weighted, equivalent sound level at a receptor resulting from operation of a piece of equipment over a 1-hour time period;
L_{max}	Maximum noise emission level of equipment based on its work cycle at distance *Do*;
E.F.	Equivalency Factor, which accounts for the difference between the maximum and minimum sound levels in the equipment work cycle and the percent of time spent at the maximum level. Table 4.3 (U.S. DOT) reference provides E.F.s based on these differences. For example, an E.F. of 0 applies to a steady-state noise source, while an E.F. of -9 applies to source that is quite variable and is at the maximum sound level for a short time during the work cycle;
U.F.	Usage Factor, which accounts for the percent time that equipment is in use over the time period of interest (1 hour). For example, a U.F. of 1.0 applies for equipment in use over 1 entire hour, while a U.F. of 0.33 applies for equipment in use for 20 minutes per hour;
D	Distance from the equipment to the receptor of interest; and

Do Reference distance at which the L_{max} was measured for the piece of equipment of interest.

Reference sound level data for some of the important sources are shown in Table 4.2. The E.F. values are based on the reported range of the equipment work cycle. The equipment assumed to run continuously for an hour is assigned to have a utilization factor (U.F.) of 1.0. Pile driver is assumed to run for 45 minutes in an hour (U.F. = 0.75). The flat-bed trucks (2 in number) to deliver material and equipment are assumed to run over a period of 45 minutes in an hour. A crane is expected to operate for 40 minutes in an hour with an idling period of 20 minutes (U.F. = 0.67). The cement mixture is expected to run for 30 minutes in an hour (U.F. = 0.5). These input were used, along with the L_{max} values presented in Table 4.3 in the screening-level noise attenuation model (Eq. 4.1).

Table 4.2: Reference sound levels of selected construction equipment

Equipment	Number	Reference Sound Level (dBA)	Distance (m)
Auger Drill Rig	1	84	15
Compactor (ground)	1	83	15
Concrete Mixer Truck	1	79	15
Crane	1	81	15
Dozer	1	82	15
Excavator	1	81	15
Flat Bed Truck	2	79	15
Off – route Truck	5	85	15
Front – end Loader	1	79	15
Vibratory Pile Driver	1	101	15
Impact Pile Driver	1	115	15

Source: http://www.fhwa.dot.gov/environMent/noise/index.htm

Table 4.3: Model input values for selected equipment to be used in Construction

Equipment	No.	Reference Sound Level (dBA)	E.F.	U.F.	D_0(m)
Auger Drill Rig	1	84	-5	0.20	15
Compactor (ground)	1	83	-2	0.20	15
Concrete Mixer Truck	1	79	-2	0.40	15
Crane	1	81	-3	0.75	15
Dozer	1	82	-2	1.00	15
Excavator	1	81	-2	0.40	15
Flat Bed Truck	2	79	-2	1.00	15
Off – route Truck	5	85	-2	1.00	15
Front – end Loader	1	79	-1	0.50	15
Vibratory Pile Driver	1	101	-2	0.50	15
Impact Pile Driver	1	115	-2	0.50	15

Figure 4.8 shows predicted noise level from some of the major sources as a function of distance from the source. Such predictions are being used for assessment of impact of noise during construction phase of the project. Noise may cause mild to severe impact on human

nervous system if exposed to sustained high level noise exposure. The physical and psychological impacts depending on level of exposure may be annoyance, speech interference, sleep deprivation, performance degradation and hearing loss. The Bangladesh Standard for noise level is 75 dBA at daytime and 70 dBA at night (DoE, 1997). Table 4.4 shows the average L_{eq} identified as requisite to protect the public health and welfare with an adequate margin of safety.

Table 4.4: Average L_{eq} identified as requisite to protect public health and welfare with an adequate margin of safety (Source: USEPA, 2001)

		Indoor		Outdoor	
	Measure	Activity Interference	Hearing loss consideration	Activity Interference	Hearing loss consideration
Residential with outside space and farm residences	L_{dn}	45		55	
	$L_{eq(24)}$		70		70
Residential with no outside space	L_{dn}	45			
	$L_{eq(24)}$		70		
Commercial	$L_{eq(24)}$	(a)	70	(a)	70
Inside transportation	$L_{eq(24)}$	(a)	70		
Industrial	$L_{eq(24)(d)}$	(a)	70	(a)	70
Hospitals	L_{dn}	45		55	
	$L_{eq(24)}$		70		70
Educational	$L_{eq(24)}$	45		55	
	$L_{eq(24)(d)}$		70		70
Recreational areas	$L_{eq(24)}$	(a)	70	(a)	70
Farmland and general unpopulated land	$L_{eq(24)}$			(a)	70

(1) Since different types of activities appear to be associated with different levels, identification of a maximum level for activity interference may be difficult except in those circumstances where speech communication is a critical activity. (2)Explanation of identified level of hearing loss: The exposure period that results in hearing loss at the identified level is a period of 40 years.

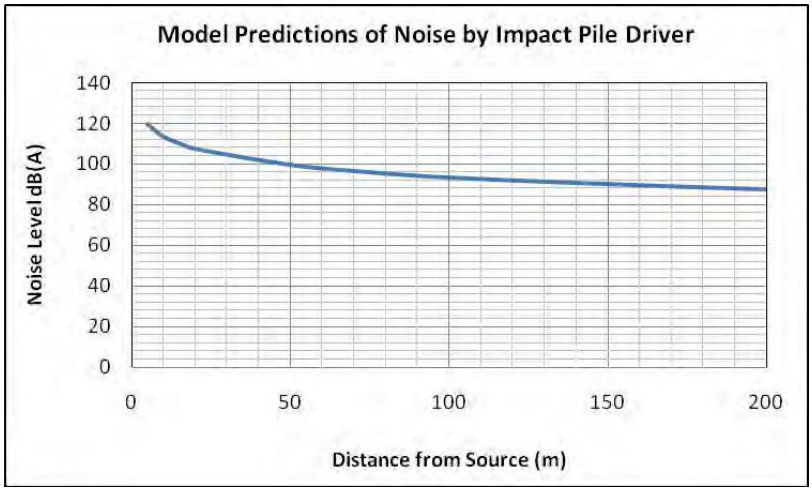


Figure 4.8(a): Level of noise produced by an Impact Pile Driver as a function of distance from the equipment

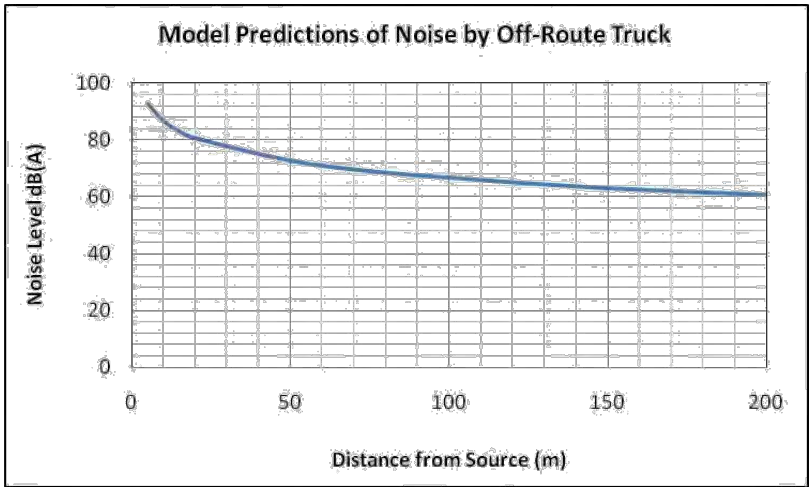


Figure 4.8(b): Level of noise produced by an off-route truck carrying equipment as a function of distance from the vehicle

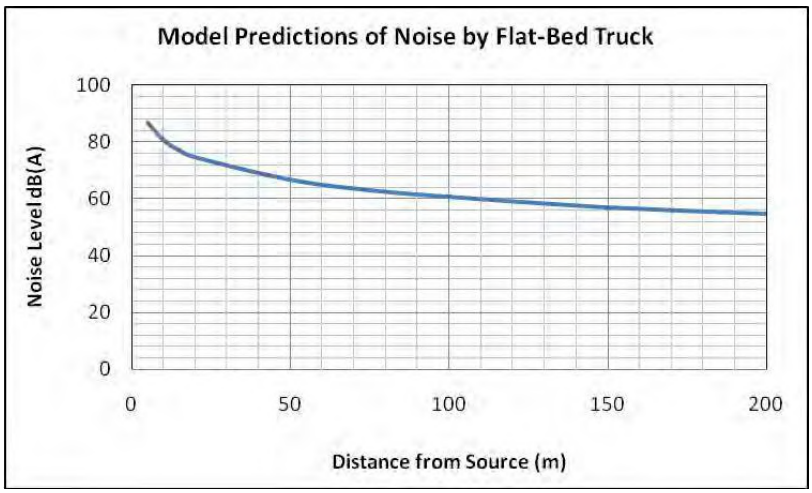


Figure 4.8(c): Level of noise produced by a Flat-bed Truck carrying equpiment as a function of distance from the vehicle

4.3.2.2 Drainage Congestion

Drainage congestion may result from possible obstruction to natural flow of drainage water during construction activities. Such congestion is important at the project sites close to low-lying areas. This could be particularly critical during monsoon when drainage becomes a major concern to all city dwellers. Therefore, care should be taken to avoid drainage congestion at Khilkhet-Kuril area, Hatirjheel (near Karwan Bazar-Moghbazar), Khilgaon, and Kamalapur.

4.3.3.3 Generation and Disposal of Wastes

During construction phase, problems related to sanitation and solid waste may result from improper/inappropriate facilities at the labor sheds. At the peak of construction period, large numbers of workers are likely to be involved in different construction activities. Lack of proper sanitation facilities for project people, including the labor/construction worker and absence of proper solid waste (e.g., food waste, construction debris) facilities may create an unhealthy environment (including water pollution) within and around the project sites.

Demolition of the existing structures will also produce huge quantity of debris, which would have to be properly disposed of.

4.3.3 Socio-economic Impacts

The major parameters considered for assessment of socio-economic impacts of project activities include:

- Loss of income,
- Temporary dislocation/ displacement,
- Traffic congestion,
- Safety, and
- Employment

4.3.3.1 Loss of Income

Loss of income (in addition to those described in Section 4.2.2) could result from inability to perform certain income generating activities during construction operations, e.g., due to closing of markets/ shops/ offices located close to the Expressway alignment due to safety considerations.

4.3.3.2 Temporary Dislocation/ displacement

Apart from permanent displacement of people currently living on lands to be acquired for the project (described in Section 4.2.2), some people living/working close to the Expressway alignment may have to move away temporarily during construction activities due to safety risks or other considerations (e.g., privacy, noise/ air/ vibration pollution).

4.3.3.3 Traffic Congestion

The Expressway alignment passes over a number of major roads, level crossings, flyover/ elevated road and foot overpass. Besides, two Links of the Expressway are to be constructed over very busy roads of the city. There are 31 entry and exit ramps of the Expressway, which connect it with major existing roads of the city. Significant traffic disruption is likely during construction of Expressway over roads/ flyovers/foot overpasses, construction of the two elevated Links along busy roads, and construction of the entry and exit ramps on busy roads. Table 4.5 shows the locations where traffic disruption is likely during construction of the Expressway. Figure 4.9 shows locations susceptible to traffic congestion during construction phase.

Table 4.5: Locations where traffic disruption likely during construction phase

Sl. No.	Location	Expressway Component
1	Airport road near VVIP terminal	Ramp
2	Khilkhet rail crossing	Main Carriageway
3	Kuril Bishwa road	Ramp
4	Baridhara DOHS bypass road	Ramp
5	Banani rail crossing (Kakoli to Kuril/Radison Road)	Main
6	Banani rail crossing	Ramp
7	Navy Head quarter Gate to Kakoli	Ramp
8	Banani Chairman Bari	Ramp
9	Sainik Club (Chairman Bari)	Ramp

Sl. No.	Location	Expressway Component
10	Mohakhali	Ramp
11	Mohakhali (BAF Shaheen College to Mohakhali rail crossing)	Ramp
12	Tejgaon I/A (industrial traffic)	Ramps
13	Tejgaon Over bridge	Main Carriageway
14	Tejgaon Truck Terminal (Loop intersection)	Link 1
15	Bijoy Sarani Intersection	Interchange
16	Tejgaon-Bijoy Sarani Link Road	Ramp
17	Farmgate intersection	Link 1
18	Indira Road	Link 1
19	Farmgate to Tejgaon rail crossing	Link 1
20	Kawranbazar Rail Crossing	Main Carriageway
21	Moghbazar Rail Crossing	Main Carriageway
22	Karwanbazar	Link 2
23	Karwanbazar to Palashi (Sonargaon Road)	Link 2
24	Boro Moghbazar Rail Crossing	Main Carriageway
25	Wireless Gate Moghbazar rail crossing	Main Carriageway
26	Rampura Road rail crossing	Main Carriageway
27	Mailbagh Bazar Rail Crossing	Main Carriageway
28	Khilgaon flyover	Main Carriageway
29	Dhaka-Chittagong Road	Main Carriageway

Temporary traffic congestion during the construction phase may result from increased movement of vehicles carrying materials and equipment to and from the site. Traffic congestion may be aggravated if materials (e.g., construction materials) are stored on the street and equipment /machines/vehicles (e.g., mixing machines) are kept/parked on the street.

4.3.3.4 General Safety

As noted earlier, the Expressway would passes over a number of major roads, level crossings, flyover/ elevated road and foot over-bridge. In addition to regular safety measures, special construction methodology would have to be followed to ensure safety during construction of Expressway over live railway tracks, over and along major busy roads. The major crossings are listed below:

Figure 4.9: Alignment of the Expressway showing areas susceptible to traffic congestion during construction phase

- Airport road near Hazarat Shahajalal International Airport
- Kuril Bishwa Road near Kuril Interchange
- Airport Road at Banani Level Crossing
- Banani DOHS road at DOHS Level Crossing
- Cantonment Road at Cantonment Level Crossing/Overpass
- Banani Road 11 near BBA Building
- Mohakhali Intersection over Mohakhali Flyover/overpass
- Elevated Road connecting Bijoy Sarani and Shahid Tajuddin Ahmed Sarani
- Farmgate Intersection over Farmgate Foot Over-bridge (Link-1)
- Sonargaon Road at Karwan Bazar Rail Crossing (Chainage: 12+600)
- VIP road connecting Sonargain intersection with Banglamotor Intersection (Link-2)
- Tongi Diversion Road at Moghbazar Rail Crossing over Moghbazar-Mouchak Flyover
- Road at Boro Moghbazar Rail Crossing over Moghbazar-Mouchak Flyover
- Road at Wireless Gate Rail Crossing
- Road at Rampura Rail Crossing
- Bishwa Raod at Malibagh Rail Crossing
- Khilgaon Flyover
- Over MMHF (parallel to the flyover)

As noted above (see Table 4.1), the Exit Ramp of the Expressway will merge with the existing Ramp of the Zillur Rahman flyover bound for Mirpur. In order to make this integration, the part of the existing Mirpur-bound Ramp of the President Zillur Rahman flyover needs to be demolished. Special care should be taken to ensure safety of pedestrians, vehicles, and project personnel during this demolition worksAlso for “integration” of the DEE with Rangs flyover (i.e., the elevated road connecting Bijoy Sarani and Shahid Tajuddin Ahmed Sarani), partial demolition of the Rangs flyover would be required. This elevated road is directly above the railway track. Therefore, extreme care should be exercised while carrying out the demolition (as well as construction activities) over active rail line, and necessary safety precautions should be taken in order to avoid any accident.

4.3.3.5 Occupational Health and Safety

Occupational health and safety is an important issue during construction phase. General construction activities pose safety risks, which should be addressed as part of occupational health and safety plan. Chapter 6 presents guideline on occupational health and safety issues.

4.3.3.6 Impact on Archeological and Historical Sites

Archeological and historical sites are protected resources. Damage of such sites by digging, crushing by heavy equipment, uprooting trees, exposing sites to erosion, or by making the sites more accessible to vandals are of particular concern. During field surveys along the DEE alignment, no such sites was identified that could be affected by the sub-project activities. Nevertheless, a guideline for archaeological impact assessment is presented in **Appendix E**.

4.3.3.7 Safeguarding physical cultural resources (PCR)

A guideline for identification of physical cultural resources (PCR) is provided in **Appendix F.** The likely impacts to PCR for typical project activities are also discussed in Appendix F. The "Chance Find" procedure for protection of cultural property is presented in **Appendix G**, following the World Bank Operational Policy OP 4.11 (Physical cultural resources).

4.3.3.8 Employment and Commercial Activities

The construction of the Expressway will generate employment opportunities for both skilled manpower (e.g., engineers) as well as unskilled workforce (i.e., labor). This in turn would induce positive impacts on some other parameters including commercial activities in the project area.

Table 4.6 presents summary of physicochemical and socio-economic impacts during construction phase of the DEE project.

Table 4.6: Summary of physicochemical and socio-economic impacts during pre-construction and construction phase

Project Activities	Important Physicochemical Impacts					
	1					
Labor camp setting and its operation	0	0	-1S	-1S		
Demolition of existing structures	-2S	-1S	0	-1S		
Movement of project vehicles, equipment	-2S	-2S	0	0		
Earthworks, excavation	-1S	-2S	-2S	-1S		
General construction works (e.g., piling, RCC works)	-2S	-1S	-1S	-1S		
	Important Socio-economic Impacts					
Project Activities	2, 3	3		4	Safety 5	
Land acquisition	-3S	-2S	0	0	0	0
General construction works	0	0	-1S	-2S	-2S	+2S

[Note: S = Short-term impact; L= Long-term impact; -3S = High negative impact; -2S = Moderate negative impact; -1S = Low negative impact; +3S = High positive impact; +2S = Moderate positive impact; +1S = Low positive impact]

[1] see Figure 4.7 for areas susceptible to air and noise pollution and vibration

[2] see Figure 4.1 for areas where significant land acquisition will take place

[3] see Figure 4.2 for areas with significant slum population

[4] see Figure 4.9 for areas susceptible to traffic congestion

[5] see Section 4.3.3.4 for locations with safety concerns

4.4 ENVIRONMENTAL IMPACTS DURING OPERATIONAL PHASE

The primary objectives of the Expressway are to increase traffic capacity within and around the city and to reduce traffic times and provide travel comfort and convenience. As noted in Chapter 1, in particular the Expressway will: (a) increase traffic capacity by improving north-south connectivity and linking important commercial and business centers; (b) reduce traffic times and provide travel comfort and convenience; (c) improve connectivity between North (N4) and South (N1) gateways; (d) provide truck access facility even during the daytime to the Dhaka's industrial belt comprising Savar, DEPZ, Dhamsona, Kaliakoir, Gazipur; and (e) establish better level of service (LOS) along the Asian Highway (AH2) corridor and thereby improve regional connectivity. At the same time, the Expressway may induce some undesirable effects, many of which could be minimized with appropriate mitigation measures. As a part of EIA, a detail assessment of "traffic impacts" of the Expressway has been made. Vehicular air pollution, noise pollution and vibration from traffic movement along the Expressway are also important considerations. Shadow and aesthetic issues/considerations are also important. This Section presents an assessment of impacts during operational phase of the Expressway.

4.4.1 Traffic Impacts

In the operational phase, the DEE is expected to bring about tangible reduction in travel time and congestion level in the North-South traffic corridor. The airport bound traffic will enjoy high speed utilizing the proposed DEE corridor, thereby reducing pressure on the at-grade roadway during peak and off-peak hours. Traffic from peripheral satellite cities (e.g. Purbachal) will be able to utilize the proposed DEE corridor to gain access into Dhaka city through on-ramps, and the off-ramps will provide a discharge opportunity in the locality of the Kuril Interchange area. The DEE configuration in the Saink Club and Banani area will present a favorable travel scenario for long distance CBD traffic (e.g. Banani, Gulshan, Mohakhali), providing an opportunity for flushing out of peak hour traffic from at-grade congestion-prone location such as Mohakhali intersection. The proposed DEE configuration accommodates two on-ramps, facilitating access opportunity for traffic approaching from East and West at the BijoySarani-Tejgaon link road in the form of a single trumpet interchange. The proposed on-ramp and off-ramp adjacent to Kamlapur Railway Station together with the engineering measures adopted at the Kamlapur and Outer Circular Road intersections will act as a flush out point for peak hour CBD traffic, reducing pressure on at-grade roadway capacity in the Motijheel area. Apart from these significant positive impacts, the DEE may generate some undesirable impacts, e.g. increase in local congestion at some locations, and long-term increase in traffic volume. Overall, the important traffic impacts of DEE during its operational phase include the following:

1. Congestion abatement in the existing North-South corridor
2. Possible increase in local congestion adjacent to the ramp touch-down points
3. Increase in traffic volume in the long run due to diverted and induced traffic

These traffic impacts are elucidated below:

4.4.1.1 Congestion Abatement in the Existing North-South Corridor

DEE is expected to have a major impact in the existing North-South corridor traffic of Dhaka city. In particular, it is expected to divert a substantial portion of traffic from New Airport Road, Kazi Nazrul Islam Avenue, Shaheed Tazuddin Sarani and S. Captain Mansur Ali Sharani and relieve congestion in these roads. According to the AECOM Traffic study, the total number of traffic diverted from these roads has been approximated to be 22,239 per day in 2014 and expected to increase to more than 235,060 per day by 2050. It may be noted that according to the BUET review, the number of transactions at the selected toll gates are not expected to exceed 100,000 per day due to capacity constraints. In either case, it is expected that there will be tangible reduction in travel time and congestion level in the North-South corridor traffic.

4.4.1.2 Increased Local Congestion in the Ramp Touch-down points

DEE will connect to the existing road network by 15 on-ramps and 16 off-ramps. The proposed configuration will accommodate two elevated links (Elevated Link-1 extending from Tejgaon Crossing to Manik Mia Ave and Elevated Link-2 extending from Moghbazar Rail Crossing to Polashi). The ramps accommodated in the proposed configuration of the DEE are listed in Table 4.7.

Table 4.7: Number of Ramps in proposed configuration of DEE

Reference Area	No. of On-ramp(s)	No. of Off-ramp(s)
HazratShahjalal International Airport, Kurmitola	**1** (Entrace-1)	**1** (Exit-1)
Kuril Interchange	**1** (Entrace-2)	**1** (Exit-2)
MES Colony	-	**2** (Exit-3 and Exit-4)
Army Stadium	**1** (Entrace-3)	**1** (Exit-5)
Sainik Club	**1** (Entrace-4)	**1** (Exit-6)
ShaheedTajuddin Ahmed Ave.	**1** (Entrace-5)	**2** (Exit-7 and Exit-8)
BijoySarani	**2** (Entrace-6 and Entrace-7)	-
Sonargaon Intersection	**1** (Entrace-8)	**2** (Exit-9 and Exit-10)
Kamlapur Railway Station	**2** (Entrace-9 and Entrace-10)	**2** (Exit-11 and Exit-12)
ShonirAkhra	**1** (Entrace-11)	**1** (Exit-13)
Elevated Link 1 (Indira Road)	-	**1** (Link Exit-1)
Elevated Link 2 (Polashi Intersection)	**1** (Link Entrace-1)	**1** (Link Exit-2)

The capacity of the on-ramps and off-ramps are generally less than that of expressways due to the grade and turning radius (900 PCU/lane/hr in ramps as opposed to 2000 PCU/lane/hr in urban expressways).

Generally the toll plaza areas of the DEE are composed of toll canopy with toll booths, toll surveillance building and weigh station. Weigh station are provided at the entrance of the expressway to identify overloaded vehicles. The general location of toll plaza area is on entrance ramps, conforming to the requirement of open toll collection system. The capacity loss is more in tolled facilities where queue build-ups are typical due to speed reductions and/or manual toll collection operations. The proposed DEE will incorporate eight toll plazas along on-ramp (entrance) approaches, of which four toll plazas will be elevated (see Table 4.8). Physically elevated toll plazas have been accommodated in order to reduce the effect on railway operations.

Table 4.8: Toll plazas along the DEE corridor

Reference Area	Number of toll Plazas	Number of toll booth	Location
HazratShahjalal International Airport	**1**	**6**	**Elevated**
Kuril Interchange	**1**	**6**	**At grade**
Army Stadium	**1**	**5**	**At grade**
Bangladesh Bridge Authority Office	**1**	**4**	**At grade**
Shaheed Tajuddin Ahmed Ave.	**1**	**4**	**At grade**
Bijoy Sarani	**1**	**4**	**Elevated**
Hatirjheel	**1**	**6**	**Elevated**
Kamlapur Railway Station	**1**	**8**	**Elevated**

The ramp touch-down points, particularly those around the on-ramps are likely to be subjected to queue spillbacks. Such queue spillbacks as well as increased traffic volume are likely to increase local congestion. In order to assess possible extent of local congestion in the touch-down points, the critical points of the DEE have been analyzed and described below alphabetically to generate an overview of traffic impacts along the DEE alignment.

A. Hazrat Shah Jalal International Airport, Kurmitola

The proposed configuration of DEE consists of one origination (Entrance-1) and one terminal (Exit-1) ramps adjacent to the Airport area. The construction of the DEE will commence from the location adjacent to Kawla Level Crossing (Figure 4.10). The proposed alignment of the DEE will have both positive and negative impact at the concerned location. The airport bound traffic will enjoy high speed utilizing the proposed DEE corridor, reducing pressure on the at-grade roadway during peak and off-peak hours.

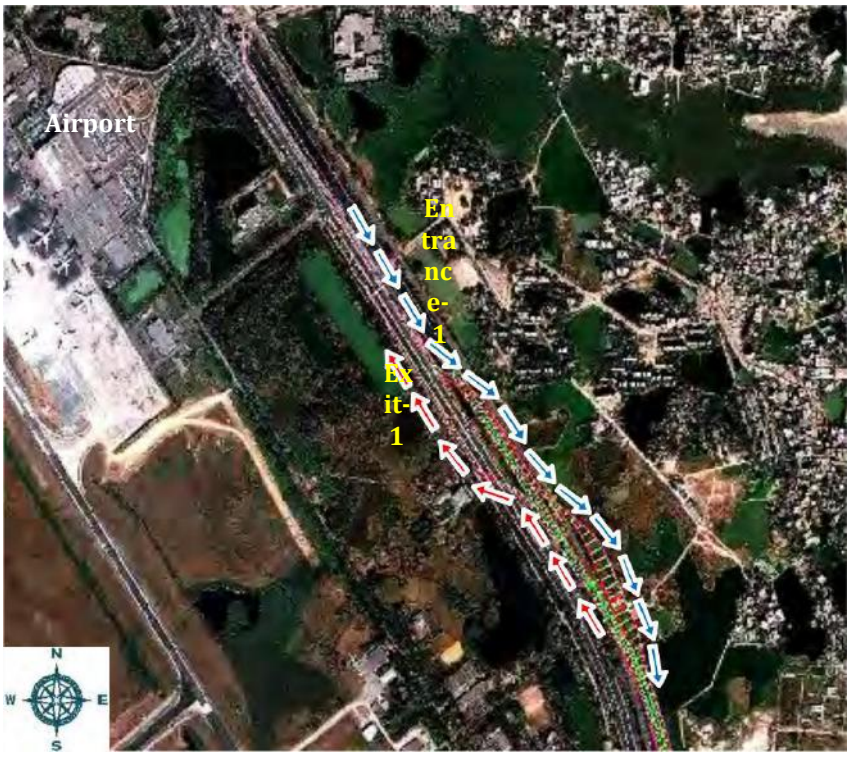


Figure 4.10: Ramp Location at Airport Area

The at-grade congestion in the concerned area primarily occurs in early morning and late evening period when the intercity bus and truck traffic enter the city through this northern gateway. Moreover, the heavily loaded truck traffic (which are banned from entering the city during the peak hours) moving at relatively slower pace than passenger cars, if permitted to utilize the DEE corridor all throughout the day, may engender speed differential promoting safety issue and capacity reduction of the DEE concurrently. Therefore, time regulation will have to be imposed on truck traffic utilizing the DEE corridor. Furthermore, there is a plan to integrate DEE with the Airport terminal. If implemented, the prevalent congestion scenario at the adjacent roundabout will be reduced progressively.

B. Kuril Interchange Area

The proposed configuration of DEE in this area incorporates one on-ramp (Entrance-2) and one off-ramp (Exit-2). The on-ramp (Entrance-2) will commence from the Pragati Sarani (Figure 4.12) and the off-ramp (Exit-3) will merge at the side of New Airport road (Figure 4.12). The integration of the proposed DEE with the Kuril Interchange [Figure 4.11 (a)] during construction and operation will be a major challenge.

It may be noted that the Pragati Sharani is associated with a number of burgeoning residential areas (e.g. Bashundhara Residential Area) which has the potential to generate significant traffic. Furthermore, the presence of several shopping complexes (e.g. Jamuna Future Park), educational institutions (e.g. North South University, IUB) and hospitals in the Bashundhara area attracts traffic through this location. Consequently, the traffic in Pragati Sarani is already experiencing congestion owing to capacity constraints. Integration of DEE will attract more traffic adjacent to Kuril Interchange approaches, which may engender congestion situation in the future, particularly when Purbachal city will be developed.

(a) Kuril Interchange

(b) Road to Kuril Flyover Approach

(c) Kuril Interchange area

(d) A view of Kuril Interchange

Figure 4.11: Existing traffic Condition at Kuril Interchange Area

Figure 4.12: Ramp Location at Kuril Interchange Area

C. MES Colony and Army Stadium

The proposed configuration of DEE incorporates one on-ramp (Entrance-3) and three off-ramps (Exit-3, Exit-4 and Exit-5) in this area (Figure 4.13). The on-ramp will commence from adjacent to the New Airport Road and one of the off-ramp (Exit-4) will merge adjacent to the Army Stadium, while the other (Exit-4) will connect to President Zillur Rahman Flyover cum Trumpet Interchange.

Although, the present level of congestion are moderate to high in this stretch of Airport Road that will accommodate the proposed off-ramp (Exit-4) and on-ramp (Entrance-3), the population density in the areas along New Airport Road is increasing rapidly. As a result, the capacity of the adjacent roads may become exhausted over time, giving rise to traffic congestion.

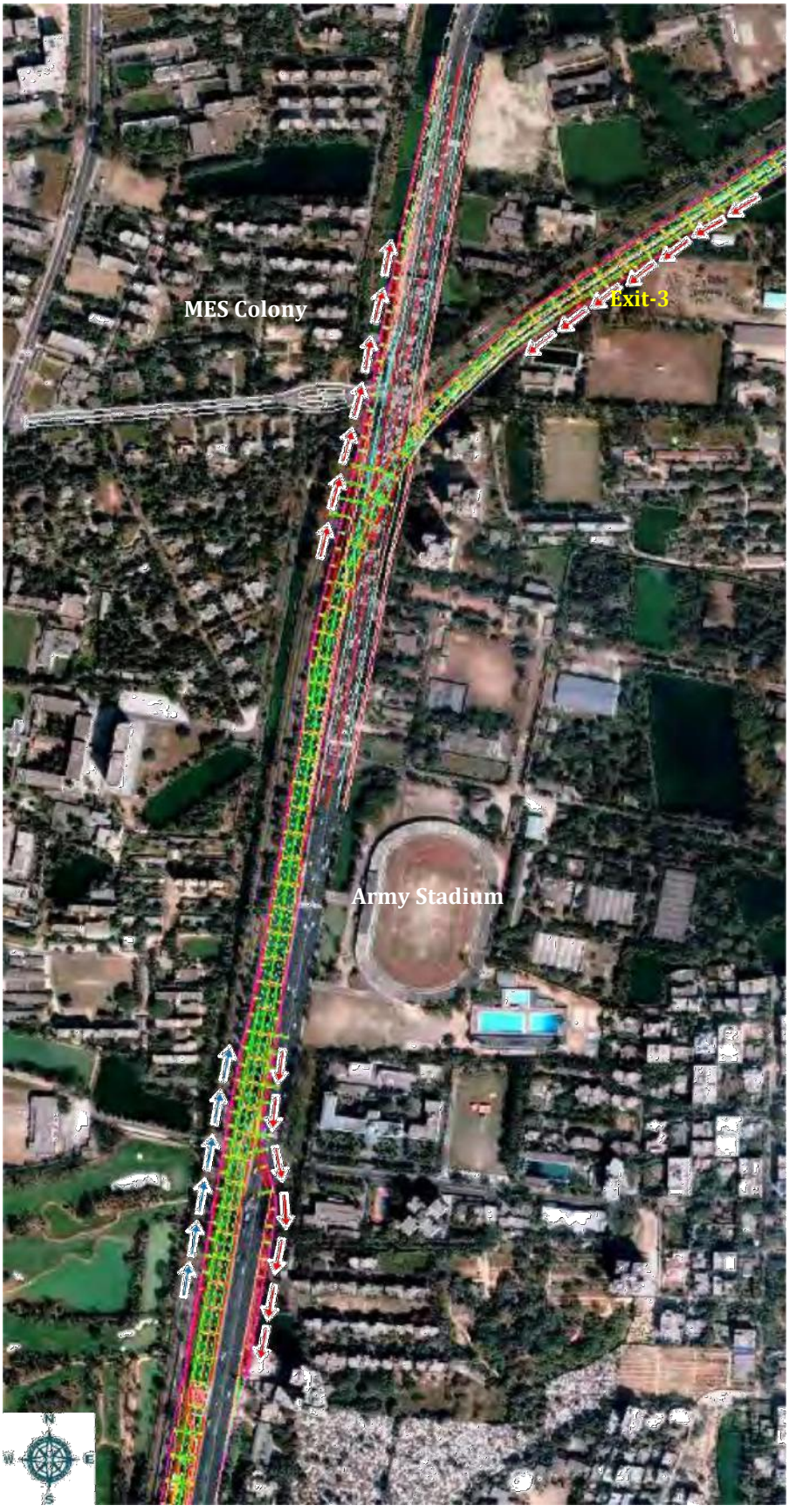


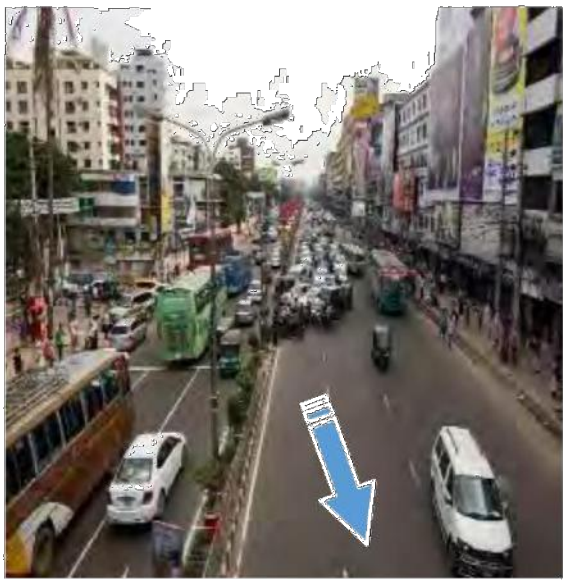
Figure 4.13: Ramp Location at MES Colony and Army Stadium

D. Shainik Club and Banani Area

The proposed DEE configuration has one on-ramp (Entrance-4)for the southbound traffic and one off-ramp (Exit-6)for the northbound and eastbound (Banani Gulshan, Mohakhali) traffic in the concerned location (Figure 4.14). The on-ramp will commence from the side of Airport Road adjacent to BBA (Bangladesh Bridge Authority) office and the off-ramp (Exit-6) will terminate on the side of Shadhinata Sharani adjacent to the Shainik Club area.

Figure 4.14: Ramp Locations at Shainik Club and Banani Area

At present, the traffic flow in Shadhinata Sharani is moderate and the connecting road between Shadhinata Sarani and Airport Road Road experiences moderate at-grade congestion. There is an at-grade level crossing at Shadhinata Sharani before it connects to Airport Road. Distance between level crossing and Airport Road is approximately 50 meters. Presence of a level crossing along the route of the merging traffic from DEE will stimulate congestion by queue spillback on the descending ramp (Exit-6). There is a T-junction at Banani-11 [Figure 4.15 (d)], prior to the commencement point of on-ramp (Entrance-4), which has the potential of generating traffic congestion.



(a) Dhaka-Mymensingh Highway

(b) Shadhinata Sharani to Sainik Club Approach

(c) Sainik Club Intersection

(d) Sainik Club to Banani – 11 Approach

Figure 4.15: Existing Traffic Condition in Sainik Club and Banani Area

The DEE corridor in the concerned location will provide a favorable travel scenario for long distance CBD traffic (e.g. Banani, Gulshan, Mohakhali),providing an opportunity for flushing out of peak hour traffic from at-grade congestion prone location such as Mohakhali intersection. However, the proposed DEE on-ramp (Entrance-4) and the proposed U-Loop in the vicinity of the at-grade roadway will attract more traffic at this location due to land use pattern (commercial and residential), resulting in high concentration of at-grade traffic. Furthermore, another proposed project entitled as Bus Rapid Transit (BRT)-3 project will

utilize this roadway, reducing the at-grade roadway capacity. At peak hour the off-ramp (Exit-6) may have to accommodate more traffic than any other time of the day causing a probable congestion scenario, in addition to the effect of level crossing described above. Disparate traffic circulation plan for at-grade and DEE traffic can be a possible solution to minimize the traffic congestion at this location.

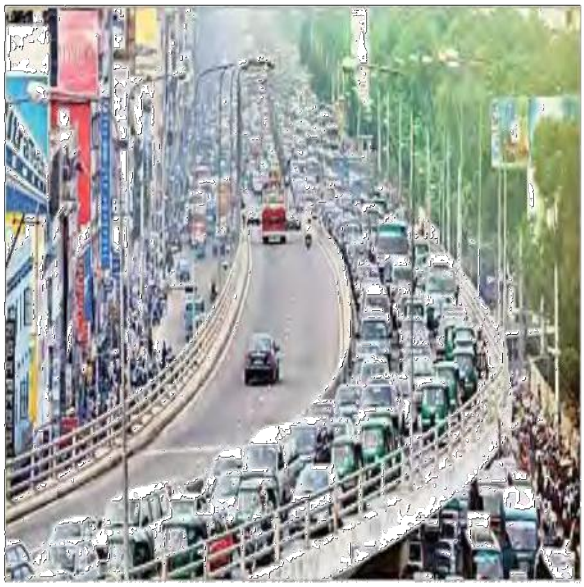
E. Mohakhali Area

At this location, the DEE has one on-ramp (Entrance-5) for the northbound traffic and two off-ramps (Exit-7 and Exit-8) for southbound and northbound traffic, respectively, in the concerned location (Figure 4.16).

Figure 4.16: Ramp Locations at Mohakhali Area

The traffic activity in Mohakhali area is influenced by the Mohakhali bus terminal, Mohakhali Kitchen Market (under-construction), ICDDRB and other approaches generating trips for commercial activities and other purposes.

(a) Mohakhali Bus Terminal



(b) Mohakhali Flyover

(c) Shaheed Tajuddin Ahmed Avenue

(d) Mohakhali to Kakoli Approach

Figure 4.17: Existing Traffic Condition in Mohakhali Area

The off-ramp (Exit-7 and Exit-8) traffic will merge with the at-grade traffic at Shaheed Tajuddin Ahmed Avenue where congestion is prevalent, primarily due to the side friction induced by on-street parking, boarding-alighting activities of public bus, pedestrian movements. The presence of Mohakhali Bus Terminal and kitchen market at the mouth of the exit points will cause difficulty for merging traffic from DEE, which will promote congestion by possible queue spillbacks on the descending ramps (Exit-7 and Exit-8).

Traffic from under construction Moghbazar-Tejgaon flyover and deduction of right of way due to Piers of grade-separated BRT-3 would further aggravate the existing level of service.

Furthermore, existing congestion adjacent to Mohakhali intersection [Figure 4.17 (c)] and the DEE induced traffic for the off-ramp approaches will stimulate more at-grade congestion at Shaheed Tajuddin Ahmed Avenue. In order to increase the roadway capacity to handle at-grade and additional traffic induced by DEE, capacity augmentation incorporating exclusive merging lanes and adequate channelization may be adopted.

F. Bijoy Sharani and Tejgaon Area

The proposed DEE layout configuration has two on-ramps (Entrance-6 and Entrance-7), facilitating access opportunity for traffic approaching from East and West at the Bijoy Sarani-Tejgaon link road in the form of a single trumpet interchange (Fig. 4.18). The existing overpass incorporates two lanes for each direction of traffic. The proposed on-ramps of DEE will merge at two sides of the existing overpass, inducing high concentration of traffic at both directions. Moreover, the DEE induced traffic together with at-grade traffic will utilize the Bijoy Sarani intersection and Tejgaon intersection to approach the on-ramps at the overpass from both directions.

Figure 4.18: Ramp Locations at Bijoy Sarani and Tejgaon Area

The existing congestion scenario at Bijoy Sarani intersection is more serious than Tejgaon Intersection owing to existing land use pattern, public transport route, Government establishments (e.g. Prime Minister's office, DTCB office), community centers (e.g. BAF Falcon Hall) and Army residential area (cantonment), attracting traffic through Bijoy Sarani Intersection presence of right turning movements particularly from PMO and Bijoy Sarani approaches. The DEE induced traffic has the potential to deteriorate the existing congestion scenario even more in these two intersections.

G. Sonargaon Intersection and Hatirjheel area

The DEE configuration accommodates one on-ramp (Entrance-8) adjacent to Sonargaon intersection at Panthakunja park area and two off-ramps (Exit-9 and Exit-10) at two sides of Hatirjheel project (Figure 4.19). One of the on-ramp approaches will commence from Bangla Motor to Farmgate approach adjacent to Sonargaon intersection and the other will commence from the vicinity of Sonargaon intersection at the Sonargaon road. The two off-ramps will commence from two sides of the level crossing at Hatirjheel, one of which (Exit-9) merges with the at-grade East-bound traffic towards Shaheed Tajuddin Ahmed Avenue and the other (Exit-10) merges with at-grade West-bound traffic toward Sonargaon Intersection.

Figure 4.19: Ramp Locations at Sonargaon Intersection and Hatirjheel Area

There are many establishments in this area that attract significant traffic, such as shopping malls (e.g. Basundhara City Shopping Complex), Hospitals (e.g. MH Shomorita Medical College, Square Hospital) and community centers along the Panthapath road. As a result, massive at-grade traffic approaching towards the Sonargaon intersection is generated both in weekdays as well as weekend. Particularly, presence of an at-grade level crossing on the eastern approach of the Sonargaon Intersection [Figure 4.20 (d)] affects the at-grade traffic condition significantly. Traffic from the Maghbazar-Tejgaon Flyover will further overload the FDC to Sonargaon approach. Deduction of r.o.w due to construction of Govt. committed MRT-6 will also cause capacity constraint at the busy N-S approaches of Sonargaon Intersection.

Information available from the BRTA, it is evident that Sonargaon intersection is of paramount importance for public transport, as approximately 34 percent of the registered public transport of Dhaka city utilizes this intersection. As a result, public transportation system may experience some detrimental effects due to potential congestion as DEE becomes operational at this location. Moreover, the relatively higher speed DEE traffic may pose some safety risks immediately after merging with relatively low speed at-grade traffic. Whereas, the diverging traffic (from at-grade to DEE) from Bangla Motor Approach to on-

ramp will experience difficulties owing to congestion [Figure 4.20 (c)] resulting from substantial volume and non-lane behavior of the local heterogeneous at-grade traffic.

(a) Sonargaon Intersection

(b) Panthpath to Sonargaon

(c) Banglamotor to Sonargaon

(d) Hatirjheel to Sonargaon

Figure 4.20: Existing Traffic Condition at Sonargaon Intersection and Hatirjheel Area

H. Kamlapur Area

The proposed alignment of DEE has an on-ramp (Entrance-9) for northbound and an off-ramp (Exit-11) for southbound traffic (Figure 4.21) at Outer Circular Road [Figure 4.23(b)] adjacent to the Kamlapur Railway Station. The descending and ascending ramps of DEE will merge at the outer circular road reducing its at-grade capacity substantially. The existing roadway capacity should be augmented adopting lane widening, channelization and flaring measures.

On a typical weekday, traffic in this area experiences moderate congestion, which is aggravated by roadside parking of non-motorized vehicles and boarding-alighting activities of public buses adjacent to Kamalapur Railway Station [Figure 4.23 (a)] and BRTC bus stand. It is expected that a significant number of attracted CBD (Motijheel) traffic will utilize the Outer-Circular Road and Kamalapur intersection, exhausting the capacity during peak hour. Therefore, adequate measures to augment the capacity of the intersection should be taken including exclusive on-ramp and off-ramp approaches, channelization and lane widening at the intersection. The proposed on-ramp and off-ramp adjacent to Kamalapur Railway Station together with the engineering measures at the intersection mentioned above, will act as a flush out point for peak hour CBD traffic; reducing pressure on at-grade roadway capacity in the Motijheel area.

It should be noted that close proximity to the railway station and bus stand results in significant pedestrian volumes. And high concentration of induced traffic from DEE together with high speed differential (due to heterogeneous traffic) may raise safety concerns of non-motorized traffic at the ramp touchdown at this location.

The proposed configuration of DEE has one on-ramp (Entrance-10) for north bound and one off-ramp (Exit- 12) for southbound traffic at Atish Dipankar Road (Figure 4.22) adjacent to Dhaka Inland Container Depot (ICD).The ICD, located in this area covers a substantial land mass and discussions are currently underway to relocate it to Dhamsona in near future. Any future development in this area should be complementary to the DEE configuration.

Figure 4.21: Ramp Locations at Kamalapur Railway Station

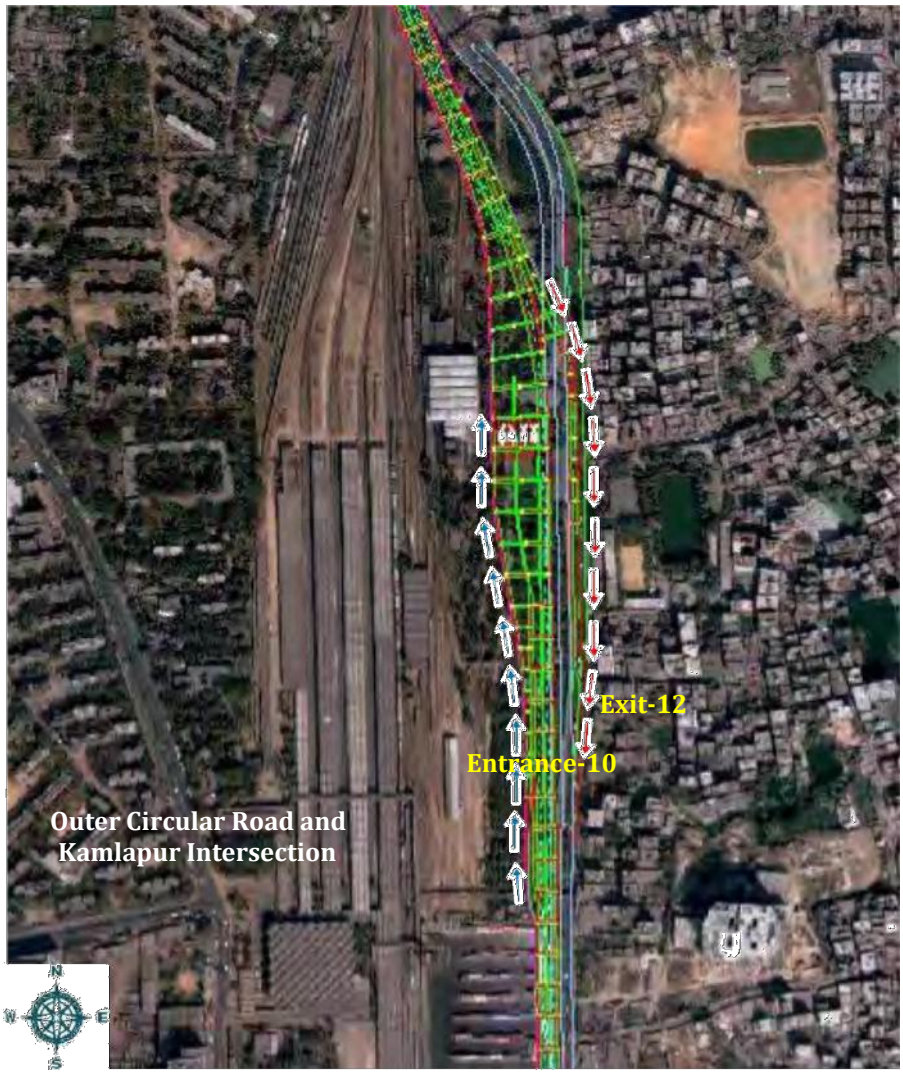


Figure 4.22: Ramp Locations at Atish Dipankar Road

Figure 4.23: Existing Traffic Condition in Kamlapur area

I. Shonir Akhra Area

The proposed configuration of DEE has an origination (Entrance-11) and termination (Exit-13) point at the east (Shonir Akhra) adjacent to Mayor Mohammad Hanif flyover (MMHF). The foundation and touch-down point of Mayor Mohammad Hanif flyover has already constricted the operational capacity of the Dhaka-Chittagong highway [Figure 4.25(a)] (one lane is available for at-grade traffic at the ramp touchdown point). As a result, significant congestion is prevalent for the at-grade traffic, especially for public transports.

Figure 4.24: Ramp Location at Shonir Akhra

Construction of DEE ramps in such a location will further stimulate potential congestion scenarios between DEE traffic (at-grade traffic diverging to DEE and DEE traffic merging with at-grade traffic) and MMHF traffic, further deteriorating the prevailing situation. Moreover, high volume of induced traffic together with high speed differential will pose some safety concerns for at-grade public transport in the proximity of touch down point (Rear-end collision due to diverging movement among DEE and MMHF traffic). It should be noted that the congestion is aggravated by roadside parking and boarding-alighting activities at the flyover touchdown point [Figure 4.25 (d)]. In order to address this situation, there should be provision of proper land-use restrictions, adequate pedestrian facilities, safety barrier, sufficient off-street parking and public transport terminal facilities as well as enforcement measures.

(a) Mayor Mohammad Hanif Flyover Approach from N1

(b) Pedestrian movement near to on-ramp of Mayor Mohammad Hanif Flyover

(c) Roadside parking near to on-ramp of Mohammad Hanif Flyover

(d) Boarding-alighting activities near to Mayor Mohammad Hanif Flyover

Figure 4.25: Existing Traffic Condition near to Mayor Mohammad Hanif Flyover and on Dhaka-Chittagong Highway

J. Manik Mia Avenue and Zahir Raihan road

The proposed configuration of DEE has two elevated links terminating adjacent to Manik Mia Avenue and Polashi Intersection. The proposed elevated link-1 will have a termination point located on the eastern side of the Manik Mia Avenue at Sher-e-Bangla Nogor Park beside Indira road (Figure 4.26). This link (Elevated link-1) will supplement off-ramp (Link Exit-1) provision to both northbound and southbound traffic at this location. The descending DEE traffic will eventually merge with at-grade traffic of Indira road.

Figure 4.26: Ramp Location of Elevated Link-1

Roadside parking, heterogeneous traffic [Figure 4.27 (c)] and boarding-alighting activities of public transport (i.e. tempo, bus) increase congestion at this road where traffic circulation is one way. At peak hour, the DEE traffic will experience congestion situation immediately after merging with at-grade traffic. In the operational phase, the Elevated Link -1 (Figure 4.26) will be utilized as a down link for the traffic of Mirpur, Dhanmondi and Mohammadpur areas, attracting numerous trips owing to residential settlement, educational institutions, hospitals and shopping malls in these areas. As a consequence, high volume of traffic destined to these areas will be attracted towards DEE (Elevated Link – 1) for merging with at-grade traffic towards Manik Mia Avenue. Manik Mia Avenue is a high capacity road with 6 lanes in each direction of travel. The merging traffic arriving from DEE will enjoy this capacity whereas the diverging traffic (at-grade traffic willing to utilize the DEE) will have no provision of Elevated Uplink adjacent to Manik Mia Avenue. This at-grade traffic will have to utilize on-ramps located adjacent to Sonargaon intersection and Tejgaon overpass. Overcrowding situation adjacent to these on-ramp approaches will further stimulate at-grade congestion scenario in this locations.

Before crossing Airport road, the Link-1 will use very tight r.o.w of Farm Gate-Tejturi Bazar link road, resulting significant reduction of accessibility problem of this important short-cut road. Occupation of DEE piers would make the road almost non-functional.

(a) Farmgate to Parliament House Approach

(b) Indira Road

(c) Mid-block of Indira Road

(d) Indira Road to Farmgate Intersection

Figure 4.27: Existing Traffic Condition Adjacent to Indira Road

The proposed Elevated link-2 (Figure 4.28) of the DEE has a commencing (Link Entrance-1) point at Moghbazar continuing behind the Hotel Sonargaon to Sonargaon Road and terminating (Link Exit-2) point at Zahir Raihan Sharani adjacent to Polashi Intersection. Reduction of r.o.w due to presence of piers along the Sonargaon to Nilkhet narrow road segment would cause capacity constraint for at-grade road users. Polashi Intersection is a confluence point of 5 approaches. The approach legs consist of Zahir Raihan Road to Polashi approach, Azimpur to Polashi approach, Shadinota Chottor to Polashi approach, Dhakeshori Road to Polashi approach and BUET to Polashi Approach. Integration of complex junction operation along with a multi-storied market and Kitchen market at the very junction corner create congestion situation.

Figure 4.28: Ramp Location of Elevated Link-2

Integration of high volume of DEE traffic with non-motorized and heterogeneous local traffic would create more at-grade congestion scenarios at this location. Moreover, Polashi intersection is the hub of regular activities of students of Dhaka University, BUET and Dhaka Medical College. The at-grade traffic diverging to DEE will be motivated to move through the University area. Traffic to and from old part of Dhaka city, Azimpur and Newmarket area would make the junction operation more complicated and unmanageable. As the touchdown point is set very near to the junction without keeping transitional length, this essentially implies that it would act as a serious bottleneck due to huge capacity drop. Moreover, the higher speed of DEE traffic merging with at-grade traffic may raise safety concerns. It should also be noted that the touch-down point of the Mayor Mohammad Hanif flyover is located adjacent to Bakshibazar, which is approximately 700 meters from Polashi Intersection. As a result, the traffic operation of the flyover will superimpose with the traffic operation of the proposed DEE, engendering a negative scenario which will aggravate existing local at-grade congestion.

4.4.1.3 Long-term increase in traffic volume

DEE is expected to provide significantly better Level of Service (LOS) to vehicular traffic, private cars in particular, compared to other transportation options. In the long-run this may attract more people to shift from public transport to private car and may eventually lead to higher car ownership. The total traffic plying through the corridor may therefore

increase due to the trips diverted from other transportation options. This will also eliminate the possibility of implementing any mass transit oriented priority measure (viz. dedicated bus priority lane) along this segment of DEE alignment. On the other hand, the increased LOS will also lead to induced traffic (e.g. new trips which would not have occurred without the improved LOS). This may also lead to increase in total number of trips through the corridor.

It is of paramount importance to improve the junction operation of the road network which will ultimately dictate the overall capacity of the network. Without this pertinent improvement, the objective for adopting DEE would remain unfulfilled.

4.4.2 Air and Noise Pollution and Vibration

Similar to construction phase, noise and air pollution and vibration are important considerations in areas where the Expressway alignment runs close to human habitations. Figure 4.7 shows areas susceptible to such pollution. Noise pollution and vibration during the operational phase will result from movement of vehicles along the Expressway; blowing of horns would also generate noise pollution.

Vehicular air pollution affecting human habitations close to the Expressway alignment is also likely. It should be noted, however, that air quality on a city scale is not likely to aggravate as a result of commissioning of the Expressway. In fact, it may contribute in reducing air pollution to some extent by reducing traffic congestion and engine idle time.

4.4.3 Shadow and Air Circulation

At a number of areas, the DEE will create shadow and air circulation problems underneath. This will be particularly important for Elevated Link-1 and Link-2, which run directly over busy roads (covering entire/significant width of these roads), with high-rise structures along them. Hatirjheel area behind Sonargaon Hotel will also experience shadow problems due to the DEE.

Chapter 5

Public Consultations

5.1 INTRODUCTION

A baseline study was carried out to understand the current situation of people living in and around the proposed project sites and to get feedback from them regarding different aspects of the proposed project. The specific objectives of the study were:

- to understand people's socio-economic condition
- to understand extent of people's access to current basic services
- to understand people's perception regarding possible impacts of proposed project, and
- to get feedback from people regarding mitigation measures.

Five focus group discussions (FGDs) and several formal and informal meetings have also been carried out as a part of the EIA. This Chapter presents the major findings from the FGDs and meetings.

5.2 METHODOLOGY

Considering the diverse socio-economic characteristics, the proposed expressway (from Hazrat Shahjalal International Airport to Kutubkhali) has been divided into five sections for carrying out public consultation. These five sections were: (a) Section 1: Hazrat Shahjalal Internatinal Airport to Kuril intersection; (b) Section 2: Kuril intersection to Mohakhali flyover; (c) Section 3: Mohakhali flyover to Moghbazar rail crossing; (d) Section 4: Moghbazar rail crossing to Kamlapur railway station; and (e) Section 5: Kamlapur railway station to Kutubkhali. A total of five FGDs were conducted during January 2011, one in each Section. Table 5.1 shows the details of the FGDs; a total of 136 people participated in the FGDs. A wide range of stakeholders (e.g., daily laborer, businessmen, house/land owners, doctors, teachers, Parliament Member) were invited to participate in the FGDs. Members of the EIA team, lead by a socio-economist, and representatives from Bangladesh Bridge Authority (BBA) participated in the FGDs. **Appendix H** shows the list of individuals who were invited and those who participated in the FGDs. In addition, several formal and informal discussions were carried out; about 50 people participated in other meetings/ interviews.

Table 5.1: Locations and other details of FGDs

FGD #	Project Section	Venue	Date and Time	No. of People Invited	No. of People Attended
1	Section 1: Hazrat Shahjalal Internatinal Airport to Kuril intersection	Kurmitola High School (Auditorium), Khilkhet	28/01/2011 10 am – 12 pm	27	21
2	Section 2: Kuril intersection to Mohakhali flyover	DGHS Auditorium, Mohakhali	28/01/2011 3.30 – 5.30 pm	34	36
3	Section 3: Mohakhali flyover to Moghbazar rail crossing	Tejgaon College (Teachers Room), Farm Gate	29/01/2011 9.00 –10.30 am	20	31
4	Section 4: Moghbazar rail crossing to Kamlapur railway station	Kamlapur High School (Auditorium), Kamalapur	29/01/2011 11.30am–1.00 pm	40	31
5	Section 5: Kamlapur railway station to Kutubkhali	Dania University College (Room - 211), Jatrabari	29/01/2011 3.30 – 5.30 pm	31	17

Figure 5.1: Meeting with doctors of Islamia Eye Hospital regarding the Expressway Project

Figure 5.2: Meeting with Member of Parliament regarding the Expressway Project

Figure 5.3: FGD-1 at Kurmitola High School, Khilkhet, Dhaka

Figure 5.4: FGD-2 at National Health Institute, Mohakhali, Dhaka

Figure 5.5: FGD-3 at Tejgaon College, Farmgate, Dhaka

Figure 5.6: FGD-4 at Kamlapur High School, Kamlapur, Dhaka

Figure 5.7: FGD-5 at Donia University College, Dhaka

5.3 Findings of FGDs and Meetings

In the FGDs and meetings, the participants expressed their opinions regarding different issues, including their knowledge about the DEE project, socio- economic condition of people in their localities, possible impact of the proposed project on the environment and in their localities, and suggestions of mitigation measures. The findings of the FGDs and meetings are summarized in Table 5.2.

Table 5.2: Summary outcomes of FGDs

Issues	Project Section -1	Project Section -2	Project Section -3	Project Section -4	Project Section -5
Knowledge regarding DEE project	• From TV • Newspaper	• From TV	• From TV • Newspaper	• From Field team	• From Field team
Major Profession of people in the area	• Small business	• Rickshaw pulling • Porter • Day laborer • Small business	• Small business • Medium business	• Small and medium Business owners	• Service holder • Small and medium business owners
Alternative sources of light/energy during power outage	• Generator • IPS • Candle • Kerosene light	• Not available • Waits until the electricity comes back	• Candle • Kerosene light	• IPS • Candle • Kerosene light • Charger	• Generator • Charger • Candle
Water and gas supply	• Have sufficient water • Low gas pressure • No gas at peak time	--	--	--	• Problem in some area • Dirty water in some area
Sewerage system	• Sewerage system not satisfactory	• Sewerage system not satisfactory	• Very poor sewerage system • Road flooded during rainy season	• Sewerage system is less than satisfactory	• Very poor sewerage system • Water logging
Bank account	• Most people have no bank account	• All house owners have bank account • $1/5^{th}$ of tenants have no bank account	• Most people have bank account	• Most people have no bank account	--
Source of credit / loan	• Government commercial bank • Cooperative society • Personal source (relatives, friends etc.)	• Cooperative society	• Commercial Banks	• Multipurpose cooperative society • Commercial bank	• Multipurpose cooperative society • Loan facilities are limited as the community falls outside Dhaka City Corporation

Issues	Project Section -1	Project Section -2	Project Section -3	Project Section -4	Project Section -5
Status of social organization	• No social organization without political affiliation	• Have more religious and social institutions	--	--	• Political party (strong) • Social organizations (weak)
Main problem in the locality	• Traffic jam • Non availability of electricity • Non availability of water supply	• Electricity • Gas • Water • Law and order situation • Sound pollution • Air pollution	• Sound pollution • Air pollution • Electricity • Gas • Water • Traffic jam	• Sound pollution • Air pollution • No children play ground • Electricity • Law and order situation • Communication system	• Traffic jam • Frequent road accidents • Sewerage system • Electricity • Gas • Law and order situation
Project Impact on education facilities	• Good communication due to DEE will enable students to travel to better schools located away from locality	• Traffic congestion as an impact on education facilities	• Lack of sufficient school and college in the area; good communication due to DEE may encourage establishment of better schools	• Education facilities will improve • Physical access to school will be easier, due to lesser traffic congestion	• Physical access to educational institutions will be hampered during construction of DEE • Access to educational institutions will be easier after commissioning of DEE
Project Impact on health care	• Critical patients will have easier access to the health care centers	• Patient can be moved to the health centre within short time	• Do not have good hospitals in the area	• Insufficient health care facilities in the area	• Insufficient health care facilities in the area
Project Impact on Religious establishments	• Might have negative impact	• Loss of religious establishment (mosque)	--	--	• Might have impact on establishment (mosque)
Project impact on Historical establishment	• Have no historical establishment	• Have no historical establishment	--	--	• Have no historical establishment

Issues	Project Section -1	Project Section -2	Project Section -3	Project Section -4	Project Section -5
Recommendations regarding proposed DEE project	• Local recruitment during construction • Fair compensation for victims • Local people's opinion needs to be addressed • Arrange alternative sources of water for construction	• Arrange alternative electricity and water for construction	• Proper rehabilitation of affected people • Required toll concessions for educational institutions	--	• Land acquisition in consultation with local people • Wider roads required • Public interest should be respected and protected.
Overall opinion			• Will be develop socio-economic status • This DEE will be more effective for foreigner		

A significant portion of the proposed alignment of the DEE travels through or close to densely populated areas. Significant slum population exists in some portion of the alignment (especially by the side of railway tracks). In the FGDs and meetings, people expressed their opinions regarding potential risk of the project and also suggested mitigation measures to reduce/eliminate the adverse impacts. Inability to address these issues would generate negative image of people regarding the project. The potential significant impact (PI) from the project and the corresponding mitigation measures, as identified in the FGDs and meetings are summarized below.

PI # 1: Land acquisition and dislocation
Private land acquisition for the proposed project is the most serious concern among local inhabitants. Loss of land and property, demolition of existing structures (residential and business establishment), and possible displacement are major concerns.

Mitigation measure

- Creating awareness among people about the project
- Avoid private land as much as possible
- Fair and quick compensation against acquired land/property
- Temporary accommodation for displaced population

PI # 2: People's livelihood
The lives and livelihood of people living on and close to the alignment of the proposed DEE project would be affected during expressway construction. Available livelihood supporting commodities (e.g. food, medicine, water, gas, electricity, etc) may be impacted if project people need those in large scale. Some people may have to stop business on or beside rail line. Noise, dust etc may affect local people's health and affect sensitive institutions like schools and hospitals.

Mitigation measure

- Alternative livelihood strategies should be prepared for the affected people.
- Separate sources of water, electricity for construction work
- Effective measures for reducing dust and noise pollution

PI # 3: Obstruction to movement (especially access to educational facilities, hospitals)
Blocking or damaging of crucial infrastructure (e.g. roads, culverts etc) could be a significant impact, which may restrict easy access for schools/colleges, hospitals, etc.

Construction materials and construction work could create obstacle for accessing nearby health care facilities. Critical patients may find it difficult to reach nearby hospitals for necessary first treatment.

Mitigation measure

- Arrangement of alternatives
- Proper scheduling of work, so that it has minimum impact on movement of people and vehicles

PI # 4: Water and Sanitation Problems

Water for expressway construction and also for workers sanitation could have a significant impact, which may aggravate the current water and sanitation problems of the project site. Lack of water and proper sanitation may lead to health problems to the people and also to the construction workers.

Mitigation measure

- Sanitary latrine for construction workers
- Alternative sources of water for construction work
- Making sure that construction materials/debris do not affect drainage of water/wastewater

PI # 5: Increased social crimes

Job loss and failure to provide alternative livelihood have the risks to increase anti-social activities such as stealing, robbery and prostitution. People may suffer from depression due to relocation and losing jobs.

Mitigation measures need to be taken:

- Proper action plan for land acquisition and resettlement (e.g., compensation and alternative livelihood)
- Hiring local people to the extent possible for construction related works
- Immediate actions, so that people could get and lead a satisfactory life style during and post construction.

Chapter 6

Mitigation Measures and Environmental Management Plan

6.1 INTRODUCTION

As described in Chapter 5, the proposed elevated Expressway project has a number of significant impacts. In this Chapter, mitigation and abatement measures to reduce or eliminate potential adverse impacts and to enhance beneficial impacts have been suggested. It summarizes the mitigation and abatement measures for pre -construction, construction and operational phases of the project. It also presents an environment management plan (EMP), including a monitoring program.

6.2 MITIGATION MEASURES

6.2.1 Pre-Construction and Construction Phase

The significant environmental impacts of project activities during pre-construction, construction and operational phases of the proposed project have been presented in Chapter 4. Table 6.1 shows the mitigation measures corresponding to specific adverse impacts, along with assignment of responsibilities for their implementation. These mitigation measures should be implemented as a part of the Environmental Management Plan (EMP), presented in Section 6.3.

The measures presented in Table 6.1 are aimed at minimizing the effects of the possible adverse impacts and enhancing the positive impacts. Impacts related to acquisition of land for the Expressway have significant socio-economic implications and should be handled with utmost care. It appears that adverse impacts related to the alignment of the Expressway could be largely addressed by carefully shifting the Expressway alignment at some critical points. Table 4.1 (in Chapter 4) describes how some of the critical issues related to conflicts arising out of the DEE alignment have been resolved. Table 6.1 shows that most of the adverse impacts during construction phase could be minimized if appropriate mitigation measures are taken. However, a post-project monitoring program needs to be put in place to ascertain that the potential impacts have been predicted adequately and that suggested mitigation measures are effective in minimizing adverse impacts.

6.2.1.1 Principles for Acquisition of Private Land and Property

In order to facilitate preparation of the resettlement action plan (RAP), a report on "resettlement principles and approaches" has been prepared (BBA-BRTC-BUET, 2014), which lays out the principles and approaches to be followed for acquisition of land. In this document, the following principles have been suggested for compensation against acquisition of private land and property:

(a) Private land owners would get compensation against land acquisition (land and immovable assets on acquired land) following the guidelines contained in the ESMF

for IPFF; disputed lands/lands without proper ownership records/land with joint ownership (Government and private) should be treated as "private land" for the time being (for preparation of land acquisition proposals), until the issue of land ownership is settled.

(b) Depending on availability of "suitable land for resettlement", people who would lose their vacant lands (without any built structures) may be offered compensation in the form of land or apartments (to be built on vacant lands acquired for resettlement) following a valuation process/guideline to be developed under RAP.

(c) Depending on availability of "suitable land for resettlement", people who would lose their dwellings (e.g., tin-shed house, semi-pucca buildings, single- and multi-storied buildings/ apartments) may be offered land or apartments of similar/ equivalent sizes to be built on vacant lands acquired for resettlement, following a valuation process/guideline to be developed under RAP;

(d) Educational institutions (schools/ colleges), mosques/ madrassas acquired for the DEE project would be replaced by constructing structures of similar sizes (to be built on land acquired for the project), preferably close to the existing location. Relocation of educational institutions should be carried out after completion of construction of replacement structures; in order to avoid delay in project implementation for such relocation, arrangement may be made for temporary relocation in consultation with the authority of the institutions. In case of partial acquisition, compensation could be in the form of renovation or vertical extensions of the existing structure.

(e) During the period of shifting/ relocation of educational institutions, mosques/ madrassas, continuation of project construction works may be allowed, ensuring adequate safety and security provisions, and mitigation measures (e.g., against noise and air pollution).

(f) Existing commercial structures (e.g., markets, shops) under the proposed Expressway, which will not require demolition for constructing the proposed Expressway, may be allowed to operate, if it is judged to be feasible by both BBA and the Concessionaire considering safety, security, access and other relevant issues. For such commercial structures, compensation for restriction of vertical expansion (due to the Expressway overhead) may be considered through consultation.

(g) Acquisition of land over existing graveyards would be avoided; expressway should be planned in such a way that no pier is located on graveyards. In case expressway superstructure runs over a graveyard, the sanctity of the graveyard must be preserved by ensuring adequate measures.

(h) Provision of compensation for slum dwellers (against loss of dwellings and income);

(i) Provision of compensation for loss of businesses/ income;

(j) Provision of compensation for loss of trees, and/ or re-plantation program;

(k) In case of loss of utility infrastructure (e.g., deep tubewell pump station) on acquired land, efforts would be made to provide land to utility providers (subject to availability of suitable land) for construction of the affected utility infrastructure.

All project affected people (PAPs) should be compensated for losses resulting from project interventions regardless of title to land, following the entitlement matrix in Table 6.2.

Table 6.1: Environmental impact during construction phase and mitigation measures

Activity/Issues	Potential Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
Pre-Construction Phase			
Alignment of the Expressway	• Conflicts with future expansion of rail lines and operation of some rail stations • Conflicts with three flyovers, Banani overpass, proposed U-loops • Conflicts with Hatirjheel, built structures (e.g. Khilkhet railway market), Kamalapur Container depot, etc • Possible conflict with MRT-6 and MRT-5	• Conflicts of Expressway alignment with future expansion of rail lines at some locations (e.g. near Airport, Khilgaon), and operation of some Rail Stations (Cantonment and Tejgaon); conflicts with flyover (President Zillur Rahman flyover; MMHF, Moghbazar-Mouchak flyover) and overpass (Banani) projects; proposed U-loops (near Golf Course and Banani graveyard; Kamalapur Container depot, Hatirjheel low lands; and conflicts with MRT-6 and MRT-5 have been largely resolved by modifying/shifting alignment of DEE Expressway, as explained in Table 4.1.	BBA, GoB and FDEE (ITD Group)
Land acquisition	• Loss of land / property	• Raise awareness of PAPs through public consultation process prior to actual land acquisition. • Avoid acquisition of private land as much as possible • Serve land acquisition notices to actual land owners. • Provide adequate (considering present market value), fair, and quick compensation to real land owners, in accordance with applicable laws of GoB, and the Environmental and Social Management Framework (ESMF) for Investment Promotion Financing Facility (IPFF). • Provide appropriate and quick compensation for loss of land, property and income to all project affected people (PAPs) following the entitlement matrix in **Table 6.2**. • Involve local people and peoples' representatives in settling social tension related to land acquisition and those that may develop during the progress of work from the very beginning of project implementation.	BBA, GoB
	• Permanent Dislocation/ displacement (mainly slum population)	• Giving time to residents for shifting to new places • Temporary accommodation for displaced population • Provision of compensation (according to entitlement matrix presented in **Table 6.2**).	BBA, GoB

Activity/Issues	Potential Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
	• Loss of Income	• Provide adequate compensation according to the entitlement matrix presented in **Table 6.2**. • Provide alternative job opportunities for PAPs, give priority to PAPs having requisite skills for jobs in the proposed project. • Avoid important festival times (e.g., Eid) for possible dismantling activities to minimize loss.	BBA, GoB
Construction Phase			
Mobilization	• Generation of sewage and solid waste at project site	• Construction of sanitary latrine and septic tank system • Erection of "no litter" sign, provision of waste bins/cans, where appropriate • Waste minimization, recycle and reuse principles to be followed • Proper disposal of solid waste	FDEE (ITD) (Monitoring by BBA)
	• Health of workers	• Clean bill of health a condition for employment • Provision of water supply with acceptable water quality • Raising awareness about hygiene practices among workers • Regular medical monitoring of workers	
	• Possible development of labor camp into permanent settlement	• Contractor to remove labor camp at the completion of contract	
	• Outside labor force causing negative impact on health and social well-being of local people	• Contractor to employ local work force, where appropriate; promote health, sanitation and road safety awareness	
• Construction of Expressway	• Noise pollution and Vibration	• Use of noise suppressors and mufflers in heavy construction equipment. • Avoid using of construction equipment producing excessive noise during school hours and also at night • Avoid prolonged exposure to noise (produced by equipment) by workers. • Regulate use of horns and avoiding use of hydraulic horns in project vehicles.	FDEE (ITD) (Monitoring by BBA)

Activity/Issues	Potential Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
	• Air pollution	• Ensure that all project vehicles are in good operating condition • Spray water on dry surfaces/ unpaved roads regularly reduce dust generation • Pave access roads • Maintain adequate moisture content of soil during transportation, compaction and handling • Sprinkle and cover stockpiles of loose materials (e.g., fine aggregates). • Not using equipment such as stone crushers at site, which produce significant amount of particulate matter	
	• Disruption of local drainage	• Provision for adequate drainage of storm water • Provide adequate diversion channel, if required • Provide facilities for pumping of congested water, if needed • Ensure adequate monitoring of drainage effects, especially if construction works are carried out during the wet season.	
	• Water and soil pollution	• Prevent discharge of fuel, lubricants, chemicals, and wastes into surface waters or on land. • Install sediment basins to trap sediments in storm water prior to discharge to surface water. • Replant vegetation when soils have been exposed or disturbed.	
	• Traffic congestion, communication problems	• Implementing suggestions, to the extent possible, presented in Section 6.2.1.2. • Adequate traffic lights, signals, personnel for controlling traffic during construction along/ over existing roads, level crossings • Schedule deliveries of material/ equipment during non-school hours and after regular working hours • Depute flagman for traffic control • Arrange for signal light at night	
	• Safety	• Follow occupation health and safety guidelines presented in Section 6.2.1.3. • Ensuring safety during demolition of existing structures • Ensuring safety of trains and rail lines during construction of Expressway above rail tracks through proper design of formwork/ centering • Ensuring safety of pedestrians and vehicles during construction of Expressway above roads, level crossing through proper design of formwork/ centering • Erection of signs (with lights) advising people/vehicle to avoid certain areas during overhead construction	

Activity/Issues	Potential Impacts	Proposed Mitigation and Enhancement Measures	Responsible Parties
	• Accidents	• Following standard safety protocol while erecting poles and stretching cables. • Environmental health and safety briefing • Provision of protective gear	
	• Spills and leaks of oil, toxic chemicals	• Good house keeping • Proper handling of lubricating oil and fuel • Collection, proper treatment, and disposal of spills.	
	• Temporary dislocation and loss of income	• Avoid important festival times (e.g., Eid) for stoppage of commercial activities to minimize loss. • Provide alternative job opportunities for PAPs; employ such people in project works where possible	
	• Employment of work/labor force	• Employ local people in the project activities as much as possible. • Give priority to poor people living in slums within project area in project related works (e.g., excavation and other works, which do not require skilled manpower).	

Table 6.2: Compensation and Entitlement Matrixes

Matrix No.	Type of Loss	Application	Entitled Person	Compensation
M – 1	Private Land	Entire (i.e., 100%) land holding lost	Title-holder (private)	• Compensation in cash at replacement cost. (see Note 1)
		Part of the land holding lost and remaining land viable for present use	Title-holder (private)	• Compensation in cash at replacement cost. (see Note 1) • Restoration of pre-acquisition basic utilities (water supply and sanitation, electricity, etc.)
		Part of the land holding lost but the remaining area becomes unviable for continued use	Title-holder (private)	• Compensation at replacement cost. • Transition allowance equivalent to one year's return from the land
M – 2	Structures on acquired land, or on land to be vacated for project purpose	Structures partially affected but the remaining structure viable for continued use for rent or business purpose.	Owner with valid title to land or with valid lease deed for land	• Compensation in cash for affected portion of the structure and other fixed assets at replacement cost (see Note 1) • Repair Allowance, minimum 20% of cash compensation
			Squatters (residential)	• Compensation in cash for affected portion of the structure • Transition allowance equivalent to three months' rental allowance of similar structure in the same vicinity OR three months' family income whichever is higher.
			Tenants (residential)	• Cash compensation equivalent to three months' rental allowance • Assistance in alternate rental accommodation.
			Encroachers (residential)	• Early notice on the demolition • Technical advice in demolition, relocation/repairing of affected structure • Payment for repairing only those damages to structure resulting from demolition, if required • Transition allowance equivalent to three months' rental allowance of similar structure in the same vicinity.
		Entire structure affected OR where structures partially affected such that the remaining structure is unviable for continued use.	Owner with valid title to land or with valid lease deed for the land	• Compensation in cash for entire affected structure and other fixed assets (wells, electric and water connections, etc.) at replacement cost, without depreciation. • Transition allowance equivalent to three months' rental allowance of similar structure in the same vicinity.
			Tenant (residential)	• Cash compensation equivalent to three months' rental allowance • Assistance in alternate rental accommodation.

Matrix No.	Type of Loss	Application	Entitled Person	Compensation
			Squatters (residential)	• Compensation in cash for affected structure • Transition allowance equivalent to three months' rental allowance of similar structure in the same vicinity. • Early notice for eviction and demolition • Technical advice in demolition or repairing of affected structures
			Encroachers (residential)	• Early notice on the demolition • Technical advice in demolition, relocation and repairing of affected structure • Transition allowance equivalent to three months' rental allowance of similar structure in the same vicinity.
		Affected female headed households	Female head of household (titled or non-titled – squatters and encroachers)	• Female headed household affected with structures will be entitled for additional financial assistance equivalent to 3 months' subsistence cost for the incumbent household.
M – 3	Loss of business /income due to displacement	Temporary or permanent loss of business/ incomes	Affected individuals (titled/non-titled)	• Transition allowance for the permanent loss of business, income and wages equivalent to the loss of income/wages for a period of 6 months for each affected households. • In case of temporary relocation and temporary loss of business incomes, compensation will be wages equivalent to closure period OR Alternative business site for continued income stream.
M - 4	Standing crops on affected lands	Crops affected by temporary acquisition/easement	Owner of affected crops(titled/non-titled)	• Compensation in cash at market value.
M – 5	Trees on affected lands	Trees lost	Owner of affected trees(titled/non-titled)	• Compensation in cash calculated on the basis of type, age and productive value of affected trees. • Trees on Government lands to be addresses following government rules. Government to carry out plantation replace lost trees, and nurture those for at least one year.
M - 6	Loss of public infrastructure	Infrastructure (electric, water supply, sewerage &telephone lines; public water tanks)	Relevant agencies.	• As per Government policy
M - 8	Unforeseen Losses	As identified	As identified	• Appropriate mitigation measures as determined to meet the objectives of this policy framework

Note 1: depending on availability of "suitable land for resettlement", people who would lose their vacant lands may be offered compensation in the form of land or apartments; similarly, people who would lose their dwellings may be offered land or apartments of similar/equivalent sizes to be built on lands acquired for resettlement.

6.2.1.2 Mitigation of Traffic Impacts

Ramp lengths

A major concern of DEE is the potential of adverse local impacts due to queue spillbacks. Therefore, in all locations, adequate ramp lengths and appropriate tolling facilities should be accommodated to contain the queue spillbacks (if any) on the on-ramp (ascending) approaches and ensure that this situation is not encouraged due to the toll booths location at elevated or at grade positions.

Parking restriction

On street parking should be restricted along the construction zone all throughout the construction phase to reduce local congestion. Field observations suggestthat on -street parking, boarding-alighting and loading-unloading activities are common practice, which aggravate traffic congestion.

Integration with MMHF

Integration between MMHF and Link-2 of DEE is warranted for seamless movement of traffic and off-loading Polashi intersection.

6.2.1.3 Occupational Health and Safety Guidelines

In general, the objectives of occupational health and safety (OHS) plan are: (a) To develop, in the workplace, a collaborative approach to managing Occupational health and Safety between management and workers; (b) To provide and maintain safe working procedures and operations; (c) To ensure awareness of all potential work related risks and hazards and to develop preventive strategies against these risks and hazard; (d) To provide appropriate training to all concerned to work safely and effectively; (e) To maintain a constant and continuing interest in the improvement of occupational health and safety performance and to provide the required resources necessary for the implementation and maintenance of the OHS plan.

For the DEE project, the occupational health and safety primarily focuses on work equipment and protective gear. The following section provides guidelines/ directives for: (a) work equipment, (b) protective gear, and (c) safety and health signs.

Suggested Safety Directives for Work Equipment

It is contractor's obligation that every possible measure is taken to ensure the safety of the work equipment made available to workers. During the selection of the work equipment the employer shall pay attention to the specific working conditions which exist at the workplace, especially in relation of safety and health of the workers. A brief list of work equipment safety issues is given below:

- Work equipment control devices which affect safety must be clearly visible and identifiable and appropriately marked where necessary.
- Work equipment presenting hazards due to emissions of gas, vapor, liquid or dust must be fitted with appropriate containment and/or extraction devices near the sources of the hazard.

- Where there is a risk of mechanical contact with moving parts of work equipment which could lead to accidents, those parts must be provided with guards or devices to prevent access to danger zones or to halt movements of dangerous parts before the danger zones are reached.
- Work equipment may be used only for operations and under conditions for which it is appropriate.
- Work equipment must bear the warnings and markings essential to ensure the safety of workers.
- All work equipment must be appropriate for protecting workers against the risk of the work equipment catching fire or overheating, or of discharges of gas, dust, liquid, vapor or other substances produced, used or stored in the work equipment.
- All work equipment must be appropriate for preventing the risk of explosion of the work equipment or of substances produced, used or stored in the work equipment.
- All work equipment must be appropriate for protecting exposed workers against the risk of direct or indirect contact with electricity.
- Mobile work equipment such as Bulldozer or Road Rollers with ride-on workers must be designed to restrict, under actual conditions of use, the risks arising from work equipment roll-over.
- Fork-lift trucks carrying one or more workers must be adapted or equipped to limit the risk of the fork-lift truck overturning.
- Self-propelled work equipment, such percussion drills, which may, when in motion, engender risks for persons must have facilities for unauthorized start-up.
- Machinery for lifting loads, such as Crane, must be clearly marked to indicate its nominal load, and must where appropriate be fitted with a load plate giving the nominal load for each configuration of the machinery.
- Work equipment must be erected or dismantled under safe conditions, in particular observing any instructions which may have been furnished by the manufacturer.

Safety Directives for Protective Gears

Personal protective equipment is suggested to use when the risks cannot be avoided or sufficiently limited by technical means. All personal protective equipment must

- be appropriate for the risks involved, without itself leading to any increased risk
- correspond to existing conditions at the workplace
- fit the wearer correctly after any necessary adjustment.

The Contractor shall organize orientation to use of personal protective equipment. Workers shall be informed of all measures to be taken. Consultation and participation shall take place on the matters related to the use of the protective equipment. A partial list of protective gears to be worn by the workers at designated work areas is given below; Table 6.3 presents the list in tabular form.

Head Protection: Protective helmets will be put on at all times mainly at the building and bridge construction sites, under scaffolds, erection and stripping of formworks, etc., where there are possibilities of head injuries from falling/flying objects.

Hearing Protection: Ear plugs or ear muffs should be worn in areas where exposure to high noise level is expected. Examples of such activities include percussion drill, bolt driving, etc.

Eye and Face Protection: Spectacles, Goggles, Face Shield or Arc-welding Mask with Hand Masks, whichever is appropriate, should be worn at times when percussion drilling, spray painting, welding or similar activities are in progress at the field.

Respiratory Protection: In work areas such as septic tanks, dump sites, sewers etc., where exposure to harmful or toxic gases is likely the workers should wear gas masks, dust filters, or insulating appliances with air supply, whichever is appropriate.

Hand and Arm Protection: In the work involving piercing, cutting or vibration. For protection against toxic chemicals special chemical resistant gloves should be worn. Over sleeves must be worn to protect ones arms.

Foot *Protection:* In road and bridge constructions, working on or under scaffolds, roof works, formwork erection and dismantling safety shoes/boots are essential protective measures.

Safety and Health Signs

Safety signs, health signs, prohibition sign, warning sign, mandatory sign, emergency escape sign, first-aid sign, information sign, signboard, supplementary signboard, safety color, symbol, pictogram, illuminated sign, acoustic signal, verbal communication and hand signal are essential tools for preventing accidents by providing information in advance.

Table 6.3: Brief list of protective gears to be worn during the use of some equipment

Works/ Equipment Use	Safety Measures for Workers and/or Work Areas
Common Construction Works	HH, STB, HG
Earth-works	HH, STB, HG
Electric-works	RSB, HG
Wood-works	HH, STB, HG
Road Paving	HH, STB, HG, BP, FM
Cranes	HH, STB, HG, WB
Pile Driver	HH, STB, HG, EP, WB
Arc Welder	HH, WV, HG
Bull Dozer	HH, STB, WB
Heavy Roller	HH, STB, HG, WB
Concrete Mixer	HH, STB, HG, WB
Fork Lift	HH, HG, STB, WB
Percussion Drill	HH, STB, HG, WB, EG, EP, WB
Sledge/Pick Hammer	HH, STB, HG, WB
Vibrator	HH, STB, HG, WB
Pick Axe	HH, STB, HG, WB
Electric Saw	HG, EG, EM
Working on Scaffolds	HH, STB, HG, WB

Note: HH = Hard Hat, STB = Steel -tipped Boot, HG = Hand Gloves, BH = Body Harness
WB = Waist Belt, EM = Ear Muff, EP = Ear Plug, WV = Welding Visor, FM = Face Mask,
BP = Body Protective Apron, RSB = Rubber Soled Boot, EG = Eye protection Glasses

The Contractor will provide or ensure that appropriate safety and/or health signs are in place at their work sites where hazards cannot be avoided or reduced. Workers and their representatives must be informed of all the measures taken concerning health and safety signs at work and must be given suitable instruction about these signs.

6.2.2 Operational Phase

Traffic impacts, vehicular air pollution, noise pollution and vibration from traffic movement are potential significant impacts during operational phase of the Expressway. Table 6.4 shows the mitigation measures for these possible adverse impacts.

Table 6.4: Environmental impact during operational phase and mitigation measures

Issue/Impact	Mitigation Measures
• Air Pollution	• Making sure, e.g., through regular inspection by traffic police, that vehicles are in good operating condition
• Noise Pollution	• Restriction on use of horn on Expressway, especially in sensitive areas (where households, hospitals, schools, etc. are located nearby). • Implementation of noise barrier, where appropriate
• Traffic Impacts: (i) Congestion reduction in the existing North-South roads; (ii) Increased local congestion around ramp touch-down points; and (iii) Long-term increase in traffic volume	• Adequate ramp lengths and appropriate tolling facilities to be provided to contain queue spillbacks (if any) and ensure that local traffic congestion is not aggravated due to DEE. • Proper geometric treatment and channelization at the vicinity of the ramps to ensure smooth flow of traffic. • Measures to be taken to recover lost capacities at intersections due to on-street parking, boarding-alighting and loading-unloading activities and ensure smooth traffic circulation. • DEE is likely to lead to increased traffic volumes and higher average speeds. This is likely to pose safety concerns, particularly for pedestrians. Improved pedestrian facilities should therefore be provided to ensure their safety. • A major project like DEE is likely to result significant changes in accessibility to certain areas leading to the risk of densification near the ramp locations. Strict land-use restrictions should therefore be imposed to avoid further densification in these locations and thus prevent the corresponding increase in traffic. • Implementing suggestions presented in Section 4.4.1 and Section 6.2.2.1.

6.2.2.1 Mitigation of Traffic Impacts

Measures to improve the traffic circulation at touchdown points

In the ramp touchdown points, traffic will have to accelerate/decelerate to/from much higher speeds. Proper geometric treatment and channelization are required at the vicinity of the ramps to ensure smooth flow of traffic. On the other hand, according to field observation, the capacity of many intersections is already deteriorated due to on-street parking, boarding-alighting and loading-unloading activities. Measures should be undertaken to recover these lost capacities and ensure smooth traffic circulation.

Improved pedestrian facilities

DEE is likely to lead to increased traffic volume and higher desired speed after traveling through the expressway. This is likely to cause safety concerns, particularly for pedestrians. Adequate safety measures are warranted in the design of pedestrian facilities. Well-designed walkways and road crossing facilities should be implemented on an urgent basis to ensure pedestrian safety.

Land-use restrictions

The deficiencies of the current land-use plan and the violation of the existing land-use laws have already induced irreversible deterioration to the overall traffic condition of the city. Particularly, in many instances, the benefits of a new transport initiative have been overshadowed by the change in land use pattern (e.g. unrestricted commercial developments along new roads leading to side friction and capacity reductions). A major project like DEE is likely to result in significant changes in accessibility to certain areas leading to the risk of densification near the ramp locations. Strict land-use restrictions should therefore be imposed to avoid further densification in these locations and thus prevent the corresponding increase in traffic.

Speed management

At touch-down points of DEE, high speed traffic will merge with low speed traffic which will lead to safety issues. Utilizing traffic signs, speed limits must be imposed. This will improve road traffic safety and reduce the number of road traffic casualties from traffic collisions. In addition, speed reducing measures like Jiggle bar/Rumble strips should be used on the descending ramps to minimize the potential speed differential. If possible, deceleration cum merging lane for off-ramps could be explored.

In the University area (adjacent to Palashi intersection) speed cameras may be installed at several strategic points to regulate speed of the merging or diverging traffic stream of DEE. Identification and installation of speed regulatory devices at strategic points will help in minimizing the safety risks. Therefore, meticulous analysis is warranted to identify several strategic points in the University area, adjacent to the Polashi intersection.

Provision of off-street parking

Construction of elevated expressway will encourage greater use of private modes engendering the demand of adequate parking space. Furthermore, on-street parking restriction imposed during the operational phase of the DEE will force car-owners to utilize off-street parking options. Particularly where street space is inadequate, multi-storied/high-rise parking facilities is recommended for accommodating private vehicles. Further study may be undertaken to identify the strategic off-street parking locations that will help in discouraging and regulating on-street parking, which in turn will help in relieving congestion at concerned locations.

6.3 ENVIRONMENTAL MANAGEMENT PLAN

6.3.1 Scope of EMP

The primary objective of environmental management and monitoring is to record environmental impacts resulting from the project activities and to ensure implementation of the "mitigation measures" identified earlier (see Tables 6.1 and 6.4) in order to reduce adverse impacts and enhance positive impacts from specific project activities. Besides, it would also address any unexpected or unforeseen environmental impacts that may arise during construction and operation phases of the project.

The EMP should clearly lay out: (a) the measures to be taken during pre-construction, construction and operational phases of the project to eliminate or offset adverse environmental impacts, or reduce them to acceptable levels; (b) the actions needed to implement these measures; and (c) a monitoring plan to assess the effectiveness of the mitigation measures employed. Environmental management and monitoring activities for the proposed Expressway project could be divided into management and monitoring during: (a) pre-construction phase, (b) construction phase, and (b) operation phase.

6.3.2 Work Plans and Schedules

The environmental management program should be carried out as an integrated part of the project planning and execution. It must not be seen merely as an activity limited to monitoring and regulating activities against a pre-determined checklist of required actions. Rather it must interact dynamically as project implementation proceeds, dealing flexibly with environmental impacts, both expected and unexpected.

For this purpose, it is recommended that the Project Director (PD) from BBA takes the overall responsibility of environmental management and monitoring. The PD will form a team with required manpower and expertise to ensure proper environmental monitoring, and to take appropriate measures (as outlined in Tables 6.1 and 6.4) to mitigate any adverse impact and to enhance beneficial impacts, resulting from the project activities. The PD through its team will make sure that the FDEE (ITD Group) undertake and implement appropriate measures as stipulated in the contract document, or as directed by the PD to ensure proper environmental management of the project activities.

The environmental management during the pre-construction phase should focus on addressing the possible impacts arising from:

- Alignment of the Expressway (i.e., conflicts with rail line expansion, other ongoing and proposed projects, and important installations)
- Acquisition of land, especially private land, for the Expressway

The environmental management during the construction phase should focus on addressing the following issues:

- Air and Noise pollution,
- Possible drainage congestion,
- Generation and disposal of wastes,
- Loss of income,
- Temporary dislocation/ displacement,

- Traffic congestion,
- Safety (including occupational health and safety), and
- Employment

The environmental management during the operational phase should primarily focus on addressing the following issues:

- Air and Noise pollution,
- Traffic impacts

The mitigation measures for addressing the above issues are listed in Table 6.1 and Table 6.4. It must be ensured that these measures are implemented and monitored in the field under the supervision of the PD of the project.

6.3.3 Monitoring Program

The primary objective of the environmental monitoring is to record environmental impacts resulting from the project activities and to ensure implementation of the "mitigation measures" identified earlier in order to reduce adverse impacts from project activities.

Monitoring during Construction Phase

Apart from general monitoring and supervision of all construction activities for their possible impact on the environment, important issues to be monitored during the construction phase include air pollution, noise pollution, drainage congestion, traffic problems and safety issues.

Table 6.5 presents a plan for monitoring noise and air quality during construction phase of the project. Besides, the Project Engineer should also make necessary arrangements to test water quality, if any pollution is suspected. In addition, the Project Engineer should also monitor possible drainage congestion (especially during wet season), and disruption of traffic during construction activities. An inventory of the trees to be cut during the construction phase should be maintained by the Project Engineer, so that proper compensation could be provided and plantation of similar trees at suitable location could be done.

Table 6.5: Monitoring of air quality and noise level

Parameters	Monitoring Frequency	Resource Required and Responsibility	Comment
Particulate Matter (PM_{10}, $PM_{2.5}$)	Once every 3 months, and as directed by the Project Engineer	PM_{10} and $PM_{2.5}$ measuring equipment; Contractor's responsibility	Results to be verified by a monitoring team, lead by the Project Engineer
Noise Level	Once every month, and as directed by the Project Engineer	Noise level meter; Contractor's responsibility	

Note: Actual monitoring time and location should be decided by the Project Engineer depending on the location of specific activities.

Monitoring during Operational Phase

During operational phase, monitoring of air quality and noise level at selected locations could be carried out following the monitoring plan presented in Table 6.5.

6.4 GRIEVANCE REDRESS MECHANISM

To facilitate the resolution of affected people's concerns, complaints, and grievances about the social and environmental performance of the project, a Grievance Redress Mechanism (GRM) is established which aims to provide a time bound and transparent mechanism to voice and resolve social and environmental concerns. Grievances related to the implementation of the project, particularly regarding the environmental management plan will be acknowledged, evaluated, and responded to the complainant with corrective actions proposed using understandable and transparent processes that are gender responsive, culturally appropriate, and readily accessible to all segments of the affected people. The responsibility for addressing the grievances along with proper timelines will be clearly indicated. Records of grievances received, corrective actions taken and their outcomes will be properly maintained and form part of the environmental monitoring report for submission to ADB.

The Project Implementation Unit (PIU) of BBA shall make the public aware of the GRM through methods such as public awareness campaigns. Grievances can be filed in writing or by phone with any member of the PIU. The following steps procedures will be followed under the GRM.

First tier of GRM

The Site Project Manager (PM) under the PIU shall be the designated officer for grievance redress at the first tier. Resolution of complaints will be done within 7 working days. Investigation of grievances will involve site visits and consultations with relevant parties (e.g., affected persons, contractors, traffic police, etc.) Grievances will be documented and personal details (name, address, date of complaint, etc.) will be included, unless anonymity is requested. A tracking number shall be assigned for each grievance, including the following elements:

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

The updated register of grievances and complaints will be available to the public at the PM office, construction site, and other key public offices along the project area. Should the grievance remain unresolved within 7 working days, it will be elevated to the second tier.

Second tier of GRM

The respective site level PM will activate the second tier of GRM by referring the unresolved issue (with written documentation). The Grievance Redressal Committee (GRC) shall be established by the PIU before commencement of site works. The GRC will consist of the following persons: (i) project director; (ii) representative of city ward; (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.

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 respective APD and PM will be responsible for processing and placing all papers before the GRC, maintaining database of complaints, recording decisions, issuing minutes of the meetings, and monitoring to see that formal orders are issued and the decisions carried out.

Third tier of GRM

In the event that a grievance cannot be resolved directly by the Project Implementation Unit (PIU) (first tier) or GRC (second tier), the affected person can seek alternative redress through the city ward committees or in appropriate courts. The PIU or GRC will be kept informed by the city mayor 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 jurisdiction (first, second, and third tiers), number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon, which may be prepared with details such as name, identification (I.D.) with unique serial number, date of notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance (i.e., open, closed, or pending).

Chapter 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 CONCLUSIONS

The Government of Bangladesh has decided to build an elevated expressway stretching from Hazrat Shahjalal International Airport to Kutubkhali (connecting Dhaka-Chittagong Highway). The Expressway project will be implemented under as Public-Private-Partnership (PPP) between the Government of Bangladesh, represented by the Bangladesh Bridge Authority (BBA), and the FDEE (ITD Group).

Environmental Impact Assessment (EIA) of the proposed Dhaka Elevated Expressway (DEE) project has been carried out following the guidelines (GoB, 1997) of the Department of Environment (DoE), and the relevant operational policies and guidelines of the Environmental and Social Management Framework (ESMF) for Investment Promotion Financing Facility (IPFF) (IIFC, 2010). As a part of the EIA, a detailed baseline survey – including physical, ecological and socio-economic survey – of areas along and surrounding the preliminary alignment of the proposed Expressway have been carried out. Five focus group discussions (FGDs) and several formal and informal meetings have been carried out at the project areas.

Impacts during Pre-construction Phase
The major activities to be carried out during the pre-construction phase include: (a) Finalization of the alignment of the proposed Dhaka Elevated Expressway (DEE), and (b) Acquisition of necessary land.

The major impacts related to the alignment of the Expressway include: (i) conflicts with future expansion (third and fourth lines) of rail lines, and operation of some rail stations (Cantonment and Tejgaon Station); (ii) conflicts with some existing (e.g. President Zillur Rahman Flyover, Banani Overpass, MMHF, U- loops at Golf Course and Banani Graveyard), ongoing (e.g., Moghbazar-Mouchak Flyover) Banani overpass, Zia Colony flyover), and committed (e.g., MRT-5 and MRT-6) projects; (iii) conflicts with some important installations (e.g., Kamalapur container depot), and land use (e.g., Hatirjheel lowlands).

Land acquisition will be required for the proposed project and detailed land acquisition proposals (LAPs) have been developed by BRTC, BUET, are being used by the Bangladesh Bridge Authority (BBA) for acquisition of necessary land for the Expressway project. The socio-economic impacts related to land acquisition would be significant and could be categorized as: (i) loss of land and property; (ii) permanent dislocation/ displacement; (iii) loss of income.

Environmental Impacts during Construction Phase

The project activities are likely to have minor impact on the ecological parameters. Major physicochemical parameters considered for assessment of environmental impacts include: (i) Noise pollution, (ii) Air pollution, (iii) Vibration, (iv) Possible drainage congestion, and (v) Generation and disposal of wastes,

Noise and air pollution and vibration are important considerations, particularly where the Expressway alignment runs close to human habitations. Noise pollution and vibration during the construction phase may result from movement of vehicles carrying materials and equipment to and from the project sites, operation of machines and equipment, and different construction activities. Localized and temporary air pollution may generate from earthworks during site preparation, movement of vehicles and demolition activities. However, air pollution generated from these activities is likely to be localized. Drainage congestion, particularly during wet season, may result from possible obstruction to natural flow of drainage water during construction activities. Demolition of the existing structures will also produce huge quantity of debris, which would have to be properly disposed of.

The major parameters considered for assessment of socio-economic impacts of project activities include: (i) Loss of income, (ii) Temporary dislocation/ displacement, (iii) Traffic congestion, (iv) Safety, and (v) Employment

The Expressway alignment passes over a number of major roads, level crossings, flyover/ elevated road and foot overpass. Besides, two Links of the Expressway are to be constructed over very busy roads of the city. There are 31 entry and exit ramps of the Expressway, which connect it with major existing roads of the city. Significant traffic disruption is likely during construction of Expressway, links and ramps at these locations. The Expressway would passes over a number of major roads, level crossings, flyover/ elevated road and foot over-bridge. In addition to regular safety measures, special construction methodology would have to be followed to ensure safety during construction of Expressway over live railway tracks, over and along major busy roads.

Environmental Impacts during Operational Phase

Traffic impacts, vehicular air pollution, noise pollution and vibration from traffic movement are potential significant impacts during operational phase of the Expressway. The main traffic impacts of DEE during its operational phase will be as follows:

- Congestion reduction in the existing North-South roads
- Increase in local congestion around the ramp touch-down points
- Increase in traffic volume in the long-run due to diverted and induced traffic

Mitigation Measures and EMP

Mitigation measures to reduce/ eliminate adverse impacts during pre -construction, construction and operational phases have been suggested. Impacts related to acquisition of land for the Expressway have significant socio-economic implications and should be handled with utmost care, following the Environmental and Social Management Framework (ESMF) for Investment Promotion Financing Facility (IPFF). Adverse impacts related to the alignment of the Expressway have already been largely addressed by modifying/shifting the Expressway alignment at some critical points. It appears that that most of the adverse

impacts during construction phase could be minimized if appropriate mitigation measures are taken. An environment management plan (EMP), including a monitoring program, has also been developed.

7.2 RECOMMENDATIONS

As a part of the EIA, mitigation and abatement measures to reduce or eliminate potential adverse impacts and to enhance beneficial impacts have been suggested. Mitigation and abatement measures for pre-construction, construction and operation phases of the project have been outlined in the EIA. An environment management plan (EMP), including a monitoring program has been developed. The EIA report should now be submitted to the Department of Environment (DoE) for getting necessary environmental clearance.

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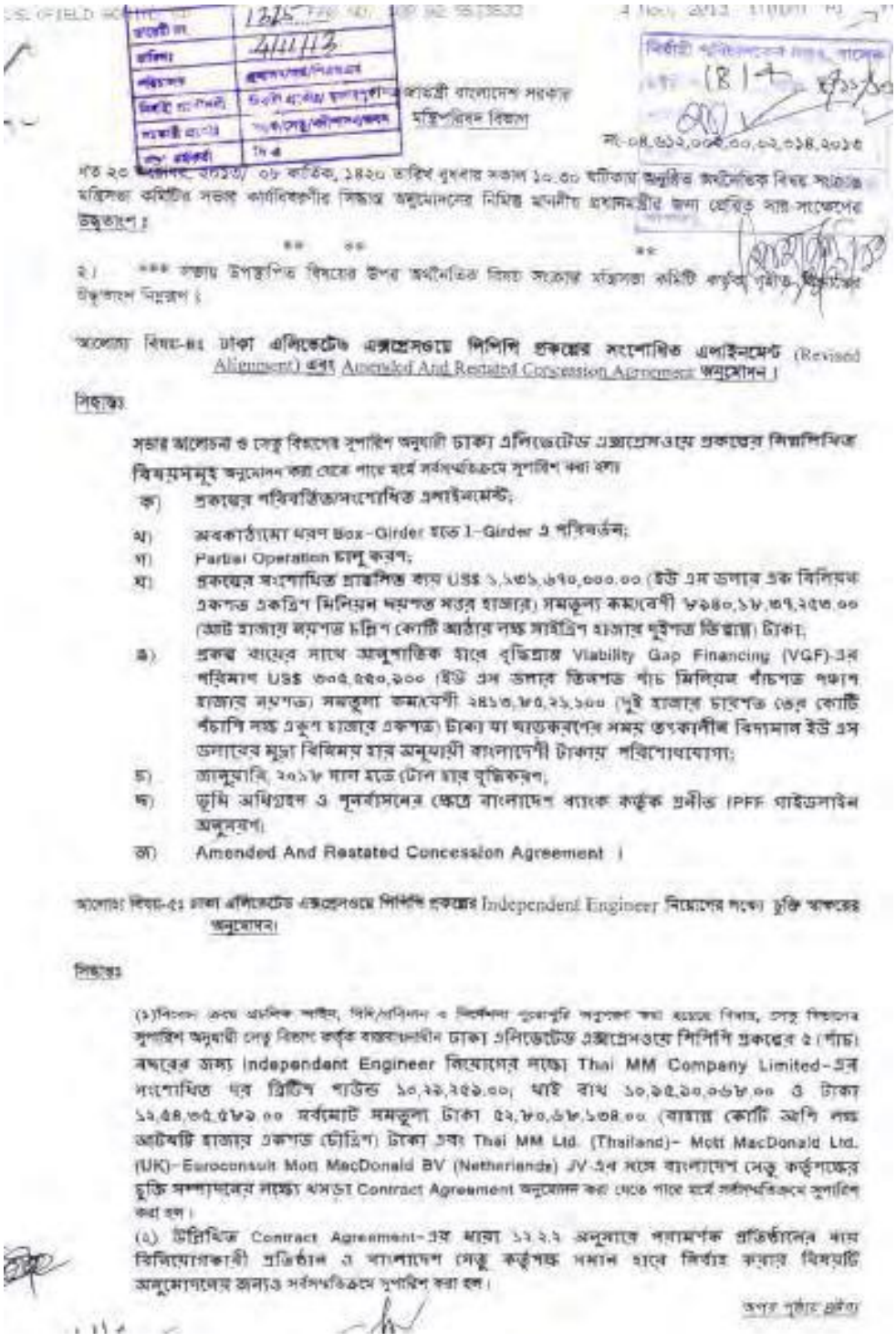
Appendices

Table of Contents

Appendix A: Approval of Revised Alignment of DEE by GoB



গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
মন্ত্রিপরিষদ বিভাগ

নং-০৪.৬১২.০০৫.০০.৯২.৩১৪.২০১৫

গত ২৩ [illegible] ১৪২০/ ০৮ ফাল্গুন, ১৪২০ তারিখ বুধবার সকাল ১০.৩০ ঘটিকায় অনুষ্ঠিত অর্থনৈতিক বিষয় সংক্রান্ত মন্ত্রিসভা কমিটির সভার কার্যবিবরণীর সিদ্ধান্ত অনুমোদনের নিমিত্ত মাননীয় প্রধানমন্ত্রীর জন্য প্রেরিত সার-সংক্ষেপের উদ্ধৃতাংশ :

২। *** সভায় উপস্থাপিত বিষয়ের উপর অর্থনৈতিক বিষয় সংক্রান্ত মন্ত্রিসভা কমিটি কর্তৃক গৃহীত সিদ্ধান্তের উদ্ধৃতাংশ নিম্নরূপ :

আলোচ্য বিষয়-৪১ ঢাকা এলিভেটেড এক্সপ্রেসওয়ে পিপিপি প্রকল্পের সংশোধিত এলাইনমেন্ট (Revised Alignment) এবং Amended And Restated Concession Agreement অনুমোদন।

সিদ্ধান্ত:

সভায় আলোচনা ও সেতু বিভাগের সুপারিশ অনুযায়ী ঢাকা এলিভেটেড এক্সপ্রেসওয়ে প্রকল্পের নিম্নলিখিত বিষয়সমূহ অনুমোদন করা যেতে পারে মর্মে সর্বসম্মতিক্রমে সুপারিশ করা হয়:

ক) প্রকল্পের পরিবর্তিত/সংশোধিত এলাইনমেন্ট;

খ) অবকাঠামো ধরণ Box-Girder হতে I-Girder এ পরিবর্তন;

গ) Partial Operation চালু করণ;

ঘ) প্রকল্পের সংশোধিত প্রাক্কলিত ব্যয় US$ ১,১৩১,৬৭০,০০০.০০ (ইউ এস ডলারে এক বিলিয়ন একশত একত্রিশ মিলিয়ন ছয়শত সত্তর হাজার) সমতুল্য কম/বেশী ৮৯৪০,১৮,৩৭,২৫৩.০০ (আট হাজার ছয়শত চল্লিশ কোটি আঠার লক্ষ সাইত্রিশ হাজার দুইশত তিপ্পান্ন) টাকা;

ঙ) প্রকল্প ব্যয়ের সাথে আনুপাতিক হারে বৃদ্ধিপ্রাপ্ত Viability Gap Financing (VGF)-এর পরিমাণ US$ ৩০৫,৫৫০,২০০ (ইউ এস ডলার তিনশত পাঁচ মিলিয়ন পাঁচশত পঞ্চাশ হাজার দুইশত) সমতুল্য কম/বেশী ২৪১৩,৮৫,২১,১০০ (দুই হাজার চারশত তের কোটি পঁচাশি লক্ষ একুশ হাজার একশত) টাকা যা অন্তর্করণের সময় তৎকালীন বিদ্যমান ইউ এস ডলারের মুদ্রা বিনিময় হার অনুযায়ী বাংলাদেশী টাকায় পরিশোধযোগ্য;

চ) জানুয়ারি, ২০১৮ সাল হতে টোল হার বৃদ্ধিকরণ;

ছ) ভূমি অধিগ্রহণ ও পুনর্বাসনের ক্ষেত্রে বাংলাদেশ ব্যাংক কর্তৃক প্রণীত IPFF গাইডলাইন অনুসরণ;

জ) Amended And Restated Concession Agreement ।

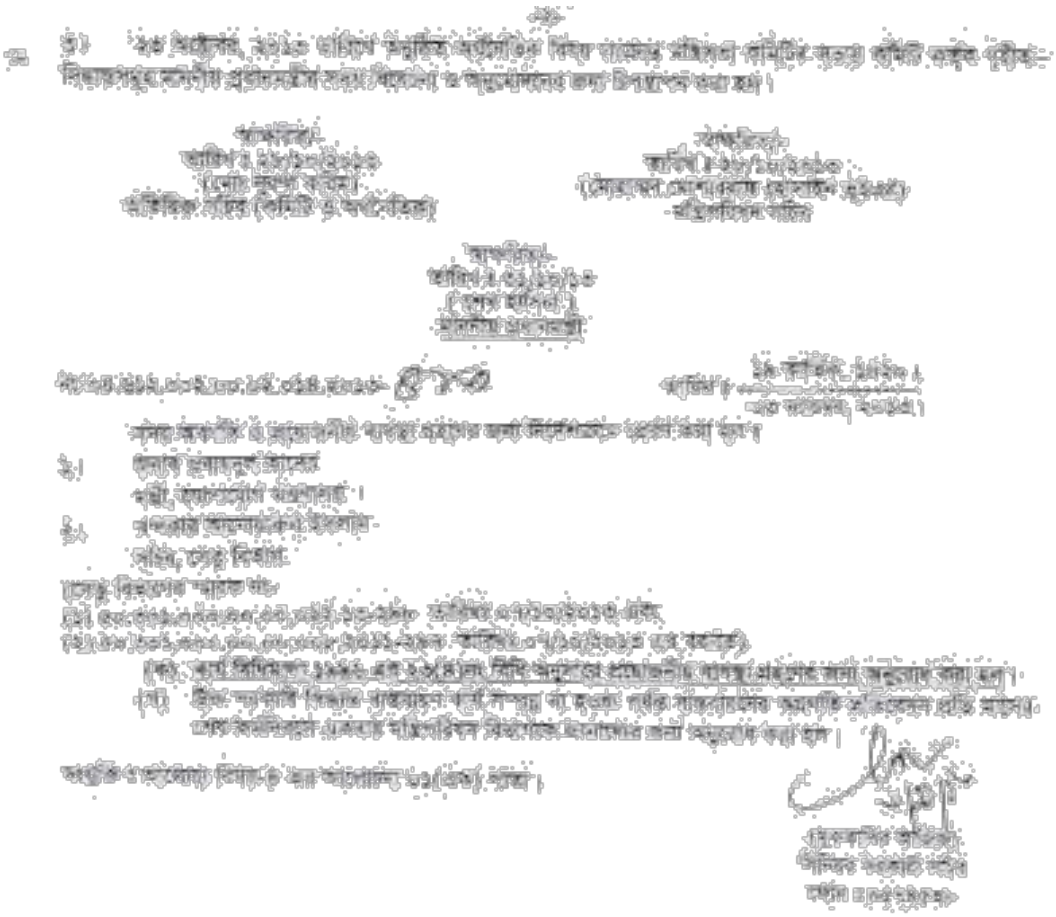
আলোচ্য বিষয়-৪২ ঢাকা এলিভেটেড এক্সপ্রেসওয়ে পিপিপি প্রকল্পের Independent Engineer নিয়োগের লক্ষ্যে চুক্তি স্বাক্ষরের অনুমোদন।

সিদ্ধান্ত:

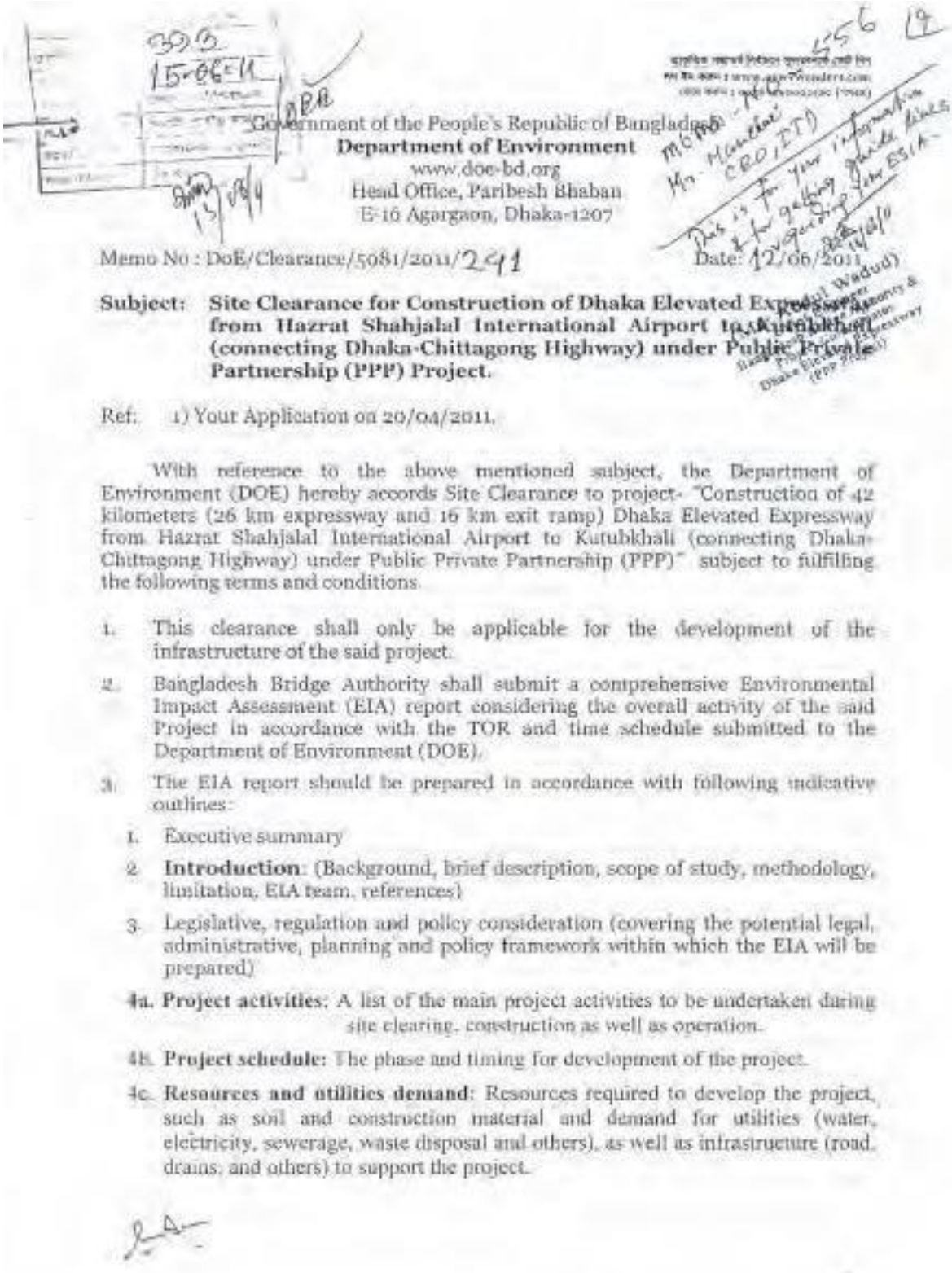
(১)বিস্তারিত প্রকল্প প্রস্তাব, দরপত্র/দরবিজ্ঞপ্তি ও নির্দেশনা পুঙ্খানুপুঙ্খ অনুসরণ করা হয়েছে বিধায়, সেতু বিভাগের সুপারিশ অনুযায়ী সেতু বিভাগ কর্তৃক বাস্তবায়নাধীন ঢাকা এলিভেটেড এক্সপ্রেসওয়ে পিপিপি প্রকল্পের ২ (পাঁচ) বছরের জন্য Independent Engineer নিয়োগের লক্ষ্যে Thai MM Company Limited-এর সংশোধিত ফার্ম প্রাইস পাউন্ড ১০,২২,২৫৯.০০; থাই বাথ ১০,৯৫,৯০,৩৬৮.০০ ও টাকা ১২,৫৪,৩৫,৫৮২.০০ সর্বমোট সমতুল্য টাকা ৫২,৮০,৬৮,১৩৪.০০ (বায়ান্ন কোটি আশি লক্ষ আটষট্টি হাজার একশত চৌত্রিশ) টাকা এবং Thai MM Ltd. (Thailand)- Mott MacDonald Ltd. (UK)-Euroconsult Mott MacDonald BV (Netherlands) JV-এর সঙ্গে বাংলাদেশ সেতু কর্তৃপক্ষের চুক্তি সম্পাদনের লক্ষ্যে খসড়া Contract Agreement অনুমোদন করা যেতে পারে মর্মে সর্বসম্মতিক্রমে সুপারিশ করা হল।

(২) উল্লিখিত Contract Agreement-এর ধারা ১২.২.১ অনুসারে পরামর্শক প্রতিষ্ঠানের ব্যয় বিনিয়োগকারী প্রতিষ্ঠান ও বাংলাদেশ সেতু কর্তৃপক্ষ সমান হারে নির্বাহ করার বিষয়টি অনুমোদনের জন্যও সর্বসম্মতিক্রমে সুপারিশ করা হল।

অপর পৃষ্ঠায় চলবে



Appendix B: Site Clearance Issued by the DoE



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

Memo No : DoE/Clearance/5081/2011/241 Date: 12/06/2011

Subject: Site Clearance for Construction of Dhaka Elevated Expressway from Hazrat Shahjalal International Airport to Kutubkhali (connecting Dhaka-Chittagong Highway) under Public Private Partnership (PPP) Project.

Ref: 1) Your Application on 20/04/2011.

With reference to the above mentioned subject, the Department of Environment (DOE) hereby accords Site Clearance to project- "Construction of 42 kilometers (26 km expressway and 16 km exit ramp) Dhaka Elevated Expressway from Hazrat Shahjalal International Airport to Kutubkhali (connecting Dhaka-Chittagong Highway) under Public Private Partnership (PPP)" subject to fulfilling the following terms and conditions.

1. This clearance shall only be applicable for the development of the infrastructure of the said project.
2. Bangladesh Bridge Authority shall submit a comprehensive Environmental Impact Assessment (EIA) report considering the overall activity of the said Project in accordance with the TOR and time schedule submitted to the Department of Environment (DOE).
3. The EIA report should be prepared in accordance with following indicative outlines:
   1. Executive summary
   2. **Introduction**: (Background, brief description, scope of study, methodology, limitation, EIA team, references)
   3. Legislative, regulation and policy consideration (covering the potential legal, administrative, planning and policy framework within which the EIA will be prepared)

   4a. Project activities: A list of the main project activities to be undertaken during site clearing, construction as well as operation.

   4b. **Project schedule**: The phase and timing for development of the project.

   4c. **Resources and utilities demand**: Resources required to develop the project, such as soil and construction material and demand for utilities (water, electricity, sewerage, waste disposal and others), as well as infrastructure (road, drains, and others) to support the project.

4d. **Map and survey information**

Location map, Cadastral map showing land plots (project and adjacent area), Geological map showing geological units, fault zone, and other natural features.

5. Baseline Environmental Condition should include, inter alia, following:
   - Physical Environment : Geology, Topology, Geomorphology, Soils, Meteorology, and Hydrology.
   - Biological Environment : Habitats, Aquatic life and fisheries, Terrestrial Habitats and Flora and Fauna
   - Environment Quality : Air, Water, Soil and Sediment Quality.

6. Sclo-economic environment should include, inter alia, following:
   - Population: Demographic profile and ethnic composition
   - Settlement and housing
   - Traffic and transport
   - Public utilities: water supply, sanitation and solid waste
   - Economy and employment: employment structure and cultural issues in employment
   - Fisheries: fishing activities, fishing communities, commercial important species, fishing resources, commercial factors.

7. Identification, Prediction and Evaluation of Potential Impacts (identification, prediction and assessment of positive and negative impacts likely to result from the proposed project).

   In identification and analysis of potential impacts'-the 'Analysis' part shall include the analysis of relevant spatial and non-spatial data. The outcome of the analysis shall be presented with the scenarios, maps, graphics etc. for the cases of anticipated impacts on baseline. Description of the impacts of the project on air, water, land, hydrology, vegetation-man maid or natural, wildlife, socio-economic aspect shall be incorporated in detail.

8. Management Plan/Procedures:

   For each significant major impact, proposed mitigation measures will be set out for incorporation into project design or procedures, impacts, which are not capable of mitigation, will be identified as residual impacts. Both technical and financial plans shall be incorporated for proposed mitigation measures..

   An outline of the Environmental Management Plan and an emergency response plan shall be developed for the project.

   In Environmental Monitoring Plan, a detail technical and financial proposal shall be included for developing an in-house environmental monitoring system to be operated by the proponent's own resources (equipments and expertise).

consultation with interested parties and the general public will take place and their views taken into account in the planning and execution of the project)

Beneficial impacts (summarize the benefits of the project to the Bangladesh nation, people and local community and the enhancement potentials)

10. Conclusion and Recommendations

4. Without approval of EIA report by the Department of Environment, Bangladesh Bridge Authority shall not be able to open LC in favor of importable machineries.

5. Without obtaining Environmental Clearance, Bangladesh Bridge Authority shall not be able to start the physical activity of the project.

6. Bangladesh Bridge Authority shall submit the EIA along with an application for Environmental Clearance, the applicable fee in a treasury challan, the no objection certificates (NOCs) from the local authority and and NOC from other relevant agencies to the head office with a copy to Dhaka Divisional Office of DOE in Dhaka.

7. A soft copy of the image data as well as the maps to be generated from the image along with the EIA report shall be submitted to DOE Head Office.

8. This clearance is valid for one year from the date of issuance and Bangladesh Bridge Authority shall apply for renewal to Head Office with a copy to the Dhaka Divisional Office of DOE at least 30 days ahead of expiry.

(Syed Nazmul Ahsan)
Deputy Director (Environmental Clearance)
Phone : 8123783
E-mail : nazmul.doe-bd.org

Chief Engineer
Bangladesh Bridge Authority (BBA)
&
Project Coordinator
Dhaka Elevated Expressway PPP Project
Shera Bhaban, New Airport Road, Banani, Dhaka-1212

Copy Forwarded to :

1) The Secretary, Ministry of Environment and Forests, Bangladesh Secretariat, Dhaka.
2) Director, Department of Environment, Dhaka Division, Dhaka.
3) Staff Officer to the Director General, Department of Environment, Head Office, Dhaka.

Appendix C: Team of Consultants for EIA

Team of Consultants for EIA

No.	Name	Position Assigned
1.	Professor Dr. M. Ashraf Ali	Task Leader
2.	Professor Dr. A. B. M. Badruzzaman	EIA Specialist
3.	Professor Dr. Md. Shamsul Hoque	Transportation Planning Specialist
4.	Dr. Tanvir Ahmed	Air quality specialist
5.	Dr. Md. Hadiuzzaman	Transportation Specialist
6.	Dr. Mahbuboor Rahman Choudhury	EMP Specialist
7.	Dr. Md. Mohsinuzzaman Chowdhury	Ecologist and Resettlement Specialist
8.	Mr. Abdul Alim	Surveying Specialist
9.	Mr. Mahmudul Hasan	Field Engineer

Appendix D: Plants and Equipment to be used in Construction of DEE

Table B1: List of Plant and Equipment Proposed to be used during construction of elevated Expressway by FDEE (ITD Group)

Serial No.	Description of Machinery	Capacity	Specific Usage Purpose
1	Bull Dozer	120-180 hp	Site preparation, Earth work
2	Hydraulic Excavator	148-170 hp	Site preparation, Earth work
3	Hydraulic Excavator Long boom	148-170 hp	Substructure work
4	Hydraulic Excavator with Breaker + Bucket	180-210 hp	Site preparation
5	Hydraulic Excavator with Vibrohammer + bucket	250-270 hp	Site preparation
6	Motor Grader	165-222 hp	Road work
7	Wheel Loader	197-260 hp	Crushing/Batching Plant
8	Vibrating Roller	100-160 hp	Road work
9	Concrete Batching Plant	60-120 m^3 /hr	Concrete Work
10	Transit Mixer	3-7 m^3/unit	Concrete work
11	Asphaltic Concrete Plant	60-120 t/h	Asphalt Concrete work
12	Asphaltic Paver	190-250 hp	Asphalt Concrete work
13	Asphaltic Distributor I	4000-8000	Asphalt Concrete work
14	Rough Terrain Crane	45-55 t.	Substructure work
15	Rough Terrain Crane	100-150 t.	Precast I-Girder Erection
16	Crawler Crane	180-250 t.	Precast Segmental Yard
17	Mobile Concrete Pump	25-40 m.& 140-170 m^3/hr	Concrete work
18	Tower Crane	6-8 t.	Precast Segmental Yard
19	Generator Set	500 KVA	Crushing/Batching Plant
20	Generator Set	200-300 KVA	Precast Segmental Yard
21	Generator Set	50-150 KVA	Precast Segmental Yard
22	Gantry Crane & Electric Hoist	100 t.	Precast Segmental Yard
23	Gantry Crane & Electric Hoist	25 t.	Precast Segmental Yard
24	Truck 10 wheels with Crane 3-6 t.	3-6 t.	Substructure work
25	Flat Bed Trailer	20-35 t.	Material Transport
26	Low bed Trailer	50-100 t.	Precast Segmental Transport
27	Tractor Head	300-500 hp	Precast Segmental Transport
28	Backhoe Loader	80-125 hp	E & M
29	Dump Truck 10 Wheel	200-350 hp	Material Transport
30	Steel Roller 3 Wheel	10-20 t	Asphalt Concrete Work

Serial No.	Description of Machinery	Capacity	Specific Usage Purpose
31	Double Drum Compactor	3-4 t.	Asphalt Concrete Work
32	Ruber Tyre Roller	10-25 t.	Asphalt Concrete Work
33	Vibratory Compactor	3-7 t.	Substructure work
34	Water Truck	9000-12000 lts	Substructure work
35	Overhead Launching Gantry	500-1500 t.	Precast Segmental Erection
36	Crushing Plant	100-350 t/hr	Aggregate Crushing
37	Drilling Rig	200-300 hp	Piling work
38	Drilling Rig	200-400 hp	Piling work
39	Fork Lift	3-6 t.	Precast Segmental yard
40	Air compressor	125-285 cfm.	Substructure work
41	Air compressor	300-825 cfm.	Substructure work
42	Welding Machine	300-500 Amp.	Steel Fabrication Work
43	Double Drum Compactor	5-8 t.	Asphalt Concrete work
44	Farm Tractor with Blade	80-90 hp	Asphalt Concrete work
45	Service Truck	6-10 wheel	Equipment Maintenance
46	Fuel Truck	9000-12000 l.	Equipment Maintenance
47	Mini Bus or Van	10-20 Seat	Transport
48	Pickup Truck	2-5 Seat	Transport
49	Sedan Car	1500-2000 cc.	Transport
50	Sport Utility 2-4 WD	2500-3000 cc.	Transport

Appendix E

Guideline for Archaeological Impact Assessment

Bangladesh has long cultural history right from 3 rd century BC onwards. Enormous major and minor historical records are scattered in different parts of the country. The features of these antiquities have separated values and identities. During implementation of large-scale infrastructural development work/s an archaeologist needs to be present to rescue or recover any cultural resources present at the site.

To reduce the possibility of damaging archaeological objects, in case they are found while undertaking excavation works for different types of constructions, an authorized archaeological unit or at least an archaeologist should be asked to monitor the site periodically. The archaeologist, according to the Rules and Regulation of the Government of Bangladesh will study, make inventory and record it for the future.

Tasks:

(i) Conduct archaeological impact assessment for development programs at ULBs.
(ii) Execute sampling excavation and assess the significance of the materials found, propose mitigation measures to safeguard buried archaeology or erected/surface remains and suggest future research activity.
(iii) Assess risks to these archaeological materials by the proposed infrastructure and suggest changes to the infrastructural works.
(iv) Identify suitable mitigation measures and prepare environmental management plan.

Investigation

Archaeological impact assessment in the project area and its vicinity to identify impacted sites/remains in relation to the infrastructural work proposed. A team of experts need to conduct an extensive study and survey at the sub-project areas. The objective of this survey will also be to develop proposal of appropriate mitigation measures to be undertaken to safeguard the buried or surface archaeology. The other objective is to suggest for changes, if any, to the proposed infrastructure works which could better assure the safeguarding of archaeological materials of cultural and historical significance and also suggest for future archaeological research and excavation of the buried archaeology.

The team can adopt three different methods for this purpose.

a. Examination of available cartographic and other photographic records.
b. Review of available literature, reports of archaeological researches and explorations conducted at the Pourashava/ CC and surrounding areas.
c. Combing the city block by block or lane by lane through site inspection to unveil the historical facts.
d. On-site interaction with local people and to investigate clues if any in their traditions and legends.

Appendix F

Impact Screening and Assessment Guideline for Physical Cultural Resources (PCR)

(Ref: Physical Cultural Resources Safeguard Policy Guidebook, World Bank, 2009)

As stated in the World Bank PCR Safeguard Policy Guidebook, The PCR policy applies to projects having any one or more of the following three features:

(i) Projects involving significant excavations, demolition, movement of earth, flooding or other major environmental changes

(ii) Projects located within or in the vicinity of a recognized PCR conservation area or heritage site

(iii) Projects designed to support the management or conservation of PCR

The sub-projects under the MGSP will involve significant excavation works, movement of earth and temporary flooding. The Pourashavas and City Corporations have religious institutions (mosques, temples, Buddhist temples), few sites of archaeological importance, public libraries, cinema halls, community centers, which can be considered PCRs. However, the sub-project area of influence may or may not intersect these regions (since the sub-projects are generic in nature, actual locations of most of them still undetermined) . Therefore a generic impact assessment of Physical Cultural Resources is outlined in this section.

Guidance on identification of PCR

In the context of MGSP, the probable examples of PCR may be the following:

1. Human made: Religious buildings such as temples, mosques, churches, exemplary indigenous or vernacular architecture Buildings, or the remains of buildings of architectural or historic interest, Historic or architecturally important townscapes Archaeological sites (unknown or known, excavated or unexcavated), Commemorative monuments
2. Natural: historic trees, natural landscapes of outstanding aesthetic quality
3. Combined man-made or natural: Sites used for religious or social functions such as weddings, funerals, or other traditional community activities (community centres), burial grounds, family graves, cultural landscapes
4. Movable: registered or unregistered artifacts in temples or mosques, paintings, statues of important historical figures, religious artifacts, cultural artifacts etc.

Assessment of probable impacts due to activities:

Below is a list of project activities or features under the context of MGSP which may commonly give rise to negative impacts on PCR, divided into two periods: construction phase and operational phase.

Construction phase:

1. Establishment of work camps:
   - Vandalism, theft and illegal export of movable PCR, and of pieces of monumental PCR accessible directly or indirectly to migrant laborers,
   - Desecration of sacred sites.

2. Excavation, construction and soil compaction:
   - Direct physical damage to natural, manmade and buried PCR on site

3. Construction traffic:
   - Vibration, soil, air and water pollution causing damage to natural or manmade PCR on site.
   - Noise pollution can interfere with the use and enjoyment of PCR such as tourist destinations, historic buildings, religious establishments and cemeteries.

4. Mobilization of heavy construction equipment:
   - Damage to natural or manmade PCR on site
   - Soil compaction, damaging buried PCR (archaeological) onsite, and damaging pipelines and drains serving built PCR in the vicinity.

5. Flooding and Inundation:
   - Submergence or destruction of human-made, natural or buried PCR.
   - Barrier to access of all types of PCR.
   - Raised water table can lead to damage to all types of PCR.
   - Damage to aesthetics of scenic landscapes.

6. Waste disposal or landfill:
   - Burial or damage to natural, buried or underwater PCR.

Operation phase:

1. New and upgraded Roads:
   - Increased human traffic enjoying improved access to PCR of public interest leading to increased wear and damage, sacrilege of sacred sites, theft and vandalism of movable and, breakable PCR.
   - New highways cutting off access to living-culture PCR by residents of settlements on other side of the highway.
   - Increased air pollution and vibration from traffic causing damage to man-made PCR, particularly monuments and buildings.
   - Increased noise pollution interfering with enjoyment of people in tourist destinations, historic buildings, religious establishments and cemeteries.
   - In scenic areas, obtrusive highways having a negative visual impact on the landscape.
   - Roads and bridges which themselves constitute PCR being damaged by increased traffic.
   - Positive impacts may also occur, through the discovery of hitherto unknown sites and artifacts and generation of tourism.

2. Induced development:
   - Induced development leading to increased wear and damage, sacrilege of sacred sites, theft and vandalism of movable and breakable PCR, and damage to the aesthetics of scenic landscapes and townscapes.

3. Urban development:
   - Changes in demography or settlement patterns leading to decay of inner cities and abandonment and neglect of older residential areas containing built PCR such as vernacular architecture.
   - Developments which are out-of-character with their surroundings diminishing the aesthetic value of the townscape, decline in property values and ultimately, neglect of built PCR in the area.
   - Damage to the aesthetics of scenic landscapes and townscapes.

Guidelines for ToR for the PCR component:

In case of a sub-project which is not expected to have any impacts on PCR, it may be sufficient to include procedures for chance finds (Appendix H) . In case of Category “B” project where there may be a likely impact on PCR due to activities carried out under any of the sub-projects, the ToR may be tailor-made to the specific requirements. The ToR is expected to include potential major PCR issues, the likely impacts on PCR, the PCR impact areas, which will set boundaries for collecting the PCR baseline data along with any specialized PCR knowledge or skills required. In projects such as the MGSP, since the subproject locations are not yet determined, it will not be possible at this stage to identify the PCR impact areas and the type of PCR data that should be collected. In such cases, the ToR should require the EA team to establish these parameters at the beginning of the assignment,

and propose provisions for identifying and managing PCR during project implementation. The EA report for the corresponding sub-projects should be modified accordingly to incorporate the issues related to PCR in those cases. The investigations and findings with respect to PCR should form an integrated part of the EA report since OP 4.11 does not call for a separate report. Therefore the ToR for consultants for the generic EA assessment of sub-projects would still be valid with a few additional assignments on behalf of the consultants with respect to PCR:

- Regulatory environment: (Identification of any regulations and guidelines which will govern the conduct of the assessment) This section should also list any relevant national acts or regulations pertaining to the safeguarding of PCR
- Background information: (description of the physico-chemical, ecological and socioeconomic environment) All registered and unregistered, movable or immovable PCRs in the sub-project areas need to be identified in this part preferably using visual identification, consulting with local people. The report should have descriptions and visual illustrations of the PCRs.
- Impact assessment: (the consultant will identify the likely biophysical and social impacts in sufficient detail to be able to design suitable mitigation measures). Impacts on all types of PCR should be considered, both natural and man-made, registered and unregistered, movable an immovable.
- Analysis of alternatives: (the consultant will include PCR aspects when considering alternative projects or project locations)
- Environmental Management Plan including institutional arrangement for implementation and monitoring: (The ToR should state that mitigating measures arising from PCR impacts should be agreed to by the concerned and affected parties before they are submitted as recommendations in the EMP.)
- Public Participation (The ToR should point out the importance of the consultative process for the physical cultural resources component)

Appendix G

Chance Find Procedures

(Ref: The World Bank Operational Manual, 1999 OP4.11)

Works could impact sites of social, sacred, religious, or heritage value. “Chance find” procedures would apply when those sites are identified during the design phase or during the actual construction period and the related activity will not be eligible for financing under the project.

(1) Cultural property includes monuments, structures, works of art, or sites of significant points of view, and are defined as sites and structures having archaeological, historical, architectural, or religious significance, and natural sites with cultural values. This includes cemeteries, graveyards and graves.

(2) The list of negative subproject attributes which would make a subproject ineligible for support includes any activity that would adversely impact cultural property.

(3) In the event of finding of properties of cultural value during construction, the following procedures for identification, protection from theft, and treatment of discovered artifacts should be followed and included in standard bidding document.

(a) Stop the construction activities in the area of the chance find;
(b) Delineate the discovered site or area;
(c) Secure the site to prevent any damage or loss of removable objects.
(d) Notify the supervisory Engineer who in turn will notify the responsible local authorities;
(e) Responsible local authorities and the relevant Ministry would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures.
(f) Decisions on how to handle the finding shall be taken by the responsible authorities and the relevant Ministry. This could include changes in the layout (such as when finding an irremovable remain of cultural or archeological importance), conservation, restoration and salvage.
(g) Implementation of the authority decision concerning the management of the finding shall be communicated in writing by the relevant Ministry.
(h) Construction work could resume only after permission is given from the responsible local authorities and the relevant Ministry concerning safeguard of the heritage.

(4) These procedures must be referred to as standard provisions in construction contracts. During project supervision, the Site Engineer shall monitor the above regulations relating to the treatment of any chance find encountered.

(5) Relevant findings will be recorded in World Bank Supervision Reports and Implementation Completion Reports will assess the overall effectiveness of the project’s cultural property mitigation, management, and activities, as appropriate.

Appendix H

List of Participants in the FGDs

01 Kurmitola HS

Dhaka Elevated Expressway PPP Project

Participant List for FGD (Focus Group Discussion)

FGD: 1 Venue: Kurmitola High School Date & Time: 28/01/2011 10.00 AM

SL	Name	Address	Age	Sex	Profession	Mobile No.	Signature
1.	মোঃ জুবাইদুল ইসলাম	বিমানবন্দর	30	Male	Business	01933-465219	
2.	মোঃ কাসেম.	বিমানবন্দর	45	"	Business	01817-587279	
3.	মৌসুমী মোঃ মেজবাহুল হাসান	বিমানবন্দর	56	"	House hold Rat	01711-958629	28-1-2011
4.	মোঃ নেওয়াজ করিম	বিমানবন্দর	23	"	govt. Service	01747.012019	28/01/11
5.	শহীদুল্লাহ প্রধানী	"	48	"	house hold Rat	01711-692266	
6.	ঝু.নদী	"	32	"		01711245826	
7.	মোঃ আলমগীর উদ্দিন	"	40			01711381644	
8.	মোঃ সাহিদুল ইসলাম	"	45	"	Teacher	01711153850	
9.	মোঃ রফিকুল আলম	"	42	"	Daylabour	01190-802456	
10.	মোঃ ও মোঃ সাইফুল্লাহ	Mirpur	22	"	Surviice surveyor	01918-190347	
11.	মোঃ আরিফ	"	25				
12.	Mahmudur Rahman	Bangladesh Bridge Authority	25	"	Asst. Engs		
13.	M. ASHRAF ALI	BUET	46	"	PROFESSOR	01713-043325	
14.	MD. Mahbub						
15.	মোঃ তাহার হোসেন চৌধুরী	"	40				
16.	মোঃ আঃ সালেক	Ass. Headmaster, K.H.S.	40	"	Teaching	01670187505	

Kurmitola HS. P-2

SL	Name	Area	Point	Age	Sex	Profession	Mobile No.	Signature
17.	মোঃ আবুল খায়ের	বিমানবন্দর	1	48	Male	House holder & Business	01821653617	
18.	মোঃ সবুজ	"	"	36	"	private car driver	01731797860	
19.	মোঃ মনির	"	1	21	"	Van driver		
20.	মোঃ সবুজ মিয়া	"	1	26	"	"	01720974407	
21.	মোঃ রফিকুল ইসলাম	"	1	53	"		01916299597	
22.	মোঃ কুদ্দুস হোসেন	✓ "	1	30	"	Business	01933465219	
23.	মোঃ নেওয়াজ শরীফ	✓ "	1	23	"	Service	01747012019	
24.	শ্রীমতি নমিতা রানী বিশ্বাস	বাসী "	1	32	F		0	
25.	সফিকুল্লাহ বাদশাহী	"	1	40	M	House holder & Business	01711692266	
26.	মোঃ রফিকুল ইসলাম	"	1	42	"		01190802456	
27.	মোঃ আবুল কাশেম	"	1	45	"		01711381646	
28.								
29.								
30.								
31.								
32.								
33.								
34.								
35.								

Kurmitola HS P-2

SL	Name	Address	Age	Sex	Profession	Mobile No.	Signature
17.	[illegible]	[illegible]	42	[illegible]	Executive, Bijoy	01711397000	[illegible]
18.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	01552318202	[illegible]
19.	DR. M.M. CHOWDHURY	E. Rampura, Dhaka					
20.	Md. Mezanur Rahman	Rayerbag, Kadamtali, Dhaka	35	M	Service	01913771400	[illegible]
21.	[illegible]	[illegible]	52	M	Business	01725-682875	[illegible]
22.							
23.							
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-কুর্মিটোলা হাই স্কুল. (1)

Time - 10.00AM
Date - 28-01-2011

Dhaka Elevated Expressway PPP Project

Respondents List for FGD (Focus Group Discussion) Meeting

P-1

FGD: 1 Venue: Kurmitola High School Date & Time:

SL	Name	Area	Point	Age	Sex	Profession	Mobile No.	Signature
1.	জনাব আব্দুল কুদ্দুস ভূঁইয়া প্রধান শিক্ষক	School Teacher					8916595	
2.	জনাব আব্দুল খালেক সহকারী প্রধান শিক্ষক						9961663	
3.	শহিদুল ইসলাম						01711153850	
4.	মো: জালাল উদ্দিন						01922955204	
5.	মো: আব্দুল হাফিজ						01911147031	
6.	মো: আব্দুল কুদ্দুস খান						01911-308604	
7.	পিয়ন (1)							
8.	পিয়ন (2)							
9.	মো: জাকের ✓	পশ্চিমপ্রেত ✓	1	45	Male	Busines	01817587279	
10.	মনুনুল হক	পশ্চিমপ্রেত	1	40	"	House Holder	01828076144	
11.	মো: আব্দুল মজুমদার	"	1	31	Male	Mosque	01736612186	
12.	মো: রহমান ইউনুছ	"	1	50	"	HouseHolder	~~01717880~~ 01186895	Rahma Yusuf
13.	মো: মোমেন	"	1	30		R Service	01671169984	
14.	হাজী মো: আবুল হোসেন ভূঁইয়া	" ✓	1	56	"	House holder	01711958629	
15.	মো: আমজাদ হোসেন	"	1	29	"	Business	01714649397	
16.	মো হাজী মোস্তফা হোসেন	"	1	53	"	House Holder		

02 Public Health

A1

Dhaka Elevated Expressway PPP Project

Participant List for FGD (Focus Group Discussion)

3:30PM

FGD: 2 **Venue:** Auditorium; Public Health Institute **Date & Time:** 28/01/2011

SL	Name	Address	Age	Sex	Profession	Mobile No.	Signature
1.	Z. A. [illegible]	120 ARJTPARA	48			01730786391	
2.	[illegible]	[illegible]	80		[illegible]	01720810604	
3.	[illegible]	[illegible]	[illegible]		[illegible]	01913393151	
4.	[illegible]	[illegible]	66		[illegible]	01715498762	
5.	অনুপমা	মহাখালী বেতারাই	40		গৃহিনী		অনুপমা
6.	আবুল হামিদ	292 পশ্চিম নাখাল পাড়া	19		ছাত্র।	01191590450	Hamid
7.	মো: আনসুর আলম খান	229/2 তেজতুরী বাজার	32		ভবসুত পাথর সাপ্লায়ী ব্যবসা	01711638205	
8.	মো: ফিরোজ আলিমিক	২২৯/১ তেজতুরিবাগ	56		অবসর	01720962755	MD Hallu
9.	মো: আবুল কাশেম ভূঁইয়া	29, [illegible]	48		ব্যবসা	01726915891	BASHAR
10.	মো: [illegible]	[illegible]					
11.	মোঃ [illegible]	[illegible]			ব্যবসা	01711-088426	
12.	Azizul Haque	238/A Tejkunipara	20	male	Student	01195221134	Azizul
13.	ফকির মো: দিপ্পাত	৩৫/আবজুত পাড়া	85		ব্যবসা	01921876187	
14.	[illegible]	[illegible]	85	mail	ব্যবসা	01819194942	
15.	মো: [illegible]	[illegible]			[illegible]	01916785772	
16.	মো: [illegible]	[illegible]	88		[illegible]	[illegible]	

Public H I P-2

SL	Name	Address	Age	Sex	Profession	Mobile No.	Signature
17.	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
18.	[illegible]	[illegible]	[illegible]		[illegible]	01715505854	[illegible]
19.	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
20.	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]
21.	[illegible]	[illegible]	[illegible]	Male	[illegible]	0	[illegible]
22.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	01933-420219	[illegible]
23.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	01674-870463	[illegible]
24.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]
25.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	—	[illegible]
26.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	01	[illegible]
27.	[illegible]	[illegible]	[illegible]	Female	[illegible]	—	[illegible]
28.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	01711-397006	[illegible]
29.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
30.	Md. Mejbaur Rahman	Rayerbag, Dhaka	35	Male	Data Analyst	01913771400	[illegible]
31.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	01553389048	[illegible]
32.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	01716429557	[illegible]
33.	[illegible]		[illegible]	[illegible]	[illegible]	01782344444	[illegible]
34.	[illegible]		22	[illegible]	P. 706	01918-190347	[illegible]
35.	[illegible]		[illegible]		P. 706		[illegible]

Public HI P-3

SL	Name	Address	Age	Sex	Profession	Mobile No.	Signature
36.	Siddique Rahman	Jahangirnagar University	37	M	Consultant		
37.							
38.							
39.							
40.							
41.							
42.							
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44.							
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49.							
50.							

জনসাক্ষাৎ - প্রস্তাবিত ২য় ১০০ ফিট ফ্লাই ওভার

Time – 03:30 Pm.

Dhaka Elevated Express Way (PPP project) (2)

Date - 28-01-2011

Respondents List for FGD (Focus Group Discussion)

FGD: 2 Venue: Auditorium; Public Health Institute Date & Time: 28/01/2011

SL	Name	Area	Point	Age	Sex	Profession	Mobile No.	Signature
১.	ঠিকানা ①	মহাখালী	2		Male			
২.	ঠিকানা - ②	"	"		"			
৩.	দুলাল	"	"		"	Vangori		
৪.	শাবুন হোসেন	"	"	45	~~M~~	P. Service	01674870463 বাড়ি	
৫.	আবদুর রহমান x	"	"	35	~~M~~	Rickshaw Makanic	01920500063	
৬.	মনা মিঞা	"	"			Fariwala		
৭.	হারুন	"	"			Rickshaw driver		
৮.	পুলিশ হোসেন	"	"	32	"	Business	01913393151	
৯.	লতিফ	"	"	45	"	"	01915498762	
১০.	সাইফুল ইসলাম	"	"	40	"	"	01720810604	
১১.	মোঃ আরিফুল ইসলাম	"	"	44	"	Rickshaw Garage	01911549041	
12.	আবুল মোঃ মিনাত	"	"	45	"	Business	01921876187	
13.	মোঃ শহিদুল্লাহ	"	"	48	"	Karkhana	01730986391	
14.	মুহিব	"	"	38	"	Business	01716685293	
X15.	জামাল উদ্দিন	"	"	42	"	House holder	01913451162	
16.	মোঃ আবদাউদ্দিন	"	"	45	"	P. Service	01732875160	

DAY

Public Ht P-2

SL	Name	Area	Point	Age	Sex	Profession	Mobile No.	Signature
17.	কায়েকজন শিকদার	মহাখালী রেলগেট	2	৬৫	Male	Day labour	01739-049277	
18.	আনু বেগম	মহাখালী রেলগেট	২	৪০	Female	Day labour		
19.	মোঃ সলিম	আবজত পাড়া রেলগেট	২	৪৪	Male	ব্যবসায়ী	01716-850476	
20.	মোঃ হুমায়ুন কবির মিঠন	৪৪৩ আবজত পাড়া	২	৪৬	"	B. H Hold	01715-595854	MD Haver
21.	মোঃ হোসেন সরকার	আবজত পাড়া রেল লাইন	২	৬২	"	B. H. Hold	01711-115414	MD Haver
22.	মোঃ আবুল কাশেম	৪৬ আবজত পাড়া	২	৪৪	"	H. Hold Rent	01673-984489	
23.	সাইফুল ইসলাম	৪৩ আবজত পাড়া	২	৩৫	"	Business Leader	9111433	
24.	মোঃ গিয়াস উদ্দিন	৩২১/A পশ্চিম নাখাল পাড়া	২	৪৫	"	Business+H. Rent	9116740	
25.	(সুলতানা) X	২৭৬ পশ্চিম নাখাল পাড়া	২	৪৫	"	House wife	9129444	
26.	আবুল বাসার ভূঞা	২৭৫ পশ্চিম নাখাল পাড়া	২	৪৮	"	Doctor H. Hold	01726-915891	
27.	আবুল হামিদ	২৭২ পশ্চিম নাখাল পাড়া	২	২১	"	Student	01191-590450	Hamid
28.	মোঃ গোলাম মাওলা	১৫৪ পশ্চিম নাখাল পাড়া	২	৫৭	"	Business+H. Rent	01935-953221	
29.	মোঃ গোলাম মাওলা	১৫৪/এ ৪ ২	২	৪৩	"	Business+H. Hold	01553-389048	
30.	মোঃ বিল্লাল	২১৮/৩ পশ্চিম তেঁতুলিয়া পাড়া	২	৪৮	"	Gold Business	0191G-785772	
31.	~~মোঃ কাল্লু সরকার~~	২১৮/৩ তেঁতুলিয়া পাড়া	২	৬৫	"	H. Holder Rent	01198177266	
32.	মোঃ আরিফ উদ্দিন (আবদুল হক)	—	—	—	—	—	—	—
33.	মোঃ লিয়াকত আলী খান	২১৯/১ তেঁতুলিয়া পাড়া	২	৫০	"	Business	01720-962755	MD Kallu
34.	মোঃ সাইফুল্লিন মাহমুদ	২২৭/২ তেঁতুলিয়া পাড়া	২	৩৭	"	Business H. Hold	01711-126329	
35.								

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03 Tejgaon College

B1

Dhaka Elevated Expressway PPP Project

Participant List for FGD (Focus Group Discussion)

9.00 AM

FGD: 3 **Venue:** Teacher's Room; Tejgaon College **Date & Time:** 29/1/2011

SL	Name	Address	Age	Sex	Profession	Mobile No.	Signature
1.	Fattuq Ahmed	Tejgaon college Dhaka	30	Male	Leeturetr	01718796916	
2.	MD. Bengiz Ahmed	Tejgaon college, Dhaka	32	Male	Leeturer	01720530420	
3.	[illegible]	[illegible]	42	u	[illegible]	01711-115795	
4.	Mir. Lutfor Rahman	Tejgaon collen	38	Male	Lecturer	01717474966	
5.	[illegible]	[illegible]	05	u	[illegible]	01936-595132	
6.	[illegible]	[illegible]	55	"	[illegible]	01552305962	
7.	[illegible]	[illegible]	82	u	[illegible]	01923117930	
8.	Chowdhury Rakib Hossain	11, College street, Dhanmondi, Dhaka	35		Business	01819-220200	
9.	Chowdhury Mamf Hossain	11. College street Dhanmondi	40	u	Business	01913380540	
10.	MIRAJ HOSSAIN	49/5 SOUTH BAGUN					
11.	Md. Minar Hossain	Bari P.O. e Rail Crossing 49/2 SOUTH BAGUN	33	MALE	Bussiness	01928085816	Miraj Hossain
12.	[illegible]	Bari, Tejgaon Dhaka 20/2 [illegible]	48	u	Bussiness	01672493786	29/1/11
13.	[illegible]	20/2 [illegible]	45	"	"	01919886320	29.1.11
14.	Prof. Khan M A Manzur	DG. Islamia Eye Hospital	72	m	EYESPECIALIST.	01711423092	
15.	Nirmal Chandra Sikder	National polytechn	53	M	Teacher.	01711240266	
16.	Md. Saimul Alam	"	32	M	Director	01911316010	

Tejgaon College P-2

SL	Name	Address	Age	Sex	Profession	Mobile No.	Signature
17.	MEHEDI HASAN TAREK	BUET	25	M	Engineer	01670233130	
18.	Saifullah	Socio Economic Surya	22	M	Student	01918-190347	
19.	Aftabur Rahmen Chy.	11	40	M		01718234464	
20.	MD. Joynal Abedin	Tejgaon college	41	M	Teacher	01817124491	
21.	Md. Mizanur Rahman	Rayerbag, Dhaka	35	M	Service	01913771400	
22.	AHMS Akter	Executive Engineer	42	Male	Officer	01711-397001	
23.	MD. ARSHADUL ISLAM	Tejgaon College	44	M.	Teacher	01911769548	
24.	Md. Abdul Kaiser	Tejgaon College	55	M	Asstt. Prof.	01552-400954	
25.	Md. Memunur Rashid	Tejgaon College	30	M	Teacher	01913219893	
26.	MD. Hafizur Rahman	Tejgaon college	30	M	Lecturer	01917166176	
27.	Probash ch. Choudhury	Tejgaon college	28	Male	lecturer	01712-472645	
28.	Md Mahbub	11	54	11		01913164033	
29.	MN Zaman	T.C.	65	11	Staff	01911214[illegible]	
30.	Md. Abduzzaher	Tejgaon College.	55	M	Professor	01912131236	
31.	Nasrin AKTER	11	28	F	Lecturer	01716[illegible]	
32.							
33.							
34.							
35.							

C1 (3)

Dhaka Elevated Express Way (PPP project)

Respondents List for FGD (Focus Group Discussion)

FGD: 3 **Venue:** Teacher's Room; Tejgaon College **Date & Time:** 29/01/11 ; 9:00 AM

SL	Name	Area	Point	Age	Sex	Profession	Mobile No.	Signature
1.							01712194897	
2.							01928085816	
3.							01672443786	
4.							01936575132	
5.							01923117930	
6.							01715177037	
7.							01552305962	
8.							~~01711338032~~	
9.								
10.							01711338032	
11.		NPI Engineering Ltd. Director					01911316010	
12.		"					01711240266	
13.							01675418840	
14.							9119315	
15.							DO	
16.							01715128092	

Tejgaon College P-2

	Name	Area	Point	Age	Sex	Profession	Mobile No.	Signature
17.	[illegible]	[illegible]	[illegible]				01712155750	
18.	[illegible]	[illegible]	[illegible]				01711115795	
19.	[illegible]	[illegible]					01819220200	
20.	[illegible]	[illegible]					01913380540	
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04 Kamalapur H.S

Dhaka Elevated Expressway PPP Project D-1

Participant List for FGD (Focus Group Discussion)

FGD: 4 **Venue:** Hall Room ; Kamalapur High School **Date & Time:** 29/1/11 ; 11.30 AM

SL	Name	Address	Age	Sex	Profession	Mobile No.	Signature
1.	Md. Mizanur Rahman	Demra, Dhaka	35	M	Service	01913771400	
2.	Khan MD ALI AKBAR	Khilghaon, Bagicha	32	M	Service	01912115341	
3.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	01743-245873	
4.	[illegible]	[illegible]	80		[illegible]	01911333739	
5.	[illegible]	[illegible]	22	[illegible]	[illegible]	02-7913632	
6.	Md. FIROZ Hasan	[illegible]	45	=	Businessman	0171-957533	
7.	Md. Rabiulhasan. Rabi	Goreen	28	=	Businessman	01712-264489	
8.	Dhiraj kumar Sikder	51/7 South Basshaboo	50	M	Teaching	01726350780	
9.	Mahmudur Rahman	Bangladesh Bridge Authority	25	m	Asstt. Engr.		
10.	A.H.M.S. Akhtar	Executive Engineer	42	11	Engineer	01711-39700	
11.	Mehedi Hasan Tanek	Buet	25	M	Engineer	01670233130	
12.	M.A. Waduch	75. NOURTH MUGHDA	38	11	TEACHEAR	01919410818	
13.	[illegible]	[illegible]	[illegible]	M	[illegible]	01720306996	
14.	A.K.M. Shamim	86/29/[illegible]	[illegible]	M	[illegible]	01818215476	
15.	md. Abdullah Hil Baki	82/B/2, madertek	42	M	Business	01923804655	
16.	MD. AL-MAMUN	49/1 SOUTH MUGDA	25	M	STUDENT	01921454220	

Kamalapur H.S. P-2

SL	Name	Address	Age	Sex	Profession	Mobile No.	Signature
17.	[illegible]	[illegible]	82	M	[illegible]	01676826062	[illegible]
18.	[illegible]	[illegible]	25	M	[illegible]	01711142493	[illegible]
19.	[illegible]	[illegible]	52	M	Service	01716601463	[illegible]
20.	[illegible]	[illegible]	29	M	[illegible]	01719434828	[illegible]
21.	[illegible]	[illegible]	38	F	[illegible]	01718643148	[illegible]
22.	Saifullah	Socio Economic Surveyor	22	M	Student	01918-190347	Saifullah
23.	[illegible]	[illegible]	42	M	[illegible]	01822893793	[illegible]
24.	[illegible]		80	M		01718234444	[illegible]
25.	[illegible]	[illegible]	26	F	[illegible]	01918863333	[illegible]
26.	[illegible]	[illegible]	42	M	[illegible]	01918869333	[illegible]
27.	Md. Forman Ali	Ass. teacher, Kamalapur School & College	40	M	Service	01716942418	[illegible]
28.	Md. Sharif Khan	Asst., teacher, K.U.C	47	"	Service	01915-757655	[illegible]
29.	MD: Rasul ISLAM	15, MANIK NAGAR	30	"	Service	01734359992	[illegible]
30.	MD. AMINUL ISLAM	15 MANIK NAGAR	30	"	Service	01710203678	[illegible]
31.	[illegible]	FC. D	28	"	-	-	[illegible]
32.							
33.							
34.							
35.							

কমলাপুর স্কুলের হল রুম ④ সময়: ১১:৩০ সকাল
তারিখ: ২৯.০১.২০১১

Dhaka Elevated Express Way (PPP project)

Respondents List for FGD (Focus Group Discussion)

FGD: 4 **Venue:** Hall Room ; Kamalapur High School **Date & Time:** 29/01/11 11'30AM

SL	Name	Area	Point	Age	Sex	Profession	Mobile No.	Signature
1.	মোঃ আবু সাইদ আল মামুন	কমলাপুর	4				01716807171	
2.	আল হাজ্ব আবু তাহের	৪						
3.	মোঃ মোকাররম হোসেন	৮						
4.	মোঃ হাবিবুল হক	৮						
5.	মোঃ মাহবুব রহমান	৮						
6.	মোঃ আবুব আলীতারুক্কা	৮						
7.	মোছাঃ আবুল খায়ের	৮						
8.	মোঃ হাবিবুর রহমান	৮						
9.	শিপ্রা বিশ্বাস	৮						
10.	মোছাঃ হাসনা খাতুন	৮						
11.	মোহাম্মদ আল মামুন	কমলাপুর	৪	40		ব্যবসা	01676826060	মামুন
12.	মোঃ মিজানুর রহমান	৮				ব্যবসা	01711957533	
13.	এ কে এম কাশীর	মতিঝিল		45		চাকুরি	01818205476	
14.	মোকাররম হোসেন	কমলাপুর		42		ব্যবসা/চাকুরি	01711147493	
15.	মোঃ ইদ্রিস মুন্সী	কমলাপুর		65		ব্যবসা	01743245893	
16.	মোঃ খায়রুল	৮		45		সরকারি চাকরি	01	

Kamalapur H. S. P-2

	Name	Area	Point	Age	Sex	Profession	Mobile No.	Signature
17.	মোঃ সাইফুল	পশ্চিম	4	25	Male	ব্যবসা	01717434828	
18.	মোঃ আলী আজগর	মুগদা	1	25		ছাত্র	01921454220	Mamun
19.	তানভীর হাসনাত রনি	পশ্চিম নয়া	4	26		ছাত্র	01912101494	
20.	মোঃ বরকত উল্লাহ	"	4	35		সরকারী চাকুরী	01918863333	
21.	আবদুল্লাহিল বাকী	কাশবন	4	40		চাকুরী	01923806655	
22.	মোঃ মহসিন মিয়া	"	4	32		চাকুরী	01716601463	
23.	মোঃ হারুন অর রশিদ	Private মধুবাগ	4	45			01720306996	
24.	রবিন ইসলাম	প্রধানিক নগর মুগদা	4			বেসরকারী চাকুরী	01914340433	
25.	আবদুল মতিন	"	4	78		বেসরকারী চাকুরী		
26.	মোঃ আবুল হক	প্রধানিক নগর	6	64	M	"	02754706 3	
27.	মিঠি আক্তার	"	4	40	Female	"	01914514318	
28.	মোঃ হাসিব উদ্দিন	"	4	31	Male	ব্যবসা	01748624906	
29.	মোঃ নান্নু	"	1	35		"	01915221576	
30.	প্রধানিক নগর মহিলা পরিষদ	প্রধানিক নগর	4	28	female	গার্মেন্টস	01718-643198	
31.	মোঃ আলম	প্রধানিক নগর	4	28	Male	Business + H.Wife	01921-565253	
32.	আসিফুল	কাজী অফিস		২৫	"	কাজী সহকারী		
33.	রেজাউল ইসলাম	প্রধানিক নগর		৩৪	"	চাকুরি জীবি	01734-359992	
34.	মোঃ রফিকুল ইসলাম নয়ন	৬০ নং ওয়ার্ড মুগদা কাজী		৪৫	"	ব্যবসা + কাউন্সিলর	01715823777	
35.	শেখ রোকন আলী তালুকদার	পশ্চিম ওয়ার্ড মুগদা		৪৩	"	আমদানী জীবি	01819-011591	

Kamalapur H. S P-3

	Name	Area	Point	Age	Sex	Profession	Mobile No.	Signature
36.	মোঃ আব্দুল বাসার	উত্তর সুগন্ধা পাড়া	৫	৫২	Male	বিক্রয় প্রতিনিধি	01927-139532	
37.	মোঃ গাউসুল আলম	খিলগাঁও কাগজার পাড়	৫	22	"	ব্যবসা	01751-716383	
38.	মোঃ আঃ আবুল হাসান	ঐ	৫	৪৫	"	মুদ্রণ মালিক	01	
39.	রবি	বাসাবো	৫	২৩	"			
40.	বিপিন	খিলগাঁও রেলগেট	৫	৩২	"	P. Service	01912-115341	
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05 Donia University College

F-1

Dhaka Elevated Expressway PPP Project

Participant List for FGD (Focus Group Discussion)

3.30 PM

FGD: 5 **Venue:** Donia University College **Date & Time:** 29/01/2011

SL	Name	Address	Age	Sex	Profession	Mobile No.	Signature
1.	মুলতানা রাজিয়া	৪২৭, দনিয়া স্কুলের রাস্তা	৩২	মহিলা	প্রশিক্ষক(বাংলা)	01914418686	মুলতানা
2.	কামরুন্নেছা খান	First Security	00	M	চাকুরি	01916169974	
3.	মাহবুব আলম	First Security	২৮	M	চাকুরি	01918-691463	
4.	মোঃ মাহফুজ আলম	South Shukdi Donia	৪৩	Male	ব্যবসা	01552331354	
5.	Md. Mizanur Rahman	Rayerbag	35	M	Service	01913771400	
6.	MD. Mizanur Rahman	Sontaknain Road	40	M	Business	01554327727	
7.	Md. Faysal Mahamud	9, Shahid titumir road Santala, Donia, Jatrabari	31	M	Student	01916831833	Fmahamud
8.	Sagar ch. Debnath.	Lecturer, Dept. of Statistics Donia University College	30	M	Lecturer Dept. Statistics	01720012509	29.1.11
9.	Md. Rezaul karim	Donia University College	29	M	Lecturer	01715269545	29.1.11
10.	Md. Mahbub Rahman	Donia University College	59	M	Service (Ret)	01713047607	29/1/11
11.	Md. Mosharraf Hossain	— ০০ —	59	M	Business	01726292512	
12.	Aftabur Rahman Ray		40	M		01718234444	
13.	Md. Mahfuzur Rahman	455 Donia, jatabari	48	M	Engineer	01714340011	
14.	Saifullah	Socio Economic Surveyer	22	M	Student	01918-190347	Saifullah
15.	Mehedi Hasan Tarek	~~Engr~~ Buet	25	M	Engineer	01670233130	Tarek
16.	Mahmudur Rahman	Bangladesh Bridge Authority	25	m	Asst. Engr		Rahman

Donia Univ. College F-2 P-2

SL	Name	Address	Age	Sex	Profession	Mobile No.	Signature
17.	MD ABDUL LATIF	817 DANIA	66yrs	male	Rtd. Govt. Servic	01712007756	22/1/20
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-দনিয়া বিশ্ব বিদ্যালয় - 1 সময়: ৩:৩০ বিকাল

⑤ তারিখ: ২৯.০১.২০১১

Dhaka Elevated Expressway PPP Project

Respondents List for FGD (Focus Group Discussion) Meeting

FGD: 5 Venue: Donia University College Date & Time: 3.30 PM 29/01/2011

SL	Name	Area	Point	Age	Sex	Profession	Mobile No.	Signature
1.								
2.								
3.								
4.								
5.		College teacher						
6.								
7.								
8.								
9.								
10.								
11.								
12.								
13.	-জাহাঙ্গীর আলকন	দক্ষিন যৌবদী বলা	5	58	M	ব্যবসা করা	01916-226436	-জাহাঙ্গীর
14.	মোঃ রওশন আরফিন	দক্ষিন যৌবদী	5	49	M	ডাক্তার+কলেজী	01552381354	
15.	মোঃ বাবের চ X	পলাশপুর	5	66	M	বেসরকারি চাকুরি	01717-176457	-মোঃ বাবের
16.	মোঃ জাকারিয়া X	মাশরিফুল মিলনা	5	28	M	ইমারাতে	01737-261364	-মোঃ জাকারিয়া

Donia Univ. College

P-2

SL	Name	Area	Point	Age	Sex	Profession	Mobile No.	Signature
27.	আবুল কালাম আজাদ	কাচড়ত বাস পাশে	5	38	M	বড় ব্যবসায়ী	01712-112492	
28.	S.M Turaj	০২. শহীদ মিজানের	5	23	M	Student	01719-460134	
29.	মোঃ-ইসমাইল হোসেন	০৩. শহীদ মিজানের	5	38	M	H. Hold+B	01712-501178	
30.	মোঃ ফয়সাল মাহমুদ	০৩ শহীদ মিজানের	5	31	M	Student	01916-831833	Emahamud
31.	আবুল খায়ের	ইনার্টেক, কাকলা	5	40	M	Day Labour	01736-037087	
32.	মোঃ আবুস সাত্তার	২৯. ইনার্টেক	5	65	M	H. Hold Rent	01197061764	
33.	কুদরত আলী	B-5 ইনার্টেক	5	58	M	H. Hold	01817-644432	
34.	আলী আকবর	ঈদগাহ ইনার্টেক	5	36	M	Busines	01712-114070	
35.	মোঃআমজাদ হোসেন	06 স্কুল রোড	50	60	M	++ Hold++ Engineer	01741-582713	
36.	মোঃ কাহার্ণীর আলম	04 ইনার্টেক	5	50	M	Business	01920-993949	
37.	মোঃ মিজানুর রহমান	ইনার্টেক মোড়	5	40	M	ফার্মেসী + MBill	01554-327727	
38.	মোঃ মাহফুজুর রহমান	456 ঈদগাহ বাসস্ট্যান্ড	5	49	M	Ingenier	01714-340031	
39.	কামরুল →	ঈদগাহ	5	35	M	Service	01916189974	
40.	মোঃ গালিব মাসুদ	01-01- একিয়া ঈদগাহ	5	24	M	Business	01811-963266	
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