

Feasibility Study

EXECUTIVE SUMMARY

Dhaka East West (Middle/ Outer Ring Road) Elevated Expressway

August 2017



Structure of the Report

Vol- 1

EXECUTIVE SUMMARY

Vol-2

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1. EXECUTIVE SUMMARY

1.1. Project Overview and Description

The Dhaka East West Elevated Expressway Project (DEWEEP) is proposed as a 39.0 (approx.) km elevated expressway to allow traffic to travel around the western perimeter of Dhaka between Highway N5 (the Dhaka Aricha Highway) and Highway N1 (the Dhaka Chittagong Highway) with connections to Highway N8 (the Dhaka Mawa Highway which links directly to the Padma Bridge and to Narayanganj via Road R111 (the Dhaka Narayanganj Road). By making these connections between these major highways and thus the north, south and west of the country the expressway will have some effect on removing through traffic from Dhaka and thereby reducing traffic congestion in the capital.

The expressway is consistent with the strategic road network planning of both the Dhaka Structure Plan (2016 -2035) and the Asian Highway Network. The expressway will form an important part of AH1 and thus will be vital for establishing an improved transport link on the Trans-Asian highways.

An integral part of the project is its connection to the upgraded Highway N8 (Dhaka Mawa Highway) and hence the Padma Bridge. That connection will allow traffic to travel across the Padma River and south to Chittagong as well as northward to Joydebpur and Tangail on the outskirts of Dhaka and onwards to the northern districts such as Mymensingh.

The Dhaka East West Elevated Expressway (DEWEE) which implements the proposed Middle/Outer Ring Road will be 39.23 kilometre long signal-free expressway with a design speed of 80 km/hr, a four-lane carriageway and having two pairs of entry /exit ramps in addition to the entry/exit ramps at the northern end at Hemayetpur and at the southern connection to the Dhaka – Chittagong Highway N1 at Langolbandh. Its route alignment is from Baliarpur (N5 on Dhaka – Aricha Highway) – Baliarpur – Bhakurta – Bhawal – Sakta – Baghair – Kundar char – Dapa – Pilkuni - Jalkuri – Goadnail - Lakshman Khola – Langolbandh (on Dhaka – Chittagong Highway N1). In addition there will be two pair ramp interchange at Bhawal on Kalatia – Atibazar.

The DEWEEP is envisaged to be a tolled expressway suitable for use by motorised traffic such as trucks, buses and cars. Motorcycles will be able to use the expressway as their performance characteristics are compatible with heavier, faster vehicles. For reasons of safety and expressway capacity, CNGs and non-motorised traffic should not be permitted on the expressway.

The main features of the Dhaka East West Elevated Expressway are as shown in the table below:

Total Length (km)	39+230
Connecting NH/RH/FR	N5, N8, N1, R111 & Atibazar- Kalatia Road at Bhawal
Crossing major river	3 (Kundarchar, Buriganga & Shitalakhya)
Touching Upazila	Savar, Keraniganj, Fatullah, Siddhirganj and Bandar
Touching Mouzas	48
Reqd. Land Acquisition (Acre)	341
Time for implementation	5 Years

1.2. Outlines of the project Features

1.2.1. Alignment of the project

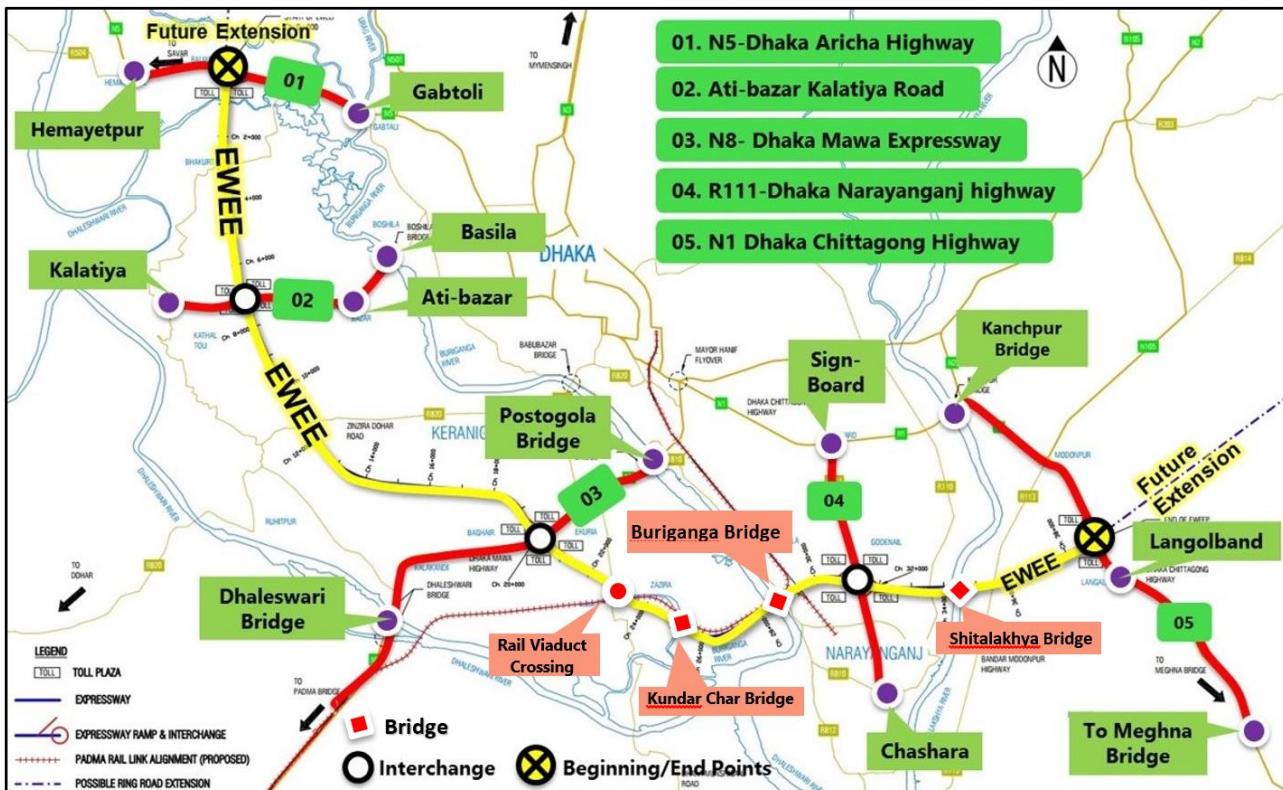
The DEWEE alignment route is as follows –

Baliarpur – Bhakurta – Bhawal – Sakta – Baghair – Kundar char – Dapa – Pilkuni - Jalkuri – Goadnail - Lakshman Khola – Langolbandh.

The Alignment would have five major road crossing point which are

01. Baliajpur, Connecting DEWEE to Dhaka – Aricha National Highway N5
02. Bhawal / Taranagar, Crossing the Ati-Bazar Kalatiya Road
03. Baghair, Crossing the Dhaka Mawa Expressway, N8
04. Jalkuri, Crossing the Dhaka Narayanganj Highway, R111
05. Langolbandh, Connecting DEWEE to Dhaka Chittagong National Highway N1

All these major crossing points would be facilitated with interchanges to DEWEE. The following diagram illustrates all the interchanges of the DEWEE alignment.



Also, there are three major river crossing points on the DEWEE Alignment which are

01. Kundar Char khal (250m channel width on alignment)
02. Buriganga River (320 channel width on alignment)
03. Shitalakhya River (256m channel width on alignment)

Another significant crossing point of DEWEE alignment is at Betka (Zazira) where the Expressway goes over the Padma Rail Link Viaduct.

1.2.2. Length of Different Components

➤ Main Expressway

- Total Length = 39234.38m
- Width = 20.56m
- Total No. of piers = 788
- No. of Piers (50m span) = 662
- No. of Piers (60m span) = 5
- No. of Piers (Bridge section, 101.5m & 95m span) = 121

- **RAMP**
 - Total RAMP Length = 22675.27m
 - Width = 7.1m
 - Total No. of Piers = 251
- **Roundabout Interchange (Elevated)**
 - Total no. of Elevated Roundabout = 4
 - Total Length = 2301.31m
 - Width = 10.3m
 - Single piers = 32
 - Portal frames (3 pier) = 32
- **Toll plaza (Elevated)**
 - Total no. of plaza = 16
 - Total no. of booth = 48 (3 booth each)
 - Total length = 10880m
 - Toll Plaza area length = 6880m
 - Acceleration lane length = 4000m
 - Total no. of portal frame (3 pier) = 144
 - Total no. of portal frame (2 pier) = 80
- **Total Ramp Length = 22675.27+2301.31= 24976.58m**
- **Total No. of Piers = 1135+1600 = 2735**
 - Total no. of single piers = 788+251+32+32+32 = 1135
 - Total no. of Portal Frames = 32+144+80 = 256
 - Total no. of piers for Portal Frames = 32*3+144*3+80*2 = 1600

1.2.1. Project Cost

Description	Project Cost Estimate			Cost per Km		
	BDT	Million BDT	Million USD	BDT	Million BDT	Million USD
DEWEE Both Phase	163,885,051,903	163,885.05	2,048.56	4,176,907,955	4,176.91	52.21
Phase 1 (CH. 0+000 to 20+230.337)	87,078,214,520	87,078.21	1,088.48	4,612,764,542	4,612.76	57.66
Phase II (CH. 20+230.337 - 39+983)	87,078,214,520	87,078.21	1,088.48	4,612,764,542	4,612.76	57.66

1.2.2. Expected construction period

Project construction is expected to begin on early 2020, and would take five years to complete each phase of the project.

1.2.3. Economic and Financial Analysis Parameter

- NPV @12% discount rate 118.7 (USD million)
- EIRR 13.3%
- BCR 1.17

1.3. Surveys

Geotechnical, traffic and topographic surveys were undertaken as part of the feasibility study.

1.3.1. Traffic Surveys

The following surveys were conducted for the travel demand forecasting of the EWEE project:

- traffic Count
- mid-block Origin-Destination (OD)
- travel Time
- stakeholder Interview

The TOR of the project did not require OD survey, travel time study or stakeholder interviews, but, as the study progressed, it was realized that without these studies an acceptable travel demand forecast would not be possible.

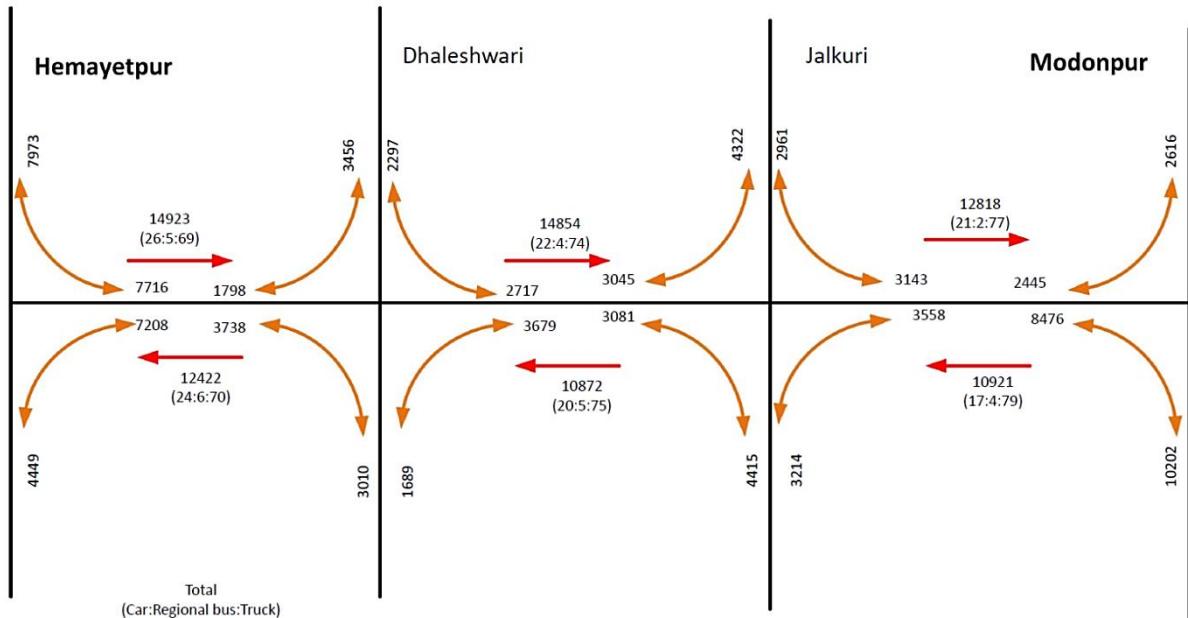
11 locations were selected for manual traffic count study. For each site, a 24-hour weekday count was conducted in both directions, starting at 6:00 am on survey days during October and November 2016. The mid-block OD surveys were coordinated with the traffic count survey at all 11 sites.

After obtaining the most frequently occurring ODs from the mid-block OD survey the ten most probable routes connecting the major OD pairs were determined and a travel time study was conducted using the average car technique. The average speed and travel time for each link of each route was calculated. The travel time surveys were conducted in December 2016.

From the preliminary study, it was apparent that the main users of the DEWEE will be truck traffic. Also, several regional buses were detected during the vehicle counts, OD surveys and the reconnaissance survey where regional buses were seen not having trip ends in Dhaka. Hence, several interviews were held with truck and bus drivers and conductors to understand their willingness to pay a toll to use the DEWEE. Interviews with truck drivers were conducted at Aminbazar, Meghna and Tongi. Interviews with bus drivers were conducted at Chandra (Savar), Board Bazar (Gazipur), Fakirarpul, Rajarbagh, Dhanmandi, Uttara and Shamoly. Taking account of the time and fuel savings and considering bridges tolls as benchmark the truck drivers stated they would pay up a toll of up to BDT500 for a route to cross Dhaka city without delays.

The drivers of regional buses stated their desire for hubs near the ramp areas where small feeder buses can load and unload passengers to and from Dhaka and nearby areas. The fuel savings will be substantial if they use the expressway and using the toll fare of bridges as a standard, they were willing to pay BDT200 to 250 per bus to use DEWEE.

The directional distribution of traffic demand on each section of the proposed DEWEE for the base year (2016) assuming a no-toll situation is shown in the following figure.

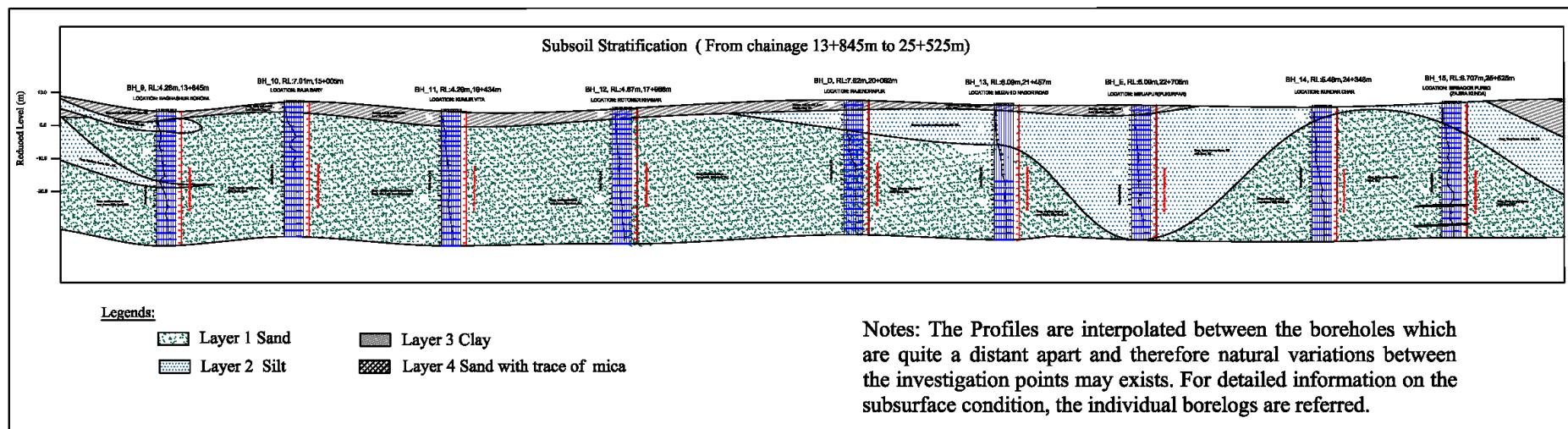
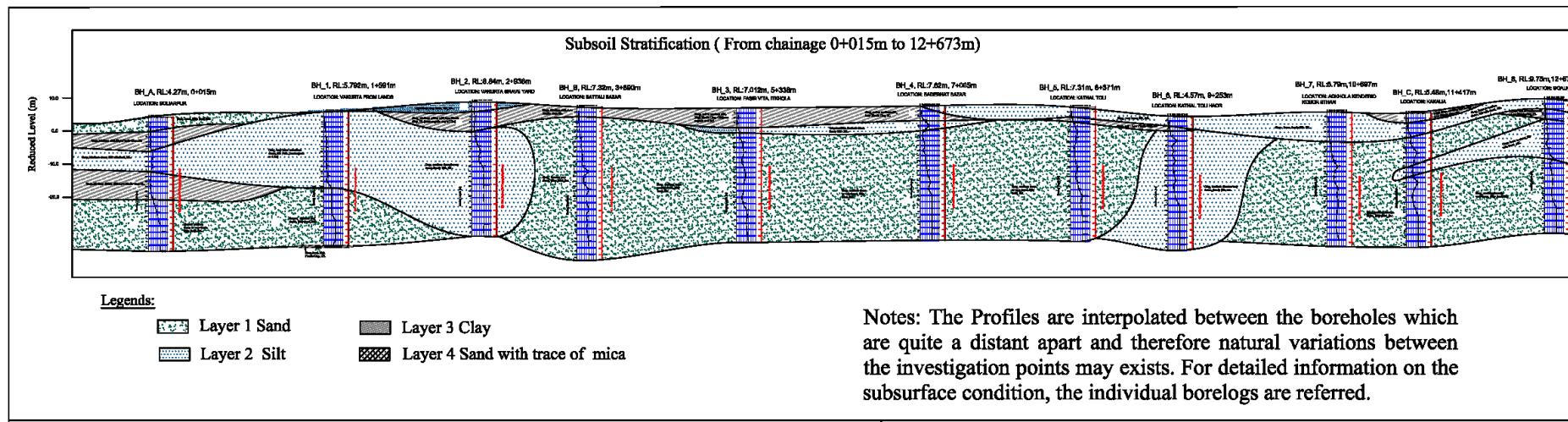


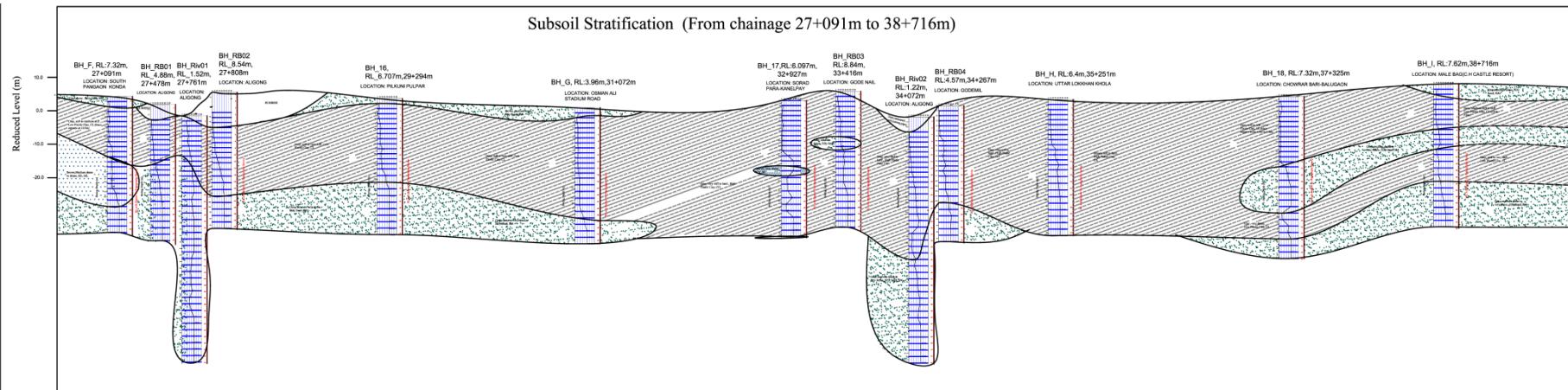
1.3.2. Topographic Surveys

The topographic survey corridor was approximately 150 m wide, extending from Highway N5 to Highway N1. A substantially larger area was surveyed at each proposed interchange site including the two terminals to allow for all likely interchange configurations. Bathymetric survey was carried out for the proposed crossings of the Buriganga and Shitalakshya Rivers.

1.3.3. Geotechnical Investigations

Field work and laboratory testing work for 33 boreholes was carried out in November and December 2016. Boreholes were 40 to 75 m deep. Starting at Hemayetpur, the soils were found to be predominately silty sand with a section of clay from km 27 to the end point at Langolbandh.





Legends:

Layer 1 Sand	Layer 3 Clay
Layer 2 Silt	Layer 4 Sand with trace of mica

Notes: The Profiles are interpolated between the boreholes which are quite a distant apart and therefore natural variations between the investigation points may exists. For detailed information on the subsurface condition, the individual borelogs are referred.

Inferred geotechnical longitudinal profile

A2 PROSOIL

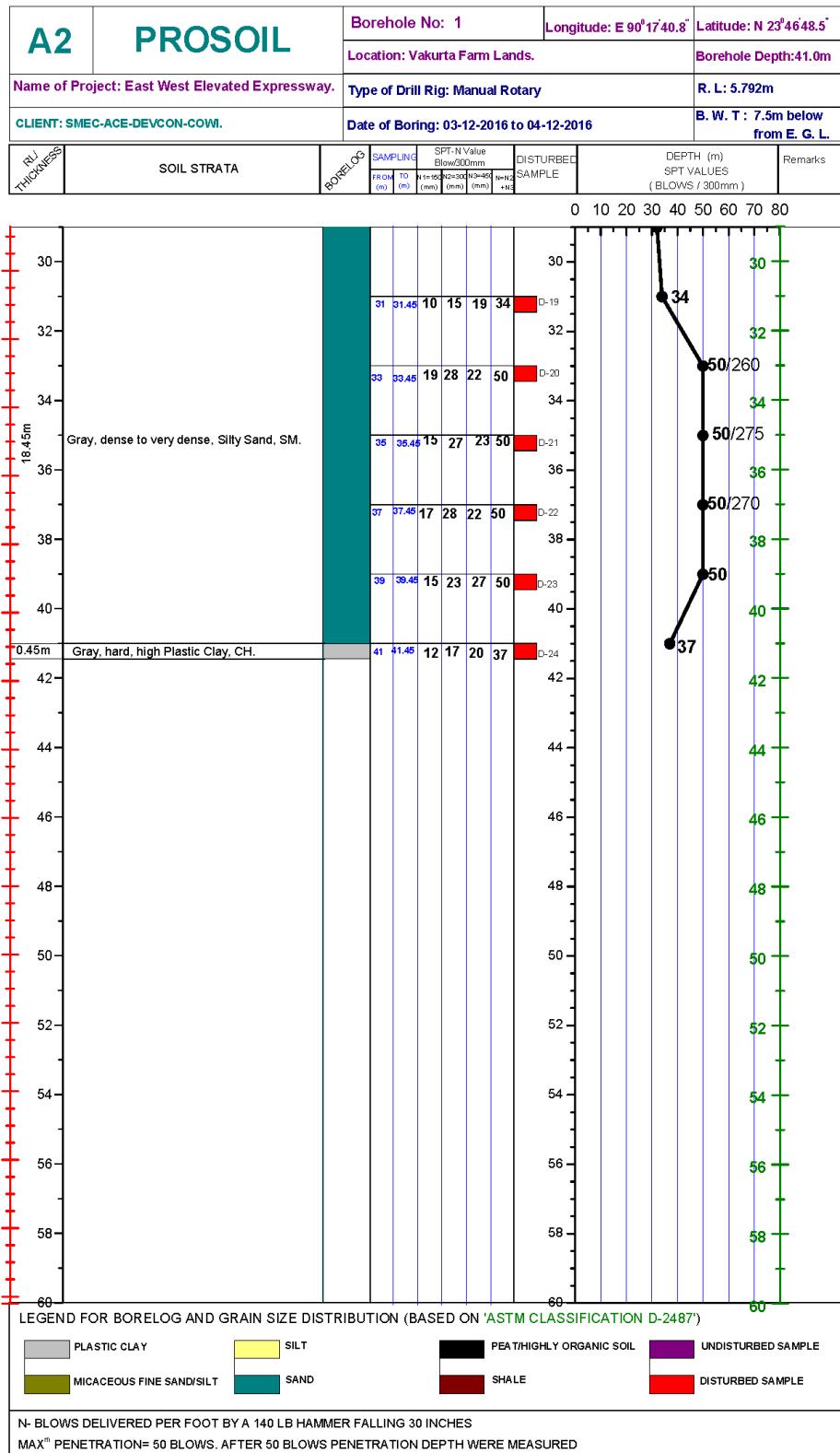
		Borehole No: 1		Longitude: E 90°17'40.8"	Latitude: N 23°46'48.5"			
		Location: Vakurta Farm Lands.		Borehole Depth: 41.0m				
Name of Project: East West Elevated Expressway.		Type of Drill Rig: Manual Rotary		R. L: 5.792m				
CLIENT: SMEC-ACE-DEVCON-COWI.		Date of Boring: 03-12-2016 to 04-12-2016		B. W. T: 7.5m below from E. G. L.				
RL/THICKNESS	SOIL STRATA	BORELOG	SAMPLING	SPT-N Value Blows/300mm	DISTURBED SAMPLE	DEPTH (m)	SPT VALUES (BLOWS / 300mm)	Remarks
		FROM (m)	TO (m)	$N = \frac{1}{6} \times \frac{1}{10} \times \frac{1}{2} \times \frac{1}{300} \times \frac{1}{N}$	mm (mm) (mm) (mm) (mm) + N			
0						0.0	0 10 20 30 40 50 60 70 80	
2		1.5	1.55	1 1 2 3		1.5	D-1	
4		3	3.45	1 2 2 4		3.0	D-2	
6		4.5	4.55	1 2 2 4		4.5	D-3	
8		6	6.45	2 4 5 9		6.0	D-4	
10		7.5	7.55	2 3 5 8		7.5	D-5	
12	Gray , Very loose to medium dense, silt, ML. (trace organic at 4.5m)	9	9.45	4 7 8 15		9.0	D-6	
14		10.5	10.95	2 4 6 10		10.5	D-7	
16		12	12.45	4 6 7 13		12.0	D-8	
18		13.5	13.95	3 6 7 13		13.5	D-9	
20		15	15.45	3 6 6 12		15.0	D-10	
22		16.5	16.95	3 5 8 13		16.5	D-11	
24		18	18.45	5 6 9 15		18.0	D-12	
26		19.5	19.95	4 7 9 16		19.5	D-13	
28		21	21.45	4 5 7 12		21.0	D-14	
30		23	23.45	12 17 18 35		23.0	D-15	
32	Gray, dense to very dense, Silty Sand, SM.	25	25.45	9 15 17 32		25.5	D-16	
34		27	27.45	10 15 18 33		27.0	D-17	
36		29	29.45	9 15 17 32		29.5	D-18	
38						30.0		

LEGEND FOR BORELOG AND GRAIN SIZE DISTRIBUTION (BASED ON 'ASTM CLASSIFICATION D-2487')

PLASTIC CLAY	SILT	PEAT/HIGHLY ORGANIC SOIL	UNDISTURBED SAMPLE
MICACEOUS FINE SAND/SILT	SAND	SHALE	DISTURBED SAMPLE

N- BLOWS DELIVERED PER FOOT BY A 140 LB HAMMER FALLING 30 INCHES
MAX[®] PENETRATION= 50 BLOWS. AFTER 50 BLOWS PENETRATION DEPTH WERE MEASURED

Borehole 1 – Log from 0 to 30 m



Borehole 1 – Log from 30 to 41 m

1.3.4. Geomorphology

The geomorphological investigation found that for the prosed crossings of the Buriganga and Shitalakshya rivers, the rivers are stable and riverbank erosion is negligible. There is no need for river training works.

1.4. Design Criteria and Constraints

The design criteria used for the preliminary design were for a four lane urban expressway with a design speed of 80 km/hr. Major design elements are

- total width - 20.56 m
- maximum grades 4%
- ramp widths 7.1 m

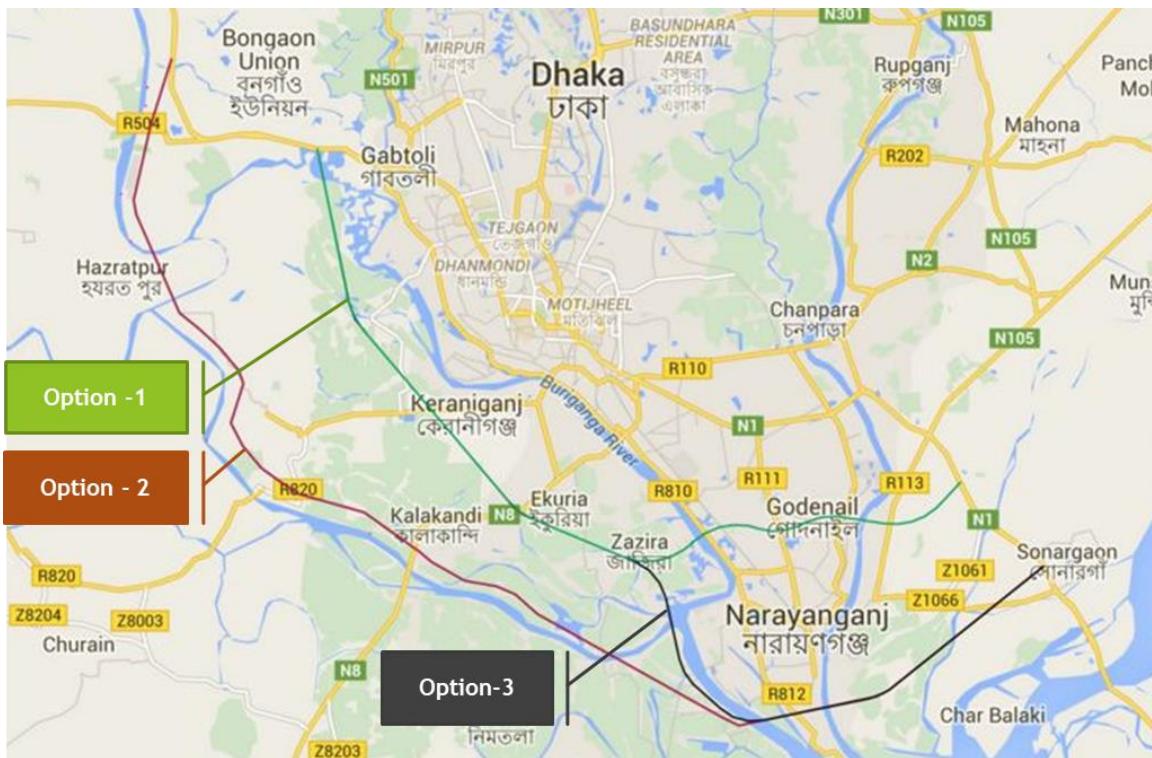
Consideration was given to known current projects such as the upgrading of the Dhaka Mawa Highway and the likely development of interchanges on the upgraded Dhaka Chittagong highway. The expressway alignment and grading have taken account of the Padma rail link and its crossing of the Buriganga River.

1.5. Concept Design

1.5.1. Location Study

The road level of the expressway has been set to allow for future land filling in the vicinity of the expressway and retention of a 5.7 m clearance below the expressway.

The alignments for the Middle and Outer Ring Roads suggested in the Dhaka Structure Plan are somewhat broad brush in nature and this feasibility study has looked in detail at the most appropriate corridor for an elevated expressway. Three alignment options were developed and costed with the costs including land acquisition. The routes are shown in figure below.



Option 2 follows the Dhaleshwari River, and whilst it will have less effect on developed land, it is substantially longer and more expensive than Option 1. Option 3 is a combination of Options 1 and 2

The costs and estimates of required land acquisition were necessarily of a preliminary nature. Compared with Option 1, Option 2 was far more expensive and would pass through the newly relocated tannery area. Option 3 would avoid construction through the Narayanganj industrial area. Both Options 2 and 3 affected more properties and required more land acquisition. Option 1 provided the best connectivity to Dhaka city area and the Narayanganj industrial area.

These considerations were sufficient to show that there were significant advantages in option 1 and it was agreed with BBA and through the Initial Consultation Workshop that Option 1 was to form the basis for the feasibility study. The costs and length given in following table reflect the preliminary nature of the concept. The recommended alignment is now slightly longer because of some adjustment to the alignment to take account of the proposed Padma rail Link and concerns of Narayanganj City Corporation. A comparison of the options is given in following table.

Comparison of Initial Alignment Options

Assessment Criterion	Option 1	Option 2	Option 3
Length	35 km	53 km	42 km
Major river crossings (no.)	2	3	3
Land acquisition	106 ha	159 ha	118 ha
Rehabilitation cost	\$237 million	\$260 million	\$240 million
Construction cost	\$1,208 million	\$1,770 million	\$1,451 million
Total cost	\$1,455 million	\$2,030 million	\$1,691 million

The recommended alignment is now slightly longer (38.9 km) because of some adjustment to the alignment to take account of the proposed Padma rail Link and concerns of Narayanganj City Corporation.

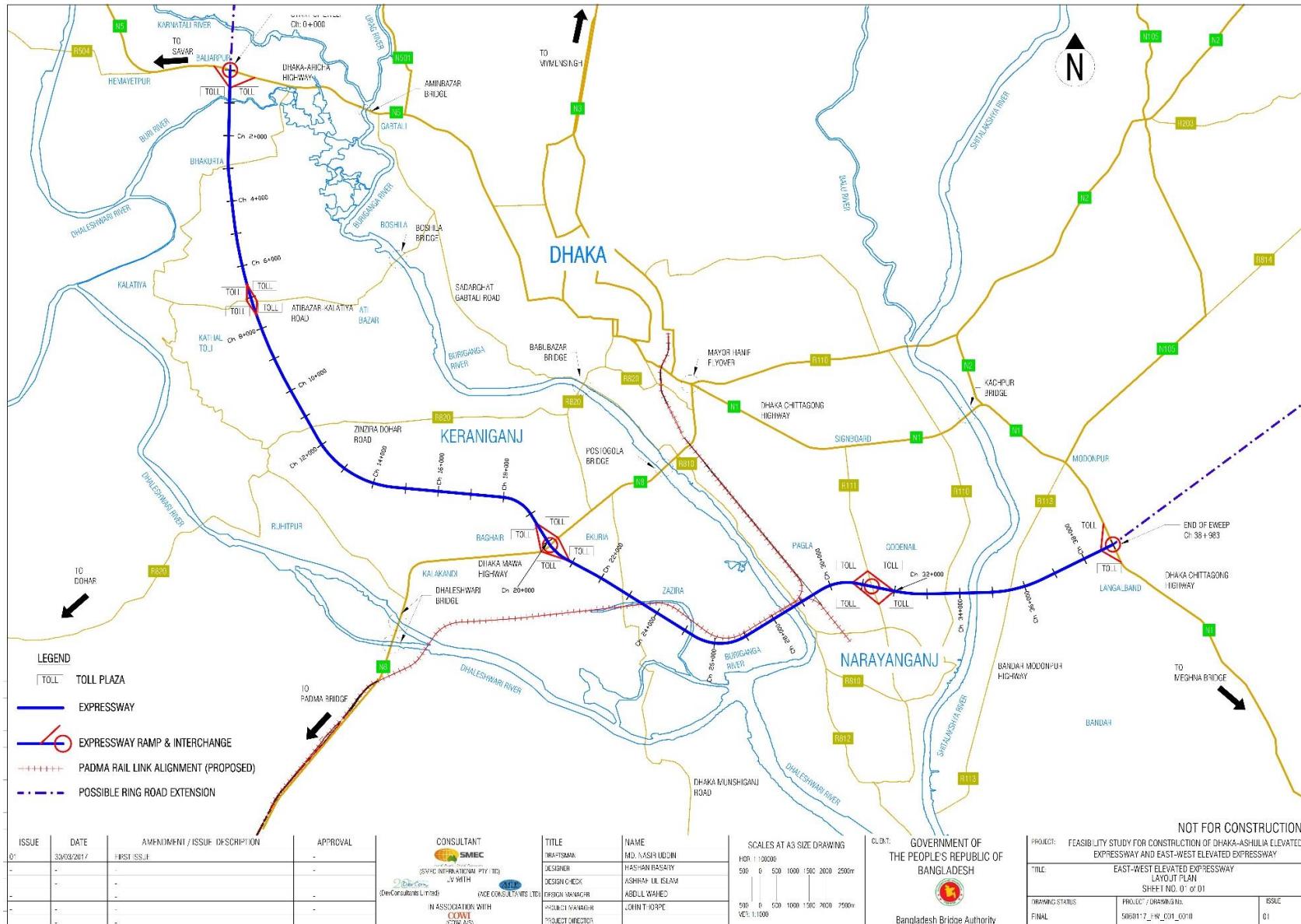
Final Alignment details of EWEE shown in table below which takes into account with all the constraints and it has been finalized in accordance with the concurrence of BBA.

Final Alignment details of EWEE

Length	39.2 km
Major river crossings (no.)	2
Land acquisition	137.89 ha
Land acquisition & Rehabilitation cost	\$ 375million
Construction cost	\$1,465.77 million
Total cost	\$2,048.62million

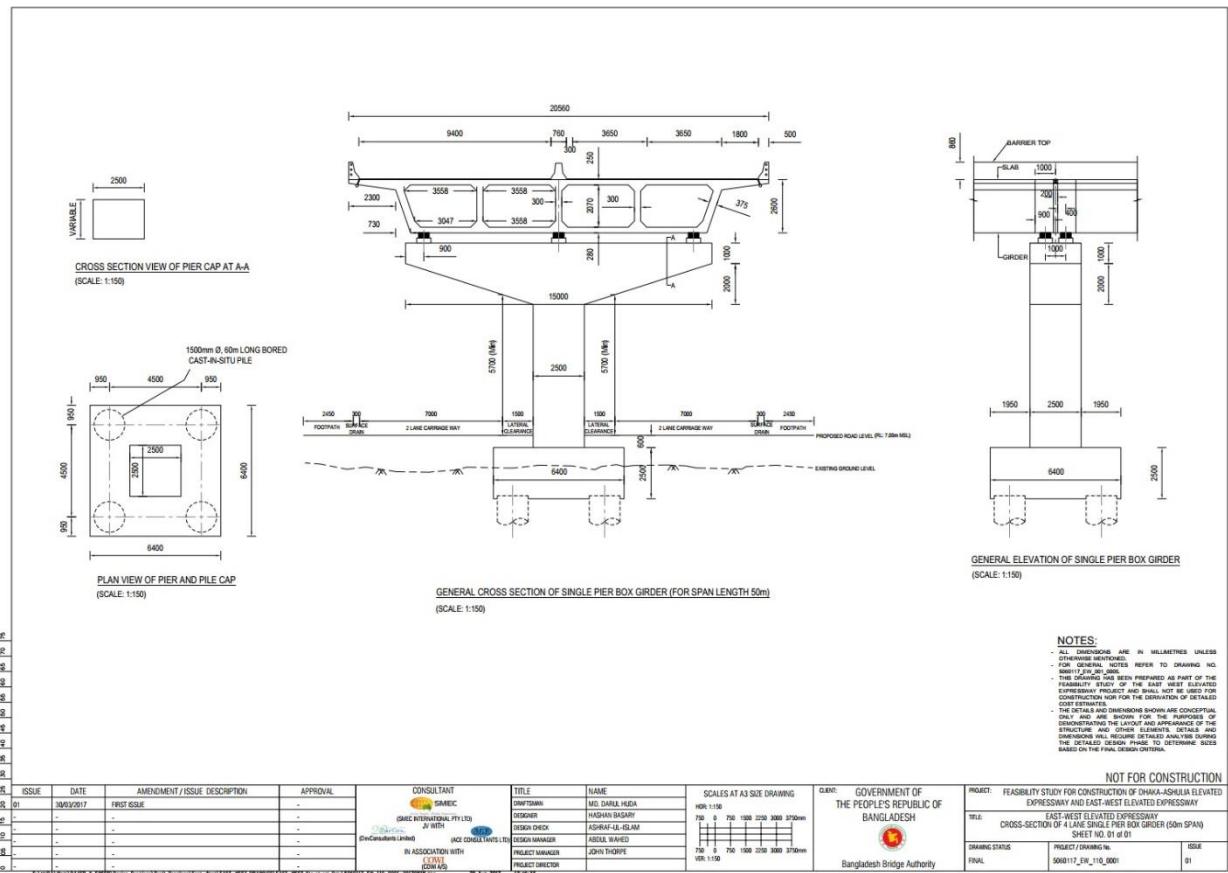
1.5.2. General View and Cross Sections

The general layout plan of DEWEE is shown in the following figure



Final Alignment of EWEE:

The following figure illustrates the typical cross section of the main expressway.

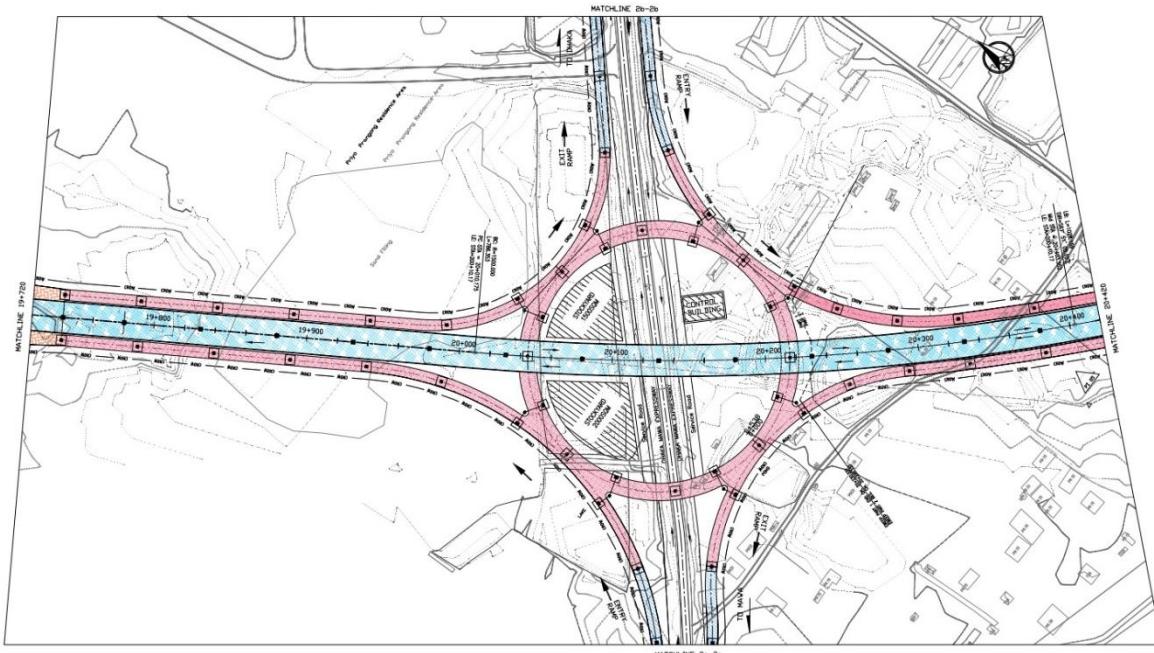


Typical Cross Section of DEWEE

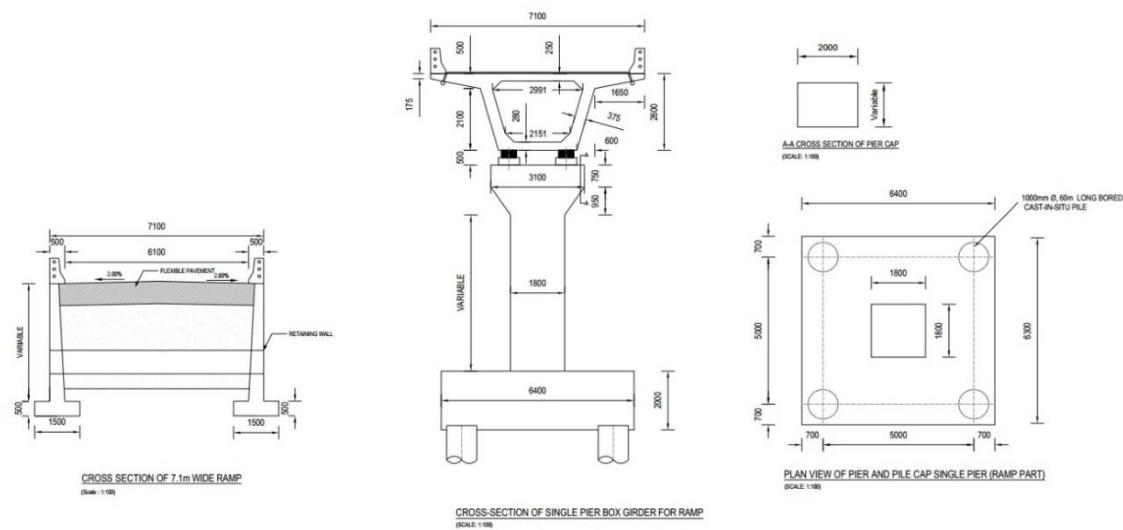
1.5.3. Interchanges and Future Extension

Interchanges are proposed at Hemayetpur, the Dhaka Mawa Highway, and Narayanganj and at the Dhaka Chittagong Highway. In each case these are to be at three levels with a roundabout at the mid-level and the expressway passing over the top. Another full pair ramp interchange is proposed at Atibazar Kalatiya road with at grade intersection treatment. Both the proposed interchanges (i) Hemayetpur on Dhaka-Aricha Road N5 and (ii) Langolbandh on Dhaka-Chittagong Road N1 will be constructed keeping provision of future extension from Hemayetpur and Langolbandh.

Plan View of Three Level Round About Interchange at Dhaka- Mawa Highway



Typical Cross Section of Ramp



1.5.4. Tolling system

A closed tolling system is proposed, with vehicles paying a toll according to the distance travelled. This will simplify future addition of interchanges, connections to other projects and extension of the expressway.

1.5.5. River and Wetland Crossings

Crossings of the Buriganga and Shitalakshya rivers will provide horizontal (76.22 m) and vertical (18.30 m) clearances to meet BIWTA's requirements for river class I. The bridges over the two rivers are to be balanced cantilevers and the same arrangement is proposed for the crossing of Kundar Char. The bridges over Buriganga River, Shitalakhya River and Kundar Char khal are proposed to have a maximum span of 101.5m, 95m, and 95m, respectively.

For Shitalakhya River, an additional two lane access bridge for local traffic is proposed on both sides of the Main expressway with similar structural arrangement, providing same navigational clearance.

1.6. Safeguards

1.6.1. Environmental Impact Assessment

A draft environmental impact assessment (EIA) has been prepared and this includes an outline environmental management and monitoring plan (EMMP). The EIA did not find the project will affect any habitat or species of significance.

1.6.2. Social Safeguards

As the elevated expressway is to be constructed on a new route, the project will require acquisition of 340.7349 acres (137.949 ha) of land and will affect 798 households (2,322 people). A census survey was conducted on 5 February 2017 and this should be considered as the cut-off date for a period of two years. Inventory of losses surveys were conducted in February and March 2017. Community consultations and focus group discussion were held in March 2017.

Based on the foregoing, a resettlement action plan has been prepared and the cost of the land acquisition and resettlement has been estimated as BDT30 billion (USD394.95 million).

The Dhaka East– West Elevated Expressway Project (DEWEEP) is proposed as an elevated expressway to allow traffic to travel around the western perimeter of Dhaka between Highway N5 (the Dhaka Aricha Highway) and Highway N1 (the Dhaka Chittagong Highway) with connections to Highway N8 (the Dhaka Mawa Highway which links directly to the Padma Bridge and to Narayanganj via Road R111 (the Dhaka Narayanganj Road). By making these connections between these major highways and thus the north south and west of the country the expressway will have some effect on removing through traffic from Dhaka and thereby reducing traffic congestion in the capital. The expressway is consistent with the strategic road network planning of the Asian Highway Network – forming an important part of AH1 and thus will be vital for establishing an improved transport link on the Trans-Asian highways.

1.6.2.1. Project Area

The project considered in this feasibility study is a 39 km elevated tolled expressway from Hemayatpur on Highway N5, to Modonpur on Highway N1. All of the alignment is along a new route not currently followed by any roads. This reflects that fact that the road network in the vicinity of Dhaka is a radial network devoid of routes that permit traffic to bypass Dhaka. In part this arises from Dhaka's location at the confluence of several major rivers ,viz the Meghna, Buriganga, the Dhaleshwari and the Shitalakshya and the proximity of the Padma River to the south. An integral part of the project is connection to the upgraded Highway N8 (Dhaka Mawa Highway) and hence the Padma Bridge. That connection will allow traffic to travel across the Padma River. The DEWEEP will facilitate travel south to Chittagong as well as northward to Joydebpur and Tangail on the outskirts of Dhaka and onwards to the northern districts such as Mymensingh.

1.6.2.2. Impact on Land Acquisition

A total of 340.735 acres of land acquisition required for construction of the East-West Elevated Expressway. A total of 722 HHs will be affected by land acquisition of the project (see Table 2). However, nearly 98 per cent of those affected will lose only up to 50 dec, which is a small parcel of land due to linear acquisition. Part-2 (Keraniganj-Bandar) has the highest number of affected landowners (502) in the alignment. The impact of land acquisition on income losses is thus limited. Crop land will be more affected (54.53%) than any other category of land. High land and wet land comprises the second and third majority of affected land (11.6% and 10.5%). The rest of the affected land categories are minimal in quantity.

Affected Land Areas (acres) by Category

Category of Land	Part-1 Savar-Keraniganj 00+00-20+230	(CH:	Part-2	Overall	
			Keraniganj-Bandar (CH: 20+230-39+900)	Total	%
A. Private Land					
Home Stead	9.304		23.789	33.093	10.152
Vita/High Land	16.012		21.787	37.799	11.596
Crop Land	130.925		46.814	177.739	54.528
Pond	3.877		8.410	12.287	3.769
Wet Land/Ditch	9.621		24.676	34.297	10.522
Fallow Land	0.000		16.339	16.339	5.013
Commercial used	1.727		12.681	14.408	4.420
Sub Total A	171.466		154.496	325.962	100
B. DC Khas Land					
Road	5.116		3.006	8.122	54.979
Canal	3.612		2.390	6.002	40.625
Halot	0.283		0.366	0.649	4.396
Sub Total B	9.01		5.762	14.773	100
Total Land	180.48		160.258	340.735	100

Source: Census and IOL survey conducted by DevConsultants, February-March 2017

1.6.2.3. Displacement and impact of the project

The project impacts for this package have been assessed based on a census survey conducted within the ROW areas on non-land physical assets following the acquisition boundary as per the final ROW design. The census survey was conducted in February and March 2017. The impact assessment was carried out both at household and community levels through various field surveys and stakeholders' consultation meeting. As already mentioned, the surveys included a census where household level data of all affected households were collected. The questionnaires established an inventory of losses of each affected household, which included details of potentially affected structures (i.e. residential houses), crop land, trees and other assets belonging to each household. The survey also included inventory of businesses structures (small scale local grocery, furniture and poultry shop) as well as public and community structure on the project ROW.

The survey showed that a total of 878 entities will be affected due to project as follows - Residential HHs: 599; Residential cum commercial HHs: 29; Roadside shops and business (small scale): 107. Major dislocation impacts will be on residential structures. As per the census survey, 599 residential structures will be affected, which is 69% of the total entities. In addition, 17 CPRs will be affected by the project. Only 49 households will lose secondary structures. The census and IOL survey mainly concentrated on the physical displaced households rather than plain land or tree owners. Land owners will be finally identified by the deputy commissioners during land acquisition process. A total of 911,207 sq ft of primary structures are to be affected by the project. 35 vulnerable HHs will be affected including 10 HHs that are female-headed with income level of less than BDT 90,000/year. A total of 177 wage labourers will be affected by the project, with most of them being unskilled (141). The project will affect 12,251 trees (excluding banana and bamboo groves) on private and government land. Table 2 presents a brief list of the project impacts.

Displacements and Other Impacts

SL	Impacts/Types of losses	Part-1 Savar- Keraniganj (CH: 00+00- 20+230- 39+900	Part-2 Keraniganj- Bandar (CH: 20+230- 39+900	Total
A	Alignment Length and Required Land Acquisition			
1	Total length of alignment/km	20.23	18.77	39
2	Total land required for the project in acre	207.3922	200.3317	407.7239
3	Required land Acquisition in acre for Private Land	171.4655	154.496	325.962
4	Required land Acquisition in acre for Khas Land	9.0114	5.762	14.7734
Total Required land Acquisition in Acre		180.4769	160.258	340.7349
B	Number of Affected entities without CPR and Large scale Business			
1	Affected Residential HHs only	177	422	599
2	Affected Residential & Business HHs only	11	18	29
3	Affected roadside shops and business HHs only (small scale)	50	57	107
4	Number of affected vendors	50	00	50
5	Number of hhs losing secondary structures only	7	42	49
6	Only trees affected HHs	10	04	14
C	Affected entities Large scale Business			
1	Affected roadside business only (large scale)	01	03	04
2	Affected Large Scale Entities losing Secondary structures only	01	05	06
D	Number of affected units other than B			
1	Affected CPRs	07	10	17
2	Affected Gob. Organization	00	01	01
3	Others (NGO office etc)	02	00	02
E	Additional data by categories (already embedded in A, B and C)			
1	Number of total affected entities (B+C)	316	562	878
2	Number of total affected Households	255	543	798
3	Number of total affected population	1071	2161	3232
4	Average HH size	3.96	3.97	3.97
F	Number of affected Trees			
1	Total Number of trees (Ex Banana/Bamboo)	4044	8207	12251
1.1	Total no. of trees on private land (Ex Banana/Bamboo)	3989	8096	12085
1.2	No of trees affected on government land (Ex Banana/Bamboo)	55	111	166
2	Total no. of Banana and Bamboo	6503	14220	20723
2.1	Total no. of Banana and Bamboo on private Land	5456	2318	7774
2.2	Total no. of Banana and Bamboo on government Land	00	03	03
G	Total quantity of Primary structure affected (In sqft)	237,738	673,469	911,207
H	Total Number of wage labourer affected	99	78	177
1	Skilled Wage labourers	24	12	36
2	Unskilled Wage labourers	72	69	141
I	Total Number of Tenants	55	434	489
1	Number of affected residential tenants	14	401	415

SL	Impacts/Types of losses	Part-1 Savar- Keraniganj (CH: 00+00- 20+230- 20+230	Part-2 Keraniganj- Bandar (CH: 20+230- 39+900	Total
2	Number of affected commercial tenants	41	33	74
J	Total Number of vulnerable HHs	16	19	35
1	Number of female headed HHs affected	04	06	10
2	Number of male headed Vulnerable HHs affected	12	13	25

Source: Census and IOL survey conducted by DevConsultants, February-March 2017

1.6.2.4. Socio-economic Profile

The socio-economic profile of the affected population can be described by its age-sex distribution, religion distribution, income, occupation, education level, etc. Male-headed HHs are 88.22% whereas female-headed HHs are 11.77%. The age-sex ratio indicates that majority of the population is 15 to 59 years old but the population sharply decreases after 60 years of age. Table ES2 shows that 798 households with 3,232 people will be affected by the proposed elevated expressway construction. The average household size in this region is 4.05, which is lower than the average national HH size of 4.35.

1.6.2.5. Consultation and Participation

Consultation and participation (C&P) in project processing are required to ensure that adequate and timely information is made available to beneficiaries and affected people. The C&P enables opportunities for them to voice their opinions and participate in decision-making and project processing. Inclusive project design and implementation relies on the C&P process. Consultation to be carried out throughout the project cycle and timely disclosure of relevant and adequate information has to be undertaken. Both men and women have to be consulted and involved equitably in project design and implementation. All relevant views of affected people and other stakeholders need to be considered in decision making, such as project design, impact assessment, mitigation measures, the sharing of development benefits and opportunities, and implementation.

Two consultation meetings and four FGDs were held during the survey works in the March, 2017 at locations along the proposed alignment. The meetings were arranged for the convenience of the local people. The census and survey started from 5 February, 2017, which has been considered as the cut-off date for the project. In addition to impact and mitigation measures discussed at the consultation meetings were: minimizing private land acquisition and making optimum use of available government land, policy of compensation and resettlement benefits for affected structure and other assets, people's preferences about mode of compensation, potential social and environmental impacts and mitigation measures, business restoration, income generating alternatives for vulnerable households, gender issues, scope of work for local people especially poor and vulnerable affected people in project civil work etc. Participants were informed that during project implementation period, a RAP booklet will be prepared in Bangla and will be distributed locally among the APs. This booklet will accurately describe the project including its impact, policy framework, compensation, mitigation measures as well as implementation procedure, institutional arrangement for resettlement action plan implementation, grievances redress of APs, information dissemination to the entitled APs, etc. Affected people and other stakeholders were consulted during census and inventory of losses survey. The consultation process was adopted to share the necessary information on the project timeline and the purpose of the census/surveys as well as building rapport with the affected households and communities. During community level meetings, people were informed about the project objectives and extensive question and answer sessions were conducted to clarify the project related works and activities.

1.6.2.6. Entitlement and Compensation

The East-West Elevated Expressway is likely to be developed as a Public Private Partnership (PPP) investment initiative of the Government of Bangladesh. Land in public sector projects is taken through DEWEEP Executive Summary, August 2017

acquisition using eminent domain law by public infrastructure agencies of the GOB and private sector investments use land through direct purchase from the open market. However, for private sector investments through infrastructure promotion and financing facility (IPFF), the Bangladesh Bank (BB) has, in July 2011, adopted an environmental and social management framework (ESMF). The ESMF is a handbook on environmental and social safeguard policy compliance of private sector and PPP projects following the World Bank's Operational Policies on Safeguards (environmental and social) and in consideration of the local laws and policy on land acquisition in Bangladesh. The acquisition of private land and resumption of public lands from private users will lead to loss of assets and displacement of peoples of various extents and categories. Land acquisition is governed by the *Acquisition and Requisition of Immovable Property Ordinance, 1982* (Ordinance II of 1982 with amendments up to 1994). The Government Bangladesh has also promulgated the East-West Elevated Expressway (Land Acquisition) Act 2011 to avoid unexpected situations in the process of land acquisition for the project. In order to address these challenging issues in a manner acceptable to all, the Government of Bangladesh, in October 2013, decided to follow the guidelines contained in the ESMF for IPFF of the Bangladesh Bank for resettlement and rehabilitation of the project affected persons. Very recently, Government of Bangladesh revised the Acquisition and Requisition of Immovable Property Ordinance, 1982 and it is now as a draft paper which is disclosed in the Ministry of Land's website for the public comment. After it is enacted, the new updated ARIPO will be operative for any development project. If the new act published with gazette notification within the project cycle, the project will have to follow the new compensation mechanism.

An entitlement matrix has been prepared on the basis of census and inventory of losses survey conducted for the households, shops and common/community properties affected within the project right of way. It identifies the categories of impact based on the census and IOL and shows the entitlements for each type of loss. The matrix describes the units of entitlements for compensating the loss of land, structure, business and various resettlement benefits. The resettlement benefits for indirect losses will be directly paid by BBA through the RAP implementing NGO (INGO). The INGO will be engaged to assist the BBA in this respect. The DPs will be allowed to fell and take away trees and salvaged materials of affected structures free of cost without delaying the project works. The crops owners will be given one month prior notice to harvest the crops if it is at or near harvesting stage. If the project damages the standing crops, the actual owners of crops will be entitled to compensation for crops at market price. Some local people have planted different species (fruit bearing and timber) of trees within the Government land. As per engineering design, if the trees are needed to fell down for the project work the actual owners of the trees will be entitled for compensation for only bamboo bush and fruit bearing trees without timber such as banana groves, guava, lemon, papaya, etc. The policy has kept provision of compensation for such types of trees planted on government land by the local people. The INGO will assist BBA in preparation of necessary papers (ID cards, EP/EC, indent, debit voucher, etc.) for making payment of additional compensation and resettlement benefits to the EPs.

1.6.2.7. Cost and Budget

The costs for land acquisition and resettlement for the project have been estimated at current market price for the year 2017 with necessary supplements for replacement cost, physical assets and businesses with assessed replacement cost for the same year, and additional assistance for loss of income and vulnerabilities as per the resettlement policy framework. This budget is indicative of outlays for different expenditure categories assessed by census (February-March, 2017) for physical assets and estimates of land for acquisition. These costs will be updated and adjusted once the land acquisition boundaries will be finalized and their communities in the period of project implementation and construction activities. Transparency is a demand of communities and affected people in procurement and maintaining the quality of construction. They may also be paying attention in construction activities. Complaints and grievances may, therefore, range from land acquisition, resettlement, procurement and quality of works on site. Dispute over ownership and inheritance of the acquired lands of affected persons and assets missed by the census, joint verification; valuation of affected assets; compensation payment; and the like may arise in the process of resettlement.

According to the grievance redress mechanism, the grievance redress committees (GRCs) will be established at two levels: (i) union/municipal level and (ii) project level. GRCs will be formed with representatives from BBA at the community level (union/municipal), local elected representatives from the local government institutions (LGI), affected persons' representatives (women representative in case of women APs), and RAP implementing NGO. GRC decisions will be publicized among the local communities on a majority basis. Where the complaining parties are not satisfied with the GRC decisions, they can go to the Project Officer (BBA level) for resolution. Cases with all proceedings from GRC and from PIU are placed with the Chief Engineer, BBA where the Chief Engineer appoints a reviewer to resolve the grievance in view of the merits and redirect the case records to the PD, PIU with written resolutions within one month of receiving the complaints. Aggrieved DPs satisfied with the resolution approach the EA for resettlement assistance under the provision of the RAP. The convener's office will communicate with the aggrieved persons for ensuring the acceptance of the resolution. The PD then approves the resolution accepted by the aggrieved person. If the resolution at BBA is not acceptable to him/her, aggrieved DPs may opt to take court action. The aggrieved persons at any level (GRC, PIU, BBA) accept the resolution and those will be approved by the Project Director and forwarded back to the Conveners' office keeping records of his/her office. To approve grievance resolution, the implementing NGO processes his/her entitlements and assists EA in arranging payment based facilities.

1.6.2.8. *Implementation arrangements*

The Bangladesh Bridge Authority (BBA) under the Bridges Division of the Ministry of Road Transport and Bridges (MRTB) is representing the Government of Bangladesh as the Executing Agency (EA) of the East West Elevated Expressway Project. The Project may be implemented under a Public-Private-Partnership (PPP) between the Government of Bangladesh represented by BBA and a concessionaire. The concessionaire will be responsible to finance design, and construct the Expressway, operate it and transfer to GOB at the expiry of concession agreement. Usually BBA will be responsible to finance land acquisition and resettlement of project affected persons and provide land for construction. No construction work will begin until all PAPs have been compensated and removed from the project site.

1.6.2.9. *Monitoring and Evaluation*

Monitoring is a periodical check-up of planned activities and provides intermediate inputs, facilitate changes, if necessary and provides feedback for project management to keep the program on schedule. Evaluation assesses the resettlement effectiveness, impact and sustainability of R&R program. Evaluation examines the actual achievement, goal and purpose compared with that which was proposed. To fulfil project objective of resettlement plan implementation that monitoring and evaluation are crucial. The chief resettlement officer and additional Project Director will be responsible, for executing the M&E of the RAP implementation. Until the end of the RAP implementation, monitoring will be sustained. Monitoring components will consist of including performance monitoring to be exact, physical progress of the work and impact monitoring and evaluation. The internal intermittent monitoring and evaluation of the PR implementation will be conducted by BBA, as PMC/resettlement specialist. The semi-annual, midterm, and final evaluation will be conducted by an external monitoring agency (EMA), and will propose necessary changes to the project implementation unit (PIU) and Social and Environment circle (SEC). External monitoring will cover compliance monitoring and social impact evaluation of RAP implementation.

1.7. Project Cost Estimate

Project costs have been estimated based on a detailed quantity take-off from the feasibility level designs, mostly using the RHD rates schedule (2015). Where there is no rate in the RHD schedule the cost has been estimated based on the Consultant's assessment of market rate for that particular item. The estimates include an allowance of 3% for physical contingency and 6% for price contingency.

Item No.	Description	Amount		
		(BDT)	(Million BDT)	(Million USD)
Civil Cost	1 Division 1 : General & Site Facilities	2,915,930,335	2,915.93	36.45
	2 Division 2 : Earthwork	1,629,441,696	1,629.44	20.37
	3 Division 3 : Pavement Work	3,326,331,719	3,326.33	41.58
	4 Division 4 : Foundation Works	22,172,430,886	22,172.43	277.16
	5 Division 5 : Structure Works	84,254,801,222	84,254.80	1,053.19
	6 Division 6 : Incidentals	1,859,400,926	1,859.40	23.24
	7 Division 7: Lighting, CCTV Cameras & Its System	640,000,000	640.00	8.00
	8 Division 8 : Toll Plazas, Interchanges & Rest Areas	459,547,174	459.55	5.74
A	<i>Sub Total</i>	117,257,883,958	117,257.88	1,465.72
B	Physical Contingency @ 3 % of (A)	3,517,736,519	3,517.74	43.97
C	<i>Sub Total (A + B)</i>	120,775,620,477	120,775.62	1,509.70
D	Price Contingency @ 6 % of (C)	7,246,537,228.60	7,246.54	90.58
E	<i>Engineer's Estimate = (C+D)</i>	128,022,157,705	128,022.16	1,600.28
F	Land Acquisition & Resettlement	30,000,000,000	30,000.00	375.00
G	Detailed Design Cost @ 3 % of (A)	3,517,736,519	3,517.74	43.97
H	Supervision Fees @ 2 % of (A)	2,345,157,679	2,345.16	29.31
I	<i>Project Estimate = (E+F+G+H)</i>	163,885,051,903	163,885.05	2,048.56
J	<i>Cost Per Km</i>	4,176,907,955	4,176.91	52.21

The project is a major undertaking and for reasons of cost and construction timing, the likely need for there to be two separate contracts for the construction. These could comprise a western contract for the section from Hemayetpur (ch 0+000) to the Dhaka Mawa Highway (ch 20+230.337) and an eastern contract from Dhaka Mawa Highway to Langolbandh (ch 38+983).

Accordingly the project has been divided in two separate Packages No 1 and No 2. Package No1 will start from Hemayetpur (Dhaka-Aricha road) (CH. 0+000) to Baghair on the Dhaka Mawa (20+230.337) Highway Package No 2 will start from Baghair (CH. 20+230.337) , Dhaka Mawa (38+983) Highway to Langolbandh on Dhaka-Chittagong Highway.

Package 1 (CH. 0+000 to 20+230.337) from Hemayetpur to the Dhaka Mawa Highway

PROJECT COST ESTIMATE (Phase 1/ Part-1)

(CH. 0+ EAST 000 to 20+230.337) from Hemayetpur to the Dhaka Mawa Highway

SUMMARY

			Exchange Rate : USD 1 = BDT	80
Item No.	Description	Amount (BDT)	Amount (Million BDT)	Amount (Million USD)
	1 DIVISION 1 : GENERAL & SITE FACILITIES	1,459,891,514	1,459.89	18.25
	2 DIVISION 2 : EARTHWORK	797,142,290	797.14	9.96
	3 DIVISION 3 : PAVEMENT WORK	1,690,544,040	1,690.54	21.13
	4 DIVISION 4 : FOUNDATION WORKS	10,509,429,508	10,509.43	131.37
	5 DIVISION 5 : STRUCTURE WORKS	39,618,296,533	39,618.30	495.23
	6 DIVISION 6 : INCIDENTALS	823,558,450	823.56	10.29
	7 DIVISION 7: LIGHTING, CCTV CAMERAS & ITS SYSTEM	320,000,000	320.00	4.00
	8 DIVISION 8 : TOLL PLAZAS, INTERCHANGES & REST AREAS	229,773,587	229.77	2.87
A	Sub Total	55,448,635,922	55,448.64	693.11
B	Physical Contingency @ 3 % of (A)	1,663,459,078	1,663.46	20.79
C	Sub Total (A + B)	57,112,095,000	57,112.09	713.90
D	Price Contingency @ 6 % of (C)	3,426,725,700	3,426.73	42.83
E	Engineer's Estimate = (C+D)	60,538,820,700	60,538.82	756.74
F	Land Acquisition & Resettlement	13,500,000,000	13,500.00	168.75
G	Detailed Design Cost @ 3 % of (A)	1,663,459,078	1,663.46	20.79
H	Supervision Fees @ 2 % of (A)	1,108,972,718	1,108.97	13.86
I	Project Estimate = (E+F+G+H)	76,811,252,496	76,811.25	960.14
	Cost Per Km	3,772,967,831	3,772.97	47.16

Package 2 (CH. 20+230.337 - 38+983) from Dhaka Mawa Highway to Langolbandh

PROJECT COST ESTIMATE (Phase II/ Part-2)
(CH. 20+230.337 - 38+983) from Dhaka Mawa Highway to Langolbandh
SUMMARY

Item No.	Description	Amount (BDT)	Amount (Million BDT)	Amount (Million USD)
Civil Cost				
1	DIVISION 1 : GENERAL & SITE FACILITIES	1,456,038,821	1,456.04	18.20
2	DIVISION 2 : EARTHWORK	832,299,406	832.30	10.40
3	DIVISION 3 : PAVEMENT WORK	1,635,787,679	1,635.79	20.45
4	DIVISION 4 : FOUNDATION WORKS	11,663,001,378	11,663.00	145.79
5	DIVISION 5 : STRUCTURE WORKS	44,640,371,489	44,640.37	558.00
6	DIVISION 6 : INCIDENTALS	1,035,842,476	1,035.84	12.95
7	DIVISION 7: LIGHTING, CCTV CAMERAS & ITS SYSTEM	320,000,000	320.00	4.00
8	DIVISION 8 : TOLL PLAZAS, INTERCHANGES & REST AREAS	229,773,587	229.77	2.87
A	Sub Total	61,813,114,836	61,813.11	772.66
B	Physical Contingency @ 3 % of (A)	1,854,393,445	1,854.39	23.18
C	Sub Total (A + B)	63,667,508,281	63,667.51	795.84
D	Price Contingency @ 6 % of (C)	3,820,050,497	3,820.05	47.75
E	Engineer's Estimate = (C+D)	67,487,558,778	67,487.56	843.59
F	Land Acquisition & Resettlement	16,500,000,000.00	16,500.00	206.25
G	Detailed Design Cost @ 3 % of (A)	1,854,393,445	1,854.39	23.18
H	Supervision Fees @ 2 % of (A)	1,236,262,297	1,236.26	15.45
I	Project Estimate = (E+F+G+H)	87,078,214,520	87,078.21	1,088.48
	Cost Per Km	4,612,764,542	4,612.76	57.66

1.8. Socio-Economic Assessment

1.8.1. Gross Domestic Product (GDP)

Bangladesh's GDP has been estimated at US\$195.1 billion. According to Bangladesh Bank, the growth in GDP has been over 6% per annum for the last five years, being:

- 6.5% (2011-12)
- 6.0% (2012-13)
- 6.1% (2013-14)
- 6.6% (2014-15)
- 7.11% (2015-2016)
- 7.24% (2016-2017p)

The growth in GDP averaged 5.99% from 1997 until 2017, reaching an all-time high of 7.24% in 2016-2017 and a record low of 4.42% in 2001-02. The CAGR in GDP for the last ten years is 6.3%. Further information is provided in following table.

Economic Growth 2000 to 2017

Year	GDP growth (annual %)	GDP per capita growth rate % (at Current Market Price)	GDP per capita growth rate % (at Constant Market Price)	GNI at Constant Market Price, growth (annual %)	Per capita Income at Constant Market Price growth (annual %)	Per capita Income at Current Market Price growth (annual %)
2000	5.94	6.53	4.58	6.19	4.48	6.78
2001	5.27	6.83	5.17	5.08	5.33	6.64
2002	4.42	6.36	3.06	5.53	4.17	7.50
2003	5.26	8.54	3.84	6.19	4.75	9.49
2004	6.27	9.30	4.86	6.02	4.61	9.06
2005	5.96	9.88	4.57	5.79	4.41	9.71
2006*	6.67	12.80	4.80	6.50	5.40	12.90
2007*	7.06	12.38	5.55	7.84	6.32	13.21
2008*	6.01	12.76	4.54	7.29	5.80	14.11
2009*	5.05	10.61	3.60	5.27	3.83	10.85
2010*	5.57	11.58	4.15	5.74	4.31	11.76
2011*	6.46	13.41	5.15	6.28	4.97	13.22
2012*	6.52	13.75	5.17	7.07	5.70	14.33
2013*	6.01	12.06	4.56	5.60	4.15	11.63
2014*	6.06	10.58	4.65	4.71	3.32	9.17
2015*	6.55	11.29	5.11	6.38	4.94	11.11
2016*	7.11	12.89	5.71	6.38	5.05	12.11
2017*P	7.24	11.58	6.08	5.65	4.44	9.93

Note: * = New base year 2005-06. Old base year: 1995-96, BB Statistical table no.-Table IXC

Source:..\04.DEWEEP_Economic_data-2017\BB_statisticaltable-JULY2017.xlsx, Bangladesh Bank (BB) and Bangladesh Bureau of Statistics (<https://www.bb.org.bd/econdata/index.php>), P=Provisional

1.9. Project Implementation

The project is a major undertaking and for reasons of cost and construction timing, the likely need for there to be two separate contracts for the construction. These could comprise a western contract for the section from Hemayetpur (ch 0+000) to the Dhaka Mawa Highway (ch 20+230.337) and an eastern contract from Dhaka Mawa Highway to Langolbandh (ch 38+983).

The eastern section is shorter than the western section but is complicated by having three large balanced cantilever bridges. These will take some time to build and will affect the location and number of casting yards for the box girder sections. Thus the eastern section is expected to take five years to build which is perhaps one year longer than the western section.

Given the possible difference in construction duration of the eastern and western two contracts, and for simplicity of construction management, the interchange at Dhaka Mawa Highway (highway N8) should be included in the works for the eastern portion of DEWEEP.

A critical activity will be the establishment of casting yards followed by the stockpiling of box girder sections. This can occur while foundation works are proceeding. Both the eastern and western sections will require establishment of three casting yards.

Activity Timeline	2017	2018	2019	2020	2021	2022	2023	2024
Procurement of funding								
Engaging PPP contractors								
Detail design								
Land acquisition								
Construction								
Project Opening								*

1.10. Economic Evaluation

The following two alternatives and generated annual cash flows were over a period of 36 years:

- Base Case Alternative: Road user costs along the existing road network being the alternatives to the Investment Alternative (DEWEE)
- Investment Alternative (DEWEE): Road user costs on the Dhaka East West Elevated Expressway.

1.10.1. Data Collection and Assumptions

The data used for the economic evaluation were obtained from various sources including from the bridge and road authorities. More data has been collected from similar studies recently carried out in the Dhaka region. The following inputs were considered for the economic evaluation.

- technical specification for investment and maintenance alternatives
- cost estimates for investments
- cost estimates for maintenance strategies
- vehicle operating costs
- time values for passenger and freight traffic
- vehicle characteristics
- traffic surveys and GDP growth forecasts
- traffic diversion scenarios
- travel speed observations and travel speed design
- accident records
- others including economic development perspectives

DEWEE - Traffic Modelling Results

	Cars	Pickups & 4WD	Mini Bus	Medium Bus	Large Bus	Small Trucks	Medium Trucks	Heavy Trucks	Total
Section 1 (2016)	3,490	3,373		1,518		5,105	12,793	1,067	27,345
Section 2 (2016)	2,603	2,777		1,100		4,405	13,654	1,187	25,726
Section 3 (2016)	2,035	2,408		776		3,842	13,352	1,325	23,739
Average distribution (2016)	11%	11%		4%		17%	52%	5%	100%
	22%		4%			74%			100%
Section 1 (2024)	5,562	5,376		2,419		7,832	19,629	1,637	42,456
Section 2 (2024)	4,149	4,426		1,754		6,759	20,950	1,821	39,858
Section 3 (2024)	3,243	3,839		1,237		5,896	20,487	2,033	36,735
Average distribution (2024)	11%	11%		5%		17%	51%	5%	100%
	22%		5%			73%			100%
Tolled EWEE based on traffic on existing road network alternative (Base Case)									
Average diversion pct.	31%	31%		39%		78%	78%	78%	39%
Section 1 (2025)	3,169	1,377		2,469		4,045	11,274	513	22,848
Section 2 (2025)	2,246	1,479		2,204		3,264	11,378	574	21,146
Section 3 (2025)	1,898	854		1,377		2,099	12,319	1,615	20,162
Average distribution on EWEE (2025)	11%	6%		9%		15%	55%	4%	100%
	17%		9%			73%			100%

Source: Consultants estimates.

AADT at Sub-sections along the existing road network alternatives (2016)

	Section 1: Start of DEWEE at Hemayetpur on N5 via Gabtoli to Dolphur New Road on N1	Section 2: Dolphur New Road - Dania Bus Stand on N1	Section 3: Dania Bus Stand - Kanchpur Bridge on N1	Section 4: Kanchpur Bridge to End of DEWEE on N1 at Langolbandh	Average
Recorded AADT (Motorised) 2016	34,405	42,839	44,844	31,358	38,362
Recorded AADT (Vehicular) 2016	27,330	32,575	33,174	28,587	30,417
Est. AADT (Motorised) 2025 (1 st yr. of DEWEEP)		22,848	21,146	20,162	30416.5
Est. AADT (Vehicular) 2025 (1 st yr. of DEWEEP)		22,848	21,146	20,162	21,385

Projected Traffic Growth Rates (Medium Traffic Growth)

Period	Passenger Vehicles incl. motorcycles	Freight Vehicles
2016 – 2021	6.0%	6.1%
2022 – 2028	6.0%	4.5%
2028 onwards	5.3%	4.0%

Source: Consultant's estimates

1.10.2. Willingness to pay and time value

The toll rate as preliminarily determined for the financial analysis is based on an average BDT9.4 per km or USD0.121 per km for a medium-sized truck, however, coordination with the outcome of toll decisions

from the DAEEP, the DEEP and other toll projects will eventually be considered. Other vehicle types will pay more or less than this, depending on their size and subsequent toll multipliers.

1.10.3. Anticipated Diverted Traffic along the DEWEE

To allow for the uncertainties of the eventual toll levels and the road users willingness to pay for using the tolled expressway, three traffic diversion scenarios were examined with respectively the Base Case Scenario, +10% and -10% diverted vehicular traffic.

1.10.4. Maintenance Strategies

The construction of the Dhaka East West Elevated Expressway is part of the economic analysis, where the future road user costs are compared to the future road user costs of the existing road network as a result of motorised and non-motorised travellers. Accordingly, maintenance strategies for the two scenarios are provided for the analysis and estimated effects made in the HDM model. The HDM model used estimated maintenance requirements and costs on the existing defined road sub-sections, being the alternative to the Dhaka East West Elevated Expressway. The maintenance strategies for the existing sections (base case alternative) and the investment alternative are selected as responsive treatments, and their impact will ensure a sufficient quality of the road sections over the lifetime of the project analysis as compared to the initial physical stage.

1.10.5. Results of Economic Evaluation

A discount rate of 12% was applied for the calculation of the net present value (NPV) and all costs are measured in economic prices and expressed in USD. The economic evaluation period is set to 36 years. The overall economic project viability of EIRR 13.3% is above the threshold of 12% for the medium traffic scenario.

Project	Traffic growth scenario	NPV (USD million)	EIRR (%)	BCR*
Dhaka East West Elevated Expressway Project (DEWEEP)	High Traffic (+20% growth)	278.5	14.9%	1.40
	Medium Traffic	118.7	13.3%	1.17
	Low Traffic (-20% growth)	-219.0	11.5%	0.94

*Benefit cost ratio

Component / Growth Scenario	NPV (USD million)
Medium Traffic Growth	
Net Investment Costs	-688.8
Residual value	15.6
Maintenance Costs	-7.1
VOC	303.3
Travel time costs	493.1
Accident Costs	2.5
NMT	0.12
NPV	118.7

1.11. Sensitivity and Risk Analysis

Parameter	NPV (USD million) @12% discount rate	EIRR	BCR
Basis Case Results	118.7	13.3%	1.17
Investment costs +20%	-17.4	11.8%	0.98
Investment costs -20%	254.7	15.2%	1.46
Vehicle operating costs +20%	179.3	13.9%	1.26
Vehicle operating costs -20%	58.0	12.6%	1.08
Value of travel time +20%	217.3	14.3%	1.32
Value of travel time -20%	20.1	12.2%	1.03
Diverted traffic +10%	198.6	14.1%	1.29
Diverted traffic - 10%	38.8	12.4%	1.06
Traffic growth +20%	278.5	14.9%	1.40
Traffic growth -20%	-41.1	11.5%	0.94

Economic IRR and Sensitivity Tests and Switching Values for DEWEE

Project	Inflation rate(2016-17): 5.8%							Real 'Economic IRR'	Nominal 'Economic IRR'	Benefit : Cost Ratio*			
	Net Present Values Discounted at 12%/year												
	Project Costs	VOC savings	Time Savings	Non- motorize d traffic	Accident Cost Savings	Net Benefit							
DEWEEP	680.3	303.3	493.1	0.12	2.5	118.67	13.3%	19.9%	1.17				
Project cost +20%	816.4	303.3	493.1	0.12	2.5	-17.4							
Project cost -20%	544.3	303.3	493.1	0.12	2.5	254.7							
Project cost +17%	799.0	303.3	493.1	0.12	2.5	0.0	12%		1.0				
Traffic +20%	680.3	364.0	591.7	0.14	3.0	278.5							
Traffic -20%	680.3	242.6	394.4	0.10	2.0	-41.1							
Traffic -15%	680.3	258.3	419.8	0.10	2.2	0.0	12%		1.0				

***For ease of reading , only the benefit side of the ratio is shown, i.e. 1.17 is shown rather than 1.17 :1**

Source: Consultant's calculations

These calculations and results are explained in above tables which also contains an analysis of the sensitivity of the findings to possible variations in the construction costs and traffic forecasts that have been assumed. It was found that DEWEEP is a robust project, as only very substantial cost increases or traffic reductions (-15%) would affect the overall viability of the project.

1.12. Breakdown of Economic Costs and Benefits

The main benefits generated by the DEWEE Project come from a combination of travel time-savings for both passenger and freight traffic and savings in vehicle operating costs. Reduced accident costs further contribute to the overall benefits.

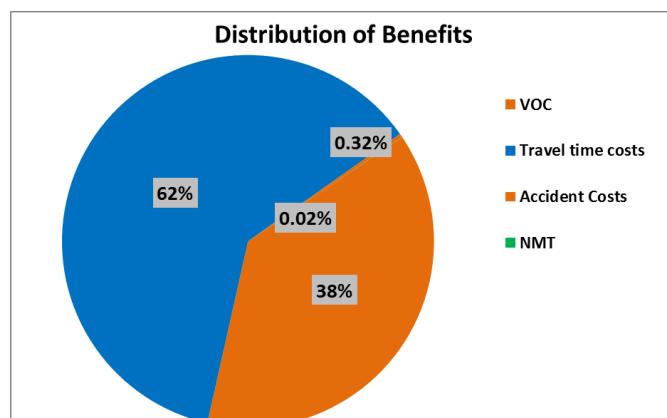
Following table shows the net present value (NPV) of the costs and benefits generated by the project. In addition are the distribution of benefits is illustrated graphically.

Benefits from travel time-savings represent the majority and correspond to 61.7% whereas benefits from reduced vehicle operating costs represent 38%, reduced accident costs 0.32% and combined VOC and time savings for non-motorised traffic close to 0.02%. (See, following figure).

Breakdown of Economic Costs and Benefits (DEWEEP)

Component / Growth Scenario	NPV discount rate@12%
	(USD million)
Low Traffic Growth (-20%)	
Net Investment Costs	-688.8
Residual value	15.6
Maintenance Costs	-7.10
VOC	242.6
Travel time costs	394.4
Accident Costs	2.0
NMT	0.10
NPV	-41.1
Medium Traffic Growth	
Net Investment Costs	-688.8
Residual value	15.6
Maintenance Costs	-7.10
VOC	303.3
Travel time costs	493.1
Accident Costs	2.5
NMT	0.12
NPV	118.7
High Traffic Growth (+20%)	
Net Investment Costs	-688.8
Residual value	15.6
Maintenance Costs	-7.1
VOC	364.0
Travel time costs	591.7
Accident Costs	3.0
NMT	0.14
NPV	278.5

Source: Consultant's calculations



Distribution of Benefits (medium traffic case)

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1.12.1. Other Benefits

The main quantifiable benefits of the DEWEEP arise from time-savings and savings in vehicle operating costs as mentioned above. In addition, less quantifiable benefits can also be justified from the project and should mainly be addressed to business and industrial development perspective as the DEWEEP and other road improvement projects in and around Dhaka. These are expected to improve considerably the connectivity to and from the port of Chittagong as well as the freight and passenger corridor traffic opportunities to the northern and western parts of the country.

The EWEE Project is further expected to improve the traffic flow by separating the through traffic from the local traffic and thus reduce the travel time of the passengers entering and exiting Dhaka to the northern and southwestern districts. This is furthermore part of the long term road development plan for ring roads in and around Dhaka City.

In addition to the benefits to the business and industrial areas in the south of Dhaka, other businesses in the northern region that are dependent on the Chittagong port will equally be positively affected by better and faster access via the EWEE.

The benefits of daytime travel through Dhaka using the EWEE depend on the existing supply chain management and the traffic conditions at other major highways. For example, if there remains major traffic bottlenecks at other locations on the highway, businesses may want to move goods only during the night to avoid those bottlenecks. In such cases, the benefits of the EWEE might be reduced.

Impact on GDP

In terms of direct impact on GDP – we have found that the project has only a slight impact on economic growth. We assumed a base case of 7.24% GDP growth. The benefit in the 2025-2035 periods will be in the range of 0.11%-0.26% of today's GDP, say 0.173%. Therefore the project would increase this amount by 0.317% that is GDP would be 7.56% with the project over the 30 years of the project.

1.13. Economic Analysis Conclusions

The overall economic project viability of EIRR 13.3% and above the threshold of 12% for the medium traffic scenario thereby making the project economically viable.

The DEWEEP is for reasons of improved traffic management and corridor improvements for road user and trade etc. a considerable influencing factor for the future industrial development opportunities in and around Dhaka that is even further expected to generate additional benefits to the project thereby justifying its implementation.

It has been observed from other similar road and highway studies in Bangladesh that a discount rate of 12% has been applied, however such level is not specifically mentioned in the ToR of this project. Therefore, if lower discount rates are used for the economic analysis of e.g. 10%, the project would according to the quantifiable benefits automatically indicate higher economic viability.

Project	Traffic growth scenario	NPV (USD million)	EIRR (%)	B:C Ratio
Dhaka East West Elevated Expressway Project (DEWEEP)	High Traffic (+20% growth)	278.5	14.9%	1.40
	Medium Traffic	118.7	13.3%	1.17
	Low Traffic (-20% growth)	-219.0	11.5%	0.94

Results of the Economic Analysis discount rate @15%, 12%, 10% and 5%

	Discount rate@ 15%	Discount rate@ 12%	Discount rate@ 10%	Discount rate@ 5%
Net investment Costs	-571.5	-688.8	-782.6	-1089.8
Maintenance Costs	-4.5	-7.1	-9.8	-24.5
VOC	187.5	303.3	429.2	1140.9
Travel time costs	278.5	493.1	744.0	2333.4
Accident	1.57	2.54	3.6	9.6
NMT	0.08	0.12	0.2	0.3
Residual value	6.0	15.6	29.8	159.2
NPV (2017)	-102.3	118.7	414.2	2529.1
EIRR	13.3%	13.3%	13.3%	13.3%
B/C	0.82	1.17	1.54	3.65
Note: NPV(2017)(USD million)				

Source: Consultant's calculations

1.14. Financial Analysis

1.14.1. Proposed Toll Structure

The proposed toll levels for the different vehicle categories have considered the experience from the DEE Project and the Dhaka – Chittagong Expressway Project. The toll rate as preliminarily determined for the financial analysis is based on an average of 9.4 BDT per km or USD 0.121 per km for a medium-sized truck, however, coordination with the outcome of toll decisions on the DEEP will eventually need to be considered. Proposed toll levels used for the financial analysis were as follows.

Item	Car / taxi	Pickup / 4WD	Minibus	Medium bus	Large bus	Small truck	Medium truck	Heavy truck	Motor cycle / rickshaw
Toll multiplier between vehicles	1	1	3	3	3	1.5	1.5	2	0.5
Toll level per km (BDT)	6.27	6.27	18.80	18.80	18.80	9.40	9.40	12.53	3.13
Toll level per km (USD)	0.08	0.080	0.241	0.241	0.241	0.121	0.121	0.161	0.040

These toll levels are tentative and, depending on the outcome of the final toll level negotiations, the impact on travel demand and subsequent financial viability will vary accordingly. Therefore, the financial analysis has provided viability indicators for varying toll levels and traffic diversion in order to show the break-even project viability for combinations of toll levels and traffic, and subsequently what will be required to make the EWEE Project financial viable and potentially attractive to private financiers and operators.

1.14.2. Results of Financial Analysis

The result of the financial analysis of the tolled DEWEE is based on the assumptions taken with regard to toll levels and diverted traffic. The capital expenditure (CAPEX) used for the analysis is without the cost of land and resettlement which will be financed by the GoB. The results indicate that the project is positive financial viability reaching a FIRR of 7.21% which is above the financial discount factor of 12% initially assumed for the analysis. The results indicate that the project is showing a positive financial viability reaching a FIRR of 7.21% (real term) and 13.5% (nominal term), NPV is 225 million USD (nominal term) and BCR is 1.38 (nominal term) before taxes, which is above the financial discount factor of 12 % initially assumed for the analysis. The FIRR is 4.65% after taxes.

Medium Traffic Growth Rates and Average 43.7% Diverted Traffic to EWEE						
Net Present Value (2017)	discount factor					
	@2.5%	@3.5%	@5%	@10%	@12%	@15%
Cost of EWEE construction	-990	-1001	-973	-757	-669	-551
Cost of construction of toll plazas	-5	-4	-4	-2	-2	-2
Cost of maintenance	-37	-30	-22	-9	-7	-4
Cost of toll operations	-38	-29	-21	-7	-5	-3
Financial Results without taxes						
Revenues from toll stations (without tax)	3032	2321	1577	488	321	179
Total	1963	1257	556	-288	-362	-381
Revenues in % of total costs	284%	218%	155%	63%	47%	32%
Financial NPV (real term)	1915	1215	530	-262	-362	-331
Financial NPV (nominal term)					225	
Financial IRR (real term)	7.21%	7.21%	7.21%	7.21%	7.21%	7.21%

Medium Traffic Growth Rates and Average 43.7% Diverted Traffic to EWEE						
Net Present Value (2017)	discount factor					
	@2.5%	@3.5%	@5%	@10%	@12%	@15%
Financial IRR (nominal term)					13.5%	
BCR* (real term)	2.84	2.18	1.55	0.63	0.47	0.32
BCR* (nominal term)					1.38	
Financial Results after 40% tax						
Revenues from toll stations (with tax)	1819	1393	946	293	192	108
Total	750	328	-74	-484	-490	-453
Revenues in % of total costs	170%	131%	93%	38%	28%	19%
Financial NPV (real term)	732	317	-71	-440	-490	-394
Financial IRR (real term)	4.65%	4.65%	4.65%	4.65%	4.65%	4.65%
BCR*(real term)	1.70	1.31	0.93	0.38	0.28	0.19
<i>Source: Consultant's calculations</i>	Inflation (%)=5.8% ,				(USD million)	

1.14.3. Sensitivity Analysis

The financial viability of the EWEE Project is considered before and after taxes, and is still maintained after taxes if the some annual compensation by e.g. BAA is made to the toll operator or that a lower financial discount rate than 5% e.g. 3.5% is used for the financial analysis resulting from lower cost of finance. Still it is assumed that more than on average 43.7% of the estimated traffic needs to be diverted to the DEWEE.

1.15. Financial Analysis Conclusions

Based on the available information, the conclusion of the financial analysis is that the DEWEE Project is found financial viable showing an FIRR of 7.21% (real term) and 13.5% (nominal term), NPV is 225 million USD (nominal term) and BCR is 1.38 (nominal term) before taxes by further assuming that land and re-settlement costs will be financed by the Government of Bangladesh, and the capital expenditures associated to the DEWEE will be the responsibility of the private financer/operator.

After taxes, the financial viability is reduced to an FIRR of 4.65%. A lower financial discount rate of e.g. 3.5% to 5% would make the project financially viable to the operator after taxes.

Depending on the eventual project cost of finance, the financial project viability may consequently require annual financial compensation from e.g. BBA to make it attractive from a toll operator's point of view.

The after taxes considerations for the project is based on the requirements that more than on average 43.7% of the existing road users decide to use the expressway in the future based on their willingness to pay an average toll fee of USD 0.147 per km or BDT 11.5 per km.

Different composition of vehicle categories may end up with traffic diversion scenarios most likely favouring heavy traffic rather than passenger vehicles. Such a proportion will also likely have positive impacts on the generated revenues from toll collections