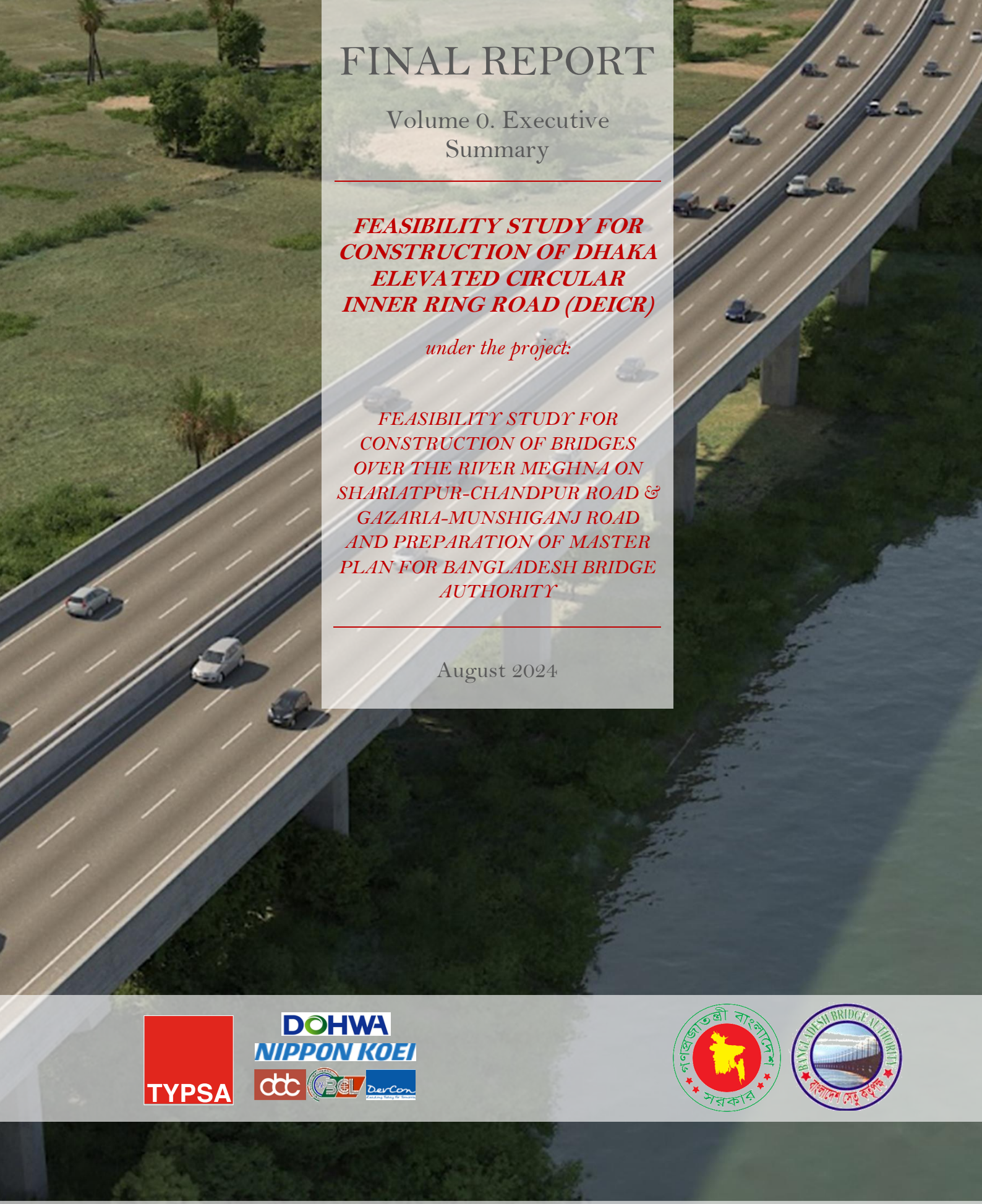

FINAL REPORT

Volume 0. Executive Summary

FEASIBILITY STUDY FOR CONSTRUCTION OF DHAKA ELEVATED CIRCULAR INNER RING ROAD (DEICR)

under the project:

FEASIBILITY STUDY FOR CONSTRUCTION OF BRIDGES OVER THE RIVER MEGHNA ON SHARIATPUR-CHANDPUR ROAD & GAZARIA-MUNSHIGANJ ROAD AND PREPARATION OF MASTER PLAN FOR BANGLADESH BRIDGE AUTHORITY

August 2024

TYPSA

DOHWA

NIPPON KOEI

ddc BCL DevCon

Government of the People's Republic of Bangladesh
Ministry of Road Transport & Bridges
Bridges Division
Bangladesh Bridge Authority (BBA)

FINAL REPORT FOR THE FEASIBILITY STUDY FOR CONSTRUCTION OF DHAKA ELEVATED INNER CIRCULAR ROAD (DEICR)

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EXECUTIVE SUMMARY

VOLUME 1
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HYDROLOGICAL & MORPHOLOGICAL MATHEMATICAL MODELLING STUDY

VOLUME 3 (FIVE BOOKS)
GEOTECHNICAL INVESTIGATION

VOLUME 4
TRAFFIC SURVEY REPORT

VOLUME 5
TECHNICAL REPORT

VOLUME 6
PRELIMINARY DESIGN DRAWINGS

VOLUME 7
LAND ACQUISITION PLAN

VOLUME 8
RESETTLEMENT ACTION PLAN

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ENVIRONMENTAL ASSESSMENT PLAN

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ECONOMIC AND FINANCIAL ANALYSISI

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Quality Control Sheet

DOCUMENT	**FINAL REPORT. DHAKA ELEVATED INNER CIRCULAR ROAD (DEICR)** **VOLUME 0. EXECUTIVE SUMMARY**			
PROJECT	TR8138-MASTER PLAN BBA			
CODE	TR8138-JV-FS-G307-RP-000001-FFS_Vol0-D02			
AUTHORS:	Signed:	MCP		
	Date:	30/08/2024		
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	Date:	31/08/2024	31/08/2024	31/08/2024
RECIPIENT	Bangladesh Bridge Authority (BBA)			
NOTES	Document created by the Joint Venture formed by TYPSA-DOHWA-NIPPON KOEI-DDC-BCL-DEVCON			

Control of Versions

VERSION	CONTROL OF CHANGES
1	First Submission
2	Second Submission

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List of Abbreviations

1D	One Dimensional
2D	Two Dimensional
AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
ADB	Asian Development Bank
ADT	Average Daily Traffic
AP	Affected Person
ARIPA	Acquisition and Requisition of Immovable Property Act
BAU	Business as Usual
BBA	Bangladesh Bridge Authority
BDT	Bangladesh Taka
BFRI	Bangladesh Fisheries Research Institute
BIWTA	Bangladesh Inland Water Transportation Authority
BWDB	Bangladesh Water Development Board
CAPEX	Capital Expenditure
CBA	Cost Benefit Analysis
CC	Cement Concrete
CCB	Control Centre Building
CEGIS	Centre for Environmental and Geographic Information Services
CL	Lean Clay
CPR	Common Property Resources
DBFOT	Design-Build-Finance-Operate-Transfer
DC	Deputy Commissioner
DNP	Defects Notification Period
DoE	Department of Environment
DSCR	Debt Service Coverage Ratio
EBCR	Economic Benefit Cost Ratio
EBITDA	Earnings before Interest, Taxes, Depreciation and Amortization,
EE	Elevated Expressway
EFP	Economic Financial Plan
EGL	Existing Ground Level
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EMP	Environmental Management Plan
ENPV	Economic Net Present Value
EPC	Engineering, Procurement and Construction
EZ	Economic Zone
FBCR	Financial Benefit-Cost Ratio
FDR	Financial Discount Rate
FHWA	Federal Highway Administration
FIDIC	The International Federation of Consulting Engineers
FIRR	Project Investment Cost

FNPV	Financial Net Present
FS	Feasibility Study
GDP	Gross Domestic Product
GoB	Government of Bangladesh
HH	Household
IEE	Initial Environmental Examination
IFC	International Finance Corporation
INGO	International Non-Governmental Organization
IoL	Inventory of Losses
IRC	Indian Road Congress
IRR	Inner Ring Road / Inner Circular Elevated Expressway (Dhaka)
IWM	Institute of Water Modelling
JV	Joint Venture
Ke	Cost of equity
Km	Kilometre
LAP	Land Acquisition and Resettlement
LGB	Left Guide Bund
LGED	Local Government Engineering Department
LRFD	Load Resistance Factor Design
m	Meter
MDB	Multilateral Development Banks
ML	Silt
MSL	Mean Sea Level
MSS	Movable scaffolding system
MUSD	Million United States Dollar
N1	National One (Dhaka–Chattogram Highway)
NPV	Net Present Value
OPEX	Operating Expenses
PAPs	Project Affected Person
PBS	Palli Bidyut Samity
PDB	Power development Board
PCM	Public Consultation Meeting
PM	Prime Minister
PPP	Public and Private Partnership
PWD	Public Works Datum
PWD	Public Works Department
RAJUK	Rajdhani Unnayan Kartripakkha
RAP	Resettlement Action Plan
RC	Replacement Cost
RHD	Roads and Highways Department
RoW	Right of Way
RTW	River Training Work
SCF	Standard Conversion Factors
SCP	Sand Compaction Pile
SHWL	Standard High-Water Level

SM	Silty Sand
SP	Poorly Graded Sand
SPT	Standard penetration
SRD	Social Rate of Discount
SWOT	Strengths, Weakness, Opportunities, Threats
TAC	Technical Advisory Committee
ToR	Terms of Reference
USD	United States Dollar
VAT	Value Added Tax
VGF	Viability Gap Financing
VOC	Vehicle Operating Costs
WACC	Weighted Average Cost of Capital
WB	World Bank
WL	Water Level

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Executive Summary

Summary of Key Findings and Recommendations of the Feasibility Study

(Final Report – August 2024)

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Feasibility Study
Final Report

1. PROJECT BASIC INFORMATION

Table 1. Basic Information

1.	Name of the Project	:	FEASIBILITY STUDY OF CONSTRUCTION OF DHAKA ELEVATED INNER CIRCULAR ROAD
2.	(a) Sponsoring Ministry/Division (b) Implementing Agency	:	(a) Government of the People's Republic of Bangladesh Ministry of Road Transport & Bridges (b) Bridges Division Bangladesh Bridge Authority (BBA)
3.	Project Objectives (Project to be taken based on the study)	:	To assess the feasibility of construction of an elevated inner circular road around Dhaka city. Analysis includes technical, socio-economic, financial, and environmental aspects
4.	Estimated project Cost. (Taka in Crore)		Estimated project Cost. Eastern Part-1 38,835.82 Cr BDT Western Part-2 53,496.52 Cr BDT
5.	Sector & Sub-Sector		Transport Sector / Bridges Infrastructures
6.	Project Category		Project Red Category (Based on Environment Conservation Rules 1997)
7.	Project Geographic Location Countrywide Division: District: Upazila:		The People's Republic of Bangladesh Division: Dhaka District: Dhaka Upazila: 29 uts.
8.	Project Duration	:	Eastern Part-1 Investment Period: 11Y – 2025/2035 Operation Period: 34Y – 2031/2064 Western Part-2 Invest. Period: 12Y Operation Period: 30Y

2. INTRODUCTION

The Bangladesh Bridge Authority (BBA) assigned in June 2021 a series of four Feasibility Studies to be undertaken by the Consultant JV under the project "Construction of Bridges over the river Meghna and Preparation of Transport Master Plan for Bangladesh". Later in December 2021 and through the signature of the Contract Variation Order No. 1 in October 2022, the assignment from the BBA was increased in scope, by means of adding three new bridges to be implemented at Feasibility study level. One of the four initial feasibility studies was the **Dhaka Elevated Inner Circular Road (DEICR).**

An Inception Report of the FS of Dhaka Elevated Inner Circular Road (DEICR) was submitted in 2023. This report, clearly split the whole Dhaka Circular Route into two main parts Part-2 (western side) from Abdullapur to Demra counterclockwise and Part-1 (eastern side) from Demra to Abdullapur. The first version of this report was submitted by the consultant on May 7th, 2023. After this first submission, on May 18th, 2023, the consultant sent a letter to BBA regarding the Resolution of 13th Meeting of the Executive Council (Memo No: 35.02.0000.002.35.003.19-589). Based on this letter, another version of the Inception Report was submitted in July 2023, mainly focused on the Part-1 (eastern side). During the outset of year 2024, BBA confirmed to the Consultant, the instruction to follow the first version of the report, thus covering, split in two sections, eastern and western parts, the entire Dhaka Inner Ring project, which length is near 84 km, circumvallating the capital city.

The Draft Report was submitted on May 2nd, 2024 (Ref. Letter:TR8138-LET-JV-BBA-375) and a TAC meeting (No. 19) on the Draft Report was held on May 27th, 2024 (Memo No: 50.01.0000.671.16.013.21-679). The recommendations raised in the TAC meeting and BBA instructions were implemented in the Final Report submitted on July 18th, 2024 (Ref. Letter: TR8138-LET-JV-BBA-406). The TAC (No.25) on the Final Report was arranged on August 28th, 2024 (Memo No: 50.01.0000.671.16.013.21-793). The final recommendations received and the comments from BBA have been taking into consideration in this Final Report Revised version.

The Project is considered of high priority by the Ministry of Transport, by the BBA and for the whole Dhaka area and extended areas of influence as a key infrastructure to be implemented aiming to alleviate the current traffic congestion around Dhaka city. In this regard, the Consultant has taken the project accordingly to this level of high priority and relevancy, and split it in two sections, in line with the implementation strategy conveyed by the Client during the meetings held in December 2023 and January 2024.

2.1. Background

With a view to boost up the economy of every corner of Bangladesh equally, a roadmap and action plan (Master plan) of transport connectivity is being implemented by Bangladesh Bridge Authority. In response to long felt need for easy and quick communication among major cities of Bangladesh, the Master plan, prepared by BBA includes construction of several key infrastructures to be implemented during several short-term, mid-term and long-term scenarios. Among these, one of the important high priority infrastructures to be implemented in the short-term is the Dhaka Elevated Inner Circular Road (DEICR).

The Dhaka Elevated Inner Circular Road (DEICR) was identified by the RSTP in the year 2016, as a key priority project that could potentially ease the severe congestion in the city central business areas. The improvement of traffic movements was proposed to be done by implementing circular roads that avoid entering in the city centre and the busy commercial districts. The study was undertaken by DTCA under a JICA Funding. After the RSTP report was published, different transport agencies (such as RHD, BBA, BR, BWDB & BIWTA) considered it as a base to prepare their own Urban Transport Plan and to implement and plan future projects.

At a former stage, after joint agencies under the Ministry of Transport meetings were held, and the Executive Council Resolution of the 13th Meeting held on December 8th, 2019 (Memo. 35.02.0000.002.35.003.19-589), it was agreed that Roads and Highways Department (RHD) would implement the Inner Circular Road at-grade, western side of the ring, while both, Bangladesh Railway (BR) and Bangladesh Bridge Authority (BBA) would implement, if decided and deemed necessary in the future, the appropriate elevated complementary infrastructure, based on an alignment running parallel to the one designed by RHD. Also, it was agreed that in the eastern part of the ring, where not any other transport infrastructure development was being planned by any agency, the DEICR would be planned and implemented by the BBA, running parallel to the BWDB embankment project area.

The Inner Circular Road mostly covers the DNNC, DSCC and NCC areas, being bounded by embankments of the following four rivers – Turag, Buriganga, Sitalakhaya and Balu. The section related to the Eastern Part-1 mostly runs parallel to the area related to the BWDB embankment project, although separately, due to the need of avoiding any intricated and curved sections in the elevated expressway alignment.

The elevated expressway would facilitate an easier and smoother road communication for city and surroundings. The proposed alignment would be located near Bishwa Ijtema ground, Dhour, Uttara, Dhaka Zoo, Dhaka Zoo South, Gabtoli, Mohammadpur, Rayerbazar, Kamrangirchar, Sadarghat, Postagola, Pagla, Fatullah, Chashara, Chittaranjan, Adamjee, Siddhirganj, Demra, Trimohini, Beraid, Purbachal, Purbachal North, Termukh, and Tongi. Of these, Dhour, Gabtoli, Mohammadpur, Sadarghat, Chashara, Siddhirganj, Demra, Trimohini, Beraid, Purbachal, Termukh, and Tongi will have interchange facilities with other mode of transport like the metro rail, bus, or launch.

People living in Dhaka metropolitan area, face nagging traffic jams despite a few flyovers built to divert crumbling traffic from roads. An overhead metro rail across the city and an elevated expressway connecting its northern suburb are under construction. To lessen the highway traffic from the travel's delay due to passing through the city, several ring roads are necessary. Ring Roads with grade-separated radial connectivity to outside highways and inside city primary roads will provide uninterrupted movement for passenger and freight vehicles. Ring roads are proposed at about 10 km, 15 km and 20 km distance from the city centre. Comprehensive and efficient transportation systems with good inter and intra city linkages are essential to ensure Dhaka's position as a modern city and to serve as the administrative, financial and commercial capital of the country. The city must be able to provide an efficient and equitable transport infrastructure to all citizens. Current chaotic transport condition of the city is causing huge socio-economic losses which greatly hinders the national economic and social development.

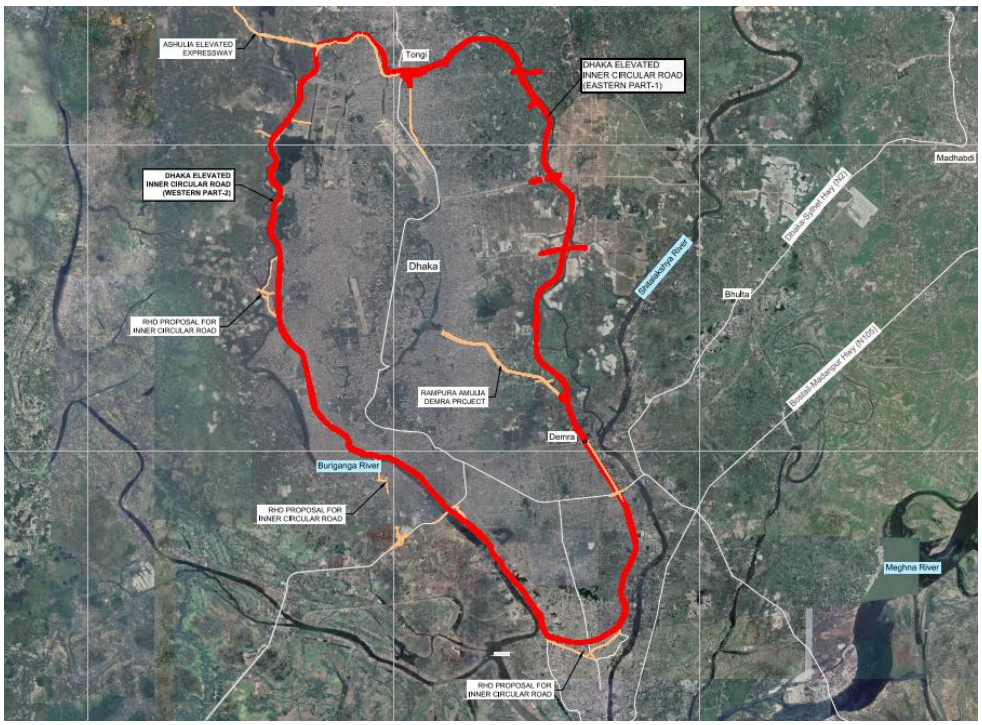

Figure 1. Inner Ring Road around Dhaka city preliminary alignment.

The DEICR project is intended to be a tolled road which is characterized by high-speed, with smooth and uninterrupted movements due to the use of entry and exit ramps. Individuals travelling outside Dhaka as well as inter-district commuters will benefit from this project due to the reduced congestion in the area and hence the lower travel time required. In addition, the design of ramps along the expressway will provide uninterrupted movements and connectivity with the national highway network.

The following images show previous projects, feasibility studies and initiatives at the DEICR affected are by other agencies, as RAJUK, RHD or BWDB.

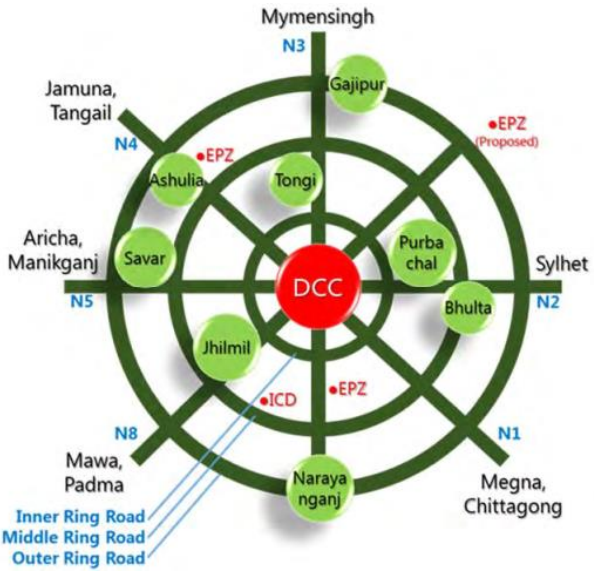

Figure 2. Three Rings and eight Radials Road Network System in RAJUK Area.

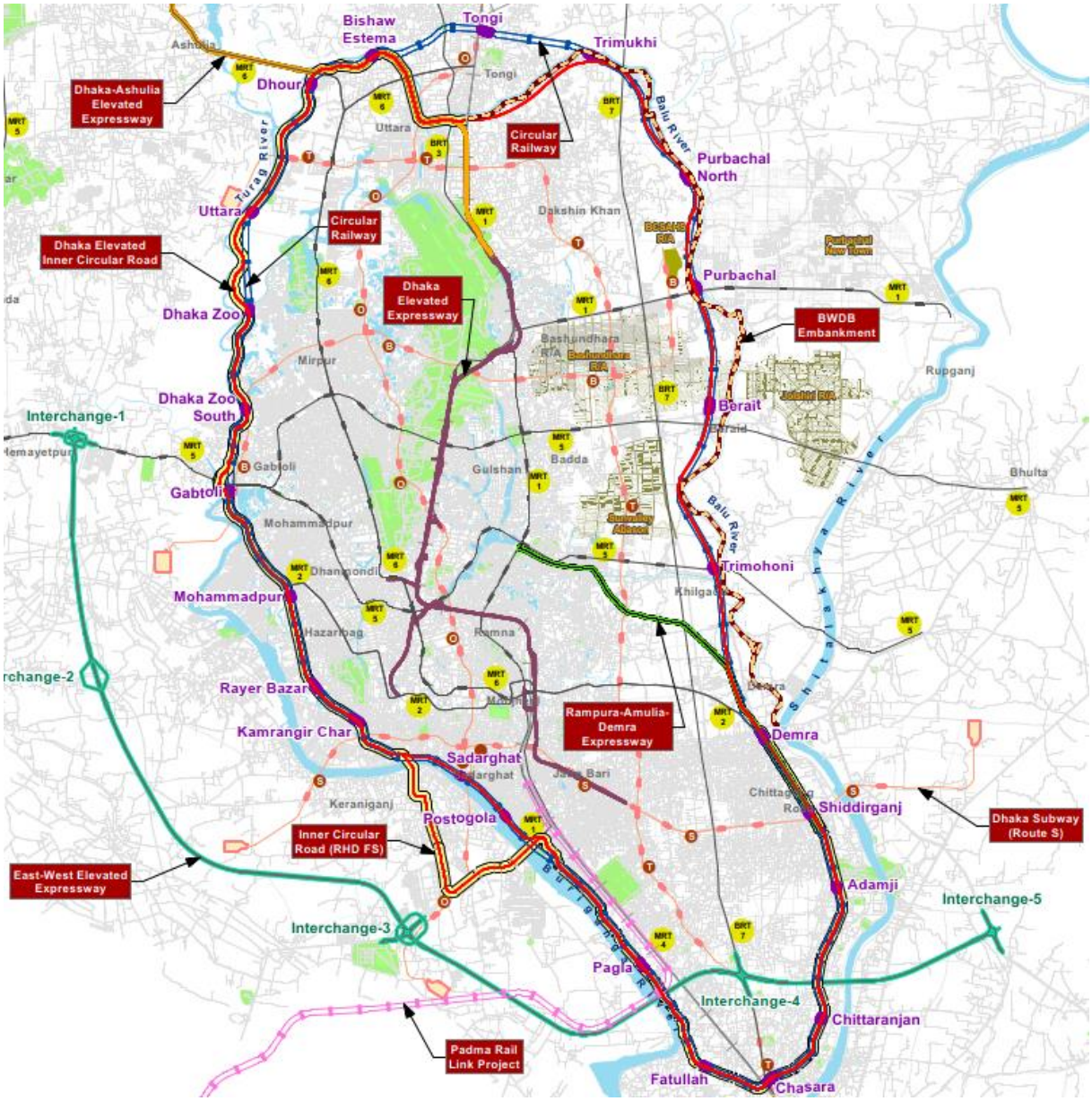

Figure 3. Development projects within/around Dhaka city.

2.2. Geographical Information

The project covers most area of Dhaka City Corporation-North & South and some area of Narayangonj City Corporation. The alignment of DEICR would run alongside four rivers – Turag, Buriganga, Shitalakshya and Balu surrounding the Capital city. The project is divided into two parts, namely Eastern Part-1 connecting Abdullahpur-Borobag-Teromukh-Poradia-Mastul-Madani Avenue-Kayetpara-Demra with a length of 26.98 km and the Western Part-2 connecting from Demra-Chattgram Road-Hajigong Bazar-Panchoboti-Postogola-Sadarghat-Showari Ghat-Hazigonj Bazar-Bosila-Nobaberbag-Birulia-Abdullahpur with a length of 57.02 km. The project area is geographically between 23.626527 and 23.897457 North latitude and 90.337332 and 90.517882 East longitude. It covers an area of approximately 303.92 sqkm, (Eastern Part-1 with 172.50 sqkm and Western Part-2 with 131.42 sqkm). The following table provides statistical data:

Table 2. Summary of projects geographical area statistical data.

Eastern Part-1: DEICR Alignment from Abdullahpur-Borobag-Teromukh-Poradia-Mastul-Madani Avenue-Kayetpara-Demra				
Sl No.	Ward No. / Union name/Upazila	Name of Upazila/City Corporation/District	Population as per 2022 Census	Literacy Rate (%)
1	Ward-01	Uttra Purbo, Dhaka North City Corporation	119,514	92.68
2	Ward-42	Badda, Dhaka North City Corporation	19,676	79.84
3	Ward-43	Khilkhet, Dhaka North City Corporation	19,337	79.00
4	Ward-44	Khilgah, Dhaka South City Corporation	26,971	87.22
5	Ward-46	Uttar Khan, Dhaka South City Corporation	43,510	88.70
6	Ward-47	Uttar Khan, Dokhhin Khan, , Dhaka South City Corporation	44,551	85.89
7	Ward-69	Demra, , Dhaka South City Corporation	20,157	86.37
8	Ward-70	Demra, Dhaka South City Corporation	22,417	84.57
9	Ward-75	Nasirabad, Dhaka South City Corporation	34,200	77.67

Western Part-2: DEICR Alignment from Demra-Chattogram Road-Hajigong Bazar-Panchoboti-Postogola-Sadarghat-Showari Ghat-Hazigonj Bazar-Bosila-Nobaberbag-Birulia-Abdullahpur				
Sl No.	Ward No. / Union name/Upazila	Name of Upazila/City Corporation/District	Population as per 2022 Census	Literacy Rate (%)
1	Ward-03	Demra, Dhaka	125,312	58.58
2	Ward-02	Kotowali, Dhaka	82,488	77.78
3	Ward-04	Lalbag, Dhaka	188,794	71.45
4	Ward-01 & 05 (Partial)	Mirpur, Dhaka	274,530	73.73
5	Ward-03 & 02 (Partial)	Mohammadpur, Dhaka	241,343	74.70
6	Ward-02 & 04 (Partial)	Pallabi, Dhaka	412,217	64.10
7	Savar	Savar, Dhaka	1,385,910	68.00
8	Ward-05	Sutrapur, Dhaka	191,879	76.17
9	Ward-01	Uttara, Dhaka	66,636	65.67
10	Ward-12	Tongi, Gazipur	476,350	64.20
11	Fotullah	Fotullah, Narayangonj	206,426	60.50
12	Ward-09	Siddhirganj, Narayanganj	256,760	66.00

2.3. Project Objectives and Phasing Approach

The objective of this project is to prepare a feasibility study based on a concept design for the construction of the Dhaka Elevated Inner Circular Road (DEICR) in two separated parts approach (Eastern Part-1 and Western Part-2).

The objectives of this study are as follows:

- Find the most suitable solutions for the alignment on each section and its integration with the existing infrastructures.
- Identify connection points throughout the alignment along with a strategy for the integration of the DEICR with the existing roads.
- Propose adequate structural solutions (viaducts or tunnels) to be applied for each section.
- Assess socio-economic status of the area.
- Evaluate technical, social, economic, and financial viability of the project.
- Recommend the mode of procurement and implementation timeline.
- Prepare a Cost Estimate.
- Implement RAP and LAP.
- Implement EIA at Eastern Part-1 and IEE at Western Part-2.

As explained previously, this study is split in two stages: Eastern Part-1 and Western Part-2.

- The Eastern section of the DEICR starts in Demra and finishes in Abdulah Rail Gate. Thus, this elevated expressway will start in the interchange with the exiting RHD elevated road in Demra and finish in an interchange with the also elevated Dhaka Ashulia Elevated Expressway.
- The Western section of the DEICR starts at the east of the interchange between the already complete Eastern part of DEICR and the Dhaka Ashulia Elevated Expressway and follows the alignment of the RHD project over its median, where feasible, up to Demra. It is said "where feasible" because there are sections where the RHD project is already occupying the median with a viaduct. As it will be described later in the report, for these sections where there is an existing viaduct, three main solutions are studied:

    - A parallel Viaduct
    - A second level structure over portals
    - A tunnel.

The meet the FS objectives, the analysis of the 84.01 km long project, was split into sections, each one of them entailing different constrains and characteristics. The study of each section / part has been done separately. The report has been split in two main independent sections, for the area where there is currently no existing infrastructure (referred to as **Eastern Part-1**), and the one where there is a previously planned infrastructure and the DEICR intervention would aim to extend and improve the one previously implemented (**Western Part-2**).

Given the large difference in the list of constrains and characteristics that were found applicable to each section, the Feasibility Study considers the following scheme of actions to be implemented:

- Firstly, the **Eastern Part-1**, covering near 26.98 km of EE, would be developed and implemented. As described in the report, the Eastern Part of the DEICR starts in Demra and finishes in Abdulah Rail Gate. Thus, this elevated Expressway would start in the interchange with the existing RHD elevated road and would finish in an interchange with the also elevated Ashulia Expressway.

  The implementation of the project's part has been proposed to split in four phases/sections to be staggered. This option would enable an earlier start, with S1 in service to be operated earlier than the rest sections S2, S3 and S4.

    - S1 - km 0.0 to km 10.5 from Demra to Madani Avenue.
    - S2 - km 10.5 to km 14.5 from Madani Avenue to Mastul.
    - S3 - km 14.5 to km 20.0 from Mastul to Teromukh.
    - S4 - km 20.0 to km 27.0 from Teromukh to Abdullahpur.

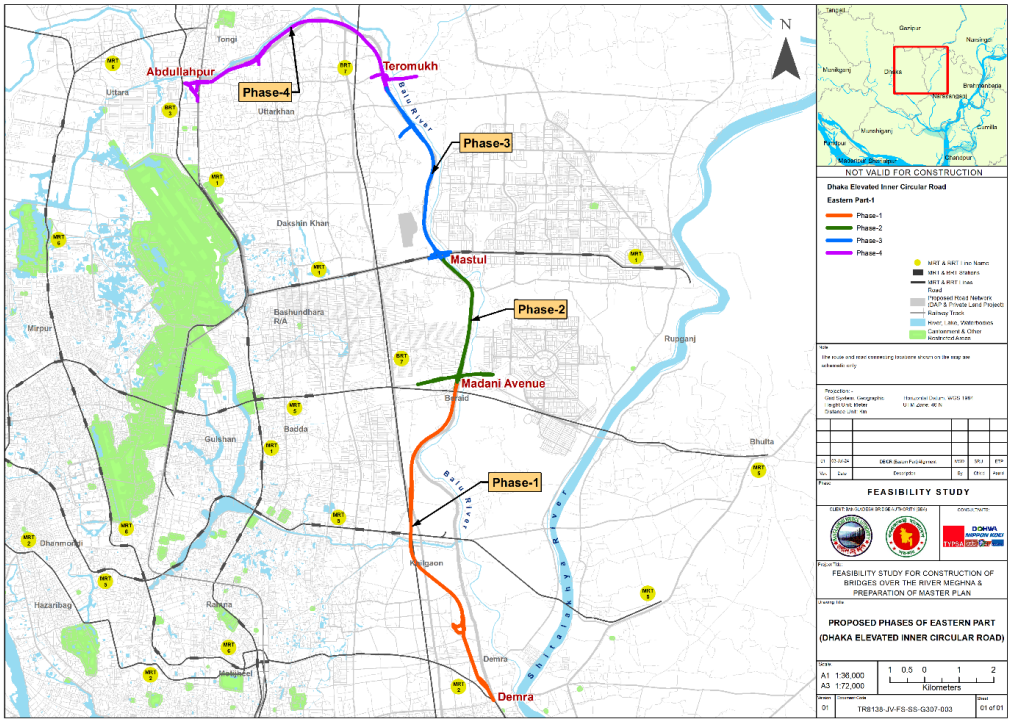

Figure 4. Eastern Part-1 project to be split in 4 sections or phases.

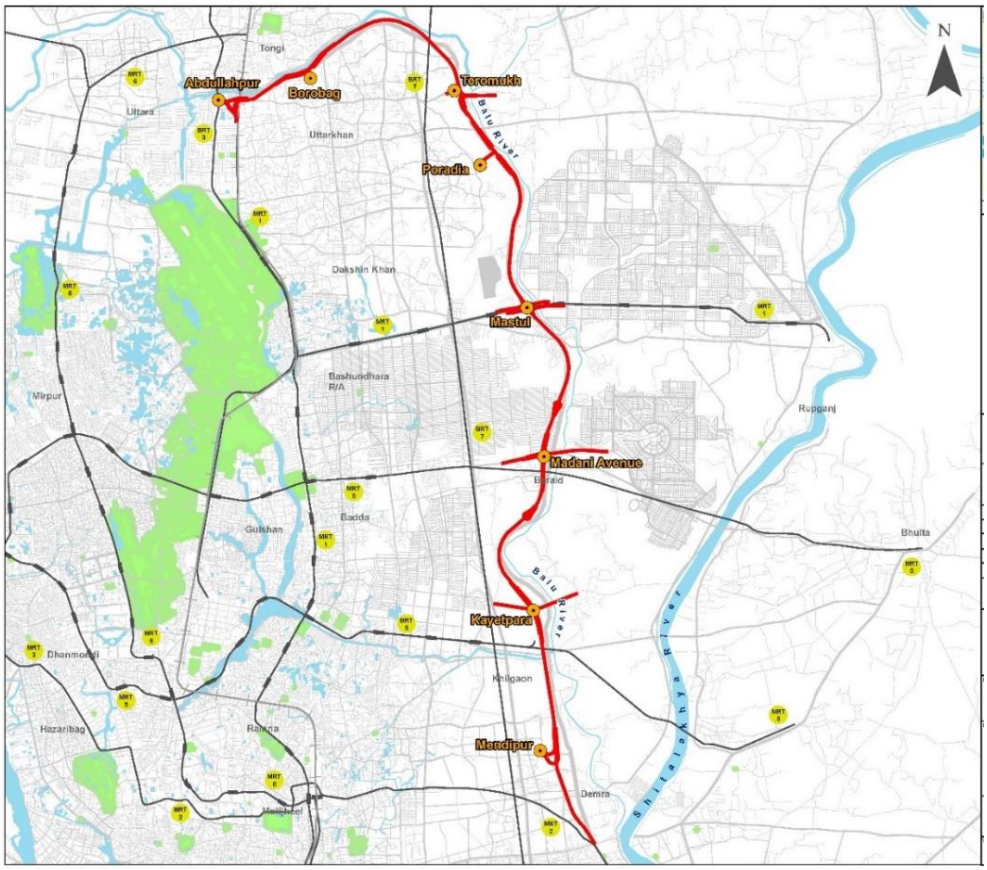

Figure 5. Eastern Part-1 alignment including 8 connection points with the existing network.

The **Western Part-2** (including up to fourteen sections), covering 57.02 km of EE, was analysed as a second stage of investment. The reason behind this approach stems from the fact that, once the RHD project is completed, it is assumed to have enough capacity for the current traffic during a certain period of operation. Future additional traffic might require additional capacity in some/all sections of this Western Part, and thus the development an elevated road. The singularities of each section, in particular the differences in traffic demand and furthermore in the cost of an eventual reinforcement of their capacity, require a separated analysis for each one of them. This is the case of those sections where the RHD project is already occupying the median with a viaduct, as the estimated costs in terms of LAP/RAP and structural solution for the implementation of the DEICR in those areas require large benefits to counteract the size of the necessary investment.

The timeline and roadmap to be adopted at the Western Part-2 is today basically uncertain, contingent on third parties' projects and on related key stakeholders' coordination. Overall, a joint strategic decision shall be taken in a few years at the highest Ministry of Transport level. Despite the level of uncertainty, an estimated calendar for the implementation of this part has been outlined and considered into the economic and financial model appraisal.

The approach has been based on two study cases: option (a) including the whole alignment of 57.02 km and option (b) including a 14.10 km reduced section covering Dhour-Diabari-Gabtoli).

Relying the factual implementation schedule, on the factual conditions and demand derived from the level of operation of the project implemented by RHD, an approach by sections is reasonable and arguably appears to be the optimum solution for this part of the DEICR.

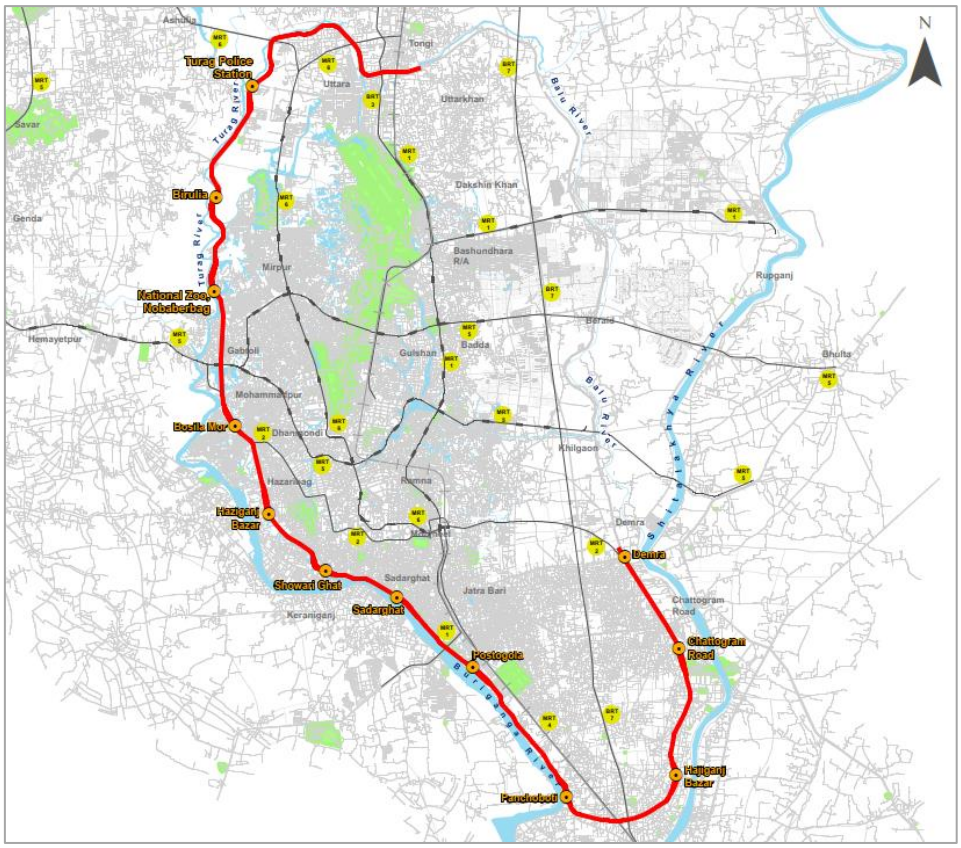

Figure 6. Western Part-2 whole alignment.

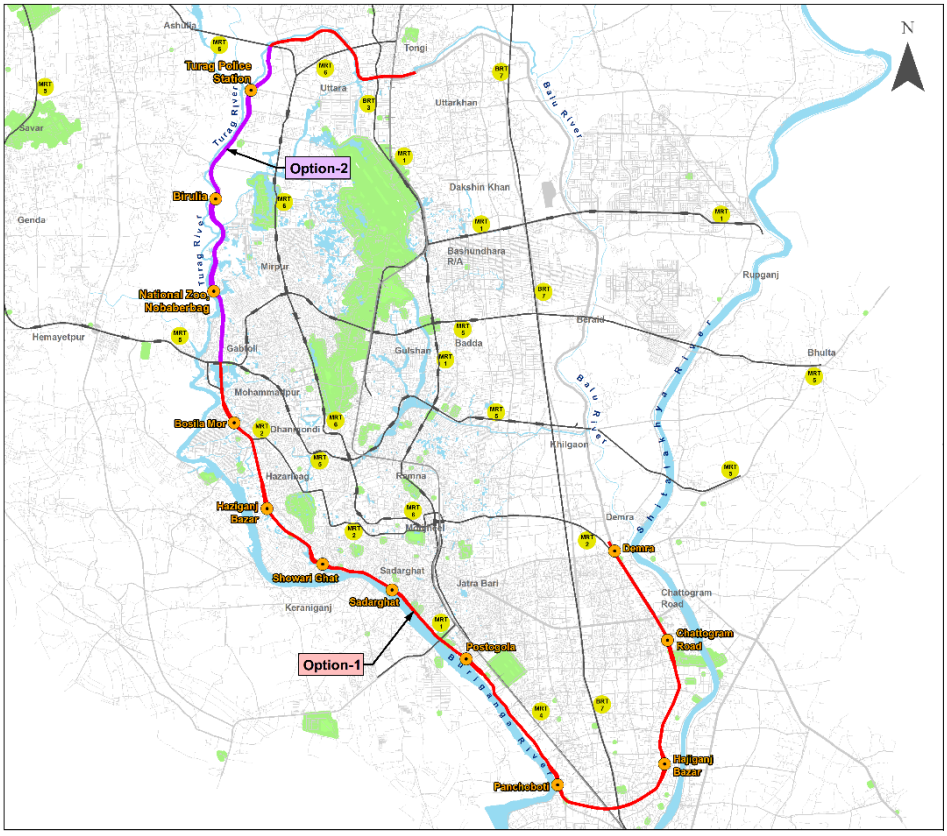

Figure 7. Western Part-2 project approach including 2 options.

2.4. Scope of the Feasibility Study

This feasibility study presents the outcome of the study that has been carried out by the Consultant. The assignment has been carried out following the scope provided by BBA in the Terms of Reference (ToR) of the contract.

The specified scope of services for the consultancy assignment consisted of all necessary surveys, investigation, planning, design, and documentation necessary for the development of the FS.

This includes the following activities according to the ToR of the project.

- Compilation, analysis and review of previous reports, studies, preliminary or detailed designs referred to the current feasibility study.
- Review available traffic count data and studies and carry out supplementary traffic counts.
- Detail traffic survey with O-D survey, traffic analysis and traffic forecast for a reasonable time horizon establishing traffic model.
- Mapping, Land Use and Topographical Model for the preferred option.
- Geological and Geotechnical Investigation Campaign for the preferred solution (field studies and Reports) for: cuts and fills geometry, pavements, sources of materials, foundation design for viaducts, bridges, and other structures.
- Detailed Hydro-morphological study and flooding conditions of the affected area.
- Determination of the preferred layout for the alignment. Optimization of Length, Location and Alignment of the Bridge taking into consideration the proposed connection points for the eastern section and the existing alignment for the western section.
- Analysis of the connection points and the junctions with the existing infrastructures. Geometric Design for the exits, entries, and junctions (Typical cross sections, Plan and Profile).
- Pavement Design for mainline, tolls and ramps.
- Structural Design. Comparative study for investment cost and O-M cost. Typological alternatives study.
- Alternatives investment budget.
- Economic evaluation (30-year benefit stream period).
- Estimate the expected distribution of the project net benefits, based on the project socio-economic analysis (CBA).
- Undertake sensitive tests for the recommended improvements by appropriately varying benefits, project costs, maintenance costs, and the implementation period.
- Initial Social impact Analysis.
- Public Consultation Meetings (PCM) and dialogue with the communities in the project areas.
- Initial environmental examinations (IEE) and Environmental Impact Assessment (EIA).
- Resettlement Action Plan (RAP).
- Preparation of Land Acquisition Plans.
- Determination of appropriate construction method, configuration, and technology.

In the case of the Dhaka Elevated Inner Circular Road, all these mentioned tasks have been completed for the whole alignment. In addition, the implementation of the project has been assumed to take place in two stages:

- First the Eastern Part will be developed. The Feasibility on this Eastern part has been analysed as a standalone element.
- The sections in the Western part are analysed as a second stage investment. The singularities of each section, in particular the differences in traffic demand and furthermore in the cost of an eventual reinforcement of their capacity, require a separated analysis for each one of them.

2.5. Technical Standards

The Consultant has carried out the assignment in accordance with international practice and procedures. However, reference was made to practices followed in Bangladesh and the established standards and procedures of Roads and Highways Department (RHD). The principal International and RHD Standards adopted are:

- The Eurocode has been adopted in the design of the structures: EN 1990, EN 1991-1, EN 1991-2, EN 1993, EN 1994 and EN 1998 along with EN 1337, EN 10080, EN 10138 and EN206.
- Despite being related to building structures, the Bangladesh National Building Code (BNBC) is followed in the determination of wind loads and the earthquake design spectrum.
- AASHTO LRFD 2017 specifications for Highway Bridges, with interim revisions 2020, 2022 and 2023.
- Geometric Design Standard for Bridges and Approaches Design Standard by RHD.
- Geometric Design Standards Manual (Revised) 2005 (GDSM 2005). Roads and Highways Division.
- A policy on Geometric Design of Highway and Streets" 2018, AASHTO
- Manual of Specifications and Standards for Expressways, IRC: SP: 99-2013
- Manual of Specifications and Standards for Four Laning of Highways, IRC: SP: 84-2019
- Pavement Design Guide for Roads and Highways Department 2005 for pavement design works along with "AASHTO Guide for Design of Pavement Structures 1993 (Edition 2021)".

2.6. Data Collection and Fieldworks

For this FS, the Consultant started the geotechnical fieldworks back in 2022 completing all the works and laboratory tests during 2023. Two companies carried out the soil investigation works, **Prosoil Foundation Consultant** (11 boreholes at the Eastern Part-1) and **Ground Instrumentation Engineering PTE Limited (GIE)** (12 boreholes at the Western Part-2), in total completing 23 boreholes along the whole ring alignment at a depth of 80 m.

Regarding the topographical surveys, the fieldworks were carried out by the firm **Surveytech Consultancy Limited**, starting the works during the dry season in 2023, and initially covering 86 km. with a width of 60 m. In this regard, the Consultant submitted in December 2023, a report titled ALIGNMENT OF DEICR in accordance with the topographical data obtained, and processes. The report consisted of 48 sheets plans at a scale 1:2000.

From January to May 2024, Surveytech completed the topographical surveys, by adding new areas, or modified sectors according with the final proposed alignment for the Eastern Part-1 and its

respective junctions points out of the main alignment. During the month of June 2024, the total revised topographical surveys were updated to its full completion as per the final alignment.

Additionally, social safeguard surveys have been carried out by specialized subconsultants, **KMC** at the Eastern Part-1 and **EQMS** at the Western Part-2. The consultant also arranged a dedicated team in charge of the utilities interface coordination, with the objective of getting a preliminary state of the impact that the project could have on the existing or planned utilities lines along its area of influence.

Environmental data collection, necessary for the EIA implementation at the Eastern Part-1 of the project, was carried out by the company **DSCL**.

2.7. Previous Studies in the Area

Several previous studies around the capital Dhaka area, have taken into consideration when preparing this Feasibility Study. Some of them were, later, updated by its respective agency, and in some cases, with the latest information not being available to this Consultant at the moment of the implementation of the FS (this is the case, i.e. of the recent RHD FS of the Western Part-2 portion of the Dhaka Inner Circular Road, currently in the process of approval by the concerned GoB authority).

DEVELOPING PLANS

- STP and RSTP Plans - Proposals for Transport Network (DMA) / (2004-2024)
- Strategic Transport Plan for Dhaka Metropolitan Area by DTCA
- Inner/Medim/Outer Ring Projects
- Dhaka Structure Plan (DSP) / (2016-2035)
- MRT & BRT, strategic road networks, elevated expressways, interchanges development.
- Dhaka Urban Transport Network Development Study (DHUTS) by Dhaka Transport Coordination Board (DTCB) under the Ministry of Communications (MOC).
- Road Network Plan by DMA.
- Dhaka Structure Plan (DSP) / (2016-2035).
- Dhaka Detailed Area Plan (DAP) / (2022-2035) by RAJUK.
- Integrated City Master Plan for DSCC / (2020-2050 draft).
- Flood Action Plan (FAP) / (1987-1992).

DEVELOPING PROJECTS

- Elevated Inner Circular Road (Alternative-1 and 3)
- Inner Circular Road (FS by RHD) – including 2024 DPP for approval at Postogola-Fatullah-Chasara Project – 14.60 km (Planning Commission April 2024)
- Dhaka Ashulia EE – Abdullahpur-Dhour (DAEEP) (BBA)
- Dhaka Elevated Expressway (BBA).
- Panchabati-Muktepur EE - 9 km (BBA).
- Bridge over Buriganga River (RHD).
- Chunkutia-Postogola EE project - 4 km (BBA) under Dhaka-Mawa-Bhanga Project.
- Rayerbazar Sluice-Loharpur expansion project 6 km (DSCC).
- Shimrail-Demra PPP project – 3 km – under Rampura-Amulia-Demra EE (RHD)

- East-West Elevated Expressway.
- Center Line of Circular Railway
- Stations of Circular Railway (BR)
- Embankment Center Line (BWDB).
- Subway Project (BBA).
- Proposed Road Network (DAP & Private Land Project).
- Circular Walkway Project (BIWTA).

The Consultant has made relevant efforts aiming to coordinate this FS analysis process and findings with the interfaced projects and other agencies, as it has remarked and highlighted monthly basis within the submitted monthly reports. However, and whilst some good progress was achieved in terms of critical coordination during the last few months, additional coordination must be carried out amongst the agencies to ensure the optimization of the adopted infrastructure final solution.

A dedicated section covering stakeholders' coordination tasks and a summary of the process is included within the Main Report Vol. 01. The main previous reports analyzed and taken into consideration are the following:

Table 3. Sources of information

Stakeholders	Available Reports	Sources	Proposed Structures/Placement	Remarks DEICR
Roads and Highways Department (RHD)	Feasibility Study including IEE and EIA of Proposed Dhaka Circular Route (Part-2) Abdullapur-Gabtoli-Postogola- Demra	Website	4- lane Expressways at grade with service lanes including Overpass/Flyovers at intersections to be constructed along the existing RHD Road over the BWDB Embankment	Updated Plans and Reports are Required
Bangladesh Railway (BR)	Feasibility Study for Construction of Circular Rail Line Around Dhaka City	Website	Elevated Rail Line to the Western Part (Part-02) (Abdullapur-Gabtoli-Demra) at the inner side and along the median of the proposed RHD road over the Proposed BWDB Embankment Eastern Part (Part-01) (Demra-Teremukh-Abdullapur	Updated reports are required
Bangladesh Water Development Board (BWDB)	Technical Study on Flood Control and Drainage Development at Dhaka Circular Road (Dhaka Eastern Bypass) Project.	Website	Construction of Flood Control and Drainage Development Embankment and Structures with the provision of RHD Road at grade and Elevated Rail Line at the median for Eastern Part (Part-01) (Demra-Teremukh-Abdullapur:	

Figure 8. Previous FS alignments, RHD (Part-2) at W and (Part-1) at E by BWDB.

2.8. Key Findings - Salient Features

2.8.1. Eastern Part-1

Table 4. Summary of salient features Eastern Part-1

SALIENT FEATURES OF DEICR EASTERN PART-1		
▪ ELEVATED SECTION		
Elevated Expressways	Total Length	26.98 km
	Number of lanes	3+3
	Total width including median, shoulder & parapet walls	31.02 m
	Lane width (each)	3.65 m
	Shoulder width (each)	1.50 m
	Inspection Path width (each)	0.80 m
Structures	Precast-I-Girder (2 independent structures, 3 lanes each)	26,390 m
	Balance cantilever Bridge (60+100+60) (2 independent structures, 3 lanes each)	220 m
Ramps	Total length including widening length of deck slab	22,482 m
	Number of ramps	24
	Maximum Width of ramp	(1+4+1) = 6.0 m (shoulder + 1 lane + shoulder)
	Lane width (each)	4.0 m
	Shoulder width (each)	1.00 m
Toll plaza	Number of toll plaza	12
	Total Nos of toll booth	30
	on Main line (2 location @ 5 booths each)	10
	on Exit Ramp (10 locations @ 2 Booths each)	20
	Total Area of toll plaza including tapper	28,000 m^2

SALIENT FEATURES OF DEICR EASTERN PART-1		
▪ CONNECTING ROAD AT GRADE		
Connecting Road at grade	Total Length	4,505 m
	Number of lanes	2+2
	Total width including shoulder & verge each side	22,80 m (verge+shoulder+2 lanes+median+2 lanes+shoulder+verge)
	Lane width (each)	3.65 m
	Median width	1.20 m
	Shoulder width (each)	1.50 m
	Verge width (each)	1.50 m
▪ INTERSECTIONS		
Intersections	No. of intersection	9
	Diamond with Roundabout	3
	Ramps only	4
	Ramps with elevated Roundabout	2
▪ ADDITIONAL INFORMATION		
Connection at Demra	Length of additional Ramp including widening length of At Demra	1,970 m
	Width of Ramp (1-lane Carriageway) with shoulder and parapet wall each side	8.0 m
Connection at At Abdullahpur	Length of additional Ramp including widening length of At Abdullahpur	2,155 m
	Width of Ramp (2-lane Carriageway) with shoulder and parapet wall each side	11.20 m
▪ OTHER FEATURES. LAND ACQUISITION		
	Width of right of way (ROW)	35.0 m
	Total land to be acquired	323.45 Acre
	Total number of projects affected units	843
	Total number of persons affected	2,656

2.8.2. Western Part-2

Table 5. Summary of salient features Western Part-2

SALIENT FEATURES OF DEICR WESTERN PART-2		
▪ ELEVATED SECTION		
Elevated Expressways	Total Length *Prescast I-Girder (Single Pier/Portal Frames (2+2))*	57.02 km
	Number of lanes	2+2
	Total width including median, shoulder & parapet walls	22.00 m
	Lane width (each)	3.65 m
	Internal Shoulder width (each)	0.50 m
	Outside Shoulder width (each)	1.50 m
	Inspection Path width (each)	0.80 m
Ramps	Total length including widening length of deck slab *(Precast I-Girder)*	18,700
	Number of ramps	22
	Maximum Width of ramp	12.30 m (verge+shoulder+2 lanes+shoulder+verge)
	Lane width (each)	3.65 m
	Shoulder width (each)	1.00 m
	Verge width (each)	1.50 m
Toll plaza	Number of toll plaza	11
	Total Nos. of booths 11 locations @ 3 Nos. each (on Exit Ramp)	33
	Total Area of toll plaza including tapper	30,800 m^2
▪ SERVICE ROAD		
Service Road	Total Length	26,400 m
	Single 2 lanes carriageway on both sides	1+1 each side
	Total width including shoulder & verge each side	22,80 m (verge+shoulder+2 lanes+2 lanes+shoulder+verge)
	Number of access points	11
▪ OTHER FEATURES. LAND ACQUISITION		

SALIENT FEATURES OF DEICR WESTERN PART-2		
	Width of right of way (ROW)	22 m
	Total land to be acquired	272.70 Acre
	Total number of projects affected units	951
	Total number of persons affected	2,429

2.9. Cost Estimate

2.9.1. Eastern Part-1

Table 6. Summary of preliminary cost estimation for Eastern Part-1 of DEICR

Cost Estimate Eastern Part-1			
No.	Item	Amount (Cr BDT)	Amount (Million USD)
1	General and Site Facilities	728.40	66.22
2	Structural Works	17,941.91	1,631.08
3	Road and Drainage Works	525.03	47.73
4	Electrical works & Traffic Management System	154.44	14.04
5	Toll Plaza Civil Works	428.27	38.93
6	Temporary Works	201.15	18.29
7	Relocation and/or removal of Public Utilities	4,500.00	409.09
(A)	**Subtotal**	**24,479.19**	**2,225.38**
(B)	Provisional Sum for Physical Contingency = 3% of (A)	734.38	66.76
(C)	**Sub Total (A+B)**	**25,213.57**	**2,292.14**
(D)	Provisional Sum for Price Contingency = 6% of (C)	1,512.81	137.53
(E)	Engineer's Estimate = (C+D)	26,726.38	2,429.67
(F)	**Land Acquisition and Resettlement Costs**	**10,395.89**	**945.08**
(G)	Design Cost = 2% of (A)	489.58	44.51
(H)	Construction Supervision = 5% of (A)	1,223.96	111.27
(I)	Project Estimate = (E+F+G+H)	38,835.82	3,530.53

(Based on 1 USD = 110 BDT according to selling rate of Bangladesh Bank in April 2024)

2.9.2. Western Part-2

Table 7. Summary of preliminary cost estimation for Western Part-2 of DEICR

Cost Estimate Western Part-2			
No.	Item	Amount (Cr BDT)	Amount (Million USD)
1	General and Site Facilities	1,693.29	153.94
2	Structural Works	27,685.62	2,516.87
3	Road Works	2,893.42	263.04
4	Electrical works & Traffic Management System	298.16	27.11
5	Toll Plaza Civil Works	389.51	35.41
6	Temporary Works	1,569.82	142.71
7	Relocation and/or removal of Public Utilities	5,000.00	454.55
(A)	**Subtotal**	**39,529.82**	**3,593.62**
(B)	Provisional Sum for Physical Contingency = 3% of (A)	1,185.89	107.81
(C)	**Sub Total (A+B)**	**40,715.72**	**3,701.43**
(D)	Provisional Sum for Price Contingency = 6% of (C)	2,442.94	222.09
(E)	Engineer's Estimate = (C+D)	43,158.66	3,923.51
(F)	**Land Acquisition and Resettlement Costs**	**7,570.77**	**688.25**
(G)	Design Cost = 2% of (A)	790.60	71.87
(H)	Construction Supervision = 5% of (A)	1,976.49	179.68
(I)	Project Estimate = (E+F+G+H)	53,496.52	4,863.32

(Based on 1 USD = 110 BDT according to selling rate of Bangladesh Bank in April 2024)

2.10. Implementation Timeline

The estimated implementation timeline for the project has been split in various parts, in accordance with the conversations held with BBA officials. Facts as the high prioritization of the Eastern Part-1, or the strategy to be adopted towards the Western Part-2 have been appropriately taken into account to reach the proposal exposed hereinunder where: the Eastern Part-1 has been split in 4 sections, staggered phases as explained further in 2.11.1 and Western Part-2 has included 2 options approach: a) covering the whole alignment and b) covering only the portion Dhour-Diabari-Gabtoli 14.22 km.

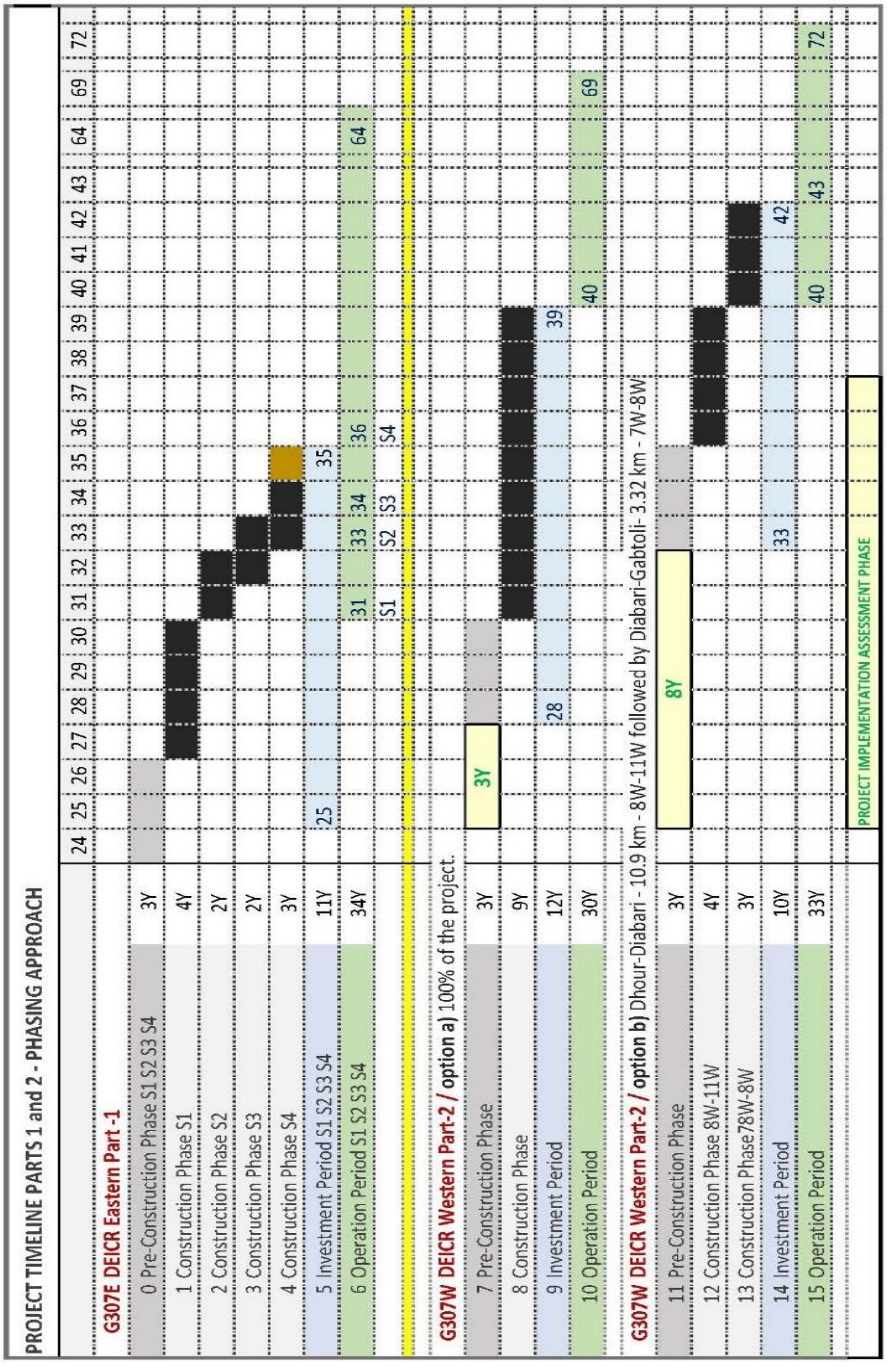

Figure 9. Project implementation proposed timeline.

2.10.1. Eastern Part-1

The implementation of the project's part has been proposed to split in four phases/sections to be staggered. This option would enable an earlier start, with S1 in service to be operated earlier than the rest sections S2, S3 and S4.

The project at the Eastern Part-1 has been divided into four sections:

- S1 - km 0.0 to km 10.5 from Demra to Madani Avenue.
- S2 - km 10.5 to km 14.5 from Madani Avenue to Mastul.
- S3 - km 14.5 to km 20.0 from Mastul to Teromukh.
- S4 - km 20.0 to km 27.0 from Teromukh to Abdullahpur.

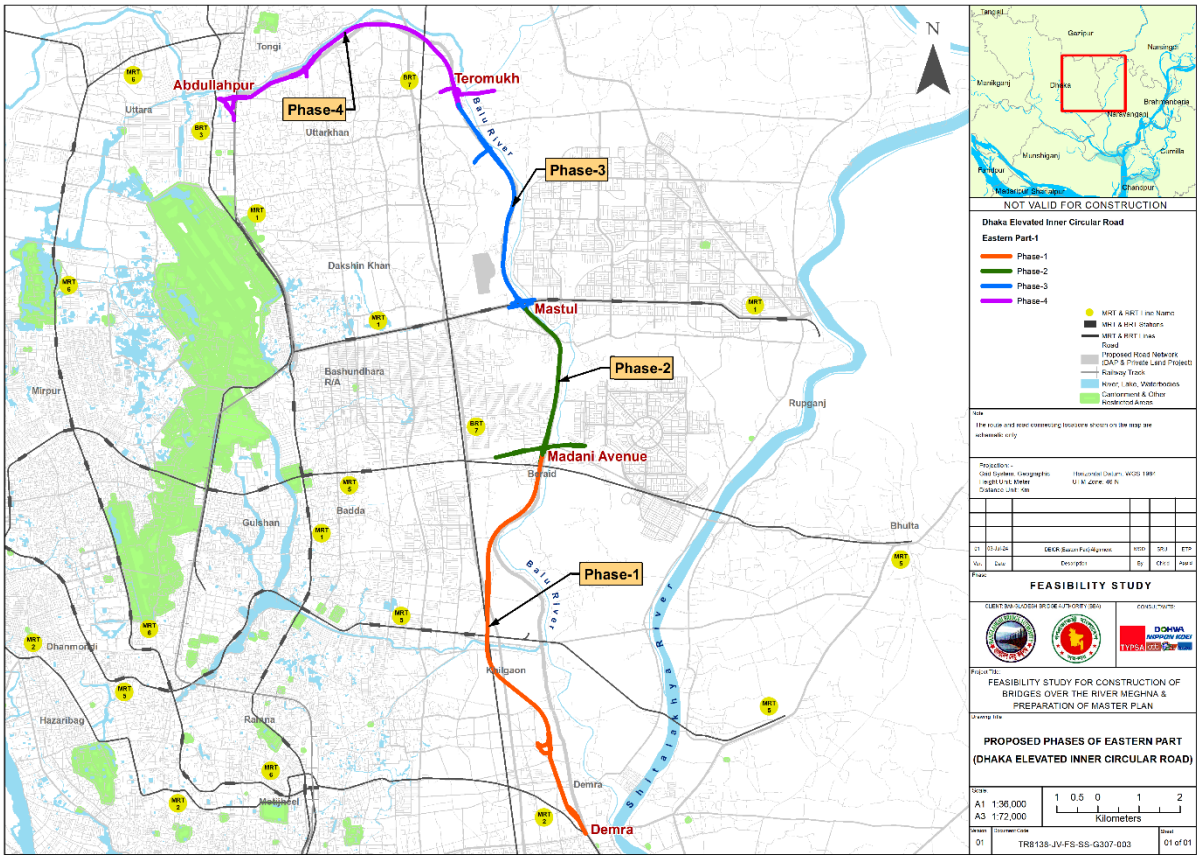

Figure 10. Eastern Part-1 project to be split in 4 sections or phases.

PRE-INVESTMENT period:

- Y0 from July 2024 to December 2025 - DPP implementation - Procurement process for Detailed Design and RAP+LAP implementation / **18 months.**
- Project Detailed Design Phase, starting in January 2025 and completed in June 2026 / **18 months.** The Detailed Design works include an update for each section 02 to 04 by allocating 6 months to be implemented the years S2-2030 S3-2031 S4-2032. This period coincides with the year before the start of the construction phase at each section.

- RAP and LAP implementation phase and Main Contractor Tender Process / **36 months** for each one of the sections.
- Construction period including Testing and commissioning has been proposed staggering each section process:
    - S1 - km 0.0 to km 10.5 - 4Y (including snagging list completion) 2027-2030
    - S2 - km 10.5 to km 14.5 - 1.5Y plus 0.5Y (snagging list completion) 2031-2032.
    - S3 - km 14.5 to km 20.0 - 1.5Y plus 0.5Y (snagging list completion) 2032-2033.
    - S4 - km 20.0 to km 27.0 - 1.5Y plus 0.5Y (snagging list completion) 2033-2035.

PROJECT INVESTMENT period: 11Y - 2025 to 2035

PROJECT OPERATION period: 34Y - 2031 to 2064

Total PROJECT period: 40Y - 2025 to 2064.

In sum, the completion of the Eastern Part-1 project construction has been estimated in 9 years (108 months of construction phase, 2027-2035) after 2 years of pre-construction activities, totalling 11 years of investment (2025 to 2035). The implementation of the project has been proposed to include four phases/sections to be staggered to enable an earlier start of the operation in service of the first stage and subsequent sections.

The project operation phase is estimated to start in 2031 (S1 Demra-Madani Avenue) and end in 2064 totalling 34 years. The project total period including investment and operation phases is proposed to be from 2025 to 2064, totalling 40 years.

2.10.2. Western Part-2

The implementation calendar to be adopted at the Western Part-2 is today basically uncertain, contingent on third parties' projects and on related key stakeholders' coordination. Overall, a joint strategic decision shall be taken in a few years at the highest Ministry of Transport level.

Despite the level of uncertainty, an estimated calendar for the implementation of this part has been outlined and considered into the economic and financial model appraisal.

The approach has been based on two study cases: option (a) including the whole alignment of 57.02 km and option (b) including a 14.10 km reduced section covering Dhour-Diabari-Gabtoli, 10.90 km+3.32 km long, (8W-11W and 7W-8W).

Relying the factual implementation schedule, on the factual conditions and demand derived from the level of operation of the project implemented by RHD, an approach by sections might be reasonable and arguably appears to be the optimum solution for this part of the DEICR.

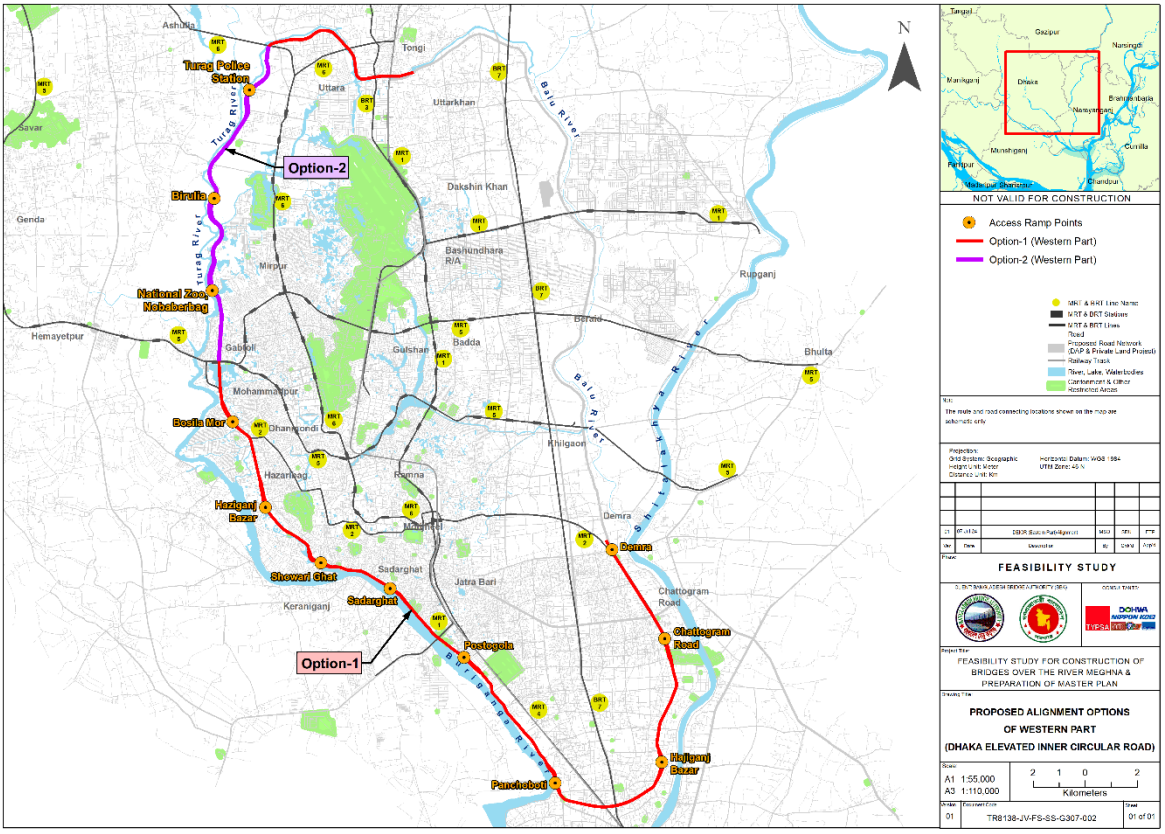

Figure 11. Western Part-2 project approach including 2 options.

In any case, options (a) or (b), the Western Part-2 has been deemed to start after the finalization of the Eastern Part-1. A period of "project implementation assessment" has been allocated as a buffer period, from 2025 to 2027 - 3Y (Option a)) and from 2025 to 2032 - 8Y (Option b)) to duly assess the optimum strategy to implement this project, under the BBA mandate, the updated revised factual demand, and considering other interrelated agencies initiatives progress.

Option (a) schedule for the completion of this whole part, is based on 9 years (108 months) of construction phase, 12 years of investment followed of 30 years of operation, for economic and financial viability study purposes.

Option (b) schedule for the completion of this reduced part, is based on 4 years + 3 years (84 months) of construction phase, 10 years of investment followed of 33 years of operation, for economic and financial viability study purposes.

The proposed implementation process phasing is explained hereinafter:

PRE-INVESTMENT period:

OPTION a)

After a period of 3 years for "project implementation assessment phase", 3 more years of pre-construction tasks have been scheduled including DPP implementation and approval, detailed design, tender procurement and part of the land acquisition and resettlement activities (which in this project are deemed to be extended and overlapped with the first years of construction stage).

OPTION b)

After a period of 8 years for "project implementation assessment phase", 3 more years of pre-construction tasks have been scheduled including DPP implementation and approval, detailed design, tender procurement and part of the land acquisition and resettlement activities (which in this project are deemed to be extended and overlapped with the first years of construction stage).

INVESTMENT AND OPERATION periods:

OPTION a)

INVESTMENT period: 12Y - 2028 to 2039

- Start of construction in January 2031.
- Finish of construction in December 2039.

OPERATION period: 30Y - 2040 to 2069.

Total PROJECT period: 42Y - 2028 to 2069.

OPTION b)

INVESTMENT period: 10Y - 2033 to 2042

- Start of construction in January 2036.
- Finish of construction in December 2042.

OPERATION period: 33Y - 2040 to 2072.

Total PROJECT period: 43Y - 2033 to 2072.

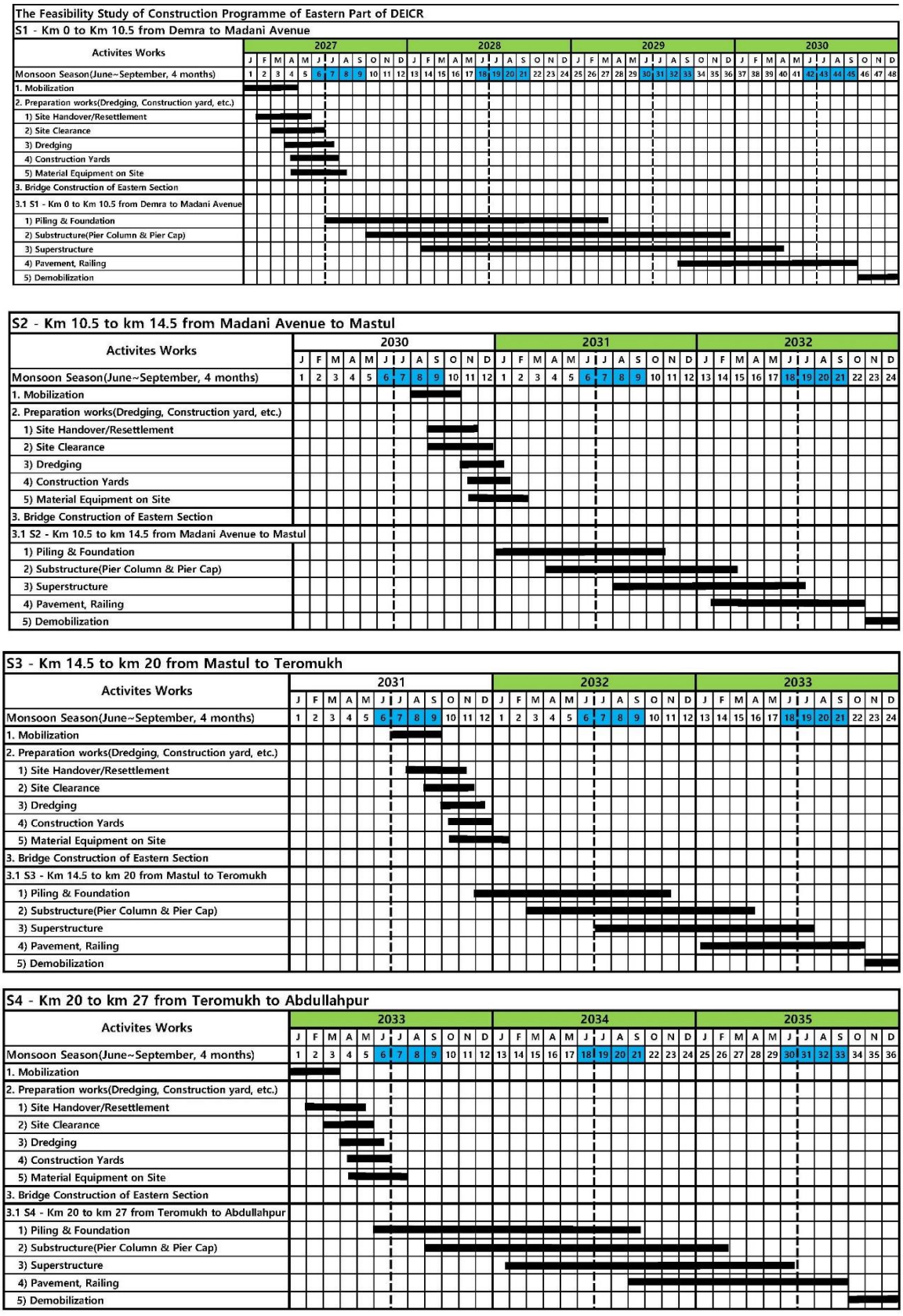

Figure 12. Project proposed Construction Schedule of Eastern Part-1 (4 Sections)

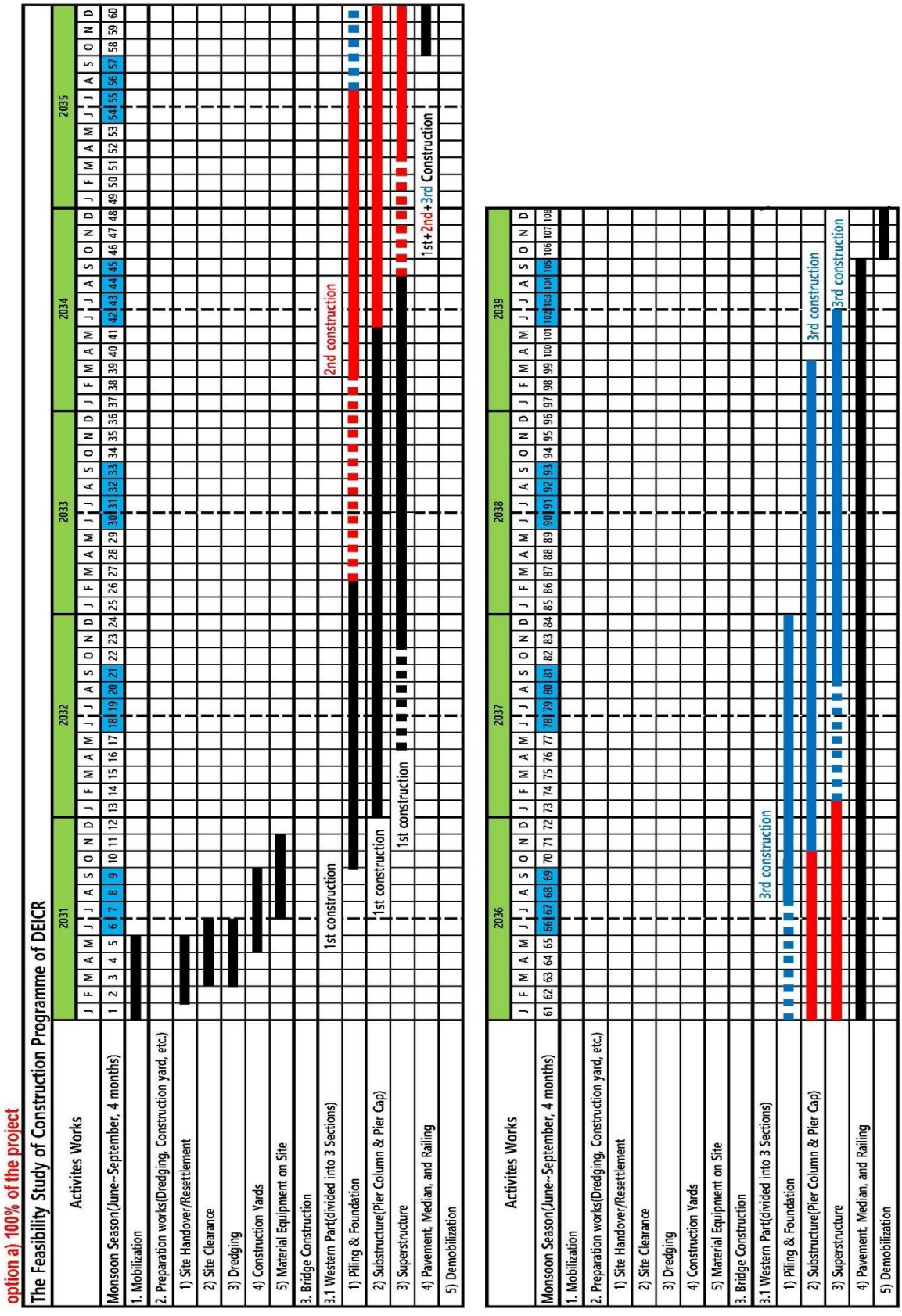

Figure 13. Project proposed construction schedule of Western Part-2 (Option a – 100%)

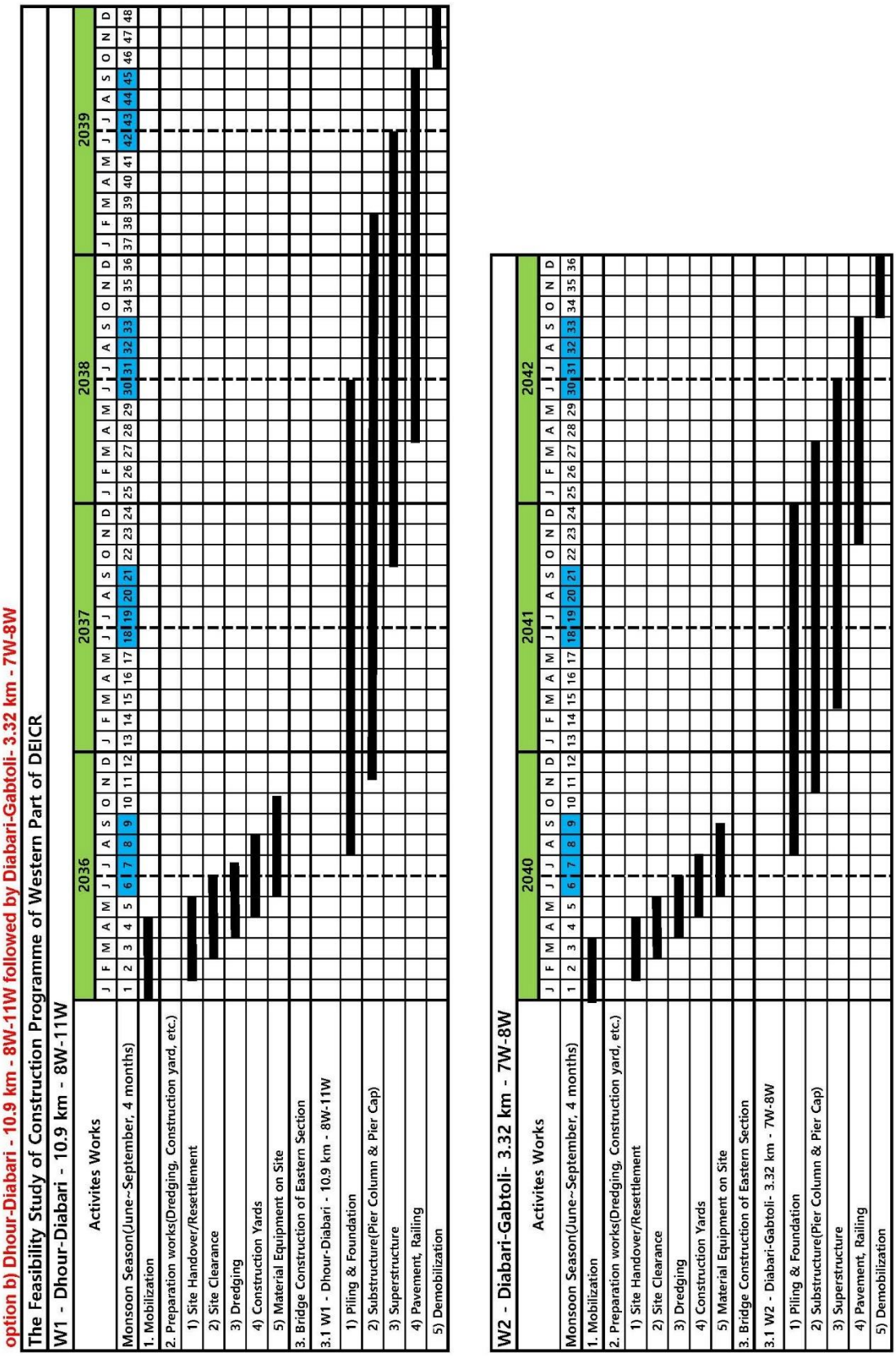

Figure 14. Project proposed construction schedule of Western Part-2 (Option b)

3. MARKET/DEMAND ANALYSIS

This section assesses the need for public investment applied to this project, as per the study of market and traffic demand that has been implemented. Benefits and need and justification for the implementation of the infrastructure are analyzed hereinafter:

3.1. Problem Statement

The existing problem, or potential improvement to be addressed is the lack of adequate infrastructure for efficient and convenient transportation around, bypassing and through Dhaka city. The existing road network within the RAJUK region, is not sufficient to meet the growing demands of transportation and connectivity in Bangladesh. This results in longer travel times, limited accessibility, traffic congestion within Dhaka metropolitan area, which dramatically hinders socio-economic development.

Some direct causes have been identified:

- Limited investment or adequate timely planning of transport infrastructures: a lack of prioritization and allocation of resources for construction in the Dhaka metropolitan area may have contributed.
- Complex interface of projects and initiatives shall be always jointly planned and implemented in a coordinated manner and through a streamlined process.

And some indirect causes:

- Population growth: an increasing population puts more pressure on existing infrastructure.
- Economic development: as Bangladesh's economy continues to grow, the need for efficient transportation and connectivity becomes more critical for businesses and industries to thrive.
- Urbanization: rapid urbanization in Dhaka has led to increased traffic congestion and greater demand for improved infrastructure.

A good way of understanding the need of the project is analyzing the situation in which the government would not carry out this investment in the bridge:

- The lack of efficient transportation and connectivity limits trade, investment, and overall economic growth in the region.
- Limited transportation infrastructure prevents residents from accessing essential services such as healthcare, education, or emergency services, in timely manner, ultimately impacting their quality of life.
- Without project, the existing Dhaka city network will become more congested, leading to longer travel times and increased transportation costs.
- Increased congestion can lead to higher emissions, air pollution, and negative impacts on local ecosystems.

3.2. Relevance of the Project Idea

The RAJUK and wider area of influence of the project will relevantly see its connectivity improved by the new infrastructure functioning as an inner ring and bypass of the capital of Bangladesh and eventually providing benefit to more than 6.5 Cr population living in 29 zilas.

The benefits of DEICR as an improvement to the lack of current infrastructure:

- Economic development: of the centre of industrial and economic activity of the country.
- Reducing pressure on existing infrastructure: circumvallating the city and avoiding the use of the existing local network would help alleviate congestion and reduce overall travel times.
- The project will improve mobility and accessibility, posing positive economic impacts including reduction of travel time and travel cost to travellers and cargo, etc.
- The project will bring potential opportunities for the private sector participation in the transport infrastructure and services.
- The project will reduce vehicle emissions and energy consumption.
- Improvement of safety conditions and security for the transport users.
- Increase of employment opportunities for the local people.

3.3. Proposed Project Interventions

The Project implementation would need not only the address the construction of the main infrastructure, 26.98 km of EE in the Eastern Part-1 and 57.02 km of EE in the Western Part-2, plus 22.48 km of ramps (24 uts) in the Eastern Part-1 and 18.70 km of ramps (22 uts.) in the Western Part-2. Additionally, 4.50 km of approach roads would be needed to connect with the existing road network at the Eastern Part-1. Other interventions as toll plaza and service buildings would be needed to be implemented by the GoB. Specific details are provided at the Salient Features tables, section 2.8.

Figure 15. DEICR Eastern Part-1.

3.4. Stakeholders Management

The list of the main involved stakeholders to be managed and coordinated for this project would be as follows:

- Dhaka North City Corporation (DNCC).
- Dhaka South City Corporation (DSCC).
- Narayanganj City Corporation (NCC).
- Eastern side Unions (32 Nos.).
- Dhaka Transport Coordination Authority (DTCA).
- Dhaka Transport Coordination Board (DTCB).
- Ministry of Communications (MOC).
- Rajdhani Unnayan Kartripakkha (RAJUK).
- Roads and Highways Department (RHD).
- Bangladesh Water Development Board (BWDB).
- Bangladesh Inland Water Transportation Authority (BIWTA).
- Local Government Engineering Department (LGED).
- Bangladesh Power Development Board (BPDB).

The Consultant, in addition to the information requested to the Stakeholders, made intense effort to promote and arrange coordination meetings with the main Stakeholders involved in the various projects interfacing with DEICR. On this basis, the Consultant has requested BBA's support to arrange these meetings with RHD and BR, and to discuss, between other matters, the alignment of the Inner Ring Road and to ensure that no part/element of the BBA Master Plan is in contradiction with that of RHD Master Plan.
During 2022, the Consultant JV reiterated by formal request communications the BBA assistance to convene a joint meeting with selected four Stakeholders namely RHD, LGED, BR and BWDB to attend a coordination meeting to discuss critical issues of interaction and coordination. This coordination meeting has yet to be convened.

Regarding a coordination meeting with the stakeholders related to DEICR, the Consultants requested PD, BBA vide Memo. No. TR8238-LET-JV-BBA-170 to include the issue in the agenda of Road Transport Sector Integration and Coordination Platform (RTSICP).

During the last year, ans specially since January 2023, the Consultant has stressed the need to hold the appropriate coordination between our project team, and other agencies, RHD, BWDB, BWDB, to mitigate the risk of working in certain direction that is not duly coordinated with other interfaced projects.

On August 31st, a team of consultant representatives, including Team Leader, DD Coordinator, Traffic Surveys Lead expert, and Roads and Highways Lead expert, and BBA officials (PD and EE) held the 1st coordination meeting with RHD officials in charge of the N1 project implementation. During the meeting the Consultant presented the project Matlab Uttar-Gazaria Bridge FS. The RHD N1 project PD and his team showed a collaborative approach to start working together in all interfaced parts of both

agencies regarding any ongoing interconnected projects. On September 10th and September 14th, two meetings were held at BBA offices with RHD representatives aiming to coordinate the Matlab Uttar-Gazaria bridge project. Further, on October 26th, a meeting was held at the RHD offices, to discuss and coordinate specific issues related to Gazaria-Munshiganj FS project and to the Matlab Uttar-Gazaria project connection.

Furthermore, two meetings with RHD were held during the month of December (4th and 19th) at RHD HQ, where general coordination topics and specifically **DEICR interface** were addressed aiming to reach a conclusion and coordinated consensus.

A DTCA meeting took place on January 18th, followed by two more meetings-site visits to the Dhaka Inner Ring Road Project, on January 20th and January 26th. Interface between RHD and BBA scope, mandate and part of the project undertaken by each agency was discussed and determined. Junctions and coordinated aspects of both projects progressed during both visits paid.

Table 8. List of meetings held up to date.

	Name	Date	Subject
1	Roads and Highway Department (RHD)	31 08 2023	RHD N1 Project PD
2	Roads and Highway Department (RHD) Bangladesh Inland Water Transport Authority (BIWTA) Bangladesh Water Development Board (BWDB)	10 09 2023	Matlab Uttar-Gazaria Project FS DPP
3	Roads and Highway Department (RHD)	14 09 2023	Matlab Uttar-Gazaria Project FS DPP
4	Roads and Highway Department (RHD)	26 10 2023	Matlab Uttar-Gazaria Project and Gazaria-Munshiganj FS
5	Roads and Highway Department (RHD)	04 12 2023	General Projects Coordination
6	Roads and Highway Department (RHD)	19 12 2023	Dhaka Inner Ring Road Coordination
7	DTCA – Inter agencies meeting	18 01 2024	Dhaka Inner Ring Road Coordination
8	DTCA – BBA RHD and Inter agencies meeting and site visit to DICR	20 01 2024	Dhaka Inner Ring Road Coordination
9	DTCA – BBA RHD and Inter agencies meeting and site visit to DICR	26 01 2024	Dhaka Inner Ring Road Coordination

3.5. Demand Analysis

A transportation model was utilized to analyze the demand. The main objective of the demand analysis is to establish the extent of the traffic demand on the study area, as well as the traffic projections on the potential Dhaka Elevated Inner Circular Road (considering scenarios with and without the project, as detailed below) for a long-term time horizon of economic life of the infrastructure. To achieve these results, surveys and traffic counts have been carried out at different relevant points along the study area.

To conduct a thorough economic and financial study, it is necessary to carefully analyze the traffic and compare the situation without the project to the situation with the project. The differences in costs between these two situations will be the benefits of constructing the proposed project.

3.5.1. Definition of Scenarios Based on the Considered Network

This study considers a range of scenarios to gain a better understanding of the distribution of traffic in the network under each scenario. Defining these scenarios is a crucial step, as it enables a more accurate cost-benefit analysis to be performed. This analysis can compare the "with" and "without" project scenarios, without considering the cost of road improvements that will take place in both scenarios. This approach allows for a thorough examination of the potential impact of the project on traffic patterns in the area.

- **Existing scenario (S0):**

The existing scenario refers to the current situation. The analysis of the existing scenario is only used as a base for the analysis of the following scenarios defined and for this reason no results related to the existing scenario will be presented.

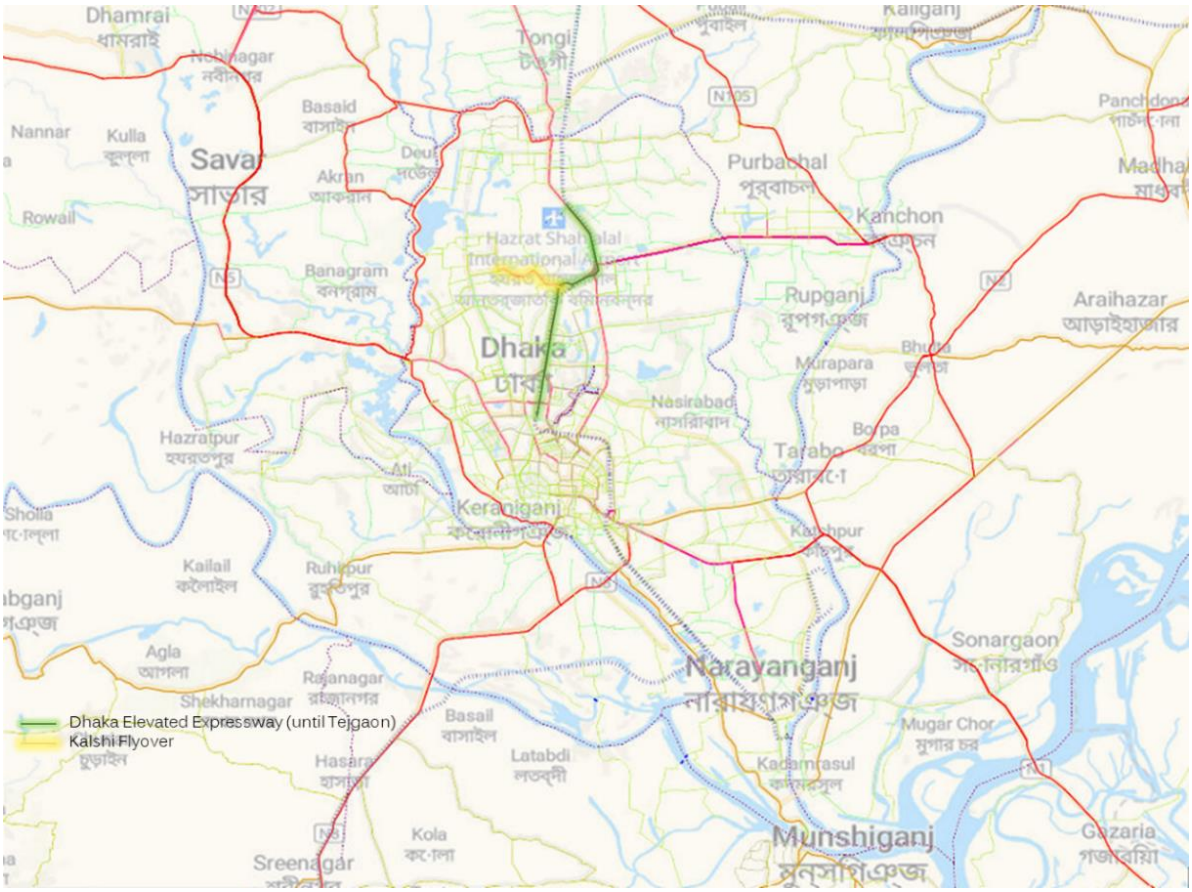

Figure 16. Current Scenario (S0).

This scenario is the current one and is based on the traffic surveys that were carried out in 2022. Under this scenario the road network around Dhaka is as at present, without any improvements related to speed or capacity.

In this scenario other development projects in and around Dhaka city were also considered as listed below:

1. Dhaka Elevated Expressway (up to Tejgaon).
2. Kalshi Flyover.

- **Scenario Without Dhaka Elevated Inner Ring Road Project (without project) (S1):**

In this scenario, ongoing, future, and potential transport infrastructure developments are considered (as illustrated in the following image).

These include the projects listed below:

- Kalshi Flyover.
- Dhaka Elevated Expressway.
- Dhaka-Ashulia Elevated Expressway.
- Inner Ring Road by RHD.
- Rampur-Amulia-Demra Road Improvement.

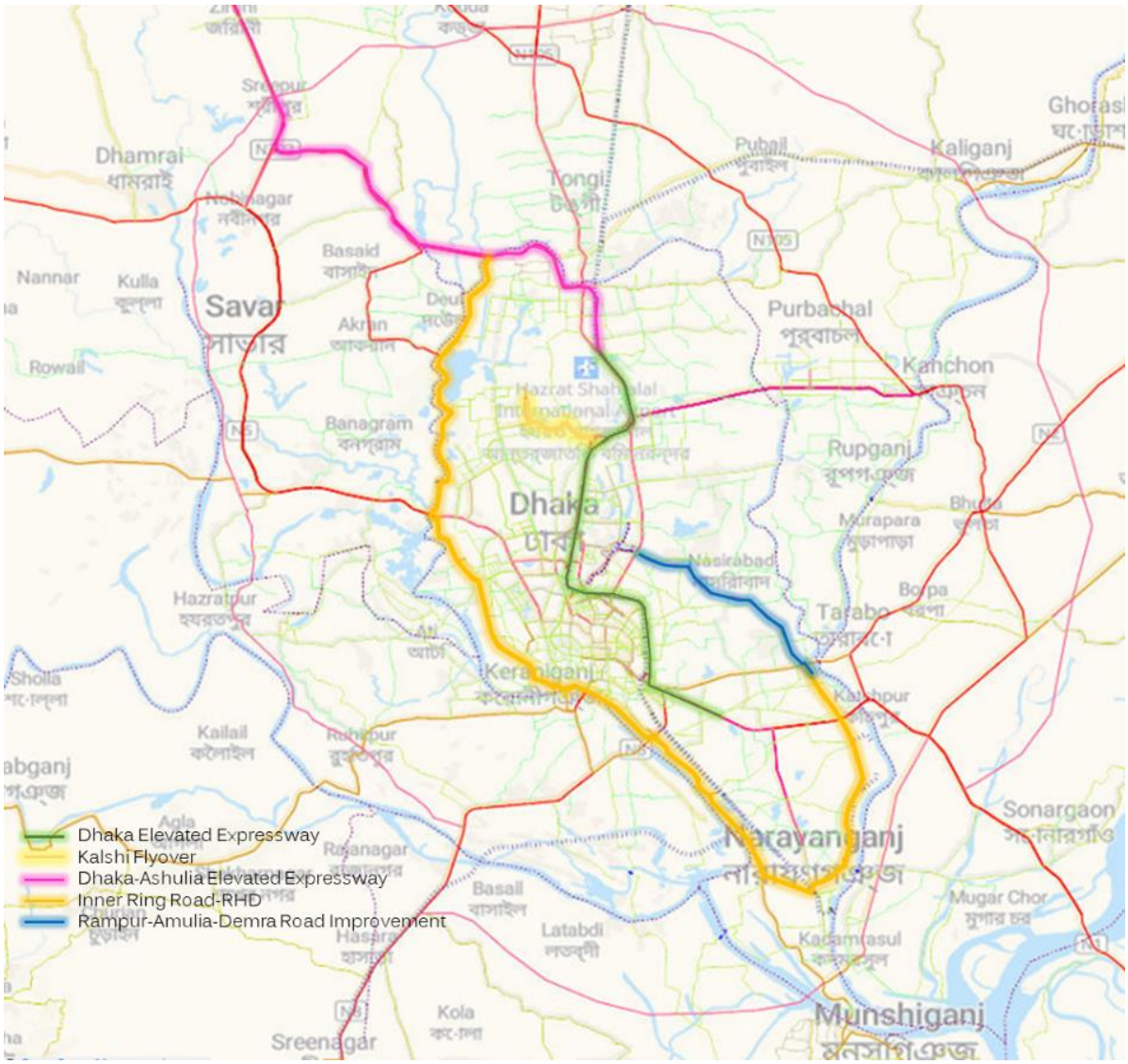

Figure 17. Without Project Scenario (S1).

This scenario also considers the Padma Bridge, which is not included in the base scenario since it was not operative during the field survey. As a result of the improvements considered within this scenarios, trip times and distances are expected to be reduced, and hence traffic is expected to optimise its route choice for each origin-destination pair.

- **Scenario With Dhaka Elevated Inner Ring Road Eastern Part-1 Project (with Eastern Part-1 project) (S2):**

The *With Dhaka Elevated Inner Ring Road Eastern Part-1 Project scenario (S2)* is defined as the previous scenario (*S1*) considering also the further addition of the construction of Dhaka Elevated Inner Ring Road Eastern Section – Part 1. In the following map the "With Eastern Part-1 project scenario" can be seen with the Eastern section of DEICR being in operation.

This scenario includes the following infrastructure and development projects that are listed below:

- Kalshi Flyover.
- Dhaka Elevated Expressway.
- Dhaka-Ashulia Elevated Expressway.
- Inner Ring Road by RHD.
- Rampur-Amulia-Demra Road Improvement.
- **Dhaka Elevated Inner Ring Road Eastern Part-1.**

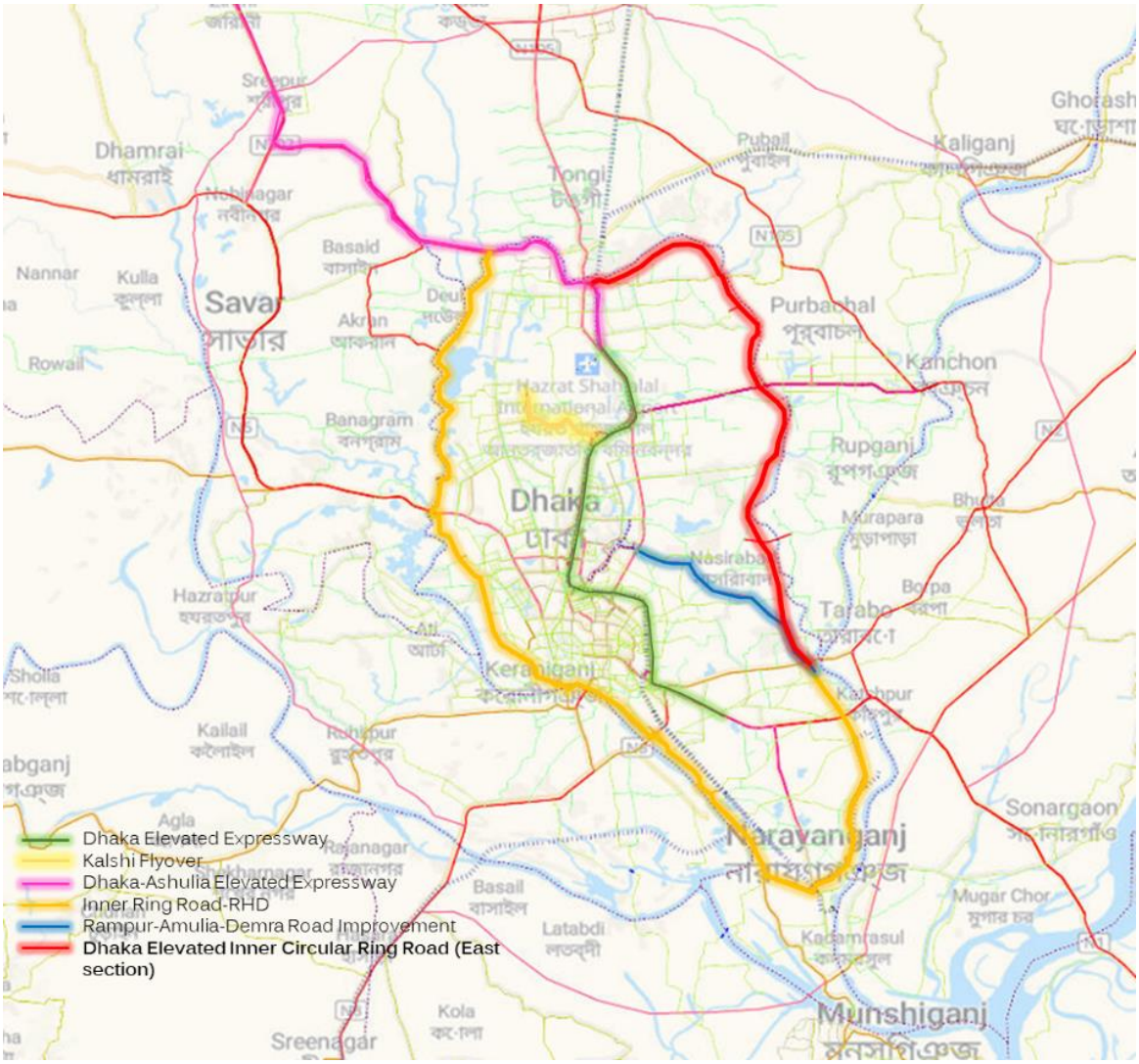

Figure 18. With Eastern Part -1 Project Scenario (S2).

- **Scenario With Dhaka Elevated Inner Ring Road Western Part-2 Project (with Western Part-2 project, Option A) (S3):**

Similarly to the definition of the S2 scenario, The *With Dhaka Elevated Inner Ring Road Western Part-2 Project scenario (S3)* is defined as considering only the construction of Dhaka Elevated Inner Ring Road Western Section – Part 2. In the following map the "With Western Part-2 project scenario" can be seen with the Western section of DEICR being in operation.

This scenario includes the following infrastructure and development projects that are listed below:

- Kalshi Flyover
- Dhaka Elevated Expressway
- Dhaka-Ashulia Elevated Expressway
- Inner Ring Road by RHD
- Rampur-Amulia-Demra Road Improvement
- Dhaka Elevated Inner Ring Road Eastern Part-1
- **Dhaka Elevated Inner Ring Road Western Part-2**

This definition is necessary in terms of feasibility study as the project needs to be analysed independently. Logically the project corresponding to the western route, if realised, will be after the eastern route, both of which are uncertain in any case.

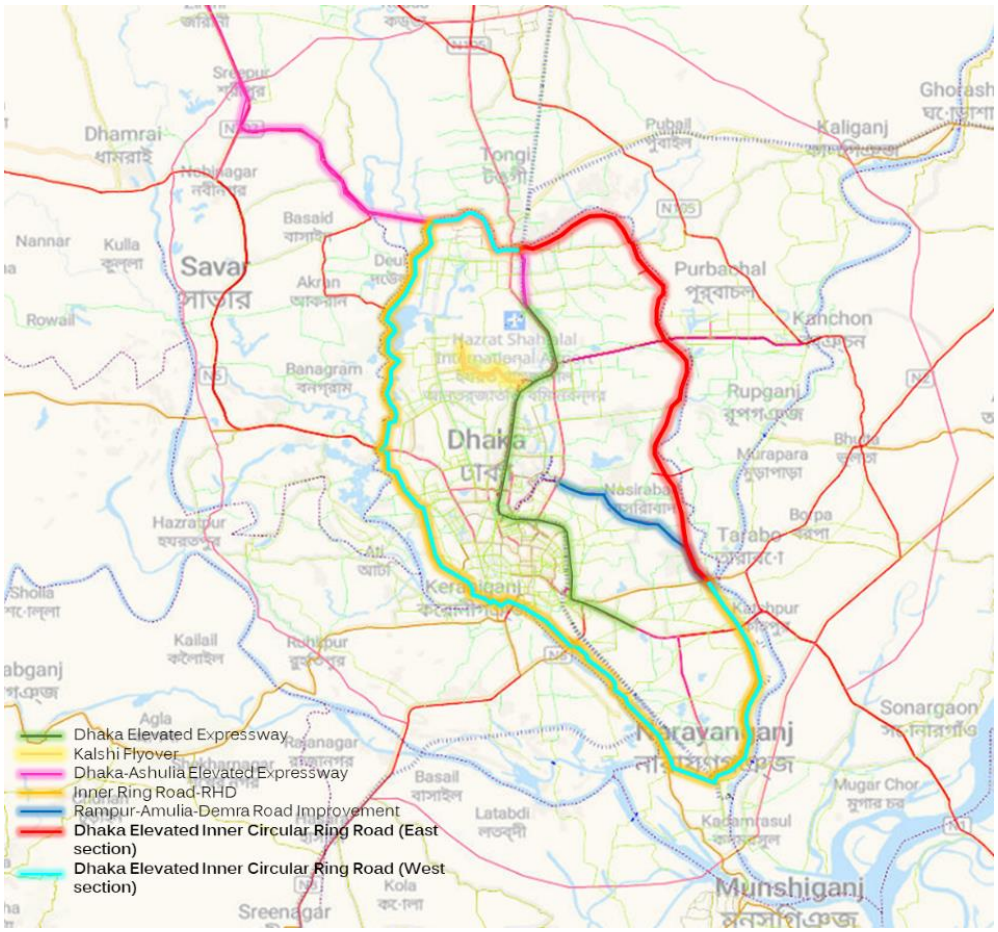

Figure 19. With Western Part -2 (Option A) Project Scenario (S3).

As commented earlier, an additional Option (Option B) has been studied, with the same assumptions as Option A but only considering the operation of a part of the western part (in two separate phases), as shown in the following image.

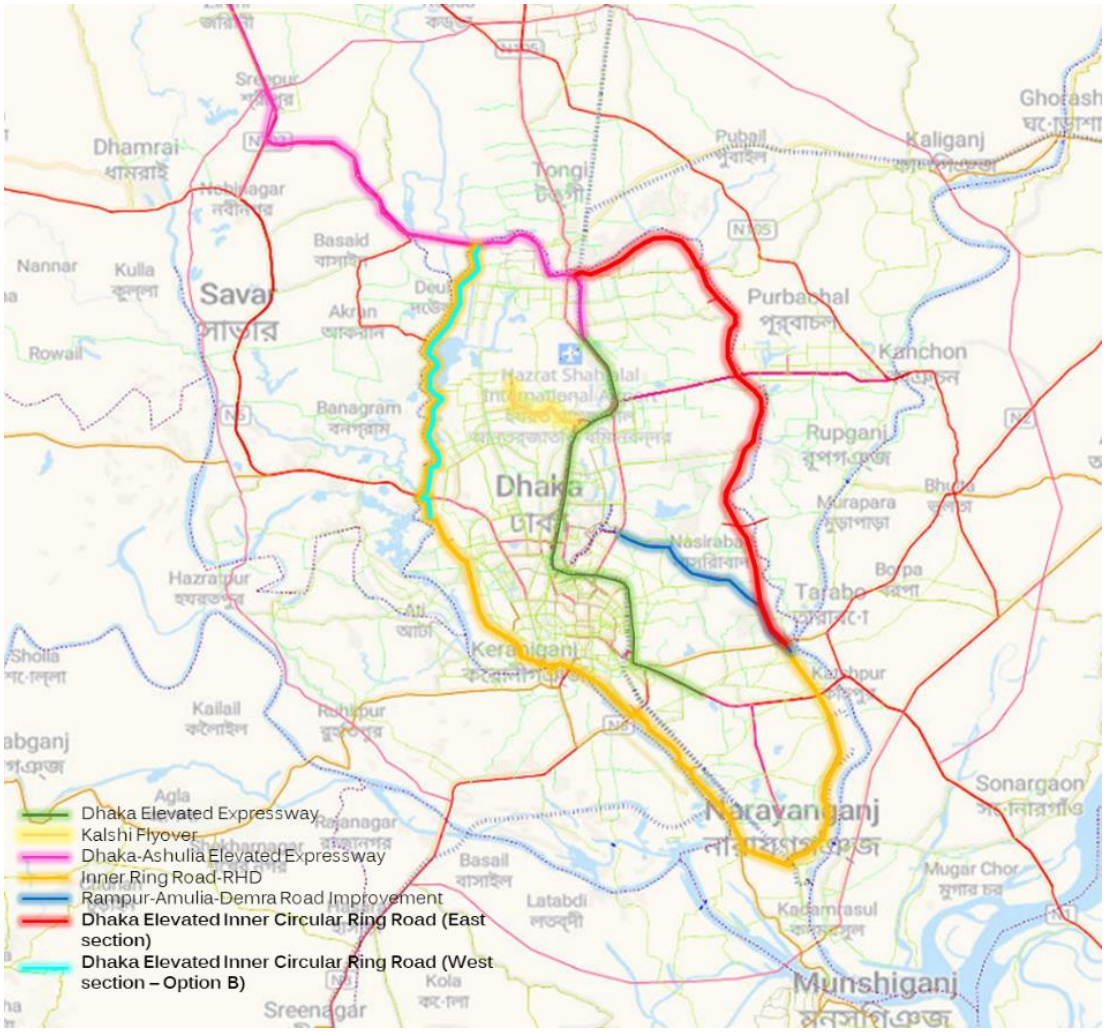

Figure 20. With Western Part -2 (Option B) Project Scenario (S3).

3.5.2. Toll Fees considered.

A flat-rate toll has been considered for the Dhaka Elevated Inner Circular Road. The toll fees have been estimated based on the fares currently applied on the Dhaka Elevated Expressway. The toll fees that could be proposed are as follows.

Table 9. Toll fees proposed.

Toll fees (BDT) proposed	
LPV	80
Bus	160
HGV (average)	360

3.5.3. Traffic Estimation for the Base Year

A first evaluation of the different scenarios studied has been done for the base year, 2022. This, together with evaluations of the years 2030, 2035, 2040 and 2050, for which the transport model has been applied, can provide an understanding of how the traffic is expected to grow in the future. The result of this analysis will later serve as input for the economic and financial evaluation of the proposed project.

Eastern Part-1

The Eastern Part-1 has been split into different sections, which are characterized by homogeneous traffic. The sections of Eastern Part-1 are shown below:

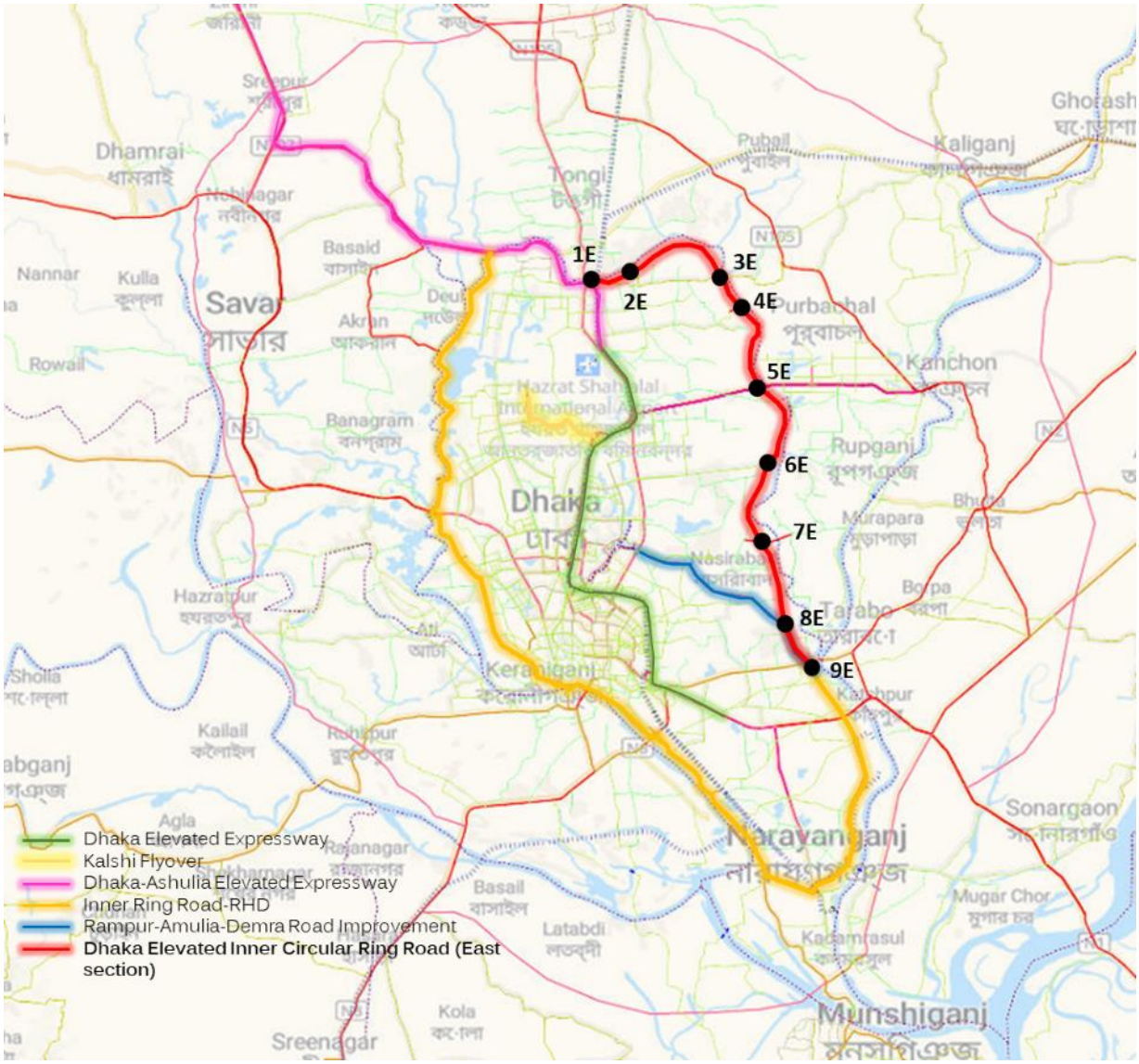

Figure 21. Eastern Part-1 studied sections.

The traffic composition of the Eastern Part-1, during the base year (2022), and for every of the sections studied is as follows.

Table 10. Daily traffic volumes by type of vehicles (veh/day) base year.

	LPV	BUS	HGV	TOTAL
1E-2E	13,543	13,207	2,259	29,008
2E-3E	13,543	13,207	2,259	29,008
3E-4E	13,543	13,207	2,259	29,008
4E-5E	13,132	10,392	3,375	26,898
5E-6E	7,473	6,088	5,073	18,634
6E-7E	6,688	5,527	4,568	16,783
7E-8E	7,107	5,527	4,607	17,241
8E-9E	5,157	5,976	1,315	12,448

Western Part-2, Option A

Similarly to the above evaluation, the Western Part-2, Option A is also split into different sections which each one of them is expected to be traversed by the same amount of traffic. The sections studied on the Western Part -2, Option A are the following.

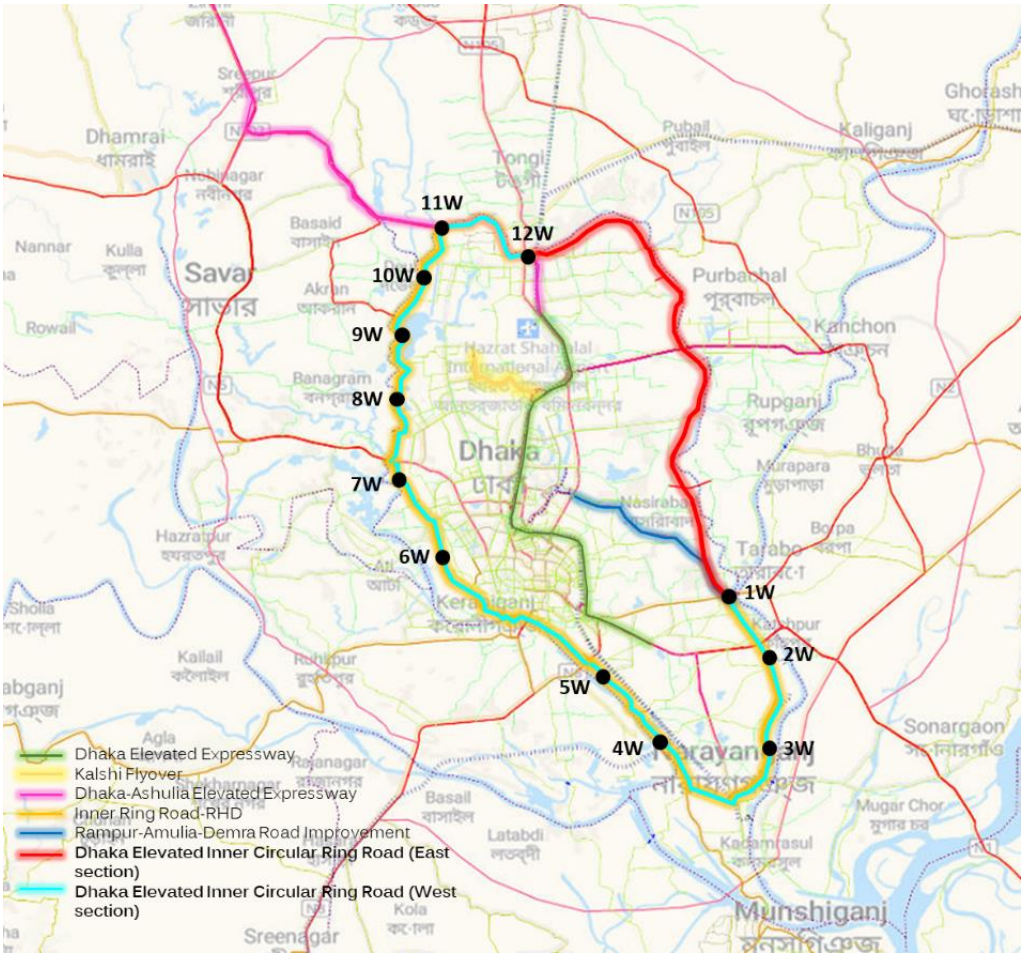

Figure 22. Western Part-2, Option A studied sections.

The daily traffic of the Western Part-2, Option A for the base year (2022) is presented in the following table for each vehicle type and each section studied.

Table 11. Daily traffic volumes by type of vehicles (veh/day) base year.

	LPV	BUS	HGV	TOTAL
1W-2W	4,541	3,784	2,334	10,659
2W-3W	2,582	1,444	583	4,609
3W-4W	1,666	1,440	127	3,233
4W-5W	439	1,232	9	1,680
5W-6W	1,645	2,597	143	4,385
6W-7W	7,440	7,311	348	15,099
7W-8W	15,118	11,674	474	27,266
8W-9W	18,824	16,338	758	35,920
9W-10W	14,147	13,506	802	28,455
10W-11W	14,798	12,792	842	28,432
11W-12W	13,727	11,110	2,646	27,483

Western Part-2, Option B

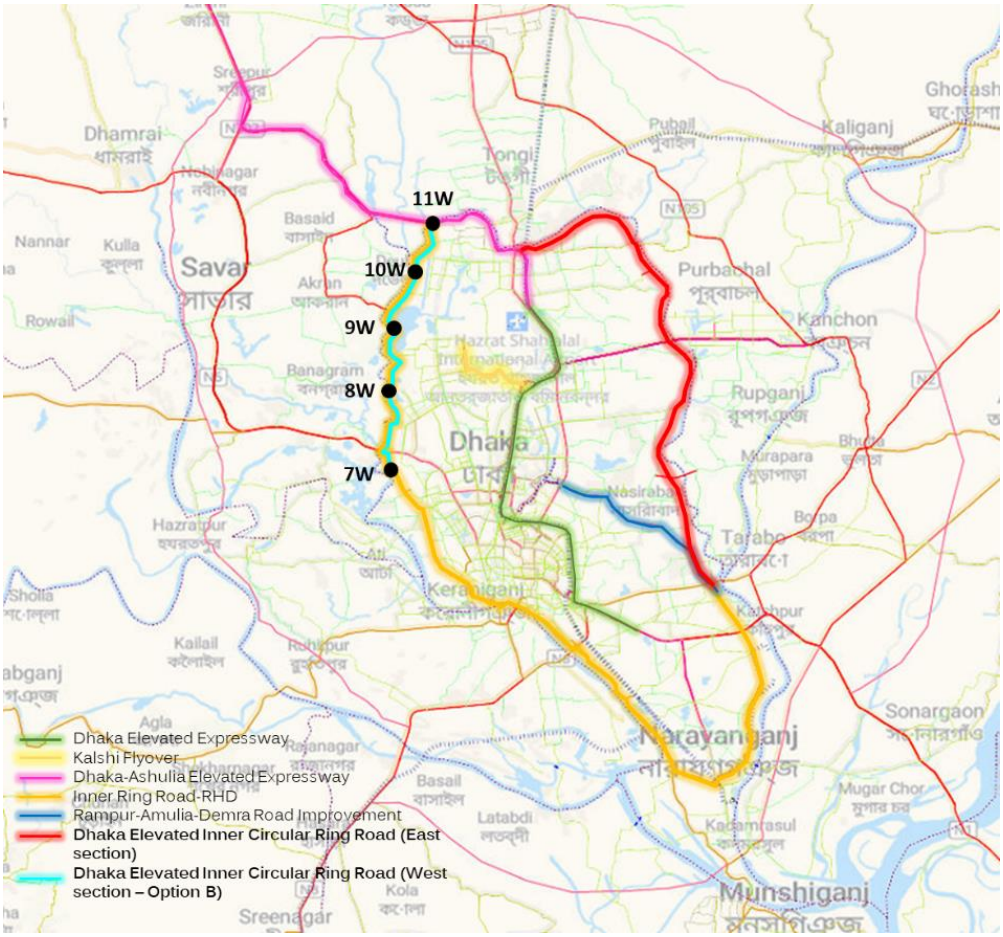

Figure 23. Western Part -2, Option B studied sections.

The daily traffic of the Western Part-2, Option B for the base year (2022) is presented in the following table for each vehicle type and each section studied.

Table 12. Daily traffic volumes by type of vehicles (veh/day) base year.

	LPV	BUS	HGV	TOTAL
7W-8W	8,704	9,781	0	18,484
8W-9W	12,201	14,796	0	26,997
9W-10W	7,007	12,046	0	19,054
10W-11W	6,820	11,237	0	18,057

3.5.4. Traffic Projection

The traffic projection is a key element for any Feasibility Study since it is used for the design of the infrastructure, the design of the pavement and the economic and financial analyses.

The economic life of the DEICR Eastern Part-1 is considered between the start of operation of the first phase (2031) till the end of operation period of all the four phases in 2064.

The DEICR Western Part-2, Option A considers 30 years period from 2040 until 2069, while the DEICR Western Part-2, Option B would start its operation in 2040 (Phase 1) and the end of operation for both phases is assumed to be in 2072.

The projection has been made based on the results of the modelling in the design years 2030, 2035, 2040 and 2050, with a projection of the latter until the project's cut-off year is reached.

Eastern Part-1

The average traffic of the Eastern Part-1 for some of the key years studied is presented below.

Table 13. Equivalent Average daily traffic (EAADT) – Eastern Part-1.

	2031	2033	2034	2036	2040	2050	2064
LPV	5,166	8,695	9,137	14,962	16,007	18,947	23,531
BUS	3,842	6,683	5,834	9,580	9,950	10,939	11,729
HGV	314	4,877	4,442	5,457	6,234	8,697	17,031
TOTAL	**9,322**	**20,255**	**19,413**	**29,999**	**32,191**	**38,583**	**52,291**

The following figure shows the evolution of traffic for each vehicle type considered (i.e. light vehicles, buses, and trucks)

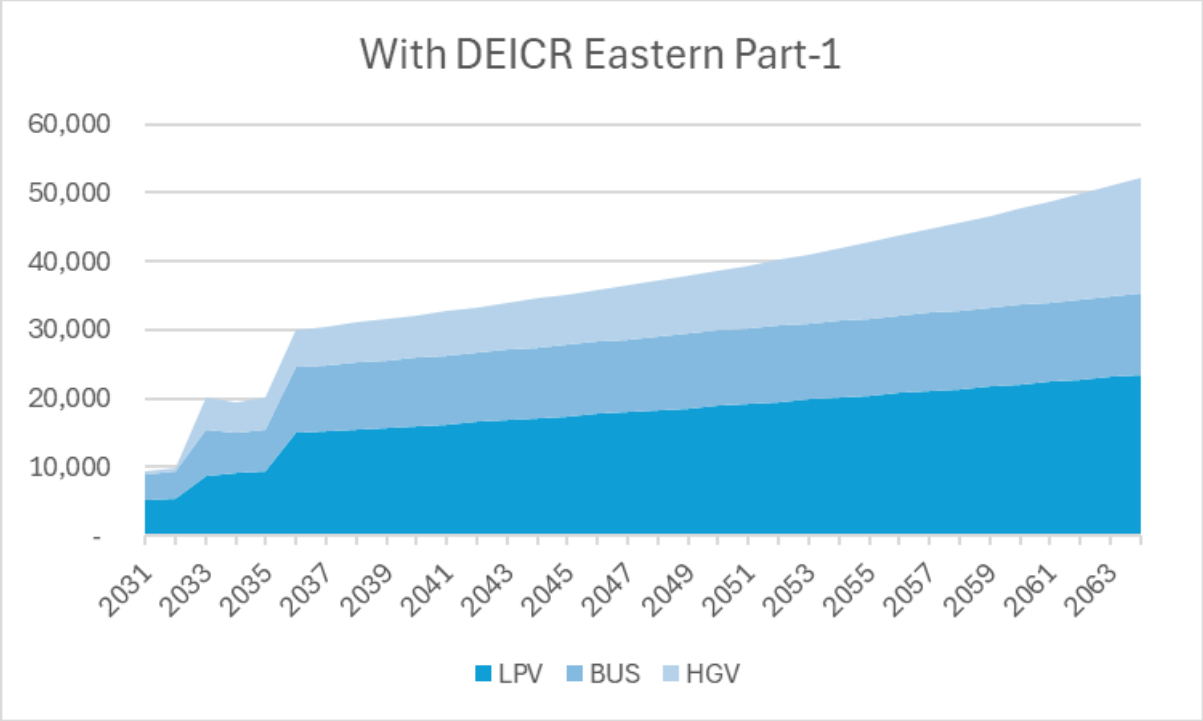

Figure 24. Total Traffic with DEICR Eastern Part-1.

Lastly, the average daily veh-km and veh-hr data of the network for the scenarios without and with the projects are as follows:

Table 14. Average daily veh-km and veh-hr without and with Eastern Part-1.

		2031	2033	2034	2036	2040	2050	2064
Veh-km/day	Without project	66,864,602	71,207,674	73,644,922	77,370,526	81,924,381	84,358,794	136,135,757
	With project	66,860,481	71,217,079	73,685,789	77,527,949	82,087,055	84,552,568	136,355,771
Veh-hr/day	Without project	2,376,546	2,673,509	2,847,270	3,093,150	3,312,905	3,824,297	6,247,613
	With project	2,368,312	2,646,870	2,805,443	3,023,019	3,231,538	3,724,365	6,108,045

Below are presented graphically the traffic flows of the network, under the With Eastern Part–1 scenario for the year 2050.

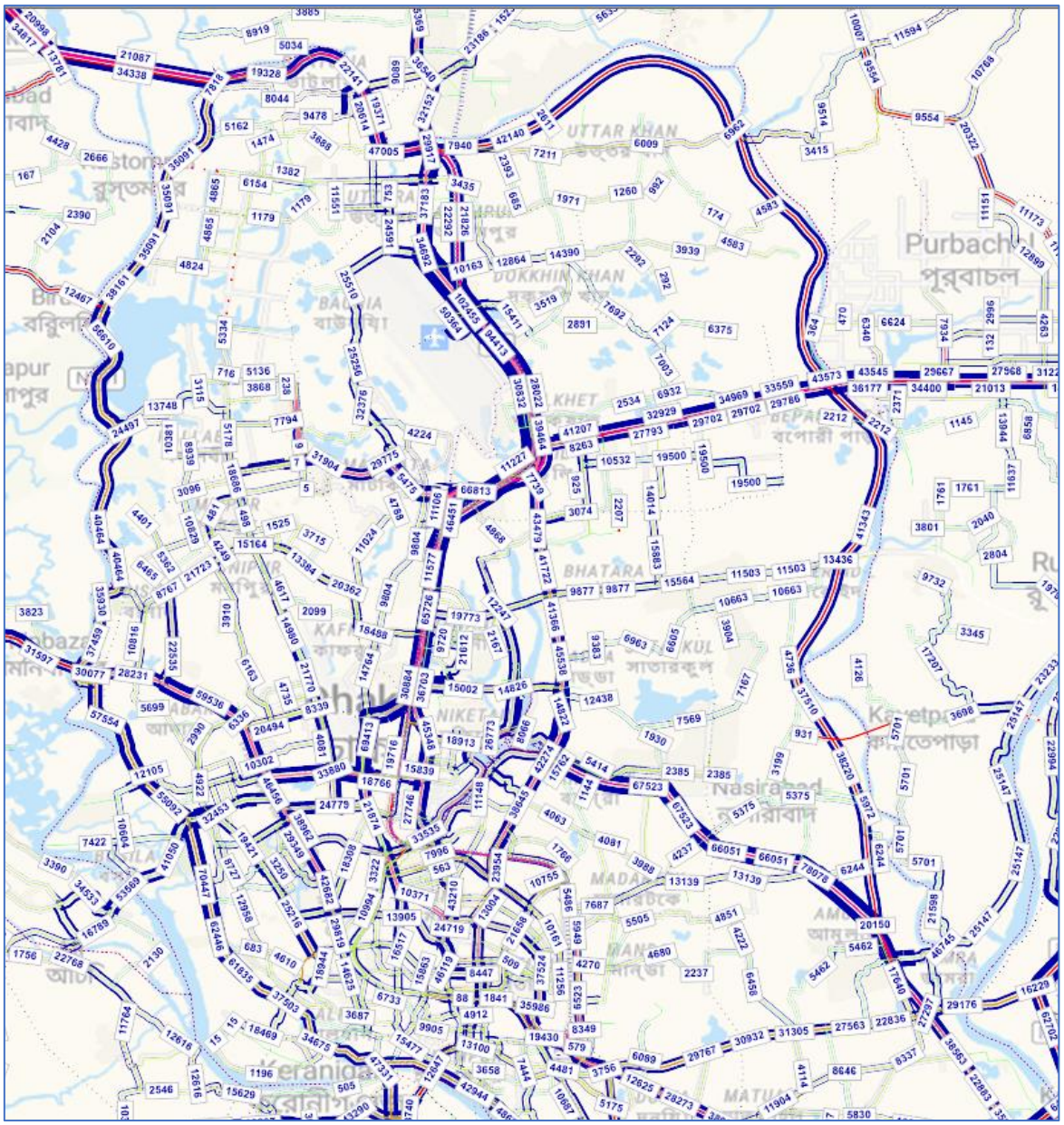

Figure 25. Daily traffic flows both directions – With Eastern Part-1, year 2050.

Western Part-2, Option A

The average traffic of the Western Part-2, Option A for some of the key years studied is presented below.

Table 15. Equivalent Average daily traffic (EAADT) – Western Part-2, Option A

	2040	2050	2069
LPV	9,505	9,949	14,240
BUS	8,236	8,289	11,019
HGV	1,867	2,230	3,256
TOTAL	**19,608**	**20,468**	**28,515**

The following figure shows the evolution of traffic for each vehicle type considered (i.e. light vehicles, buses, and trucks)

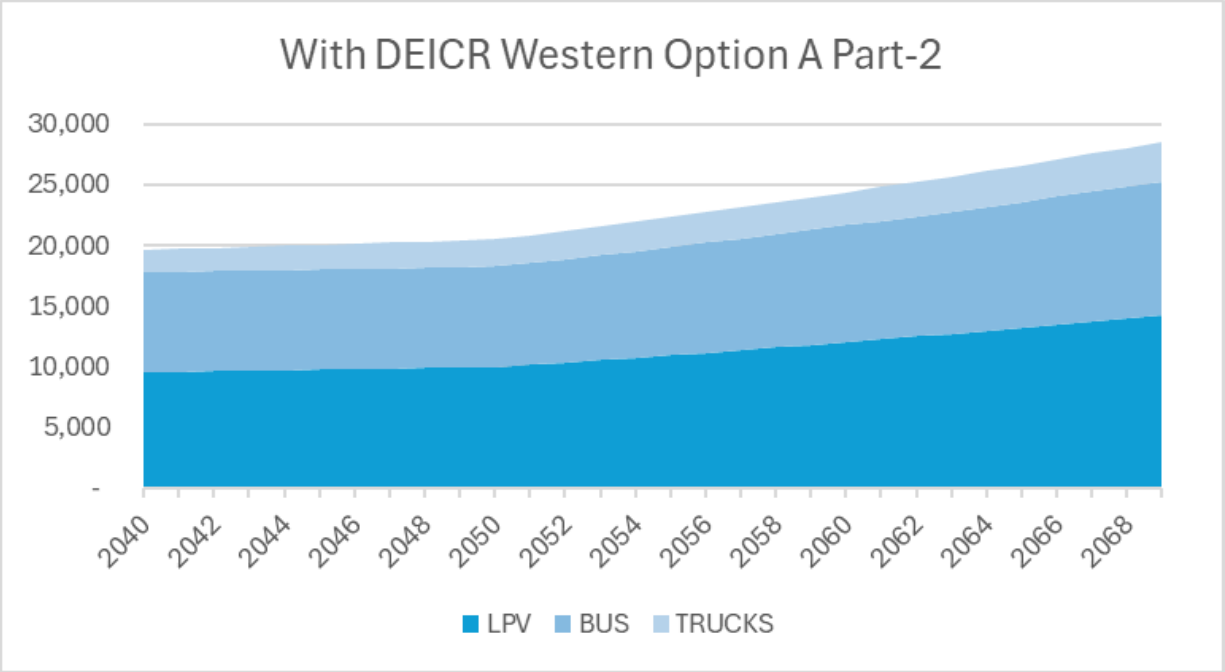

Figure 26. Total Traffic with DEICR Western Part-2, Option A.

Lastly, the average daily veh-km and veh-hr data of the network for the scenarios without and with the projects are as follows:

Table 16. Average daily veh-km and veh-hr without and with Western Part-2, Option A.

		2040	2050	2069
Veh-km/day	With project	82,110,981	84,863,148	141,934,665
	Without project	81,992,473	84,871,113	142,018,849
Veh-hr/day	With project	3,173,617	3,677,598	6,280,838
	Without project	3,218,270	3,734,333	6,365,045

Below are presented graphically the traffic flows of the network, under the With Western Part-2, option A scenario for the year 2050.

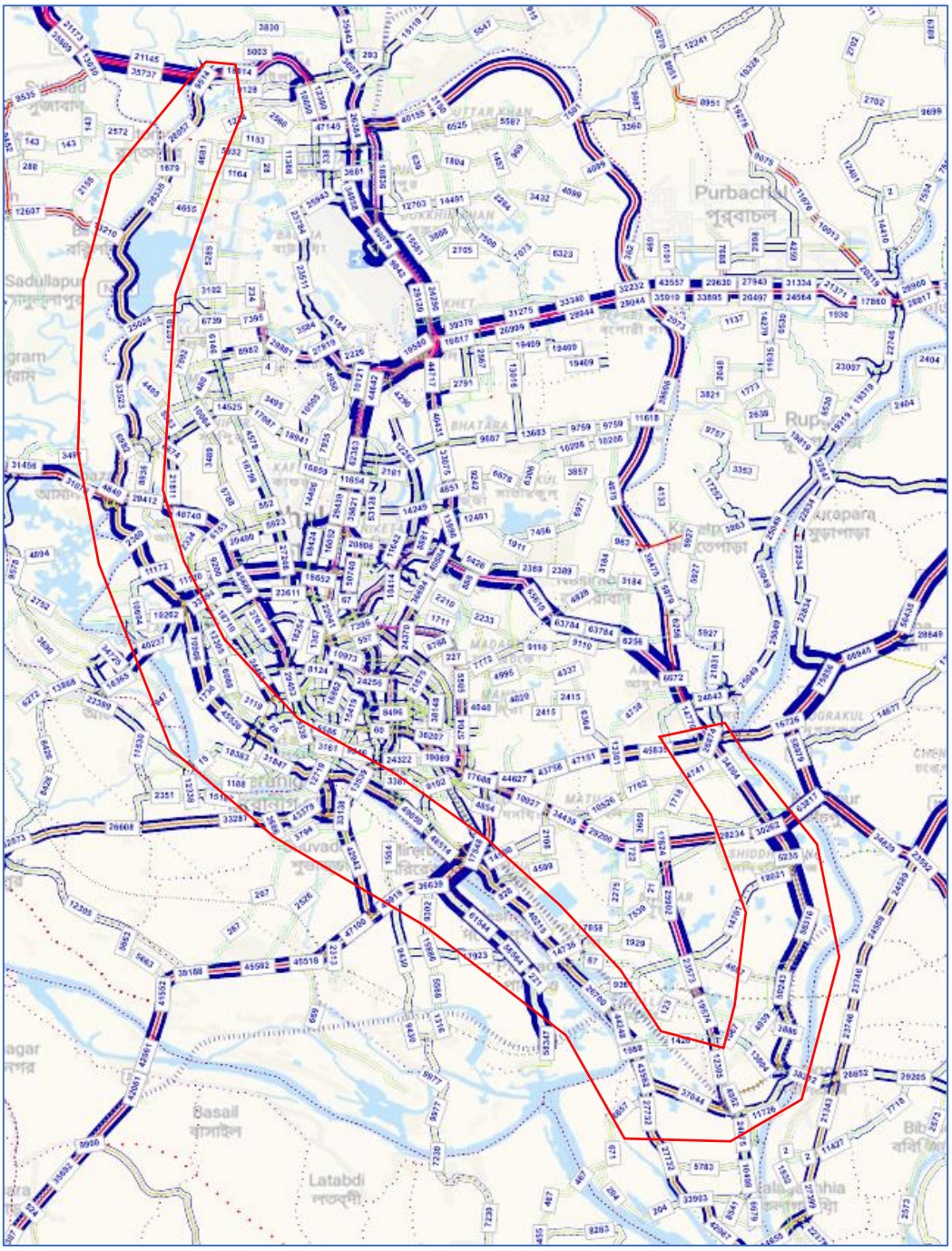

Figure 27. Daily traffic flows – With Western Part-2, Opt. A year 2050.

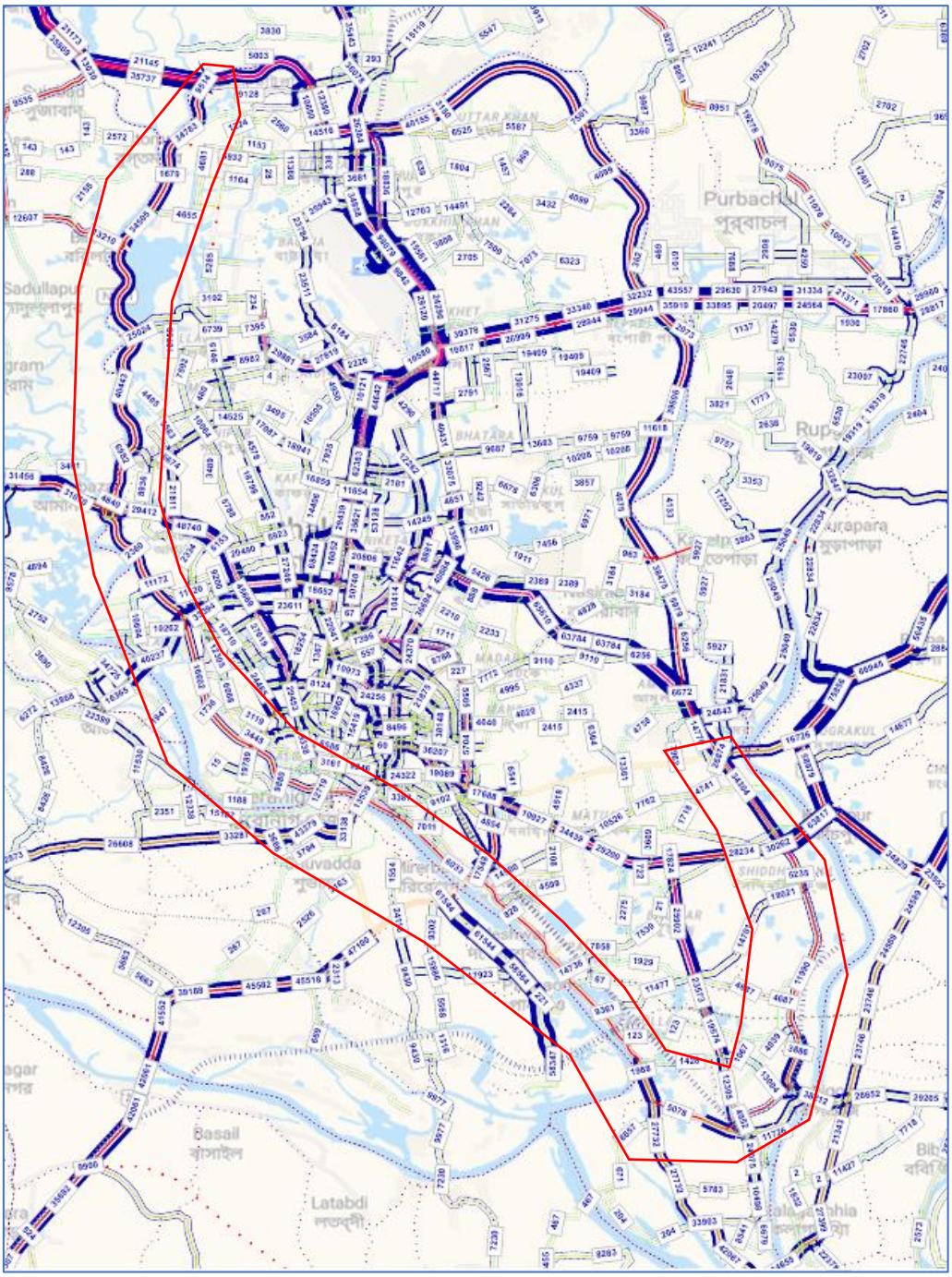

Figure 28. Daily traffic flows – With Western Part-2, Opt. A year 2050.

Western Part-2, Option B

The average traffic of the Western Part-2, Option B for some of the key years studied is presented below.

Table 17. Equivalent Average daily traffic (EAADT) – Western Part-2, Option B.

	2040	2043	2050	2072
LPV	7,997	10,528	10,807	16,368
BUS	12,443	13,337	13,715	19,071
HGV	22	3,501	4,461	6,914
TOTAL	20,463	27,365	28,983	42,353

The following figure shows the evolution of traffic for each vehicle type considered (i.e. light vehicles, buses, and trucks)

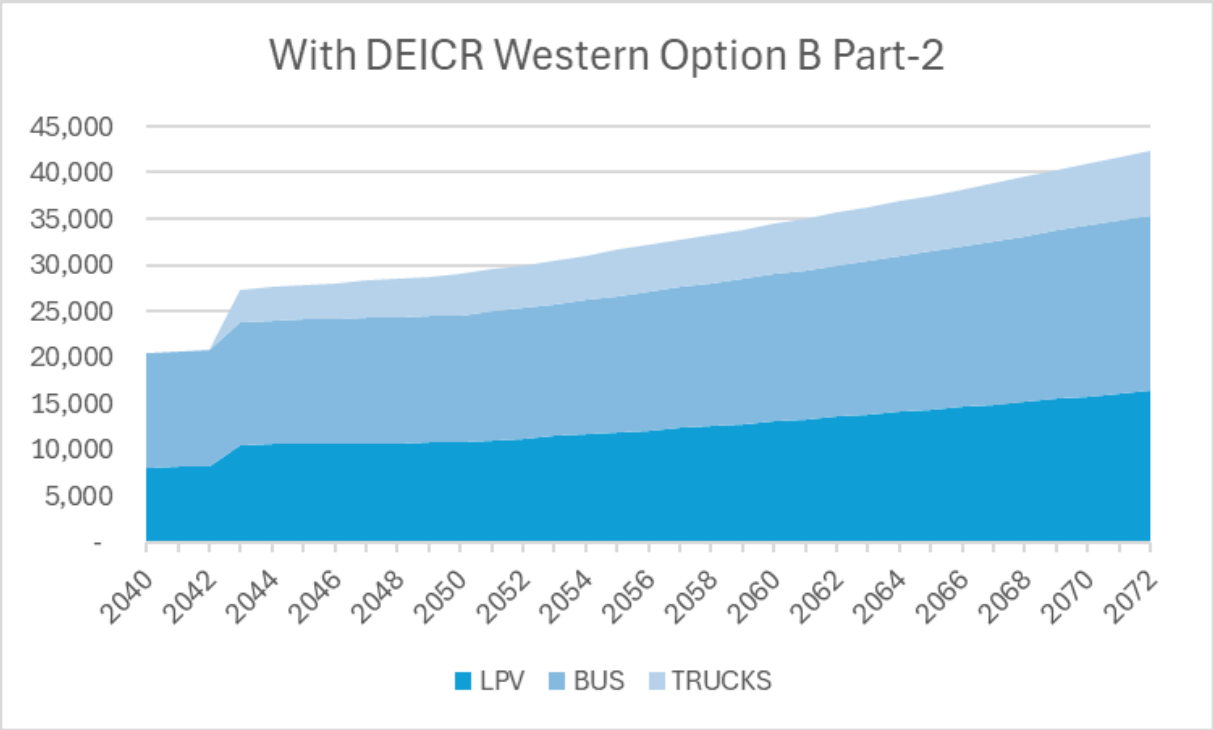

Figure 29. Total Traffic with DEICR Western Part-2, Option B.

Lastly, the average daily veh-km and veh-hr data of the network for the scenarios without and with the projects are as follows:

Table 18. Average daily veh-km and veh-hr without and with Western Part-2, Option B.

		2040	2043	2050	2072
Veh-km/day	With project	82,018,012	82,823,270	84,732,799	106,419,680
	Without project	81,992,473	82,798,753	84,716,432	106,393,975
Veh-hr/day	With project	3,206,220	3,341,448	3,703,161	4,616,304

	2040	2043	2050	2072
Without project	3,218,270	3,360,329	3,725,268	4,647,125

Below are presented graphically the traffic flows of the network, under the With Western Part-2, option A scenario for the year 2050.

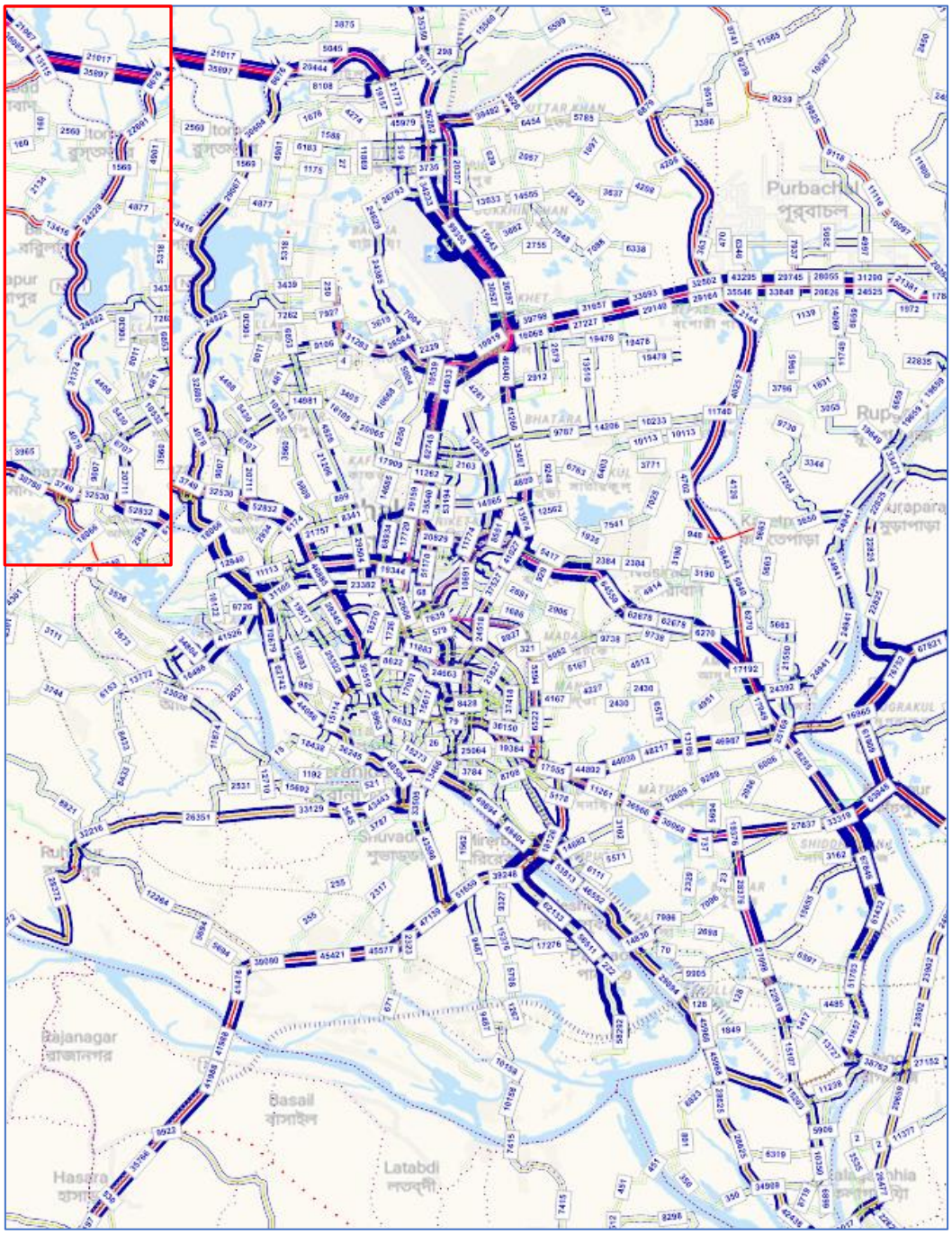

Figure 30. Daily traffic flows – With Western Part-2, Option B, year 2050.
(Traffic in the BBA Inner Ring Road Option B framed in red.)

3.5.5. Summary of Study Findings

Eastern Part-1

The summary of the traffic study findings starting from traffic survey through traffic projection is as follows:

The traffic projection outputs of total motorized traffic (including light vehicles, buses and trucks) for scenario with Dhaka Elevated Inner Circular Road Eastern Part-1 project show that the AADT in the year 2064 is around 52,291 vehicles per day.

Table 19. Equivalent Average daily traffic (EAADT) (veh/day) DEICR Eastern Part-1 project.

	2031	2033	2034	2036	2040	2050	2064
LPV	5,166	8,695	9,137	14,962	16,007	18,947	23,531
BUS	3,842	6,683	5,834	9,580	9,950	10,939	11,729
HGV	314	4,877	4,442	5,457	6,234	8,697	17,031
TOTAL	**9,322**	**20,255**	**19,413**	**29,999**	**32,191**	**38,583**	**52,291**

From the traffic survey, forecast, projection and peak hour analysis it may be deduced, at this stage, that for the DEICR Eastern Part-1 (considering the proposed toll fees that have a significant impact on the traffic) **a 6-lane carriageway is required to meet volume and capacity requirements.**

Western Part-2, Option A

The summary of the traffic study findings starting from traffic survey through traffic projection is as follows:

The traffic projection outputs of total motorized traffic (including light vehicles, buses and trucks) for scenario with Dhaka Elevated Inner Circular Road Western Part-2, Option A, project show that the equivalent AADT in the year 2069 is around 28,515 vehicles per day.

Table 20. Equivalent Average daily traffic (EAADT) (veh/day) DEICR Eastern Part-2 Opt. A

	2040	2050	2069
LPV	9,505	9,949	14,240
BUS	8,236	8,289	11,019
HGV	1,867	2,230	3,256
TOTAL	19,608	20,468	28,515

From the traffic survey, forecast, projection and peak hour analysis it may be deduced, at this stage, that for the DEICR Western Part-2, Option A (considering the proposed toll fees that have a significant impact on the traffic) **a 4-lane carriageway is required in order to meet volume and capacity requirements.**

Western Part-2, Option B

The summary of the traffic study findings starting from traffic survey through traffic projection is as follows:

The traffic projection outputs of total motorized traffic (including light vehicles, buses and trucks) for scenario with Dhaka Elevated Inner Circular Road Western Part-2, Option B project show that the equivalent AADT in the year 2072 is around 42,353 vehicles per day.

Table 21. Equivalent Average daily traffic (EAADT) (veh/day) DEICR Eastern Part-2 Opt. B.

	2040	2043	2050	2072
LPV	7,997	10,528	10,807	16,368
BUS	12,443	13,337	13,715	19,071
HGV	22	3,501	4,461	6,914
TOTAL	20,463	27,365	28,983	42,353

From the traffic survey, forecast, projection and peak hour analysis it may be deduced, at this stage, that for the DEICR Western Part-2 (considering the proposed toll fees that have a significant impact on the traffic) **a 4-lane carriageway is required in order to meet volume and capacity requirements.**

3.6. Need and Justification of the Project / SWOT Analysis

The identified key strengths and weaknesses of the project along with the opportunities and threats are presented in the following table.

Table 22. Project's SWOT

Strengths	Weaknesses
▪ The active participation, willingness, and support of the local government and the citizens involved. ▪ The promoting agency BBA possesses previous expertise in similar projects like Dhaka Elevated Expressway Project or the ongoing DAEEP, which adds to their capabilities and potential success in executing the current project. ▪ Availability of construction material such as cement, stone, and bricks from local market ▪ The project is attracting interest from potential contractors and funding agencies,	▪ Very high-cost financing challenge. ▪ Supply of some materials source. ▪ Air and noise pollution may have some negative impacts on the environment. ▪ Disturbance to the movement of vehicles and pedestrians may occur during construction. ▪ Occurrence of climate change-related and other natural hazards. ▪ The construction process could face hindrance in the event of a sudden natural disaster, impacting its continuity and progress. ▪ Excavation may result in sediments reaching watercourses.
Opportunities	**Threats**
▪ To establish better connectivity with the national transport network, particularly in areas that are currently not directly connected. ▪ To alleviate the Dhaka city road network by circumvallating the area, also creating a bypass. ▪ Decentralization of the area. ▪ To facilitate smooth, movement of people, goods, and services, thereby enhancing overall transportation efficiency and accessibility. ▪ To bring about improvements to the environment and public health, ensuring a sustainable and healthier living environment for the local communities. ▪ Near 6 Cr people living in 29 upazilas would mostly be benefited after completion of the proposed EE.	▪ Land acquisition and resettlement processes can indeed be very costly and challenging. Furthermore, social and political obstacles may complicate and prolong these procedures, potentially impacting the overall progress of the project. In resettlement cases, changes in economic activities, land-use, resource ownership, accessibility of natural resources and common property resources, loss of livelihoods, social disruption, and psychological trauma to affected persons etc. are included. ▪ Achieving the target fund for a mega project is a formidable challenge. ▪ Due to various reasons, there is a possibility of not completing the work on time and increasing the cost of the project.

Source: Consultant Team

4. TECHNICAL AND ENGINEERING ANALYSIS

A summary of the proposed project shall be presented with the following headings:

4.1. Design Standards

- The Eurocode has been adopted in the design of the structures: EN 1990, EN 1991-1, EN 1991-2, EN 1993, EN 1994 and EN 1998 along with EN 1337, EN 10080, EN 10138 and EN206.
- Despite being related to building structures, the Bangladesh National Building Code (BNBC) is followed in the determination of wind loads and the earthquake design spectrum.
- AASHTO LRFD 2017 specifications for Highway Bridges, with interim revisions 2020, 2022 and 2023.
- Geometric Design Standard for Bridges and Approaches Design Standard by RHD.
- Geometric Design Standards Manual (Revised) 2005 (GDSM 2005). Roads and Highways Division.
- A policy on Geometric Design of Highway and Streets" 2018, AASHTO
- Manual of Specifications and Standards for Expressways, IRC: SP: 99-2013
- Manual of Specifications and Standards for Four Laning of Highways, IRC: SP: 84-2019
- Pavement Design Guide for Roads and Highways Department 2005 for pavement design works along with "AASHTO Guide for Design of Pavement Structures 1993 (Edition 2021)".

4.2. Geotechnical Study

Designing an elevated structure poses a significant challenge in determining the soil profile along the proposed alignment. This necessitates a thorough geotechnical assessment to ascertain the most suitable type of foundation for the intended structure. In the case of the Feasibility Study of Dhaka Elevated Inner Circular Road (DEICR), the geotechnical engineering design relied on data obtained from a comprehensive geotechnical survey, which included 23 boreholes.

The sub-surface soil exploration program for the DEICR project was conducted between January 2023 and June 2023. In addition to the 23 boreholes specifically drilled for this project, data from a previous set of 105 boreholes were also utilized. These boreholes, drilled using the rotary method, provided insights into the profiles and properties of various soil strata. The maximum depth reached by these boreholes was 80 meters from the existing surface level. This extensive geotechnical investigation formed the basis for informed decision-making regarding foundation selection and overall structural design for the DEICR project.

The purpose of carrying out the geotechnical investigation is to obtain site and sub-surface ground data for the design of the Dhaka Elevated Inner Circular Road (DEICR). The main objectives of the geotechnical investigations are to determine:

- The presence of soft silts and clays along the alignment
- The geological stratification along the alignment
- The thickness and distribution of the various sediment layers
- The engineering properties of each soil type for the purpose of designing elevated structure.

4.2.1. Soil Investigation Campaign

The Consultant started the geotechnical fieldworks back in 2023 completing all the works and laboratory tests from Jan 2023 to June 2023. Two companies carried out the soil investigation works, Prosoil Foundation Consultant (11 boreholes, Eastern part) and Ground Instrumentation Engineering PTE Limited (GIE) (12 boreholes, Western Part), completing 23 boreholes along the alignment at a depth of 80 m.

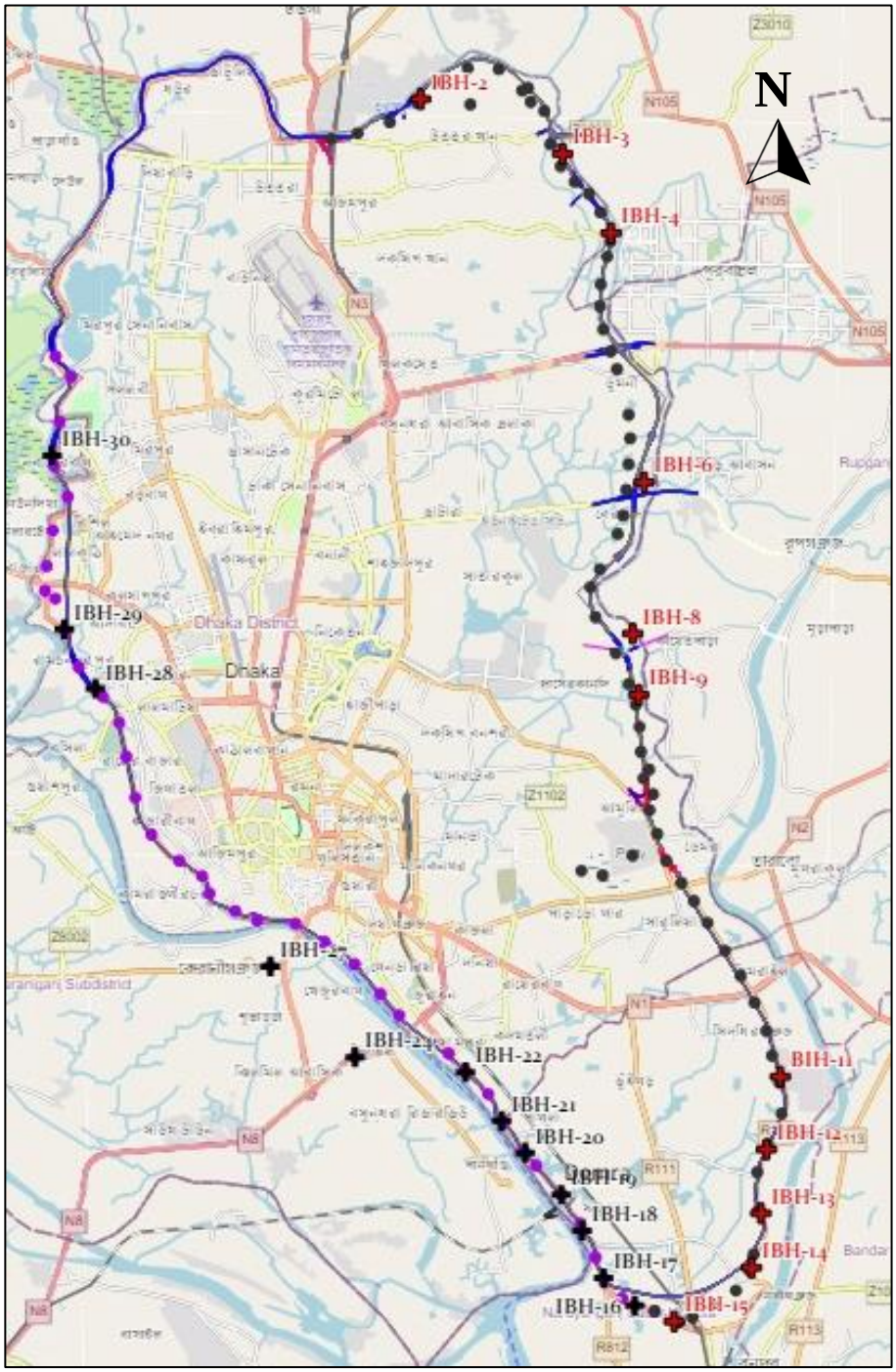

Figure 31. DEICR geotechnical campaign.

Table 23. Summary of geotechnical investigation fieldworks.

Item		Unit	Eastern Part-1 (Prosoil)	Western Part-2 (GIE)	Remarks
Borehole	Borehole	Nos	11	12	Additional previous 105 boreholes considered
	Undisturbed Sampling	Nos.	43	43	

4.2.2. Subsoil Profile

The soil properties for the soil Layers encountered at the site are presented in subsoil profile of Dhaka Elevated Inner Circular Road (DEICR) around Dhaka city.

The properties of the soils were determined from a series of field and laboratory tests to assess the site conditions. It is found that sub soil deposits comprise of some cohesive and cohesion less layers from the soil layers encountered in the project site. The cohesive layers are mostly consisting of low plastic to high plastic, CLAY (CL/CH) / Silty CLAY / Lean inorganic CLAY / Sandy CLAY. The layers are combination of cohesion less soil consisting of various types of SAND with some silt SP/SM / SP-SM/SC, SILT / Sandy SILT.

The top layers of the investigated soil have been encountered with cohesive soils of medium to high plasticity, soft to medium stiff clay and silt extending roughly up to the depth of 0- 25.0m measured from the existing ground surface. The underlying soils are non-plastic and cohesionless soils of medium dense to dense state extending up to the final depth of boring.

4.3. Proposed Engineering Solution

The solution that proved to be the optimum in terms of cost, construction process duration, interference with the existing or planned infrastructures, buildings and channels and aesthetics was the alternative based on:

Eastern Part-1: two parallel decks of precast I-Girder spans 40 m long and Balanced Cantilever Bridges with a span arrangement 60+100+60 for the crossing of the navigational channels, with a total length of 26.98 km. Both typologies in the Eastern Part-1 will have independent structures for each road direction. Precast I-Girder substructure will be a single pier.

Western Part-2: a single deck of precast I-Girder spans 40 m long over/parallel to the RHD alignment has also proved to be the most appropriate alternative. In this case, a single structure carries the 4 lanes and the substructure chosen as the better ones for each section are:

- Single pier when DEICR alignment cannot be over RDH road.
- Portal frames in the rest of the cases.

Figure 32. DEICR Western Part-2.

Table 24 Length distribution and section type for the Eastern Part-1.

Chs and location	Section Type	Lenght (km)
0+000 - Demra 10+990 - BCB	Eastern - Precast I-Girder-Single Pier-2 indep. Structures (2x (3+3))	10.99
10+990 - 11+210	2 x BCB (60+100+60)	0.22
11+210 - BCB 26+613 - Abdullahpur	Eastern - Precast I-Girder-Single Pier-2 indep. Structures (2x (3+3))	15.403

Table 25 Length distribution and section type for the Western Part-2.

Chs and location	Section Type	Length (m)
0+000 - Abdullahpur 6+200 - Dhour	Western - Precast I-Girder-Single Pier (2+2)	6,200
6+200 - Dhour 9+200 - Uttara	Western - Precast I-Girder-Frame Str over at grade RHD (2+2)	3,000
9+200 - Uttara 11+900 - Birulia	Western - Precast I-Girder-Single Pier (2+2)	2,700
11+900 - Birulia 17+100 - Diabari	Western - Precast I-Girder-Frame Str over at grade RHD (2+2)	5,200
17+100 - Diabari 20+300 - Gabtoli	Western - Precast I-Girder-Single Pier (2+2)	3,200
20+300 - Gabtoli 23+000 - Bosila Mor	Western - Precast I-Girder-Frame Str over at grade RHD (2+2)	2,700

Chs and location	Section Type	Length (m)
23+000 - Bosila Mor 23+800 - Bosila Mor	Western - Precast I-Girder-Frame Str over elevated RHD (2+2)	800
23+800 - Bosila Mor 26+700 - Nawab Ganj	Western - Precast I-Girder-Frame Str over at grade RHD (2+2)	2,900
26+700 - Nawab Ganj 28+100 - Nawab Ganj	Western - Precast I-Girder-Frame Str over elevated RHD (2+2)	1,400
28+100 - Nawab Ganj 29+700 - Kalambaj Ghat	Western - Precast I-Girder-Frame Str over at grade RHD (2+2)	1,600
29+700 - Kalambaj Ghat 35+200 - Postogola	Western - Precast I-Girder-Single Pier (2+2)	5,500
35+200 - Postogola 43+700 - Panchoboti	Western - Precast I-Girder-Frame Str over at grade RHD (2+2)	8,500
43+700 - Panchoboti 46+600 - Hajigang Bazar	Western - Precast I-Girder-Single Pier (2+2)	2,900
46+600 - Hajigang Bazar 53+000 - Chittagong Road	Western - Precast I-Girder-Frame Str over at grade RHD (2+2)	6,400
53+000 - Chittagong Road 56+900 - Demra	Western - Precast I-Girder-Single Pier (2+2)	3,900

For both parts, maximum embankment height has been fixed at 10 m to leave vertical clearance for a local road under the whole alignment. Abutments will be placed at the location of maximum embankment height of the approach roads. The same vertical clearance has been used for the Eastern and the Western Part, a minimum of 5.70 m, for the typical spans. The vertical clearance of the spans over navigational channels will meet the requirements of the BITWA according to the corresponding navigation class.

Structural types being considered for the subsequent preliminary design are mainly based on the following aspects:

- The lowest affection to existing building and infrastructures.
- The possibility of coexistence and the lower affection to the RHD circular road
- The possibility to directly benefit from the RHD junctions in the Western Part-2 to connect the DEICR with local roads.
- The lowest construction period gives priority to precast solutions over in situ alternatives.
- The lowest construction and maintenance costs.

In the Eastern Part-1, the foundation of the piers for the typical spans, which are planned to be executed in dry conditions, have been estimated to require 4 reinforced concrete bored piles Ø1.5 m of 50 m in length, while the foundations for the balanced cantilever bridges have been estimated to require 10 reinforced concrete bored piles Ø1.5 m of 55 m in length. The foundations for the access ramps in this area are designed with 4 reinforced concrete bored piles Ø1.2 m of 50 m in length.

In the Western Part-2, the foundations of the piers for the precast I-Girders supported on a single pier have been estimated to require 4 reinforced concrete bored piles Ø1.8 m of 45 m in length, for the ones supported on portal frames over the RHD alignment at grade 2 reinforced concrete bored piles Ø1.8 m of 45 m in length per column and when the RHD alignment is elevated, 4 reinforced concrete bored piles Ø1.5 m of 45 m in length per column. The foundations for the access ramps in this area are designed with 4 reinforced concrete bored piles Ø1.2 m of 45 m in length.

Typical cross sections of the different stretches are as follows:

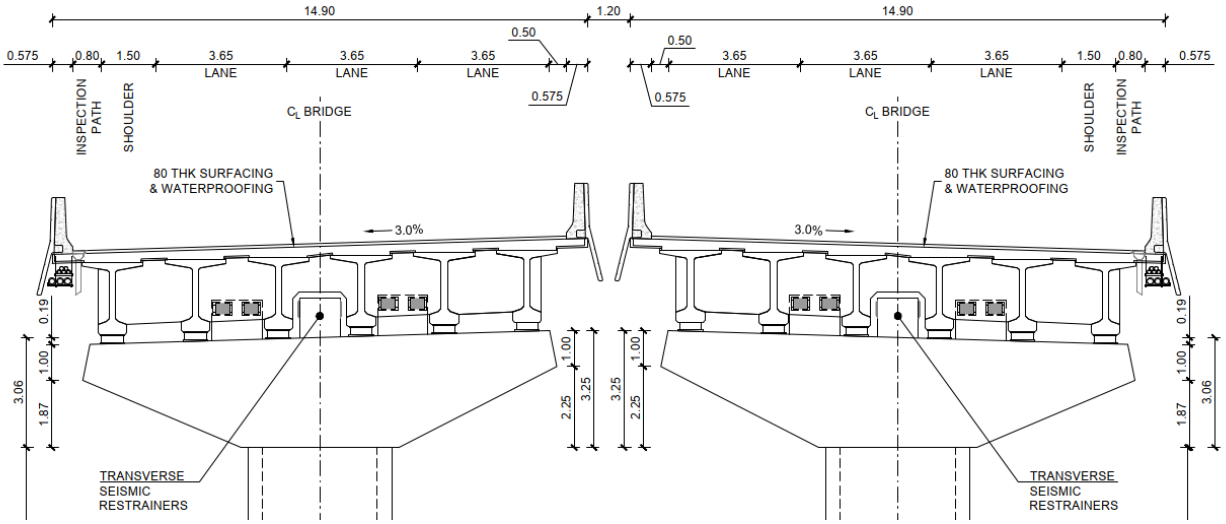

Figure 33 Eastern Part-1 – Cross section of typical spans.

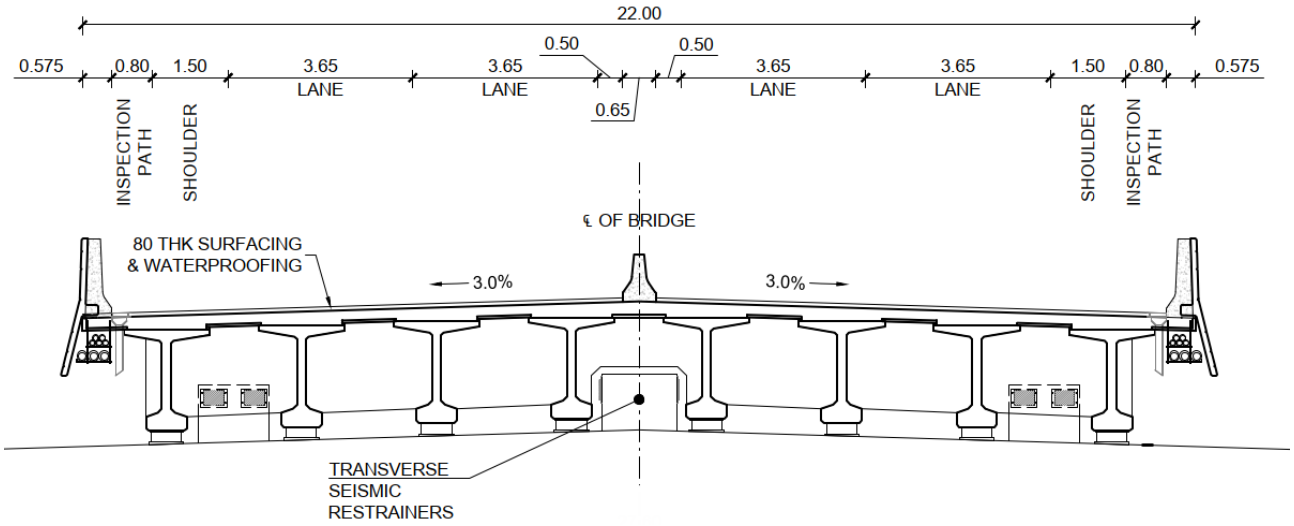

Figure 34 Western Part-2 – Cross section of typical spans.

Figure 35 Eastern Part-1 Alignment

Figure 36 Eastern Part-1 Typical connection.

Figure 37 Eastern Part-1 Typical connection.

Figure 38 Eastern Part-1 Typical connection.

Figure 39 Western Part-2. Alignment

Figure 40 Western Part-2. Cross section over RHD alignment

4.4. Approach Roads

4.4.1. Design Standards

In summary, the Road and Highway features have been pre-designed in accordance with the following standards,

- "Geometric Design Standards Manual (Revised) 2005" (GDSM 2005)
- "A policy on Geometric Design of Highway and Streets" 2018, AASHTO
- Manual of Specifications and Standards for Expressways, IRC: SP: 99-2013
- Manual of Specifications and Standards for Four Laning of Highways, IRC: SP: 84-2019
- "Bangladesh Road Sign Manual" of BRTA (Bangladesh Road Transport Authority) for traffic signage and road marking.
- "Pavement Design Guide for Roads and Highways Department 2005" for Pavement design works along with "AASHTO Guide for Design of Pavement Structures 1993".

4.4.2. Geometry Design Criteria

The design criteria as per the Design Standards of the approach roads conforms to the following requirements:

Table 26. Road Design Criteria

DESIGN CRITERIA FOR MAIN LINE CARRIAGEWAY			
Design Elements	Unit	Design Parameters	Source
Road Standard		Type 1 and Type 2	Figure 4.1, RHD Standard, Page 12
Design Speed	kmph	80	RHD, Table 2.2, Page-5
Stopping Sight Distance (SSD)	m	120	RHD, Table 2.3, Page-5
Intermediate Sight Distance (ISD)	m	250	RHD, Table 2.3, Page-6
Cross-Sectional Elements			
Carriageway Width			In each direction
EASTERN PART	m	11.0	
WESTERN PART	m	7.3	
Lane Width	m	3.65	RHD, Table2.1, Page-4
Outer Shoulder Width	m	1.5	RHD, Table 2.1, Page-4
Minimum Inner Shoulder Width	m	0.5	RHD, Table 4.13, Page-72
Minimum Median Width with Barrier	m	1.2	RHD, Table 4.12, Page-70
Normal Cross fall	%	3	RHD, Table 4.7, Page-17
Horizontal Alignment			
Minimum Radius	m	250	RHD Table 5.1, Page-75
Maximum Super Elevation	%	7	RHD, Table 5.2, Page-76
Min. Transition Length	m	25 to 65	RHD, Table 5.3, Page-75

DESIGN CRITERIA FOR MAIN LINE CARRIAGEWAY			
Vertical Alignment			
Maximum Grade	%	4	3% as per Asian Highway Standard, 6% maximum on the approach to structures
Minimum K Value			
Crest Vertical curve		35	RHD, Table 6.1, Page-82
Sag Vertical curve		26	AASHTO

4.4.3. Typical Sections

The proposed DEICR is considered to have the following typical sections, primarily consisting of elevated main carriageway, ramps for connections and additionally the some connecting roads.

Different typical cross sections are proposed for the Eastern and the Western part since different traffic is expected in both areas due to the existence of the RHD alternative in the Western Part. The main characteristics of both sections are shown in the following figures.

Eastern Part-1

a) Main Carriageway

- Total Right of Way (ROW): 40 m
- Dual 3-lane main carriageway with width of 10.95 m plus 1.5 m width of outer shoulder and 0.50 m width of inner shoulder (considering inner the closest to the adjacent structure) and 0.80. of inspection path.
- Double deck with 0.575 m parapet and distance between adjacent structures (gap) of at least 1.20m

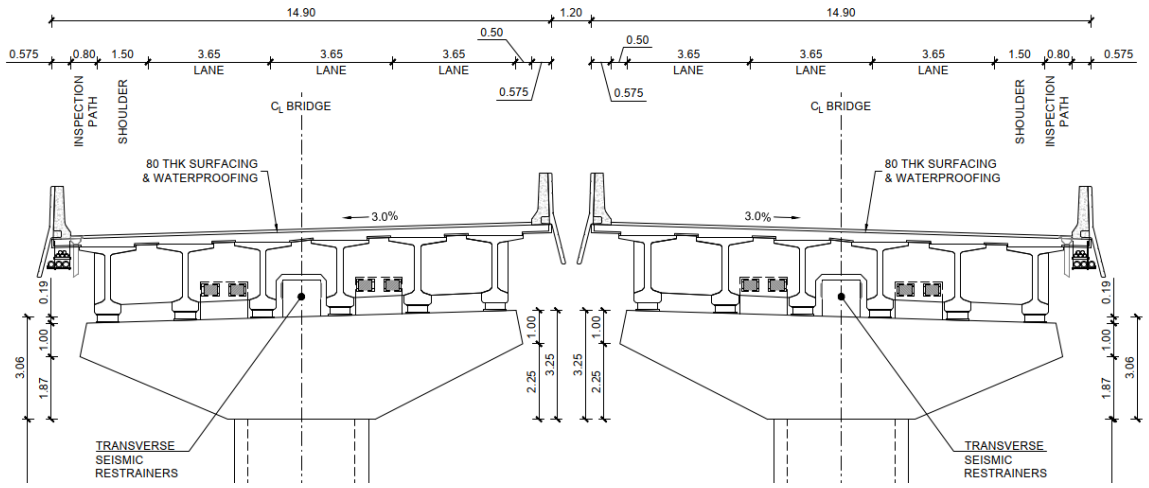

Figure 41 Proposed Cross-section Eastern Part-1

b) Connecting Roads

- Total Right of Way (ROW): 30 m
- Dual 2-lane carriageway with width of 7.30 m plus 1.5 m width of outer shoulder and 0.50 m width of inner shoulder.
- 1.2 m median and side slope of 2:1

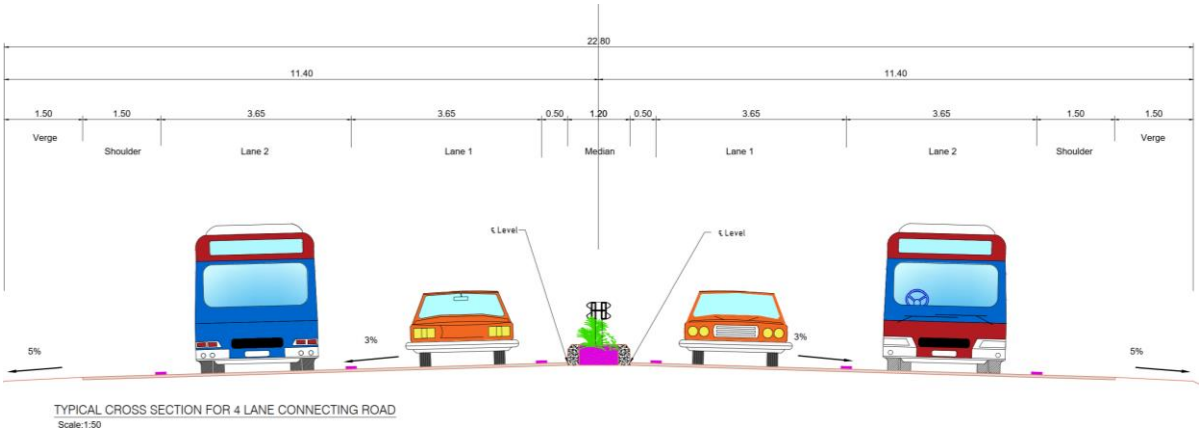

Figure 42. Proposed Approach Road Cross-section for Eastern Part-1, Connecting Road

c) For the Access Ramps

- 2-lane carriageway with width of 7.3 m plus 1.0 m width of shoulder on both side and 0.80m inspection path is considered.
  For the structural ramp 058 m parapet and for Embankment Ramp 1.5 m verge

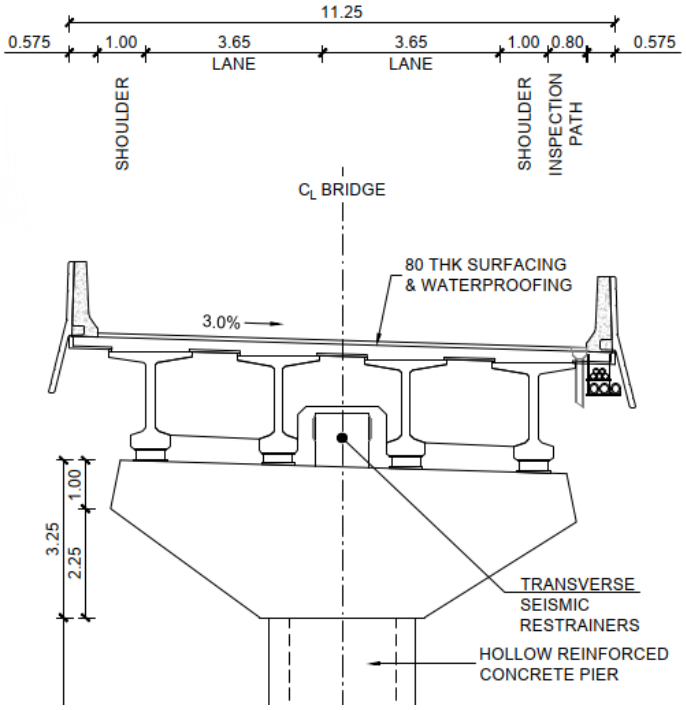

Figure 43. Proposed Approach Road Cross-section for Eastern Part-1, Ramps

Western Part-2

a) Main Carriageway

- Total Right of Way (ROW): 30 m
- Dual 2-lane main carriageway with width of 7.30 m plus 1.5 m width of outer shoulder and 0.50 m width of inner shoulder and 0.80 m of inspection path.
- Single deck with 0.575 m parapet and 0.65 m central barrier.

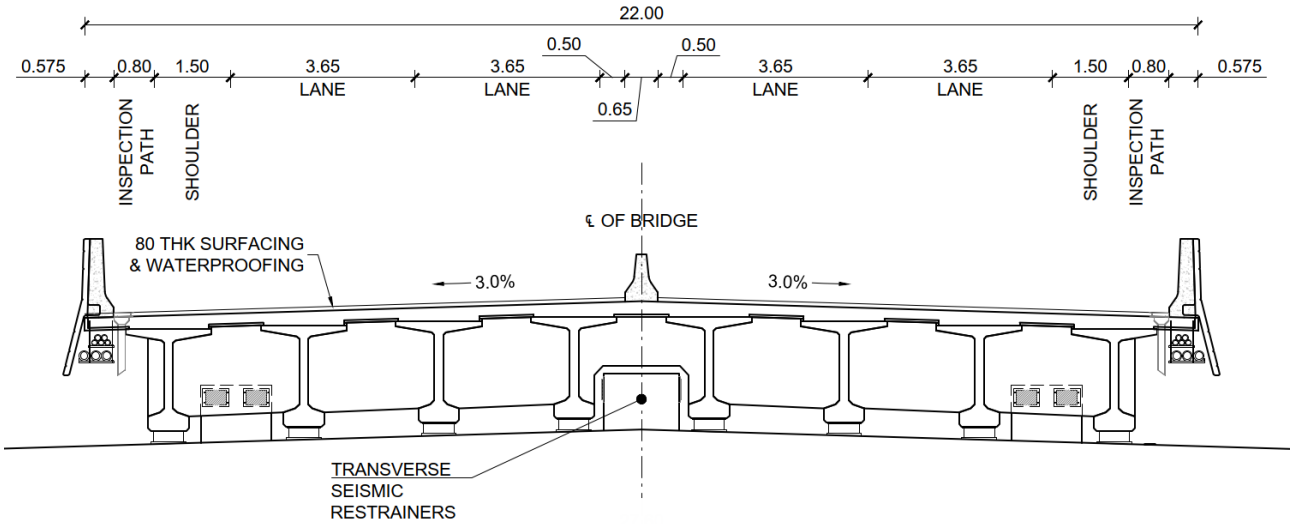

Figure 44. Proposed Cross-section Western Part-2

b) Ramps and Service roads

- 2-lane carriageway with width of 7.3 m plus 1.0 m width of shoulder on each side
- For the structural ramp 0,575 m parapet and for embankment ramp 1.5 m verge

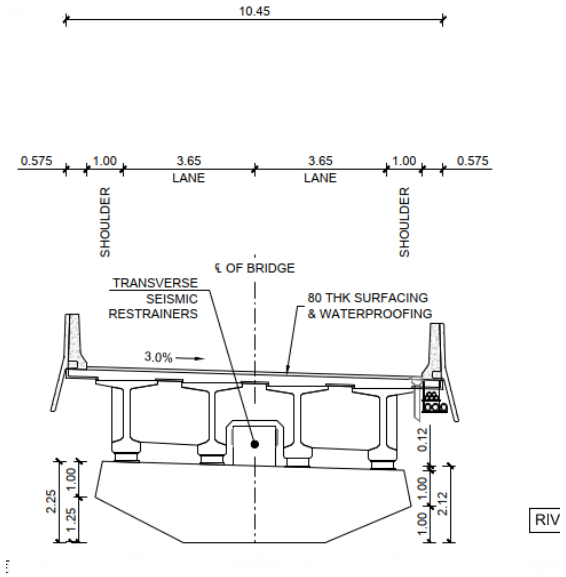

Figure 45. Western Part-2. Access ramp cross section

The geometric features for the approach road and bridge are explained below.

- **Carriageway:** Carriageway is the part of the road formation carrying moving vehicles. The approach road carriageway is considered 2 x 11.0 m (6 lane) dual carriageway for eastern part main carriageway and 2 x 7.3 m (4 lane) dual carriageway for western part main carriageway. The carriage width of ramps is considered 7.30 m (2 lane).
- **Cross-fall and Super Elevation:** Cross-fall is the transverse slope of carriageway or shoulder a cross fall of 3% has been applied for carriageway and shoulder as recommended in the GDSM 2005. For the soft shoulder/verge a cross fall of 5% has been provided where verge is provided. Maximum super elevation will normally be 7% in accordance with the stated requirements of Section 5.3 of the GDSM 2005. Super elevation has been applied about the centreline of the carriageway.
- **Embankment:** The embankments are provided for the ramps and service road or connecting road the slope of the embankment is considered 2:1. To reduce the impact on the land acquisition, an extensive use of soil reinforced retaining walls has been proposed.
- **Sight Distance:** This is the visibility distance necessary for a driver to be able to see an obstruction in time to bring the vehicle to a halt without any collision. It is assumed that the driver's eye height is 1.2 m, and the height of the obstruction is at least 0.15 m above in accordance with Sections 5.2 and 6.1 of the GDSM 2005, the requirement of provision of Stopping Sight Distance (SSD) has been complied for horizontal and vertical curve design. To improve road safety, appropriate visibility has been provided at all major junctions.
- **Shoulders:** Hard shoulder (Paved) of 1.5 m has been used for both sides on the main carriageway and 0.5 m of inner shoulder is provided with median on both sides.
- **Verge Width:** 1.5 m of verge is provided after the service road and ramps to provide safety to service road and to accommodate if requirement arises.
- **Gradient:** The ramps are provided to give access to the main line. No NMT or SMVT are allowed on the main line. For motorized traffic higher gradient can be adopted. For the ramps in DEICR ramps are designed with maximum 4% gradient.
- **K Value:** Minimum K value of 35 for crest curve and 26 for sag curve for stopping sight distance is adopted for the design of dual carriageway.
- **Median:** The median width has been designed as 1.2 m with 0.5 m inner shoulder for western main line and connecting 4 lane roads. For the eastern part the main line deck is separated by a 1.2 m gap.
- **Taper Length:** It is common practice to use a taper rate that is between 8:1 and 15:1 (longitudinal: transverse or L: T) as AASHTO 9.7.2.3. For the design of approach road, the taper length considered with 8:1 (longitudinal: transverse or L: T) ratio.

5. ENVIRONMENTAL SUSTAINABILITY, CLIMATE RESILIENCE AND DISASTER RISK ANALYSIS

5.1.1. Introduction

The Environmental report aims to identify the likely impacts, both positive and negative and assess the impacts on the environment of the proposed expressway project. The basic objective is to ensure minimum negative impact and enhance positive environmental impacts because of such development. To achieve this objective all negative impacts, must be mitigated for and the costs of doing this included in the financial and economic analysis of the proposed project.

The Environmental Impact Assessment (EIA) Report for the proposed project has been carried out following methodologies: screening of the significant environmental impacts, assessing them, enhancing the positive impacts, and recommending the mitigation measures for the negative impacts. These have been done based on generated primary data, available secondary data, field data and discussion with the project affected peoples (PAPs). Terms of reference (ToR) issued by Department of Environment (DoE), Government of Bangladesh and national regulations have been followed in preparation of the EIA report. Environmental Management Plan (EMP) has been proposed to minimize the negative impacts and achieve sustainable bridge project. Asian Development Bank (ADB), World Bank (WB), Department of Environment (DoE), Roads and Highway Department (RHD) and Local Government Engineering Department (LGED) guidelines have been followed for EIA preparation of the proposed Bridge Projects. Checklists for Environment Assessment have been completed and found no significant negative environmental impacts due to the project.

The project area is in the eastern part of Dhaka City. The larger portion of the alluvial deposits in the study area predominantly consists of fine to medium grained sand with greater density at deeper layers. All the surrounding areas are within the Padma and Jamuna flood plain formed by alluvial deposits of silt, sand and clay. Based on distribution of earthquake epicenters and morpho-tectonic behavior of different tectonic blocks Bangladesh has been divided into four generalized seismic zones. The south-central regions of Bangladesh are the most active zones and belong to the Zone-2. The project area can be classified as a moderate cyclone and bank erosion prone area. The project area is mostly an urban area, and for the rest of the area, the soil condition is productive and suitable to support different ecosystems in balance. The land in this area is mostly used for urban structures, industry and some areas for agricultural cultivation and there are a lot of discrete water bodies, some of them are used for fish cultivation. The project area is a moderate terrestrial and aquatic biodiversity rich area.

Primary data generated with respect to air quality, water quality, noise and soil indicate the fact that all the data are well within the limit of the national standards of the DoE for residential and commercial areas.

5.1.2. Anticipated Environmental Impacts and Mitigation Measures

No highly significant negative environmental impacts are expected during the construction period except the normal construction hazards. However, during construction, close monitoring is required over the following issues: interruption of traffic, contamination of surface and ground water, disruption of drainage, pollution of air, noise and soil, disturbance of wildlife mainly water birds and reptiles, aquatic life, health and sanitation hazards and social disruption including split of communities.

In the Eastern Part-1, about 323.45 acres of land would be required for the proposed project. In the Western Part-2, about 272.70 acres of land would be required. A total of 3,259 of trees (Eastern Part-1) and 2,304 of trees (Western Part-2) would be affected due to the project (large, medium and small trees excluding sapling/plants, banana and papaya). This loss could be mitigated by planting tree saplings and vetiver roots in both sides of the elevated road and on slopes of ramp and intersection embankments and other vacant lands which will enhance the environmental condition of the area (for detailed data, see Tables No 27 and No. 28).

The impacts during construction can easily be mitigated by taking advance adequate precautions and some additional measures appropriate to the construction. An Environment Management Plan (EMP) has been formulated to control/mitigate the negative impacts arising from construction related activities. Contractors will be directed to follow the suggestions for environmental management mentioned in the Initial Environmental Examination (IEE) Report. Supervision consultants will check and ensure that EMP is working well according to the plan.

The impacts associated with the change in landscape after the construction of the project can be negative unless proper landscape plan is formulated by the government and adhered to. The impact on housing and commercial structures can be compensated by providing adequate compensations and alternative job opportunities as proposed in Resettlement Action Plan (RAP) of the project.

The impacts after construction of the project, unless regulatory measures are taken in time, will be uncontrolled settlement, environmental pollution from industries and innumerable places of possible access to the road leading to traffic congestion and hazard. It will, therefore, be desirable to institutionalize some form of effective control on the growth of settlements on the Right of Way (ROW) land.

5.1.3. Community Participation, Consultation and Grievance Redress Committee (GRC)

Consultations were conducted through focus group discussion (FGD) with local level primary stakeholders, individual and group consultation with local administration, local government bodies, local elite, professional groups etc. for sharing the project and collecting their opinions on the project. Two wider consultations meetings were conducted within the project area, among them, one was at Beraid area and another one at Uttar Khan area from where people opined that if the bridge is constructed, they will save both time and money for crossing the busy Dhaka City. Number of Focus Group Discussions (FGDs) were held at different locations within the project sites and project influence areas.

Grievance Redress Committee (GRC): A two-tier bottom-up joint GRC system will be established in this project for both social and environmental conflict mitigation. First tyre GRC at local level, hereafter called Local GRC (Union Parishads level) and second one GRC at the project level to give room for grievances to be reviewed.

These GRCs will be established through gazette notifications from the Ministry of Road Transport and Bridges (MoRTB), Government of Bangladesh. The local GRCs (at the Ward level) will hear the grievances first. Only unresolved cases will be forwarded to the next tier – Project-level GRC for further review and resolution. GRC decisions will be on a majority basis and will be disclosed and available for review by the stakeholders. If any disputant is unhappy or unsatisfied with the outcome of the Project level GRC, he/she may file cases in the court.

A format of GRC is given below, which will be applicable for both tyres:

- Executive Engineer – BBA: Convener.
- 1 representative of NGO: Member Secretary.
- Chairman – concerned Union Parishad: Member.
- Female member of concerned ward of the UP: Member.
- Representative of Women APs: Member.
- One (1) representative of APs (based on the recommendation of NGO and approved by Convener).

This format of GRC has worked in the past projects – for example, Jamuna Multipurpose Bridge Project, Bhairab Bridge Construction Project, Pakshey Bridge Project, and Southwest Road Network Development Project.

5.1.4. Environmental Management and Monitoring Plan

The main aim of the EMP is to ensure that the various adverse impacts are mitigated, and the positive impacts are enhanced.

Environmental Monitoring (EM) in the EMP for the Dhaka Elevated Inner Circular Road have been designed with the following objectives to:

- Measure the extent of expected or poorly quantified impacts.
- Ensure incorporation of Environmental Mitigation Measure (EMM) during implementation of the proposed project.
- Observe effectiveness of EMM.
- Ensure early detection of unexpected impacts and adoption of appropriate protection measures.
- Provide periodic reviews to observe adherence to Environmental Quality Standards (EQS) and adjust EMM, if required; and
- Detect unacceptable level of impacts and adopt corrective measures.

The Estimated EMP cost for the Eastern Part-1 is 97,81 million BDT.

Table 27. Summary of EMP cost estimate for the Eastern Part-1.

Sl. No.	Unit	Item	Unit Price (BDT)	Quantity	Amount (BDT)
1.	No	Tree plantation in both sides of elevated road and slops of ramp and intersection embankments	300*	58,000	17,400,000
2.	No	Vetiver sapling / Bermuda grass sapling plantation on slops of ramp and intersection embankments (Length: 5.683 km)	50**	100,000	5,000,000
3.	Month x km	Maintenance of tree saplings and Vetiver / Bermuda saplings (24 months for total length of 26.766 km)	8,130**	648	5,268,240
4.	Month	Environmental monitoring (Air, water, soil, noise and vibration)	115,000***	84	9,660,000
5.	Month	Dust suppression by water sprinkling	50,000****	84	4,200,000
6.	Month	Health and safety provisions	500,000#	84	42,000,000
7.	No	Training workshop and awareness @ 3 months interval)	20,000##	30	600,000
8.	Person Month	Arborists/caretakers will maintain the security of trees, watering, fencing, etc. with necessary tools (24 months for 20 arborists)	21,119###	648	13,685,112
		Total=			**97,813,352**

Note: **Tree plantation cost as considered in EMP of Padma Multipurpose bridge project Bangladesh and South Asia Sub-Regional Economic Cooperation (SASEC) Road Connectivity Project, Bangladesh.*
***Vetiver and Bermuda grass roots plantation rates and plantation maintenance cost considered as per EMP cost of Matarbari Port Development Project (RHD component). Maintenance for 84 months for 26.987 km of the road*
****Environmental monitoring cost as per rate quoted by Development Solutions Consultant Limited (an agency approved by BBA) for Baseline data generation for EIA preparation*
*****Dust suppression by water sprinkling – as per market rate and discussion with BBA*
#Health and safety provisions - assessed by consultant
##Training workshop and awareness - assessed by consultant
###Arborists/caretaker included as suggested by Ministry of Finance, GoB.

The estimated EMP cost for the Western Part-2 has been estimated as 199.04 million BDT.

Table 28. Summary of EMP cost estimate for the Western Part-2.

Sl. No.	Unit	Item	Unit Price (BDT)	Amount	Total Amount (BDT)
1	No	Tree plantation in both sides of elevated road and slops of ramp and intersection embankments	300*	116,000	34,800,000
2	No	Vetiver sapling / Bermuda grass sapling plantation on embankment slope	50**	200,000	10,000,000
3	Month x km	Maintenance of tree saplings and Vetiver / Bermuda saplings (24 months for total length of 56.77 km)	8,130***	2,736	22,243,680
4	Month	Environmental monitoring (Air, water, soil, noise and vibration)	115,000****	108	12,420,000
5	Month	Dust suppression by water sprinkling	50,000*****	108	5,400,000
6	Month	Health and safety provisions	500,000#	108	54,000,000
7	No	Training workshop and awareness @ 3 months interval)	60,000##	40	2,400,000
8	Person Month	Arborists/caretakers will maintain the security of trees, watering, fencing, etc. with necessary tools (24 months for 20 arborists)	21,119###	2,736	57,781,584
		Total=			**199,045,264**

Note: **Tree plantation cost as considered in EMP of Padma Multipurpose bridge project Bangladesh and South Asia Sub-Regional Economic Cooperation (SASEC) Road Connectivity Project, Bangladesh.*
***Vetiver and Bermuda grass roots plantation rates and plantation maintenance cost considered as per EMP cost of Matarbari Port Development Project (RHD component). Maintenance for 108 months for 57 km of the road*
****Environmental monitoring cost as per rate quoted by Development Solutions Consultant Limited (an agency approved by BBA) for Baseline data generation for EIA preparation*
*****Dust suppression by water sprinkling – as per market rate and discussion with BBA*
#Health and safety provisions - assessed by consultant
##Training workshop and awareness - assessed by consultant
###Arborists/caretaker included as suggested by Ministry of Finance, GoB.

5.1.5. Environmental Monitoring Plan including Institutional Arrangement

An institutional arrangement must be ensured for conducting an effective and meaningful environmental monitoring. An Environmental and Resettlement Unit (ERU) instituted within Bangladesh Bridge Authority (BBA) will be overall responsible for conducting environmental monitoring. Construction contractor and Environmental Specialist of the Construction Supervising Consultants will also be included in ERU. Department of Environment (DoE) is responsible for ensuring that Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) are carried out following the requirements of the Bangladesh Environmental Conservation Act, 1995 and

Environmental Conservation Rules, 2023. The BBA has a Safeguard Unit (SU) with a few staff now. However, now it is likely that the BBA role will be confined to managing Consultants who will do the EIA work. The BBA other role will be to liaison with the DoE to ensure that the correct procedures are followed so that Environmental Clearance Certificates for the EIA of the project is issued in a timely manner.

Analysis of environmental quality parameters in relation to monitoring will be conducted by nationally accredited laboratories such as those of BUET, Atomic Energy and DoE. Following environmental parameters will be monitored during and after construction of the bridge:

Table 29. Analysis of environmental quality parameters.

Environmental Component	Parameters	Sampling No./Year
Air	CO, NO_x, SO_2, Lead and SPM ($PM_{2.5}$ and PM_{10})	4 (during pavement works) & plant site
Noise	Noise level in dB (A)	Continuous
Surface Water (River and Inland Water bodies)	Turbidity, EC, TDS, SS, COD, BOD, DO, pH, grease and oil	4 (During pile driving)
Drinking Water/Ground Water	pH, Fe, Mn, As, Fe, Chloride as CL, Coliform bacteria	4
Earth Metal	Zn, Pb, Cr, Hg, Cd	1 (prior to filling)
Road and Water Transport	Arrangement, safety	Continuous
Dust nuisance	Visual inspection	Continuous
Solid Wastes	Leachate quality at dump site	Continuous
Property Damages	Inspection and reporting	Occasional
Social Disruption/Community Split	Complaints	Occasional
Health, Sanitation and Safety	Routine checking	Continuous
Ecological monitoring (Survey of plant, fish and wildlife)	Number of trees, fish and wildlife	Quarterly

5.1.6. Emergency Response Plan and Disaster Risk Assessment

The site lies in a low cyclone and flood prone area. Thus, necessary measures are required to be undertaken in cyclone and flood conditions to manage the damage during emergency has been incorporated in the design and also in EIA report. Climate change and disaster impact assessment in the proposed bridge project area has also been incorporated in the report and found that due climate change effects the project area is low prone to earthquake, erosion and flood which has been taken care and incorporated in the design.

5.1.7. Conclusion

It can therefore be concluded that the proposed Dhaka Elevated Inner Circular Road Project would be environmentally sound and sustainable. It can arguably be stated that in the context of the Dhaka Elevated Inner Circular Road Project, aggregated positive impacts outweigh negative impacts through the implementation of the recommended mitigation measures.

6. SOCIAL SAFEGUARD ASSESSMENT

6.1. Summary of Key Findings

Table 30. Summary of the project social impacts. Eastern Part-1.

Sl. No.	Project Impacts	Unit	Total
1	Total Affected Land	Acre	323.45
1.1	Total Affected Private Land	Acre	285.23
1.2	Total Affected Govt. Land	Acre	38.22
2	Number of Mouza affected	Nos.	37
3	Commercial Structure affected HH	Nos.	123
4	Residential Structure affected HH	Nos.	623
5	Both Structure (Commercial & Residential) affected HH	Nos.	50
6	Secondary Structure affected HH	Nos.	20
7	**Total HH. (3+4+5+6)**	**Nos.**	**816**
8	Number of CPRs affected	Nos.	27
9	**Total number of Project Affected Units (7+8)**	**Nos.**	**843**
10	Number of businesses affected	Nos.	213
11	Number of trees affected	Nos.	3,259
12	Total Tenants	Nos.	514
13	Total Business loss	Nos.	213
14	Total number of persons affected	Nos.	2,656
15	Total affected primary structure from HHs and CPRs	Sft	1,847,617

Table 31. Summary of the project social impacts. Western Part-2.

Sl. No.	Project Impacts	Unit	Total
1	Total Affected Land	Acre	272.70
1.1	Total Affected Private Land	Acre	117.79
1.2	Total Affected Govt. Land	Acre	154.91
2	Number of Mouza affected	Nos.	39
3	Commercial Structure affected HH	Nos.	342
4	Residential Structure affected HH	Nos.	537
5	Both Structure (Commercial & Residential) affected HH	Nos.	65
6	Secondary Structure affected HH	Nos.	7
7	**Total HH. (3+4+5+6)**	**Nos.**	**951**
8	Number of CPRs affected	Nos.	76
9	**Total number of Project Affected Units (7+8)**	**Nos.**	**1,027**
10	Number of businesses affected	Nos.	560
11	Number of trees affected	Nos.	2,304
12	Total Tenants	Nos.	498
13	Total Wage loss	Nos.	120
14	Total number of persons affected	Nos.	2,428
15	Total affected primary structure from HHs and CPRs	Sft	4,352,289

6.2. Consultation and Participation

- **Eastern Part-1**

A total of two consultation meetings and eight Small Group Meeting were held at separate locations during the period from March to April 2024 with the affected people, local government representatives and others. A total of 380 people (male 372 and female 08) were present in the meetings. Meetings were held within the footprint of the proposed sites to address the affected people and other stakeholders associated with the road. Stakeholders were briefed about the project goals and objectives, potential impacts on the people, mitigation measures as per the Acquisition and Requisition of Immoveable Property Act (ARIPA 2017). and GOB Resettlement Policy for the affected people 2018. on involuntary resettlement, ultimate benefits of the local people, land acquisition requirements and process, roles of the affected people and project authority in delivering compensation and grievance redress. Opinion of the people was sought and well recorded during the consultation meeting. Local government representatives affected people, and beneficiary groups raised their voice and made suggestions to improve the terminals for their better communication and business.

- **Western Part-2**

A total of eight small group consultation meetings were conducted to share and discuss the project information with the local affected community.

6.3. Legal and Policy Framework

To address the legal framework for land acquisition and resettlement of the affected people by the project, the Acquisition and Requisition of Immovable Property Act, 2017 (ARIPA) would be endorsed.

6.4. Grievance Redress Mechanism

This project would follow specific grievance redress mechanism to ensure that the voices of the APs merge with implementation decisions.

6.5. Summary of Project Impact

Eastern Part-1 of the Dhaka Elevated Inner Circular Road will run along 26.98 km between the Demra Staff Quarters and the Abdullahpur Bus Stand. The impacts of a project, including 323.45 acres of land (285.23 private plus 38.22 Govt.) will require acquisition and requisition for the project. It is identified that the land acquisition will require from 37 administrative Mouzas. According to the detailed census and IOL survey, total 843 project affected units including 816 HHs and 27 CPRs will be affected by losing their immoveable assets. Due to acquisition of land 623 residential structure and commercial 123 structures will need to be dismantled. Apart from the primary structures a significant quantity of secondary structures will also be affected. The assessment was also identified that 213 business premises including running business will be affected by the project interventions.

Western Part-2 of the Dhaka Elevated Inner Circular Road will run along 57.02 km and would impact on an estimated total of 272.70 acres of land being acquired. This includes 117.79 acres of private land and 154.91 acres of government land across 39 affected mouzas. A total of 1,027 project-affected units, including 951 HHs and 76 CPRs including religious, educational, and social facilities, will be impacted by the loss of their immoveable assets, according to the detailed census and IOL survey. A sizeable number of secondary structures in addition to the primary ones will also be impacted. The project interventions will have an impact on 560 business premises, including those that are actively conducting business, according to the assessment.

6.6. Estimated Cost

Table 32. Summary of Cost & budget for RAP Implementation. Eastern Part-1.

SL.	Category of Loss	DC (BDT)	Additional (BDT)	Estimate (BDT)	%
A	Compensation For Acquisition Land	43,992,511,720	38,254,594,846	82,247,106,565	79.12
B	Compensation for structure	3,309,249,655		3,309,249,655	3.18
C	Compensation for Trees	12,807,500		12,807,500	0.01
	Impact Budget (A+C)	**47,314,568,875**	**38,254,594,846**	**85,569,163,720**	

SL.	Category of Loss	DC (BDT)	Additional (BDT)	Estimate (BDT)	%
E	Other Resettlement Benefits		9,988,678,502	9,988,678,502	9.61
F	Provisional cost of construction of resettlement side		1,500,000,000	1,500,000,000	1.44
G	Operation cost for RAP Implementing Agency/ INGO		80,000,000	80,000,000	0.08
H	Operation cost for External Monitoring Agency		20,000,000	20,000,000	0.02
I	Contingency @5% of the total budget		4,857,892,111	4,857,892,111	4.67
j	Administrative cost @ 2% on the total budget		1,943,156,844	1,943,156,844	1.87
	Grand Total	47,314,568,875	56,644,322,303	103,958,891,178	100.00

Table 33. Summary of Cost & budget for RAP Implementation. Western Part-2.

SL.	Category of Loss	DC (BDT)	Additional (BDT)	Estimate (BDT)	%
A	Compensation For Acquisition Land	37,918,585,484	20,115,418,550	58,034,004,035	76.66
B	Compensation for structure	9,574,289,956		9,574,289,956	12.65
C	Compensation for Trees	7,829,000		7,829,000	0.01
	Impact Budget (A+C)	47,500,704,440	20,115,418,550	67,616,122,991	89.31
E	Other Resettlement Benefits		1,588,781,373	1,588,781,373	2.10
F	Provisional cost of construction of resettlement side		1,500,000,000	1,500,000,000	1.44
G	Operation cost for RAP Implementing Agency/ INGO		40,000,000	40,000,000	0.05
H	Operation cost for External Monitoring Agency		10,000,000	10,000,000	0.01
I	Administrative cost @ 2% on the total budget		1,415,098,087	1,415,098,087	1.87
j	Contingency @5% of the total budget		3,537,745,218	3,537,745,218	4.67
	Grand Total	**47,500,704,440**	**28,207,043,228**	**75,707,747,669**	**100.00**

7. COST-BENEFIT AND FINANCIAL ANALYSIS

7.1. Socio-Economic Analysis

This section presents the **Socio-Economic Analysis** of the Dhaka Elevated Inner Circular project. The Economic Analysis or Cost-Benefit Analysis (CBA) is a **method used to assess the profitability of a project from a social point of view, by quantifying the costs and benefits of an investment project in monetary terms to allocate society resources in an efficient way**[1].

In this analysis, the social costs and benefits of the selected project design analysed are compared. **Social benefits** are defined as the set of all socially desirable effects derived from a project (effects which are not always equivalent to financial revenue streams) which increase the general welfare of all citizens through the efficient use of public resources. The result of this analysis is the net social benefit or social profitability of the project.

The economic adjustments from financial data using standard conversion factor have been appraised from the point of view of the entire economy, considering costs and benefits.

(a) Identify the direct, indirect, and associated cost and benefit components.

In the case of the implementation of a new public transport infrastructure, within a pre-existing network transport system, the sources of benefits to be studied could a priori are the following:

- Change in travel time costs (savings), for users in the system, before and after the construction.
- Net savings in system vehicle operating costs of all modes involved: energy, fuel, lubricants.
- Lower accident costs for travellers
- Investment and conservation cost variation (maintenance and repairs) in infrastructures
- Lower environmental costs (emissions reduction, pollution reduction, etc.).

The tables below summarize the project capital expenses breakdown for each part (Eastern Part-1 and Western Part-2) Capital expenses (costs are without VAT).

Eastern Part-1

Table 34. Total project Capex (2025 monetary units) – Eastern Part-1.

Number	Item	Cr BDT
1	General and Site Facilities	693.84
2	Structural Works	17,090.71
3	Road and drainage works	500.12

[1] Economic appraisal differs from the financial analysis in the fact that many of the social and economic benefits and costs are public goods (health, security, time…) or goods without a clear market, and therefore some technical corrections need to be incorporated: conversion factors, shadow prices, etc.

Number	Item	Cr BDT
4	Electrical works & Traffic Management System	147.11
5	Toll Plaza Civil Works	407.95
6	Temporary Works	191.61
7	Relocation and/or removal of Public Utilities	4,286.51
8	Provisional Sum for Physical Contingency = 3% of (A)	699.54
9	Provisional Sum for Price Contingency = 6% of (C)	1,441.04
10	Land Acquisition and Resettlement Costs	10,645.39
11	Design Cost = 2% of (A)	435.94
12	Construction Supervision = 5% of (A)	1,089.86
	TOTAL	37,629.63

Western Part-2, Option A

Table 35. Total project Capex (2028 monetary units) – Western Part-2, Option A.

Number	Item	Cr BDT
1	General and Site Facilities	1,800.43
2	Structural Works	29,437.31
3	Road and drainage works	3,076.49
4	Electrical works & Traffic Management System	317.02
5	Toll Plaza Civil Works	414.15
6	Temporary Works	1,669.14
7	Relocation and/or removal of Public Utilities	5,316.35
8	Provisional Sum for Physical Contingency = 3% of (A)	1,260.92
9	Provisional Sum for Price Contingency = 6% of (C)	2,597.51
10	Land Acquisition and Resettlement Costs	8,653.52
11	Design Cost = 2% of (A)	785.80
12	Construction Supervision = 5% of (A)	1,964.49
	TOTAL	57,293.15

Western Part-2, Option B

Table 36. Total project Capex (2033 monetary units) – Western Part-2, Option B.

Number	Item	Cr BDT
1	General and Site Facilities	529.89

Number	Item	Cr BDT
2	Structural Works	7,508.30
3	Road and drainage works	1,096.01
4	Electrical works & Traffic Management System	112.90
5	Toll Plaza Civil Works	147.75
6	Temporary Works	491.24
7	Relocation and/or removal of Public Utilities	716.15
8	Provisional Sum for Physical Contingency = 3% of (A)	318.07
9	Provisional Sum for Price Contingency = 6% of (C)	655.22
10	Land Acquisition and Resettlement Costs	2,720.52
11	Design Cost = 2% of (A)	198.22
12	Construction Supervision = 5% of (A)	495.54
	TOTAL	14,989.80

(b) Adjust them where necessary.

Capex costs are adjusted considering the inflation from 2022 to 2025 (starting year of investments).

Eastern Part-1

Table 37. Capital expenses deployment with project –Eastern Part-1.

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Split by year of the CAPEX	1%	5%	10%	10%	10%	10%	13%	13%	14%	7%	7%

After applying this specific time frame, the expenses (in 2025 prices) are as follows:

Table 38. Capital expenses with project (Cr BDT) –Eastern Part-1.

2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
376.30	1,881.48	3,762.96	3,762.96	3,762.96	3,762.96	4,891.85	4,891.85	5,268.15	2,634.07	2,634.07

Western Part-2, Option A

Table 39. Capital expenses deployment with project – Western Part-2, Option A.

	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Split by year of the CAPEX	2%	2%	4%	8%	8%	12%	14%	14%	10%	10%	8%	8%

After applying this specific time frame, the expenses (in 2028 prices) are as follows:

Table 40. Capital expenses with project (Cr BDT) – Western Part-2, Option A.

2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
1,145.86	1,145.86	2,291.73	4,583.45	4,583.45	6,875.18	8,021.04	8,021.04	5,729.31	5,729.31	4,583.45	4,583.45

Regarding **the without project scenario** no investments have been considered.

Western Part-2, Option B

Table 41. Capital expenses deployment with project – Western Part-2, Option B.

	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Split by year of the CAPEX	2%	2%	6%	10%	16%	16%	16%	14%	10%	8%

After applying this specific time frame, the expenses (in 2033 prices) are as follows:

Table 42. Capital expenses with project (Cr BDT) – Western Part-2, Option B.

Capital expenditures	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
TOTAL	299.80	299.80	899.39	1,498.98	2,398.37	2,398.37	2,398.37	2,098.57	1,498.98	1,199.18

Regarding **the without project scenario** no investments have been considered.

The operating and maintenance expenses are as follows.

Eastern Part-1

Table 43. Maintenance expenses. Values per year (Cr BDT) - Eastern Part-1.

	With project	
Maintenance	Ordinary maintenance [Cr BDT/year]	Extraordinary [Cr BDT/year (when applied)]
Viaducts	78.62 (Y1, Y2) 123.05 (Y3) 146.98 (Y4, Y5) 170.91 (Y6-Y34)	314.47 (Y10, Y20, Y30) 177.74 (Y12, Y22, Y32) 95.71 (Y13, Y23, Y33) 95.71 (Y15, Y25)
Approaching roads	2.30 (Y1, Y2) 3.60 (Y3) 4.30 (Y4, Y5) 5.00 (Y6-Y34)	13.80 (Y10, Y20, Y30) 7.80 (Y12, Y22, Y32) 4.20 (Y13, Y23, Y33) 4.20 (Y15, Y25)
Toll Plaza & Facilities	5.52 (Y1, Y2) 8.63 (Y3) 10.31 (Y4, Y5) 11.99 (Y6-Y34)	22.06 (Y15, Y25, Y35) 12.47 (Y17, Y27) 6.72 (Y18, Y28) 6.72 (Y20, Y30)
TOTAL (sum during Operation period (30Y)	**5,892.35**	**2,136.93**

The following figures shows the split of the main positive NPV flows, showing that the passenger time savings is the element with the highest impact: around 77%.

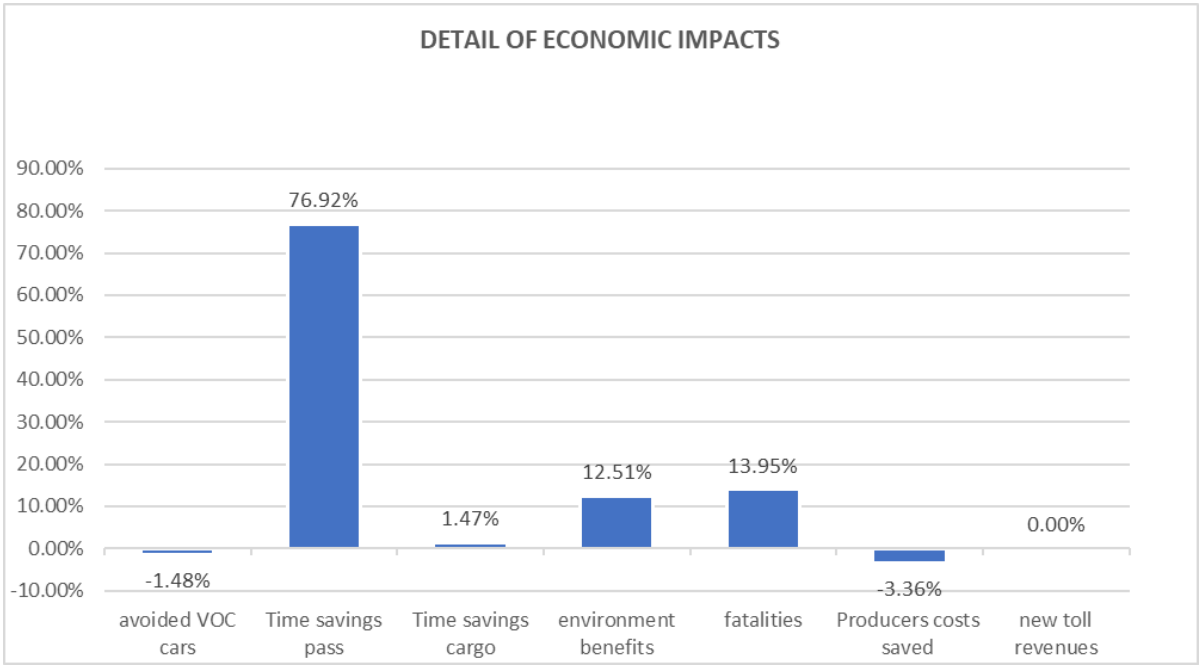

Figure 46. Detail of economic impacts.

Western Part-2, Option A

Table 44. Maintenance expenses. Values per year (Cr BDT) - Western Part-2, Option A.

	With project	
Maintenance	Ordinary maintenance [Cr BDT/year]	Extraordinary [Cr BDT/year (when applied)]
Viaducts	294.37	1,177.49 (Y10, Y20, Y30)
Approaching roads	30.76	184.59 (Y10, Y20, Y30)
Toll Plaza & Facilities	14.62	58.49 (Y15, Y25)
TOTAL (sum during Operation period (30Y)	**10,192.85**	**4,203.23**

The following figures shows the split of the main positive NPV flows, showing that the passenger time savings is the element with the highest impact: around 73%.

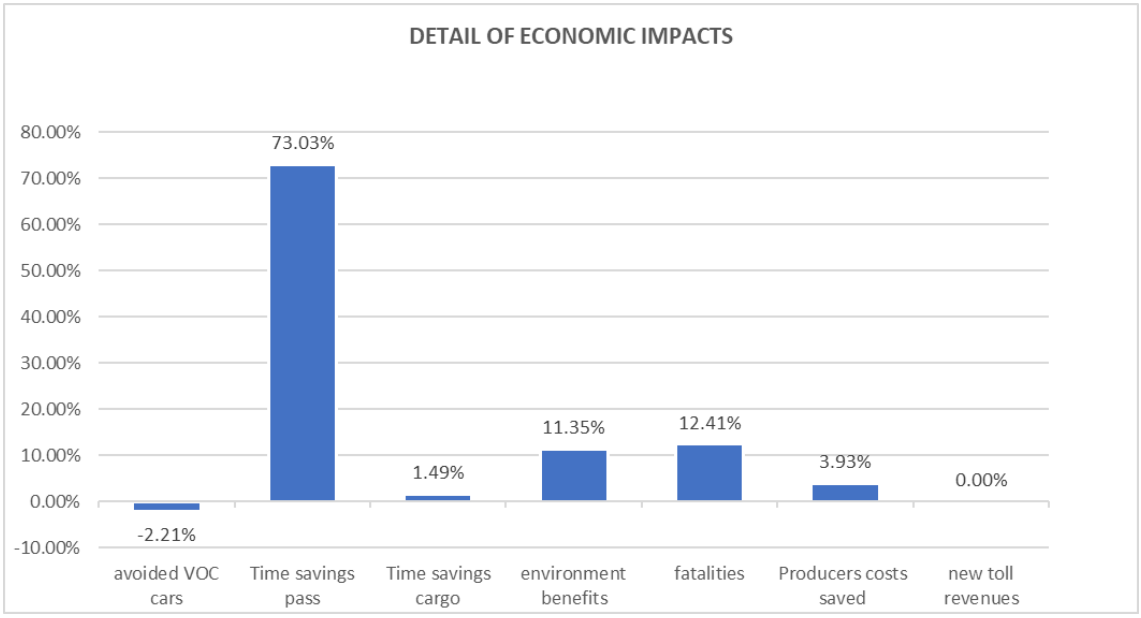

Figure 47. Detail of economic impacts.

Western Part-2, Option B

Table 45. Maintenance expenses. Values per year (Cr BDT) - Western Part-2, Option B.

	With project	
Maintenance	Ordinary maintenance [Cr BDT/year]	Extraordinary [Cr BDT/year] (when applied)]
Viaducts	51.06 (Y1-Y3) 75.08 (Y4-Y33)	204.23 (Y10, Y20, Y30) 96.11 (Y13, Y23, Y33)
Approaching roads	7.45 (Y1-Y3) 10.96 (Y4-Y33)	44.72 (Y10, Y20, Y30) 21.04 (Y13, Y23, Y33)
Toll Plaza & Facilities	3.54 (Y1-Y3) 5.21 (Y4-Y33)	6.67 (Y15, Y25) 14.18 (Y18, Y28)
TOTAL (sum during Operation period (30Y))	**2,923.84**	**1,139.98**

The following figures shows the split of the main positive NPV flows, showing that the passenger time savings is the element with the highest impact: around 91%.

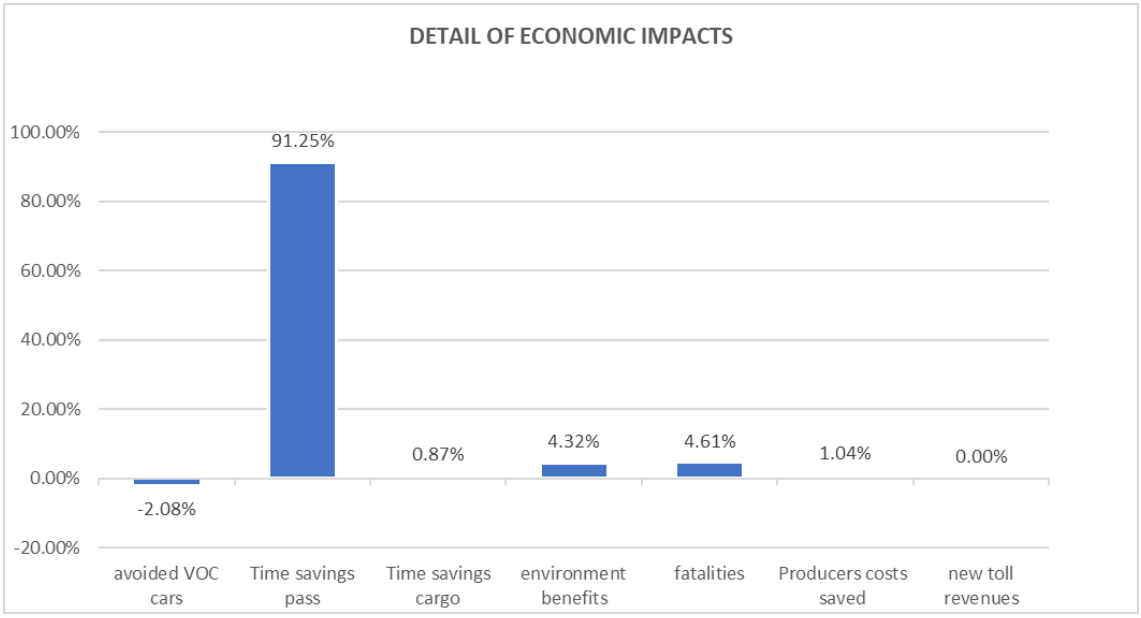

Figure 48. Detail of economic impacts.

(c) Convert the value of cost and benefit components into economic price by using Standard Conversion Factors (SCF) determined by the Government.

The conversion factors (CF) are employed to transform the market input prices into shadow prices. They represent ratios that connect both prices and they consider a more realistic value for the considered inputs. The values used frequently in ADB's Technical Assistance Consultants reports[2] have been applied for some of the outflows in this socioeconomic analysis. In particular:

Table 46. Considered Conversion factors.

Cost concept	CF value
Initial Capex	0.90
O&M costs	0.88
Reinvestment costs	0.88
Residual Value	0.90

(d) Construct the cash flow.

After having presented and described all assumptions, as well as the main methodologic elements, the project economic flows were calculated and projected for the period of analysis Project economic flows for the different years considered in the period have been estimated and projected (in Cr BDT). They are represented in the following figures, first undiscounted and then discounted:

[2] *For instance, ADB TAC report: "supporting Sustainable Urban transport I Aizawl City" (2016). Same CF values are present for instance in: "Detailed Project Report for Rail Based Mass Transit system in Kanpur" (RITES, 2019)*

Table 47. Economic model projections summary by type of impacts.

SOCIO ECONOMIC COSTS (Cr BDT)	NPV	2025	2026	2027	2028	2029	2030	2035	2040	2045	2050	2055	2060	2061	2062	2063	2064
Project initial investments	**-18,790.1**	**-338.7**	**-1,693.3**	**-3,386.7**	**-3,386.7**	**-3,386.7**	**-3,386.7**	**-2,370.7**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Residual value	**190.4**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**15,816.0**
Renovation works	**-831.9**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**-152.0**	**-465.6**	**-284.1**	**-471.5**	**-284.1**	**-471.5**	**-176.7**	**-340.0**	**-264.6**	**-176.7**
Change in Producer Surplus:	**-797.2**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**-21.2**	**-239.9**	**-310.6**	**-401.0**	**-504.2**	**-631.2**	**-659.8**	**-689.5**	**-720.4**	**-752.5**
Producers costs savings for the system	-797.2	0.0	0.0	0.0	0.0	0.0	0.0	-21.2	-239.9	-310.6	-401.0	-504.2	-631.2	-659.8	-689.5	-720.4	-752.5
Existing traffic	*-797.2*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*-21.2*	*-239.9*	*-310.6*	*-401.0*	*-504.2*	*-631.2*	*-659.8*	*-689.5*	*-720.4*	*-752.5*
Diverted traffic	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Toll revenues **generated traffic**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vehicle Op costs (generated traffic)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL ECONOMIC COSTS	**-20,228.9**	**-338.7**	**-1,693.3**	**-3,386.7**	**-3,386.7**	**-3,386.7**	**-3,386.7**	**-2,543.8**	**-705.6**	**-594.6**	**-872.5**	**-788.2**	**-1,102.7**	**-836.5**	**-1,029.5**	**-985.1**	**14,886.7**
SOCIO ECONOMIC BENEFITS (Cr BDT)																	
Change in Consumer Surplus:	**18,241.8**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1,992.7**	**4,716.8**	**6,491.4**	**8,877.0**	**11,578.5**	**15,124.2**	**15,957.2**	**16,837.3**	**17,767.2**	**18,749.7**
Existing traffic	*18,241.8*	0.0	0.0	0.0	0.0	0.0	0.0	1,992.7	4,716.8	6,491.4	8,877.0	11,578.5	15,124.2	15,957.2	16,837.3	17,767.2	18,749.7
Avoided (saved) costs private vehicle	-351.8	0.0	0.0	0.0	0.0	0.0	0.0	-25.8	-93.8	-134.9	-191.3	-257.7	-347.0	-368.3	-390.9	-414.8	-440.3
User passenger time savings	18,246.1	0.0	0.0	0.0	0.0	0.0	0.0	1,983.8	4,728.0	6,509.8	8,904.0	11,575.8	15,058.6	15,873.2	16,732.3	17,638.3	18,593.8
User freight time savings	347.5	0.0	0.0	0.0	0.0	0.0	0.0	34.7	82.6	116.5	164.3	260.4	412.5	452.3	495.9	543.7	596.2
Diverted traffic	*0.0*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Avoided (saved) costs private vehicle	*0.0*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
User passenger time savings	*0.0*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
User freight time savings	*0.0*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Generated traffic	*0.0*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
user Time costs savings	*0.0*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
user freight time savings	*0.0*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
additional costs private vehicle	*0.0*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Variation in Externalities	**6,276.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1,348.9**	**1,391.1**	**1,404.0**	**1,417.2**	**1,673.4**	**1,993.8**	**2,067.0**	**2,143.5**	**2,223.6**	**2,307.5**
accidents	3,309.7	0.0	0.0	0.0	0.0	0.0	0.0	711.9	728.1	734.0	740.0	862.4	1,014.2	1,048.7	1,084.8	1,122.5	1,161.9
Emissions	2,578.7	0.0	0.0	0.0	0.0	0.0	0.0	553.9	576.1	582.1	588.2	703.9	849.5	882.9	917.9	954.5	992.9
Air polution	1,516.5	0.0	0.0	0.0	0.0	0.0	0.0	325.9	338.8	342.3	345.8	413.8	499.5	519.1	539.7	561.3	583.9
Climate change	1,062.2	0.0	0.0	0.0	0.0	0.0	0.0	228.0	237.2	239.8	242.4	290.1	350.0	363.8	378.2	393.3	409.1
well to tank	387.6	0.0	0.0	0.0	0.0	0.0	0.0	83.1	86.9	87.9	88.9	107.1	130.0	135.3	140.8	146.6	152.6
ECONOMIC IMPACTS	**24,517.9**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**3,341.6**	**6,107.9**	**7,895.4**	**10,294.1**	**13,252.0**	**17,118.0**	**18,024.2**	**18,980.8**	**19,990.8**	**21,057.1**
NET BENEFITS (Cr BDT)	**4,289.0**	**-338.7**	**-1,693.3**	**-3,386.7**	**-3,386.7**	**-3,386.7**	**-3,386.7**	**797.8**	**5,402.4**	**7,300.8**	**9,421.6**	**12,463.7**	**16,015.3**	**17,187.7**	**17,951.3**	**19,005.7**	**35,943.8**

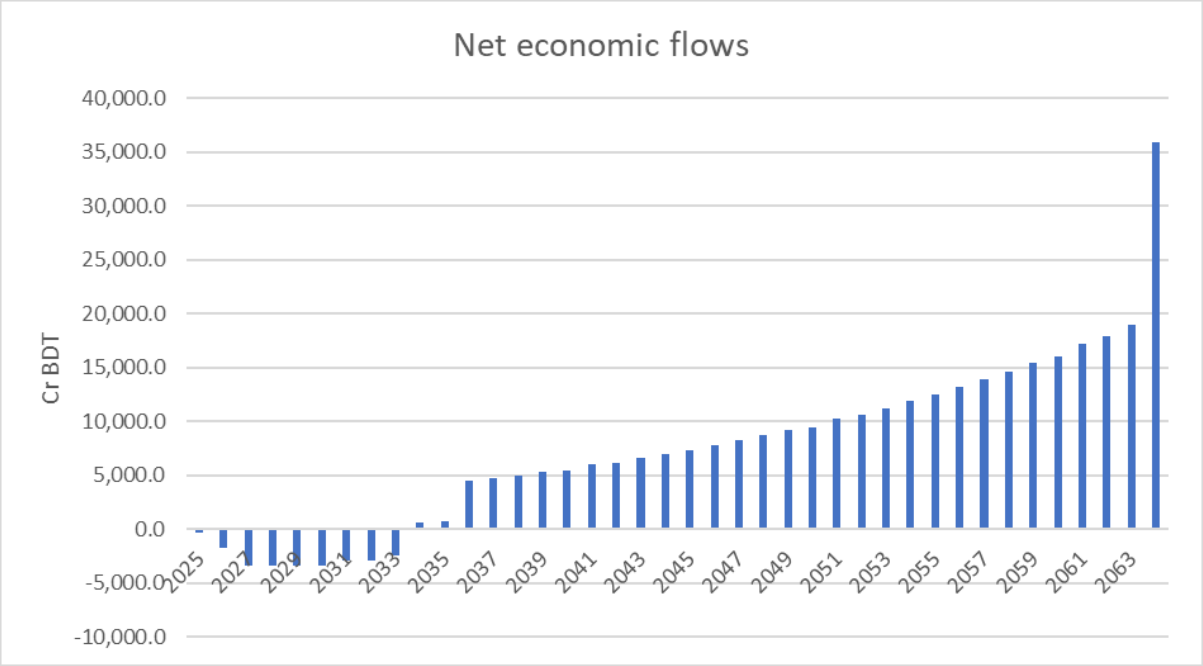

Figure 49. Undiscounted economic flows (Cr BDT).

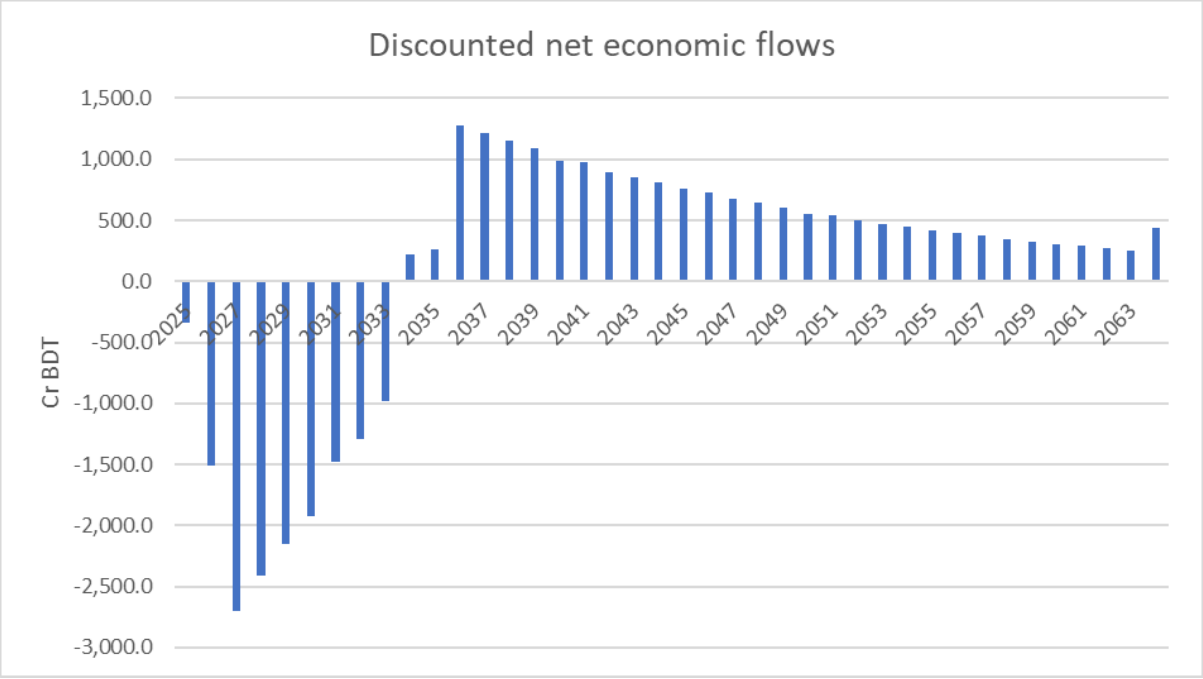

Figure 50. Discounted economic flows (Cr BDT).

Western Part-2, Option A

Table 48. Economic model projections summary by type of impacts.

SOCIO ECONOMIC COSTS (Cr BDT)	NPV	2028	2029	2030	2035	2040	2045	2050	2055	2060	2065	2066	2067	2068	2069
Project initial investments	**-26,044.0**	**-1,031.3**	**-1,031.3**	**-2,062.6**	**-7,218.9**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Residual value	**245.2**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**25,553.2**
Renovation works	**-885.2**	**0.0**	**0.0**	**0.0**	**0.0**	**-312.4**	**-312.4**	**-312.4**	**-312.4**	**-312.4**	**-312.4**	**-312.4**	**-312.4**	**-312.4**	**-1,511.1**
Change in Producer Surplus:	**672.6**	**0.0**	**0.0**	**0.0**	**0.0**	**-186.3**	**101.0**	**567.3**	**791.9**	**1,105.5**	**1,543.2**	**1,649.7**	**1,763.5**	**1,885.2**	**2,015.3**
Producers costs savings for the systen	672.6	0.0	0.0	0.0	0.0	-186.3	101.0	567.3	791.9	1,105.5	1,543.2	1,649.7	1,763.5	1,885.2	2,015.3
TOTAL ECONOMIC COSTS	**-26,011.4**	**-1,031.3**	**-1,031.3**	**-2,062.6**	**-7,218.9**	**-498.7**	**-211.4**	**254.8**	**479.5**	**793.0**	**1,230.8**	**1,337.3**	**1,451.1**	**1,572.8**	**26,057.5**
SOCIO ECONOMIC BENEFITS (Cr BDT															
Change in Consumer Surplus:	**12,391.8**	**0.0**	**0.0**	**0.0**	**0.0**	**3,126.3**	**4,206.6**	**5,649.9**	**7,730.3**	**10,577.7**	**14,474.8**	**15,412.1**	**16,410.1**	**17,472.8**	**18,604.4**
Existing traffic	*12,391.8*	0.0	0.0	0.0	0.0	3,126.3	4,206.6	5,649.9	7,730.3	10,577.7	14,474.8	15,412.1	16,410.1	17,472.8	18,604.4
Avoided (saved) costs private vehicle	-378.5	0.0	0.0	0.0	0.0	-81.6	-122.6	-180.4	-250.4	-347.6	-482.6	-515.3	-550.2	-587.6	-627.4
User passenger time savings	12,515.1	0.0	0.0	0.0	0.0	3,160.7	4,250.6	5,702.6	7,802.6	10,676.8	14,610.6	15,556.7	16,564.1	17,636.8	18,779.0
User freight time savings	255.2	0.0	0.0	0.0	0.0	47.3	78.6	127.6	178.1	248.5	346.8	370.7	396.2	423.6	452.8
Diverted traffic	*0.0*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Avoided (saved) costs private vehicle	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
User passenger time savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
User freight time savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Generated traffic	*0.0*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
user Time costs savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
user freight time savings	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
additional costs private vehicle	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Variation in Externalities	**4,072.1**	**0.0**	**0.0**	**0.0**	**0.0**	**1,654.2**	**1,720.4**	**1,788.2**	**1,960.6**	**2,149.8**	**2,357.6**	**2,401.5**	**30.0**	**30.7**	**31.4**
accidents	2,126.4	0.0	0.0	0.0	0.0	867.7	899.1	931.2	1,020.6	1,118.8	1,226.5	1,249.2	0.2	0.2	0.2
Emissions	1,691.7	0.0	0.0	0.0	0.0	683.8	714.1	745.1	817.1	896.2	983.1	1,001.4	26.0	26.5	27.1
Air polution	996.7	0.0	0.0	0.0	0.0	402.7	420.7	439.3	481.6	528.1	579.1	589.8	16.5	16.9	17.2
Climate change	694.9	0.0	0.0	0.0	0.0	281.2	293.3	305.8	335.5	368.2	404.0	411.6	9.5	9.7	9.9
well to tank	254.1	0.0	0.0	0.0	0.0	102.7	107.2	111.8	122.8	134.8	148.1	150.9	3.9	3.9	4.0
ECONOMIC IMPACTS	**16,463.9**	**0.0**	**0.0**	**0.0**	**0.0**	**4,780.5**	**5,927.0**	**7,438.1**	**9,690.9**	**12,727.5**	**16,832.4**	**17,813.6**	**16,440.2**	**17,503.5**	**18,635.8**
NET BENEFITS (Cr BDT)	**-9,547.5**	**-1,031.3**	**-1,031.3**	**-2,062.6**	**-7,218.9**	**4,281.8**	**5,715.6**	**7,692.9**	**10,170.4**	**13,520.5**	**18,063.2**	**19,150.9**	**17,891.3**	**19,076.3**	**44,693.2**

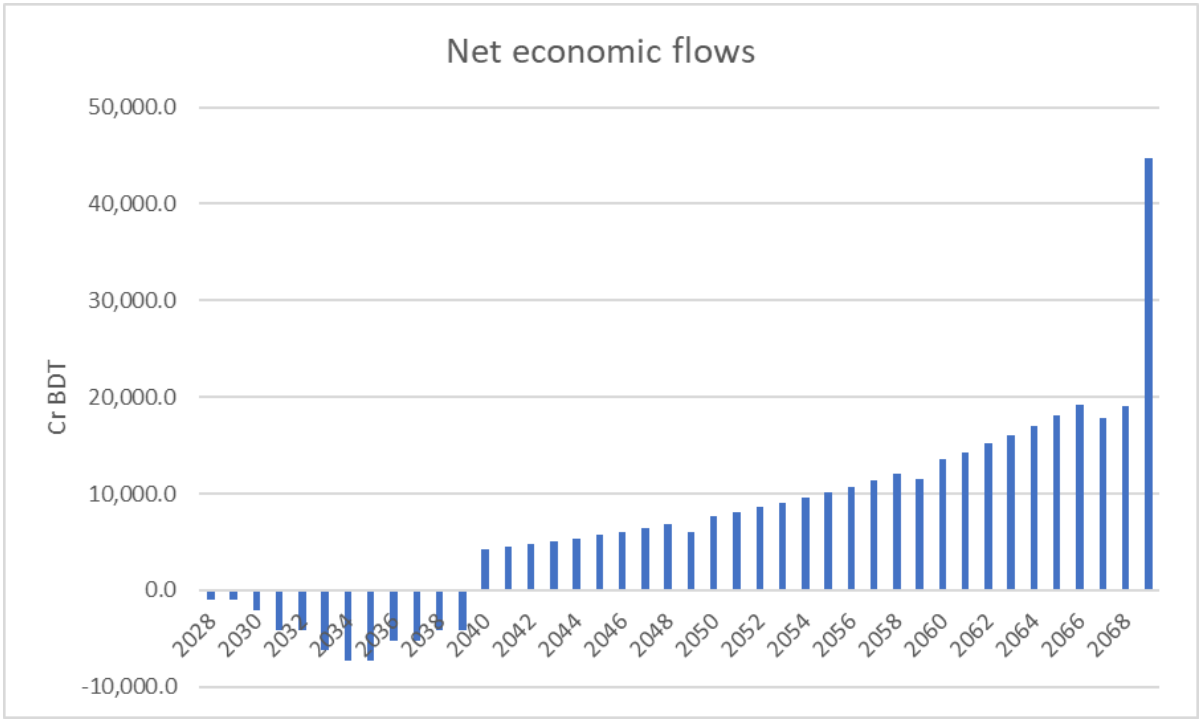

Figure 51. Undiscounted economic flows (Cr BDT).

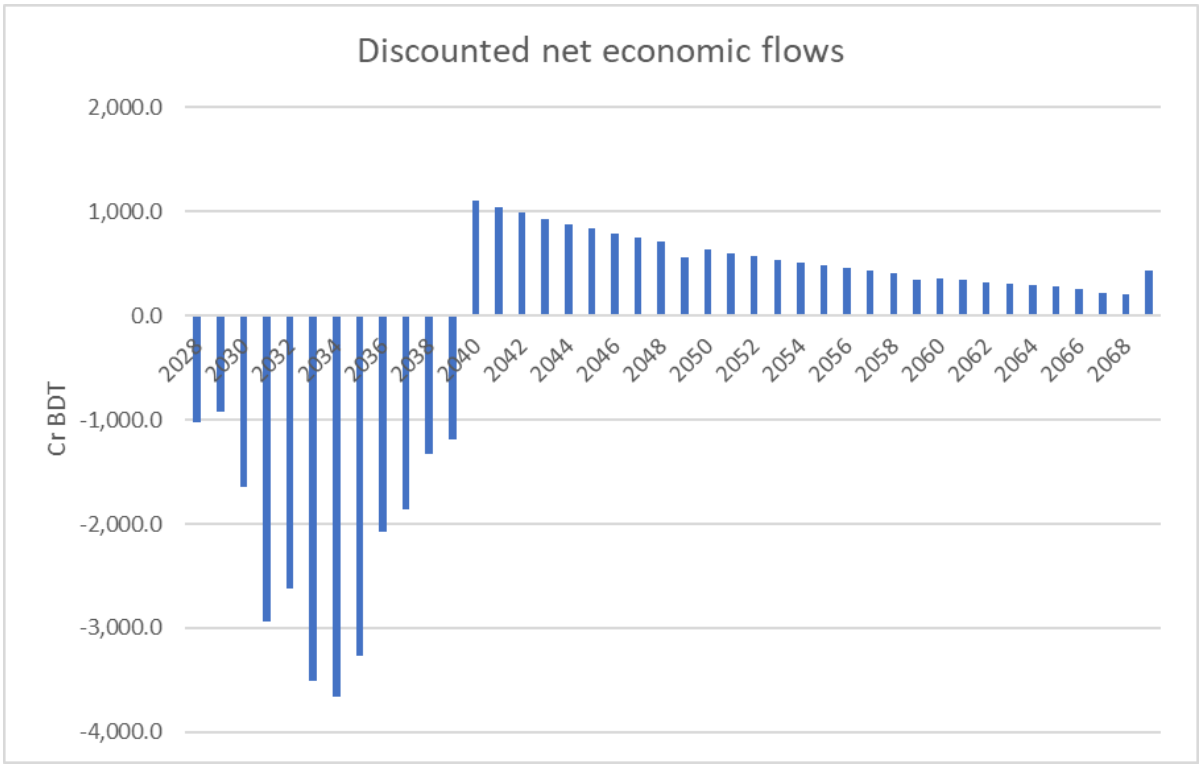

Figure 52. Discounted economic flows (Cr BDT).

Western Part–2, Option B

Table 49. Economic model projections summary by type of impacts.

SOCIO ECONOMIC COSTS (Cr BDT)	NPV	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2050	2070	2071	2072
Project initial investments	-7,594.9	-269.8	-269.8	-809.4	-1,349.1	-2,158.5	-2,158.5	-2,158.5	-1,888.7	-1,349.1	-1,079.3	0.0	0.0	0.0	0.0	0.0
Residual value	79.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6,606.9
Renovation works	-442.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-72.2	-72.2	-72.2	-97.9	-97.9	-97.9	-97.9	-201.0
Change in Producer Surplus:	122.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-19.6	-14.7	-9.1	1.0	54.2	194.5	207.2	220.8
Producers costs savings for the systen	122.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-19.6	-14.7	-9.1	1.0	54.2	194.5	207.2	220.8
TOTAL ECONOMIC COSTS	-7,834.8	-269.8	-269.8	-809.4	-1,349.1	-2,158.5	-2,158.5	-2,158.5	-1,980.5	-1,435.9	-1,160.6	-96.8	-43.7	96.6	109.4	6,626.8
SOCIO ECONOMIC BENEFITS (Cr BDT																
Change in Consumer Surplus:	10,646.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,103.2	1,179.9	1,261.7	1,799.7	2,814.2	9,816.8	10,450.1	11,124.2
Avoided (saved) costs private vehicle	-246.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-27.1	-28.3	-29.5	-41.3	-63.3	-235.3	-251.2	-268.3
User passenger time savings	10,789.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,122.7	1,199.9	1,282.0	1,823.6	2,846.5	9,966.7	10,611.5	11,298.0
User freight time savings	102.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.6	8.4	9.2	17.4	30.9	85.4	89.8	94.5
Variation in Externalities	1,055.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	238.3	240.7	243.2	246.4	262.2	318.6	321.8	1.9
accidents	545.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	123.4	124.7	125.9	126.9	134.7	167.1	169.0	-4.3
Emissions	444.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	99.9	101.0	102.0	104.0	111.1	132.1	133.3	5.7
Air polution	263.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59.0	59.6	60.2	61.6	65.9	78.4	79.1	4.2
Climate change	181.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.9	41.3	41.7	42.4	45.1	53.7	54.2	1.5
well to tank	66.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0	15.1	15.3	15.5	16.4	19.4	19.5	0.5
ECONOMIC IMPACTS	11,701.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,341.5	1,420.7	1,504.8	2,046.1	3,076.3	10,135.4	10,771.9	11,126.1
NET BENEFITS (Cr BDT)	3,866.9	-269.8	-269.8	-809.4	-1,349.1	-2,158.5	-2,158.5	-2,158.5	-639.0	-15.3	344.2	1,949.2	3,032.6	10,232.0	10,881.3	17,752.9

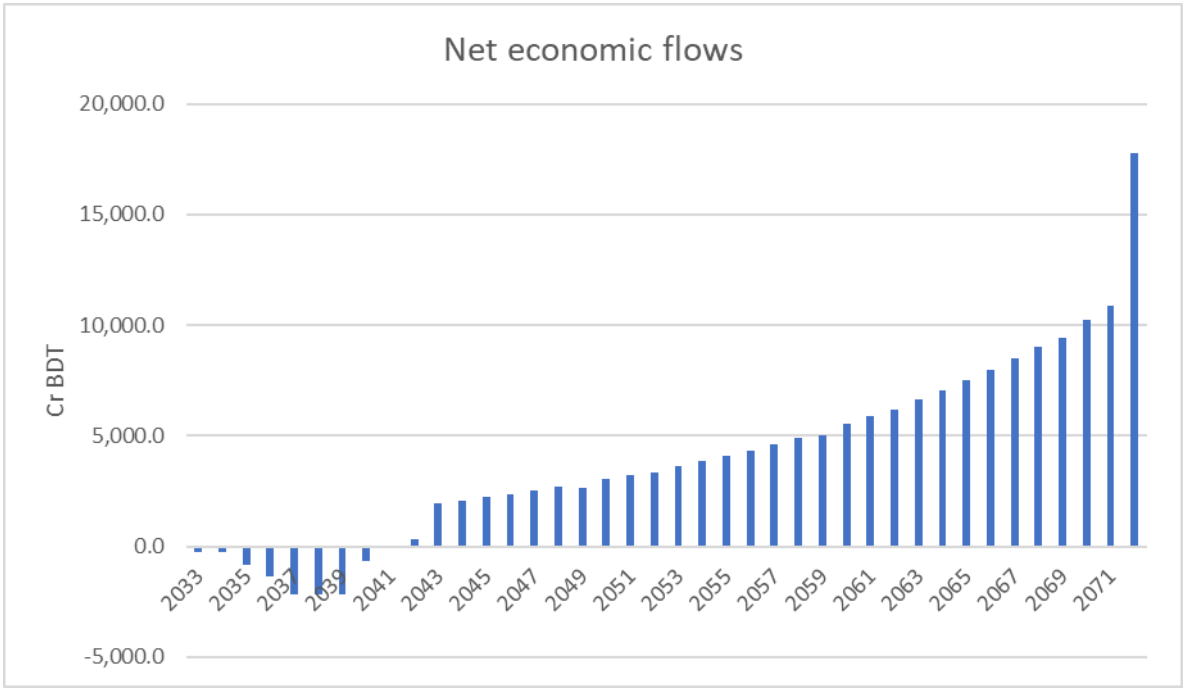

Figure 53. Undiscounted economic flows (Cr BDT).

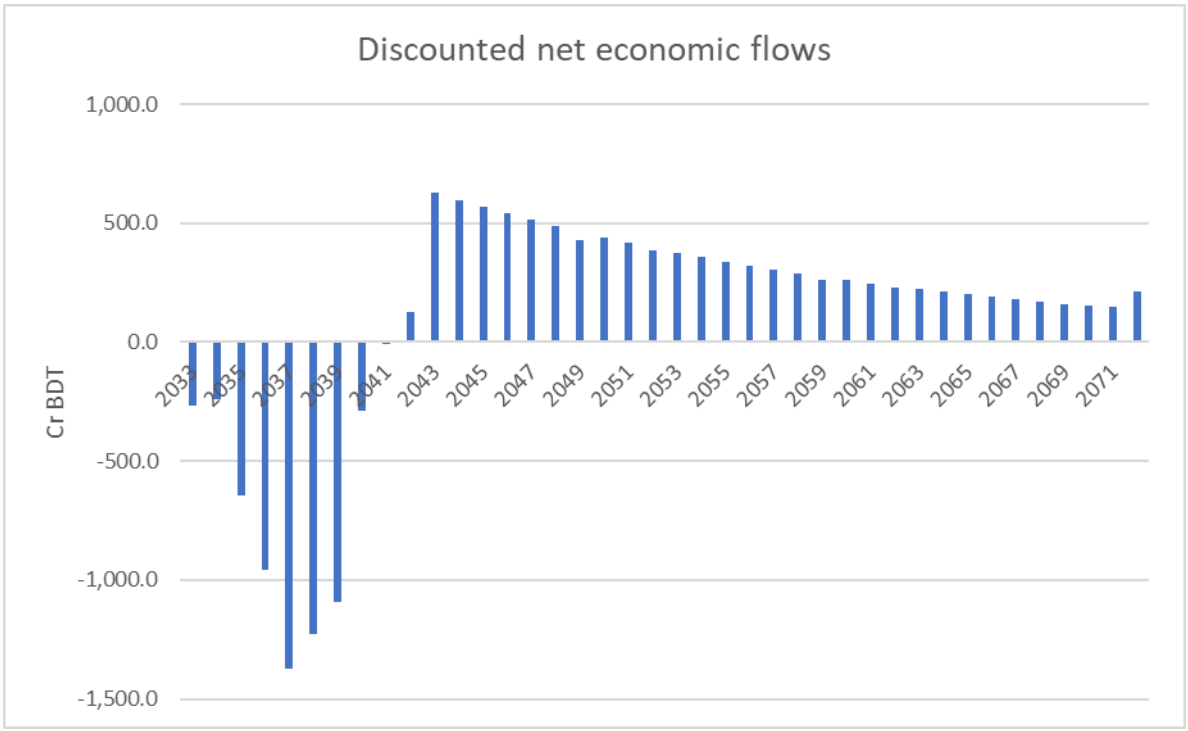

Figure 54. Discounted economic flows (Cr BDT).

(e) Mention the Assumption

Eastern Part-1

The base year for study projections of the DEICR Eastern Part-1 has been set in 2025 (1st January) and the horizon year in 2064.

- Total Investments period (including all phases): 11 years (2025-2035)
- Total operations period (starting from the operation of Phase 1): 34 years (2031-2064)

Since socioeconomic analysis is referred to the first year of operation, prices and costs initially estimated today (mid- 2024) have been converted to 2025 applying half the following inflation rates to account for half of the year 2024[3].

Table 50. Inflation considered.

Year	Inflation
2024	6.80%

The Values used for VoT in the model are clearly conservative values considering the different recent studies (ADB, JICA, etc.) and projects analysed in Bangladesh as well as other international references.

Table 51. Values for VoT.

Mode	VoT BDT/pass-h (2022)	VoT BDT/pass-h (2025)
Light vehicles	118.92 BDT/pass-h	129.54 BDT/pass-h
Buses	93.89 BDT/pass-h	102.27 BDT/pass-h
Truck	4.38 BDT/ton-h	4.77 BDT/ton-h

Value of Time is firstly capitalized from 2022 terms to 2025 terms. The total increase is 8.93%, which is: 0.7 x increase in GDP pc growth of years 2023 (5.94%) and 2024 (6.93%).

After capitalization VOT values have an annual increase (over projection period 2025 - 2063) of 4.5%/ year[4].

Vehicle Operating costs (VOC's) adopted were obtained in a case- by- case modal basis, undertaking a comparative study with cases mostly from Bangladesh, but also from India, or other international benchmarks references. In general, it has been adopted (likewise the adoption of figures for Value of Time) a quite conservative approach when selecting VOC values.

Vehicle Operating cost (VOC) value is first capitalized from 2022 terms to 2025 terms. The total increase is 16.47%, which is the compound inflation rate passed in the years 2023 and 2024.

[3] *https://www.imf.org/,International Monetary Fund, World Economic Outlook Database, October 2022*
[4] *0.7 x last year GDP growth pc computed (ie 2024: 6.43%): 0.7 x 6.43% = 4.5%.*

After capitalization VOC values have an annual increase (over projection period 2025-2063) 4.5%/y[5].

The figures adopted are:

Table 52. Vehicle operating costs by mode.

Mode	BDT / veh – km (2022)	BDT / veh – km (2025)
Light vehicles	15.40	17.94
Buses	33.00	38.43
Truck	44.00	51.24

It has been considered a reference social discount rate of **12%** for the economic analysis, following the Memo no 20.804.014.00.00.014.027.18-177 sent by the Planning Division of the *Ministry of Planning of Bangladesh*.

Residual value has been estimated according to traditional procedures and international best practices: EU Cost- Benefit handbook, ADB guidelines, World Bank, etc. More precisely the standard approach of estimating the amount of depreciation not computed in the analysis period (*net book value or remaining depreciation costs method)* has been used. The "Net Book Value" approach[6] is considered to be less distorting than the alternative approach.

Western Part-2, Option A

The base year for study projections of the DEICR Western Part-2, Option A has been set in 2028 (1st January) and the horizon year in 2069 (31st December)

- Total Investments period: 12 years (2028-2039)
- Total operations period: 30 years (2040-2069)

Since socioeconomic analysis is referred to the first year of operation, prices and costs initially estimated today (mid- 2024) have been converted to 2028 applying half the inflation rate of the current year to account for half of the year 2024, as well as the inflation rates of years 2025, 2026, 2027[7].

Table 53. Inflation considered.

Year	Inflation
2024	6.80%
2025	6.00%
2026	5.70%
2027	5.50%

[5] *0.7 x last year GDP growth pc computed (ie 2024: 6.43%): 0.7 x 6.43% = 4.5%.*

[6] *CBA handbook EU 2014, pages 34, 35*

[7] *https://www.imf.org/,International Monetary Fund, World Economic Outlook Database, October 2022*

The Values used for VoT in the model are clearly conservative values considering the different recent studies (ADB, JICA, etc.) and projects analysed in Bangladesh as well as other international references. It should be noted that the VoT has been adjusted in the current study, to represent the increased VoT in the capital of Dhaka, which is expected to be 13.8% higher compared to the other parts of the country.

Table 54. Values for VoT.

Mode	VoT BDT/pass-h (2022)	VoT BDT/pass-h (2028)
Light vehicles	118.92 BDT/pass-h	149.81 BDT/pass-h
Buses	93.89 BDT/pass-h	118.27 BDT/pass-h
Truck	4.38 BDT/ton-h	5.52 BDT/ton-h

Value of Time is firstly capitalized from 2022 terms to 2028 terms. The total increase is 25.97%, which is: 0.7 x increase in GDP pc growth of years 2023 (5.94%), 2024 (6.43%), 2025 (6.63%), 2026 (6.73%) and 2027 (6.84%).

After capitalization VOT values have an annual increase (over projection period 2028-2069) of 4.79%/ year[8].

Vehicle Operating costs (VOC's) adopted were obtained in a case- by- case modal basis, undertaking a comparative study with cases mostly from Bangladesh, but also from India, or other international benchmarks references. In general, it has been adopted (likewise the adoption of figures for Value of Time) a quite conservative approach when selecting VOC values.

Vehicle Operating cost (VOC) value is first capitalized from 2022 terms to 2028 terms. The total increase is 37.67%, which is the compound inflation rate passed in the years 2023, 2024, 2025, 2026 and 2027.

After capitalization VOC values have an annual increase (over projection period 2028-2069) of 4.79%/ year[9].

Table 55. Vehicle operating costs by mode.

Mode	BDT / veh – km (2022)	BDT / veh – km (2028)
Light vehicles	15.40	21.2
Buses	33.00	45.43
Truck	44.00	60.57

[8] *0.7 x last year GDP growth pc computed (ie 2027: 6.84%): 0.7 x 6.84% = 4.79%.*
[9] *0.7 x last year GDP growth pc computed (ie 2024: 6.84%): 0.7 x 6.84% = 4.79%.*

It has been considered a reference social discount rate of **12%** for the economic analysis, following the Memo no 20.804.014.00.00.014.027.18-177 sent by the Planning Division of the *Ministry of Planning of Bangladesh*.

Residual value has been estimated according to traditional procedures and international best practices: EU Cost- Benefit handbook, ADB guidelines, World Bank, etc. More precisely, the standard approach of estimating the amount of depreciation not computed in the analysis period (*net book value or remaining depreciation costs method)* is used. The "Net Book Value" approach[10] is less distorting than the alternative approach.

Western Part-2, Option B

The base year for study projections of the DEICR Eastern Part-2, Option B has been set in 2033 (1st January) and the horizon year in 2072 (31st December).

- Total Investments period (including both phases): 10 years (2033-2042)
- Total operations period (starting from the operation of Phase 1): 33 years (2040-2072)

Since socioeconomic analysis is referred to the first year of operation, prices and costs initially estimated today (mid- 2024) have been converted to 2033 applying half the following inflation rates to account for half of the year 2024 and the inflation rates for the years 2025-2032[11].

Table 56. Inflation considered.

Year	Inflation
2024	6.80%
2025	6.00%
2026	5.70%
2027-2032	5.50%

The Values used for VoT in the model are clearly conservative values considering the different recent studies (ADB, JICA, etc.) and projects analysed in Bangladesh as well as other international references. It should be noted that the VoT has been adjusted in the current study, to represent the increased VoT in the capital of Dhaka, which is expected to be 13.8% higher compared to the other parts of the country.

[10] *CBA handbook EU 2014, pages 34, 35*

[11] *https://www.imf.org/,International Monetary Fund, World Economic Outlook Database, October 2022*

Table 57. Values for VoT

Mode	VoT BDT/pass-h (2022)	VoT BDT/pass-h (2033)
Light vehicles	118.92 BDT/pass-h	194.53 BDT/pass-h
Buses	93.89 BDT/pass-h	153.57 BDT/pass-h
Truck	4.38 BDT/ton-h	7.17 BDT/ton-h

Value of Time is firstly capitalized from 2022 terms to 2023 terms. The total increase is 63.58%, which is: 0.7 x increase in GDP pc growth of years 2023 (5.94%) ,2024 (6.43%), 2025 (6.63%), 2026 (6.73%), 2027-2032 (6.84%).

After capitalization VOT values have an annual increase (over projection period 2033 - 2072) of 4.79%/ year[12].

Vehicle Operating costs (VOC's) adopted were obtained in a case- by- case modal basis, undertaking a comparative study with cases mostly from Bangladesh, but also from India, or other international benchmarks references. In general, it has been adopted (likewise the adoption of figures for Value of Time) a quite conservative approach when selecting VOC values.

Vehicle Operating cost (VOC) value is first capitalized from 2022 terms to 2033 terms. The total increase is 79.39%, which is the compound inflation rate passed in the years 2023-2032.

After capitalization VOC values have an annual increase (over projection period 2033 - 2072) of 4.79%/ year[13].

Table 58. Vehicle operating costs by mode.

Mode	BDT / veh – km (2022)	BDT / veh – km (2033)
Light vehicles	15.40	27.71
Buses	33.00	59.38
Truck	44.00	79.17

It has been considered a reference social discount rate of **12%** for the economic analysis, following the Memo no 20.804.014.00.00.014.027.18-177 sent by the Planning Division of the *Ministry of Planning of Bangladesh*.

Residual value has been estimated according to traditional procedures and international best practices: EU Cost- Benefit handbook, ADB guidelines, World Bank, etc. More precisely the standard approach of estimating the amount of depreciation not computed in the analysis period (*net book*

[12] *0.7 x last year GDP growth pc computed (ie 2024: 6.43%): 0.7 x 6.43% = 4.5%.*
[13] *0.7 x last year GDP growth pc computed (ie 2032: 6.84%): 0.7 x 6.84% = 4.79%.*

value or remaining depreciation costs method) has been used. The "Net Book Value" approach[14] is considered to be less distorting than the alternative approach.

(f) Compute the following indicators and interpret the results:

(i) Economic Net Present Value (ENPV)

Eastern Part-1

Project Net Present Value was estimated taking as reference the first year of the considered period – 2025 – when the investments would start. **ENPV estimated in real terms would reach: 4,289.01 Cr BDT.**

Economic Net Present Value obtained is positive which means that, in economic terms the benefits generated by the project are sufficient to compensate the rise in costs, both construction and operation of the proposed road.

Or in more precise economic terms: **potential social benefits, understood as what society is willing to pay in order to have access to the new road, seem to be higher than social costs, or the group of goods and services to which society must renounce if it decides to implement the new proposed road.**

Western Part-2, Option A

In our case **Project Net Present Value** was estimated taking as reference the first year of the considered period – 2028 – when the investments would start. **ENPV estimated in real terms would reach: -9,547.46 Cr BDT.**

Economic Net Present Value obtained is negative which means that, in economic terms the benefits generated by the project are not sufficient to compensate the rise in costs, both construction and operation of the proposed road.

Or in more precise economic terms: **potential social benefits, understood as what society is willing to pay to have access to the new road, seem to be lower than social costs, or the group of goods and services to which society must renounce if it decides to implement the new proposed road.**

Western Part-2, Option B

Project Net Present Value was estimated taking as reference the first year of the considered period – 2033 – when the investments would start. **ENPV estimated in real terms would reach: 3,866.89 Cr BDT.**

[14] *CBA handbook EU 2014, pages 34, 35*

Economic Net Present Value obtained is positive which means that, in economic terms the benefits generated by the project are sufficient to compensate the rise in costs, both construction and operation of the proposed road.

Or in more precise economic terms: **potential social benefits, understood as what society is willing to pay to have access to the new road, seem to be higher than social costs, or the group of goods and services to which society must renounce if it decides to implement the new proposed road.**

(ii) Economic Benefit Cost Ratio (EBCR)

Eastern Part-1

Project benefit cost ratio reaches 1.21 indicating the positive economic value creation from the projection of economic discounted flows.

Western Part-2, Option A

Project benefit cost ratio reaches 0.63 indicating the negative economic value creation from the projection of economic discounted flows.

Western Part-2, Option B

Project benefit cost ratio reaches 1.49 indicating the positive economic value creation from the projection of economic discounted flows.

(iii) Economic Internal Rate of Return (EIRR)

Eastern Part-1

Project Economic IRR was obtained from the economic flows estimated for each year. **The result is an E-IRR equal to 13.74%.** This data is higher than the considered social rate of discount (12%) or opportunity cost of capital, so t**he project can be considered as feasible (IRR >SRD and E-NPV positive).**

Western Part-2, Option A

Project Economic IRR was obtained from the economic flows estimated for each year. **The result is an E-IRR equal to 9.18%.** This data is lower than the considered social rate of discount (12%) or opportunity cost of capital **(IRR <SRD and E-NPV negative).**

Western Part-2, Option B

Project Economic IRR was obtained from the economic flows estimated for each year. **The result is an E-IRR equal to 15.55%.** This data is higher than the considered social rate of discount (12%) or opportunity cost of capital, so t**he project can be considered as feasible (IRR >SRD and E-NPV positive).**

(iv) Payback period

Eastern Part–1

Regarding the Payback period and since the project NPV is positive, the initial investment will be recovered in **2053**.

Western Part-2, Option A

Regarding the Payback period and since the project NPV is negative, the initial investment cannot be estimated to be **recovered** during the first 30 years of operation.

Western Part-2, Option B

Regarding the Payback period and since the project NPV is positive, the initial investment will be recovered in **2055**.

7.2. Financial Analysis

The **Financial Analysis** mainly focuses on the revenues, expenses and the cash flow generated by the project, considering the feasibility of the project in monetary terms. It provides a conclusion on how profitable the project could be in the different assessed investment structures and approaches, evaluating also the possible need of grants that could enable the project to be implemented. The analysis has been carried out to evaluate whether the project could generate enough operating income above operating expenses, repay easily external funding and remunerate equity investors under market conditions.

The procurement alternatives considered in the financial analysis are the following ones:

- Traditional procurement or Public Project: The Government of Bangladesh ("GoB") oversees project implementation as well as of the operation and maintenance of the infrastructure and related works. During operation period, GoB collects toll fares from users.
- PPP procurement or PPP Contract: A private PPP company oversees the construction, operation and maintenance of the infrastructure and collects tolls from users. Should expected revenues are not enough to cover total project costs, GoB grants and equity (from Public Budgets) will be part of the funding to implement the Project, in addition to those funds provided by a combination of the PPP investors and banks term loans.

In the case of the PPP contracts, the government has designed by law a viability gap funding (VGF) to estimate the required grant to support projects that are economically feasible and necessary but financially unviable. The aim of VGF is to make commercially nonviable infrastructure projects attractive to private investor through PPP arrangement. But the VGF in the form of the capital grant or annuity or both shall not exceed 40% of the total estimate project cost.

The approach to determining the most effective contract structure is as follows:

- Firstly, the project is analysed as a Public Project or Traditional Procurement, as more reasonable for this type of projects.

- Besides, the PPP contract alternative is analysed as it is typically more efficient to alleviate the use of GoB resources, and to shorten construction schedule.
- If the PPP contract is not viable on its own, the Viability Gap Funding ("VGF") needed to make it viable is calculated:
    - If it does not exceed 40%, the PPP structure is considered viable.
    - If the VGF required exceeds 40%, PPP structure is discarded.

(a) Components of cost & revenues

From the point of view of the revenues, the implementation of a user toll system is planned to minimize the budgetary resources from the GoB. The toll revenues should be used to cover the operation and maintenance expenses during the life of the Project as well as part of the initial investments, considering the forecasted demand and the toll fares structure.

Concerning the toll fares, four categories or vehicle classes have been considered: motorcycles, light vehicles, buses and trucks.

(b) Cost & revenues in monetary value

Costs are presented in monetary values, starting by the initial investments and, secondly, by operation and maintenance expenses.

Table 59. Investment budget. Eastern Part-1.

Investment budget (VAT included)	Cr BDT (2024)	Cr BDT (2028)
General and Site facilities	728.40	788.4
Road and drainage work & Temporary works	525.03	568.3
Toll plaza & CCB	428.27	463.6
Structural works	17,941.91	19,420.7
Relocation and/or removal of public utilities	4,701.15	5,088.6
Electrical works & Traffic Management System	154.44	167.2
Land acquisition and Resettlement costs	10,395.89	11,252.7
Design costs	489.58	529.9
Supervision costs	1,223.96	1,324.8
Contingencies	2,247.19	2,432.4
CAPEX	38,835.82	42,036.6

Table 60. Investment budget. Western Part-2. Option A

Investment budget (VAT included)	Cr BDT (2024)	Cr BDT (2028)
General and Site facilities	1,693.29	2,243.73
Road and drainage work & Temporary works	2,893.42	3,833.98
Toll plaza & CCB	389.51	516.13
Structural works	27,685.62	36,685.36
Relocation and/or removal of public utilities	6,569.82	8,705.46

Investment budget (VAT included)	Cr BDT (2024)	Cr BDT (2028)
Electrical works & Traffic Management System	298.16	395.08
Land acquisition and Resettlement costs	7,570.77	10,031.80
Design costs	790.60	1,047.59
Supervision costs	1,976.49	2,618.99
Contingencies	3,628.84	4,808.46
CAPEX	53,496.52	70,886.58

Table 61. Investment budget. Western Part-2 Option B

Investment budget (VAT included)	Cr BDT (2024)	Cr BDT (2033)
General and Site facilities	419.61	556.01
Road and drainage works & Temporary works	867.90	1,150.03
Toll plaza & CCB	117.00	155.03
Structural works	5,945.60	7,878.33
Relocation and/or removal of public utilities	956.10	1,266.90
Electrical works & Traffic Management System	89.40	118.46
Land acquisition and Resettlement costs	2,004.00	2,655.44
Design costs	167.91	222.50
Supervision costs	419.78	556.24
Contingencies	770.72	1,021.25
CAPEX	11,758.01	15,580.18

The following table shows the operating expenses, similar for both sections (Eastern and Western):

Table 62. Operating expenses. Eastern part and Western Part-2.

Operating expenses (VAT included)	Cr BDT / year
Operation	7.50
Overall expenses. Company structure	5.00

The resulting ordinary and extraordinary maintenance amount per year is shown in the following tables, for each of the parts of the DEICR:

Table 63. Maintenance expenses. Amount per year. Eastern Part-1,

Maintenance (Cr BDT VAT included)	Investment	Maintenance / year
Structural works - Viaducts	17,091	267.8
Road and drainage works	500	8.8
Electrical works & Traffic Management System	147	4.2
Toll Plaza	408	11.7
Total		292.50

Table 64. Maintenance expenses. Amount per year. Western Part-2. Option A

Maintenance (Cr BDT VAT included)	Investment	Maintenance / year
Structural works - Viaducts	34,126	504.1
Road and drainage works	3,566	59.8
Electrical works & Traffic Management System	368	10.9
Toll Plaza	480	14.2
Total		589.01

Table 65. Maintenance expenses. Amount per year. Western Part-2. Option B

Maintenance (Cr BDT VAT included)	Investment	Maintenance / year
Structural works - Viaducts	7,329	108.3
Road and drainage works	1,070	17.9
Electrical works & Traffic Management System	110	3.0
Toll Plaza	144	3.9
Total		133.05

Once detailed de project costs, the revenues are detailed. They come from the tolls to users per type of vehicles as well as from the traffic projected in four categories of vehicles, as shown in the following charts:

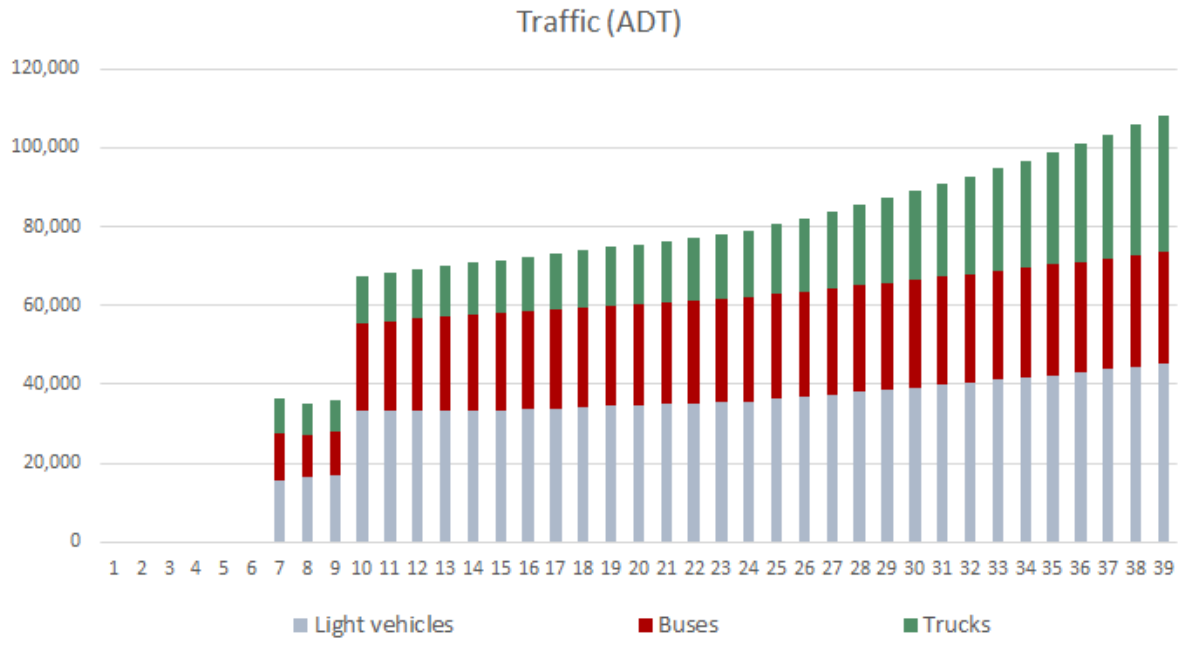

Figure 55. Demand forecasts. Eastern Part-1.

The most important classes of vehicles are light vehicles (45% of total vehicles) followed by buses.

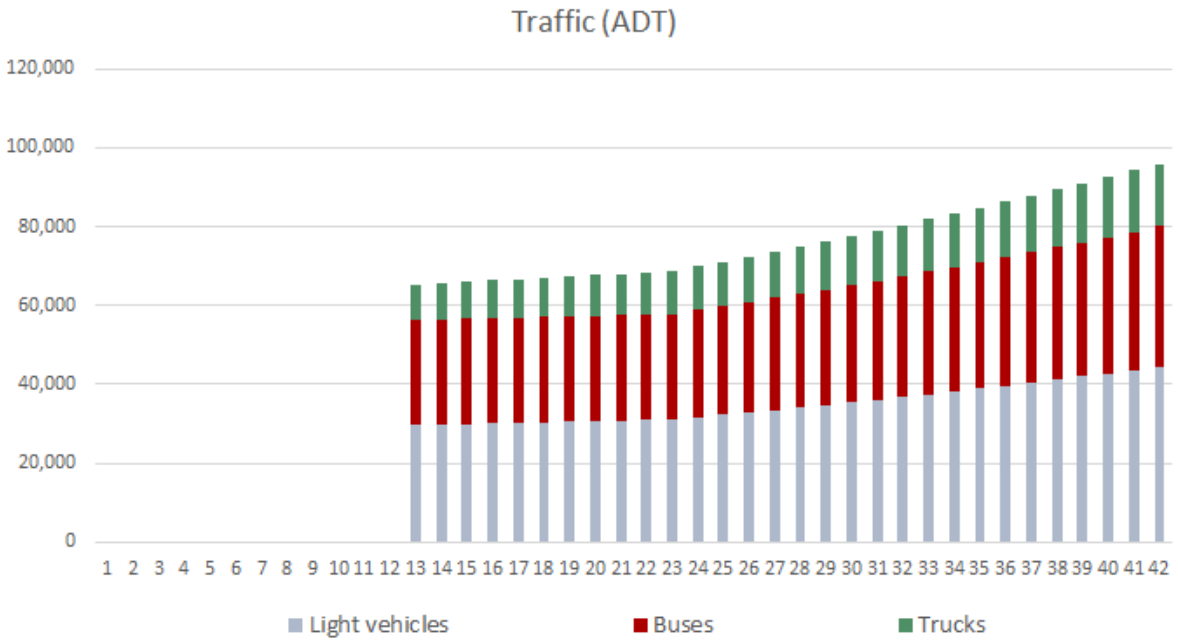

Figure 56. Demand forecasts. Western Part-2. Option A

The most important classes of vehicles are light vehicles (46% of total vehicles) followed by buses.

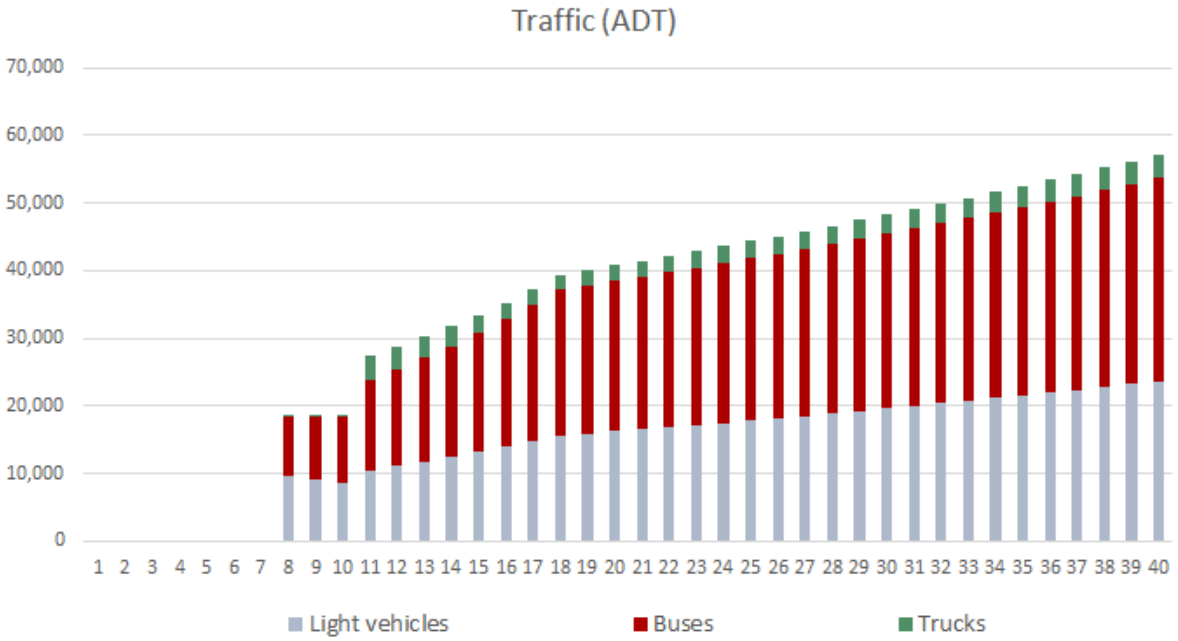

Figure 57. Demand forecasts. Western Part-2. Option B

The most important classes of vehicles are buses (53% of total vehicles) followed by light vehicles (41%).

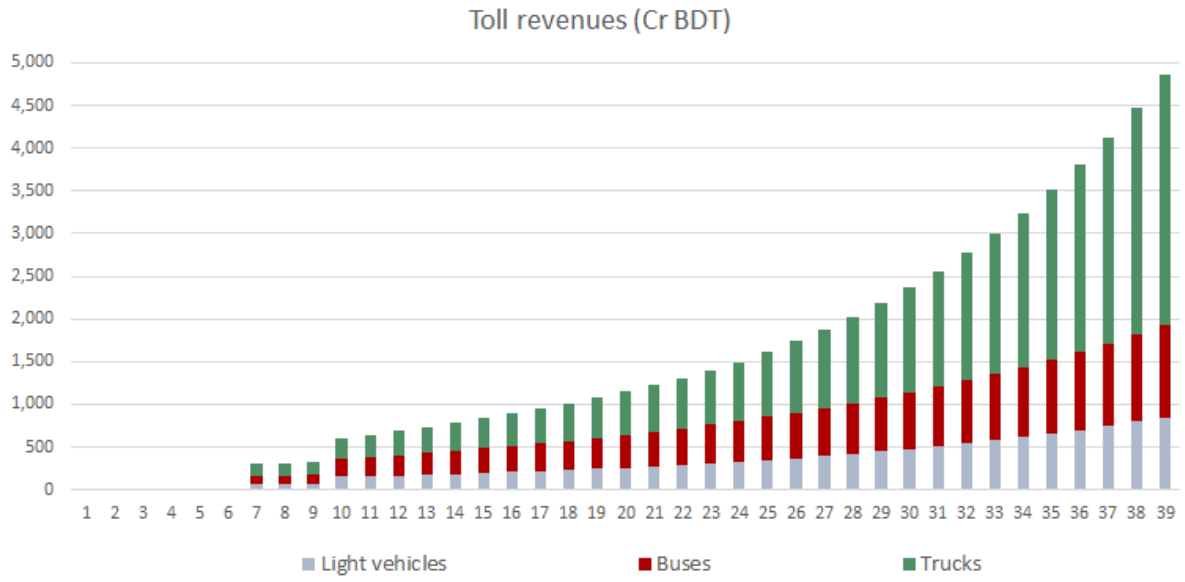

Figure 58. Toll revenues. Eastern Part-1.

Toll revenues have different impacts on the Project cash flows: trucks are the most important class, representing 54% of total revenues, followed by buses, with 27%.

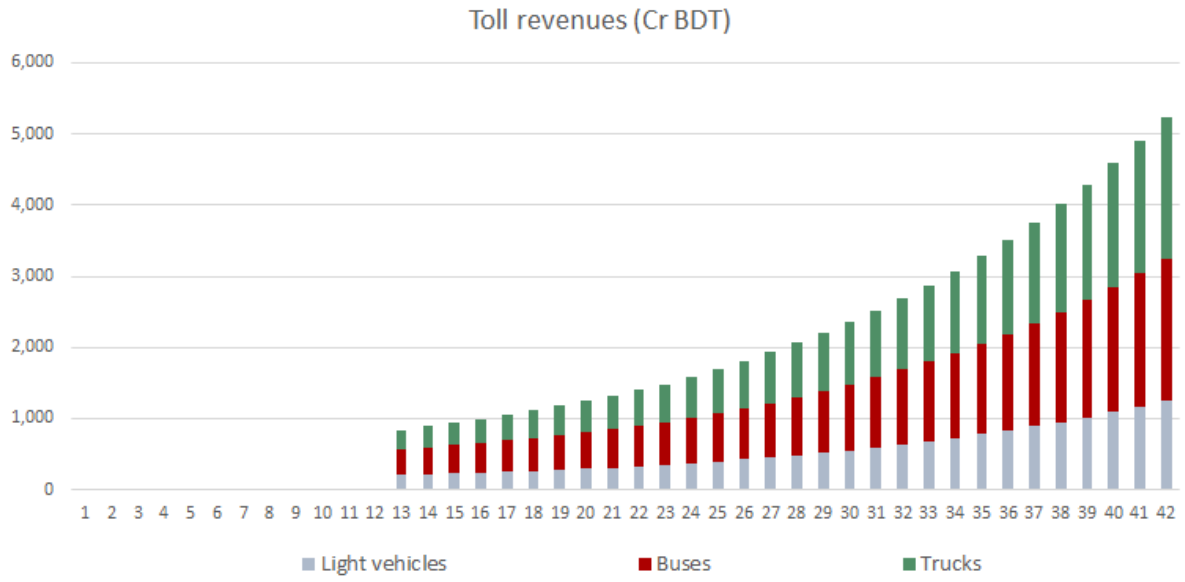

Figure 59. Toll revenues. Western Part-2. Option A

Toll revenues have different impacts on the Project cash flows: trucks are the most important class, representing 56% of total revenues, followed by buses trucks 29%.

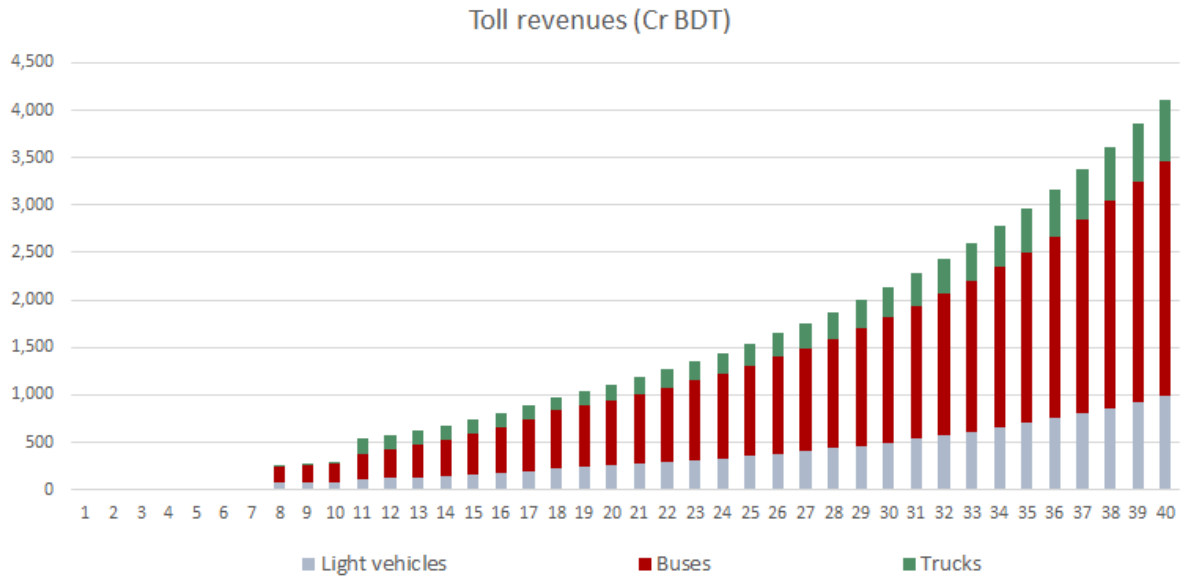

Figure 60. Toll revenues. Western Part-2. Option B

Toll revenues have different impacts on the Project cash flows: buses are the most important class, representing 61% of total revenues, followed by light vehicles, with 23%.

(c) Cash flow.

The following tables show the projected cash flows during the period of analysis for both parts, Eastern and Western, respectively, for Public Project alternative. Notice that the cash flow projections include the construction period, the first year of operation and every five years of the operation period:

Table 66. Project cash flows. Public Project or Traditional procurement. Eastern Part-1.

	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2039	2044	2049	2054	2059	2065
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 15	Year 20	Year 25	Year 30	Year 35	Year 41
Construction period	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
Operation period	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Term of analysis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Price indexation	1.00	1.05	1.10	1.16	1.22	1.28	1.34	1.41	1.48	1.55	1.63	1.98	2.53	3.23	4.12	5.25	7.04

PROJECT CASH FLOWS (Cr BDT)	2025 Year 1	2026 Year 2	2027 Year 3	2028 Year 4	2029 Year 5	2030 Year 6	2031 Year 7	2032 Year 8	2033 Year 9	2034 Year 10	2035 Year 11	2039 Year 15	2044 Year 20	2049 Year 25	2054 Year 30	2059 Year 35	2065 Year 41
Operating revenues	**0**	**0**	**0**	**0**	**0**	**0**	**313**	**305**	**331**	**599**	**641**	**837**	**1,153**	**1,608**	**2,366**	**3,515**	**5,722**
Toll revenues	0	0	0	0	0	0	313	305	331	599	641	837	1,153	1,608	2,366	3,515	5,722
Other commercial revenues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operation & Maintenance expenses	**0**	**0**	**0**	**0**	**0**	**0**	**-93**	**-98**	**-206**	**-216**	**-227**	**-413**	**-528**	**-673**	**-859**	**-1,097**	**-6,871**
Maintenance & Overhaul	0	0	0	0	0	0	-90	-94	-198	-208	-218	-398	-508	-648	-827	-1,056	-6,816
Operation	0	0	0	0	0	0	-3	-4	-8	-8	-8	-15	-20	-25	-32	-41	-55
Net Cash Flows due to Operations	**0**	**0**	**0**	**0**	**0**	**0**	**220**	**207**	**125**	**383**	**414**	**424**	**625**	**934**	**1,506**	**2,418**	**-1,149**
Cash Flows due to Investments	**-623**	**-2,132**	**-4,507**	**-4,811**	**-5,131**	**-5,468**	**-7,453**	**-7,941**	**-9,054**	**-5,232**	**-5,539**	**0**	**0**	**0**	**0**	**0**	**1,637**
Initial CAPEX	-623	-2,132	-4,507	-4,811	-5,131	-5,468	-7,453	-7,941	-9,054	-5,232	-5,539	0	0	0	0	0	0
Other CAPEX	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residual Value of Investments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,637
Project cash flows	**-623**	**-2,132**	**-4,507**	**-4,811**	**-5,131**	**-5,468**	**-7,233**	**-7,734**	**-8,929**	**-4,849**	**-5,125**	**424**	**625**	**934**	**1,506**	**2,418**	**488**

GOVERNMENT CASH FLOWS (Cr BDT)	2025 Year 1	2026 Year 2	2027 Year 3	2028 Year 4	2029 Year 5	2030 Year 6	2031 Year 7	2032 Year 8	2033 Year 9	2034 Year 10	2035 Year 11	2039 Year 15	2044 Year 20	2049 Year 25	2054 Year 30	2059 Year 35	2065 Year 41
Outflows	**-623**	**-2,132**	**-4,507**	**-4,811**	**-5,131**	**-5,468**	**-7,547**	**-8,039**	**-9,259**	**-5,448**	**-5,766**	**-3,021**	**-2,938**	**-2,887**	**-2,875**	**-2,915**	**-8,452**
Project Development (Initial CAPEX)	-398	-2,088	-4,384	-4,604	-4,834	-5,076	-6,928	-7,274	-8,226	-4,319	-4,534	0	0	0	0	0	0
Financing Fees	-225	-44	-123	-207	-297	-393	-525	-666	-828	-914	-1,005	0	0	0	0	0	0
Operating expenses	0	0	0	0	0	0	-93	-98	-206	-216	-227	-413	-528	-673	-859	-1,097	-6,871
Loan Repayments																	
Interest	0	0	0	0	0	0	0	0	0	0	0	-1,480	-1,283	-1,085	-888	-691	-454
Principal Repayments	0	0	0	0	0	0	0	0	0	0	0	-1,128	-1,128	-1,128	-1,128	-1,128	-1,128
Inflows	**506**	**1,549**	**3,342**	**3,645**	**3,966**	**4,303**	**6,252**	**6,731**	**7,753**	**5,016**	**5,365**	**837**	**1,153**	**1,608**	**2,366**	**3,515**	**5,722**
Borrowings	506	1,549	3,342	3,645	3,966	4,303	5,939	6,426	7,423	4,417	4,724	0	0	0	0	0	0
Operating revenues	0	0	0	0	0	0	313	305	331	599	641	837	1,153	1,608	2,366	3,515	5,722
Future Developments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Government cash flows	**-117**	**-583**	**-1,165**	**-1,165**	**-1,165**	**-1,165**	**-1,295**	**-1,308**	**-1,506**	**-433**	**-401**	**-2,184**	**-1,786**	**-1,279**	**-510**	**599**	**-2,730**

Table 67. Project cash flows. Public Project or Traditional procurement. Western Part-2. Option A

	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2042	2047	2052	2057	2062	2069
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 15	Year 20	Year 25	Year 30	Year 35	Year 42
Construction period	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
Operation period	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Term of analysis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Price indexation	1.00	1.05	1.10	1.16	1.22	1.28	1.34	1.41	1.48	1.55	1.63	1.71	1.98	2.53	3.23	4.12	5.25	7.39
PROJECT CASH FLOWS (Cr BDT)	2028 Year 1	2029 Year 2	2030 Year 3	2031 Year 4	2032 Year 5	2033 Year 6	2034 Year 7	2035 Year 8	2036 Year 9	2037 Year 10	2038 Year 11	2039 Year 12	2042 Year 15	2047 Year 20	2052 Year 25	2057 Year 30	2062 Year 35	2069 Year 42
Operating revenues	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**236**	**254**	**286**	**318**	**344**	**740**	**1,112**	**1,542**	**2,138**	**2,966**	**4,691**
Toll revenues	0	0	0	0	0	0	0	236	254	286	318	344	740	1,112	1,542	2,138	2,966	4,691
Other commercial revenues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operation & Maintenance expenses	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-473**	**-497**	**-522**	**-548**	**-575**	**-862**	**-1,100**	**-1,403**	**-1,791**	**-2,286**	**-3,755**
Maintenance & Overhaul	0	0	0	0	0	0	0	-461	-484	-508	-533	-560	-838	-1,070	-1,366	-1,743	-2,224	-3,669
Operation	0	0	0	0	0	0	0	-13	-13	-14	-15	-15	-23	-30	-38	-48	-61	-86
Net Cash Flows due to Operations	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-238**	**-243**	**-235**	**-229**	**-231**	**-121**	**12**	**138**	**347**	**680**	**935**
Cash Flows due to Investments	**-1,663**	**-1,544**	**-3,242**	**-6,811**	**-7,276**	**-11,458**	**-14,172**	**-15,124**	**-11,850**	**-12,604**	**-11,039**	**-11,707**	**0**	**0**	**0**	**0**	**0**	**2,038**
Initial CAPEX	-1,663	-1,544	-3,242	-6,811	-7,276	-11,458	-14,172	-15,124	-11,850	-12,604	-11,039	-11,707	0	0	0	0	0	0
Other CAPEX	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residual Value of Investments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,038
Project cash flows	**-1,663**	**-1,544**	**-3,242**	**-6,811**	**-7,276**	**-11,458**	**-14,172**	**-15,362**	**-12,094**	**-12,839**	**-11,269**	**-11,939**	**-121**	**12**	**138**	**347**	**680**	**2,974**
GOVERNMENT CASH FLOWS (Cr BDT)	2028 Year 1	2029 Year 2	2030 Year 3	2031 Year 4	2032 Year 5	2033 Year 6	2034 Year 7	2035 Year 8	2036 Year 9	2037 Year 10	2038 Year 11	2039 Year 12	2042 Year 15	2047 Year 20	2052 Year 25	2057 Year 30	2062 Year 35	2069 Year 42
Outflows	**-1,663**	**-1,544**	**-3,242**	**-6,811**	**-7,276**	**-11,458**	**-14,172**	**-17,798**	**-14,548**	**-15,327**	**-13,788**	**-14,484**	**-5,720**	**-5,573**	**-5,492**	**-5,494**	**-5,604**	**-6,534**
Project Development (Initial CAPEX)	-1,418	-1,489	-3,126	-6,565	-6,893	-10,857	-13,299	-13,964	-10,473	-10,997	-9,237	-9,699	0	0	0	0	0	0
Financing Fees	-245	-55	-116	-246	-383	-602	-873	-1,160	-1,377	-1,607	-1,802	-2,008	0	0	0	0	0	0
Operating expenses	0	0	0	0	0	0	0	-473	-497	-522	-548	-575	-862	-1,100	-1,403	-1,791	-2,286	-3,755
Loan Repayments																		
Interest	0	0	0	0	0	0	0	0	0	0	0	0	-2,658	-2,273	-1,887	-1,502	-1,117	-578
Principal Repayments	0	0	0	0	0	0	0	-2,201	-2,201	-2,201	-2,201	-2,201	-2,201	-2,201	-2,201	-2,201	-2,201	-2,201
Inflows	**1,342**	**1,223**	**2,600**	**5,527**	**5,992**	**9,533**	**11,925**	**13,113**	**10,499**	**11,286**	**10,074**	**10,768**	**740**	**1,112**	**1,542**	**2,138**	**2,966**	**4,691**
Borrowings	1,342	1,223	2,600	5,527	5,992	9,533	11,925	12,877	10,245	10,999	9,755	10,424	0	0	0	0	0	0
Operating revenues	0	0	0	0	0	0	0	236	254	286	318	344	740	1,112	1,542	2,138	2,966	4,691
Future Developments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Government cash flows	**-321**	**-321**	**-642**	**-1,284**	**-1,284**	**-1,926**	**-2,247**	**-4,686**	**-4,049**	**-4,041**	**-3,714**	**-3,716**	**-4,980**	**-4,461**	**-3,950**	**-3,356**	**-2,638**	**-1,843**

Table 68. Project cash flows. Public Project or Traditional procurement. Western Part-2. Option B

	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2047	2052	2057	2062	2067	2072
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 15	Year 20	Year 25	Year 30	Year 35	Year 40
Construction period	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0
Operation period	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Term of analysis	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Price indexation	1.00	1.05	1.10	1.16	1.22	1.28	1.34	1.41	1.48	1.55	1.63	1.98	2.53	3.23	4.12	5.25	6.70

PROJECT CASH FLOWS (Cr BDT)	2033 Year 1	2034 Year 2	2035 Year 3	2036 Year 4	2037 Year 5	2038 Year 6	2039 Year 7	2040 Year 8	2041 Year 9	2042 Year 10	2043 Year 11	2047 Year 15	2052 Year 20	2057 Year 25	2062 Year 30	2067 Year 35	2072 Year 40
Operating revenues	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**236**	**254**	**286**	**318**	**740**	**1,112**	**1,542**	**2,138**	**2,966**	**4,115**
Toll revenues	0	0	0	0	0	0	0	236	254	286	318	740	1,112	1,542	2,138	2,966	4,115
Other commercial revenues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operation & Maintenance expenses	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-117**	**-123**	**-129**	**-135**	**-213**	**-272**	**-347**	**-442**	**-564**	**-720**
Maintenance & Overhaul	0	0	0	0	0	0	0	-104	-109	-115	-121	-190	-242	-309	-394	-503	-642
Operation	0	0	0	0	0	0	0	-13	-13	-14	-15	-23	-30	-38	-48	-61	-78
Net Cash Flows due to Operations	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**119**	**131**	**158**	**183**	**528**	**840**	**1,195**	**1,696**	**2,402**	**3,394**
Cash Flows due to Investments	**-536**	**-339**	**-1,063**	**-1,871**	**-3,158**	**-3,374**	**-3,601**	**-3,393**	**-2,673**	**-2,345**	**0**	**0**	**0**	**0**	**0**	**0**	**464**
Initial CAPEX	-536	-339	-1,063	-1,871	-3,158	-3,374	-3,601	-3,393	-2,673	-2,345	0	0	0	0	0	0	0
Other CAPEX	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Residual Value of Investments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	464
Project cash flows	**-536**	**-339**	**-1,063**	**-1,871**	**-3,158**	**-3,374**	**-3,601**	**-3,274**	**-2,542**	**-2,188**	**183**	**528**	**840**	**1,195**	**1,696**	**2,402**	**3,858**

GOVERNMENT CASH FLOWS (Cr BDT)	2033 Year 1	2034 Year 2	2035 Year 3	2036 Year 4	2037 Year 5	2038 Year 6	2039 Year 7	2040 Year 8	2041 Year 9	2042 Year 10	2043 Year 11	2047 Year 15	2052 Year 20	2057 Year 25	2062 Year 30	2067 Year 35	2072 Year 40
Outflows	**-536**	**-339**	**-1,063**	**-1,871**	**-3,158**	**-3,374**	**-3,601**	**-3,980**	**-3,266**	**-2,945**	**-1,207**	**-1,219**	**-1,195**	**-1,188**	**-1,201**	**-1,241**	**-1,315**
Project Development (Initial CAPEX)	-312	-327	-1,031	-1,804	-3,030	-3,182	-3,341	-3,069	-2,302	-1,934	0	0	0	0	0	0	0
Financing Fees	-224	-12	-32	-68	-128	-192	-260	-323	-371	-412	0	0	0	0	0	0	0
Operating expenses	0	0	0	0	0	0	0	-117	-123	-129	-135	-213	-272	-347	-442	-564	-720
Loan Repayments																	
Interest	0	0	0	0	0	0	0	0	0	0	-601	-535	-453	-371	-288	-206	-124
Principal Repayments	0	0	0	0	0	0	0	-471	-471	-471	-471	-471	-471	-471	-471	-471	-471
Inflows	**465**	**269**	**851**	**1,519**	**2,594**	**2,810**	**3,037**	**3,134**	**2,574**	**2,350**	**318**	**740**	**1,112**	**1,542**	**2,138**	**2,966**	**4,115**
Borrowings	465	269	851	1,519	2,594	2,810	3,037	2,899	2,320	2,063	0	0	0	0	0	0	0
Operating revenues	0	0	0	0	0	0	0	236	254	286	318	740	1,112	1,542	2,138	2,966	4,115
Future Developments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Government cash flows	**-71**	**-71**	**-212**	**-353**	**-564**	**-564**	**-564**	**-846**	**-692**	**-595**	**-889**	**-478**	**-83**	**354**	**937**	**1,725**	**2,800**

The projected cash flows of the above tables, as well as in the following charts, can be classified in two periods: investment cash flows during the construction period and operating cash flows (EBITDA) during the operation period:

- Eastern Part-1: The resulting Project Cash Flows are negative during the construction period for the amounts of the annual investments, while partially negative and partially positive during the operation period:

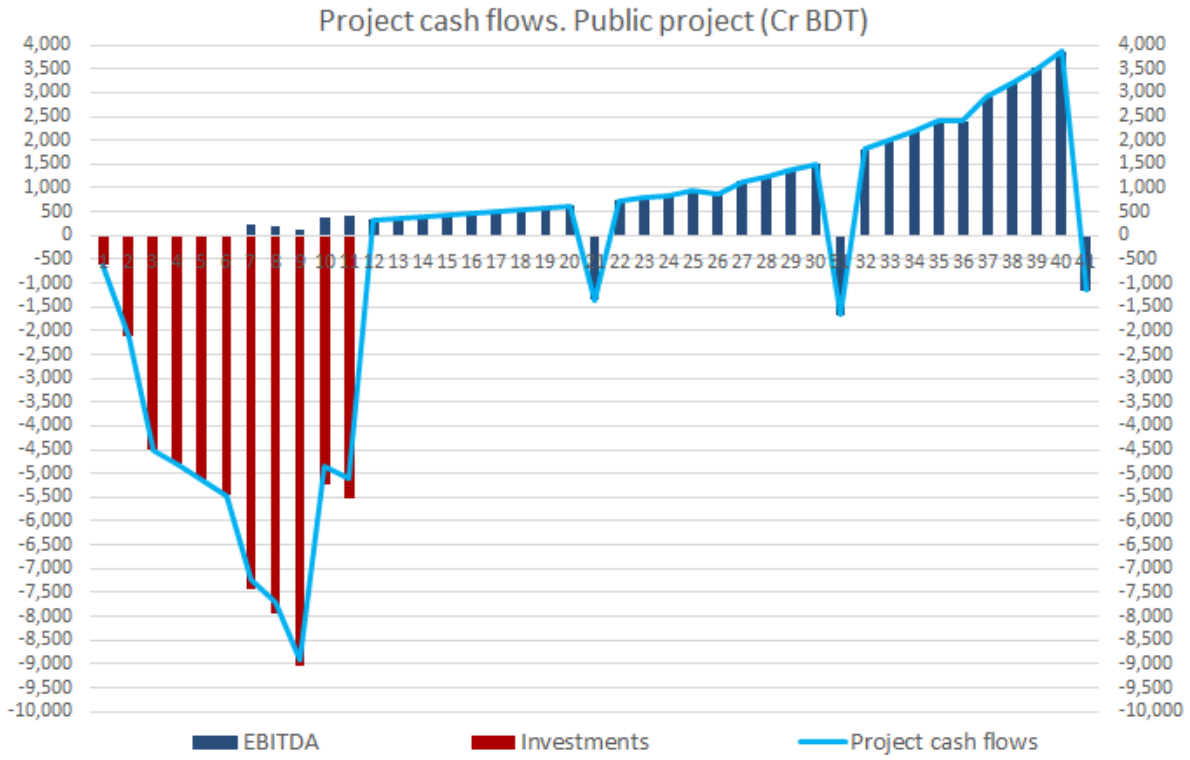

Figure 61. Projected cash flows. Public Project. Eastern Part-1.

To view the flows with an appropriate scale, the following chart has been prepared, which contains only the results of the operating phase. Operating cash flows are positive during the period of analysis, being close to breakeven during the first three years of partial operation, and increasing once the works are completed, except in certain years (21st, 31st and 41st) when certain extraordinary maintenance costs are considered, as shown in the following chart:

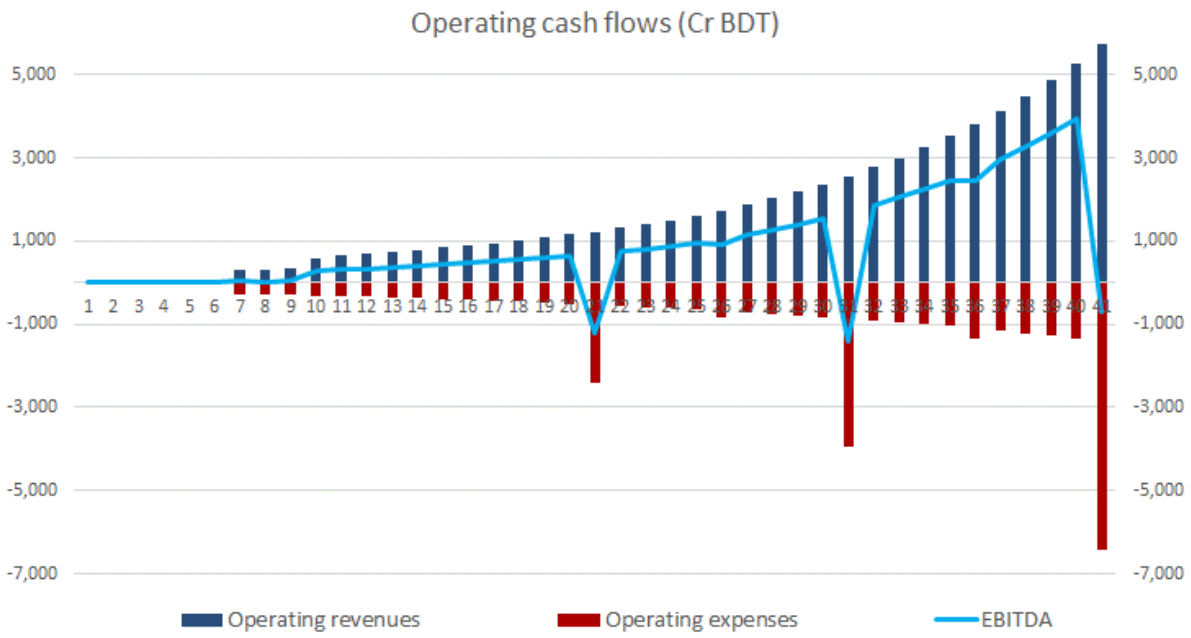

Figure 62. Projected cash flows. Public project. Eastern Part-1.

- Western Part-2. Option A: The resulting Project Cash Flows are negative during the construction period for the amounts of the annual investments, as well as during the operation period:

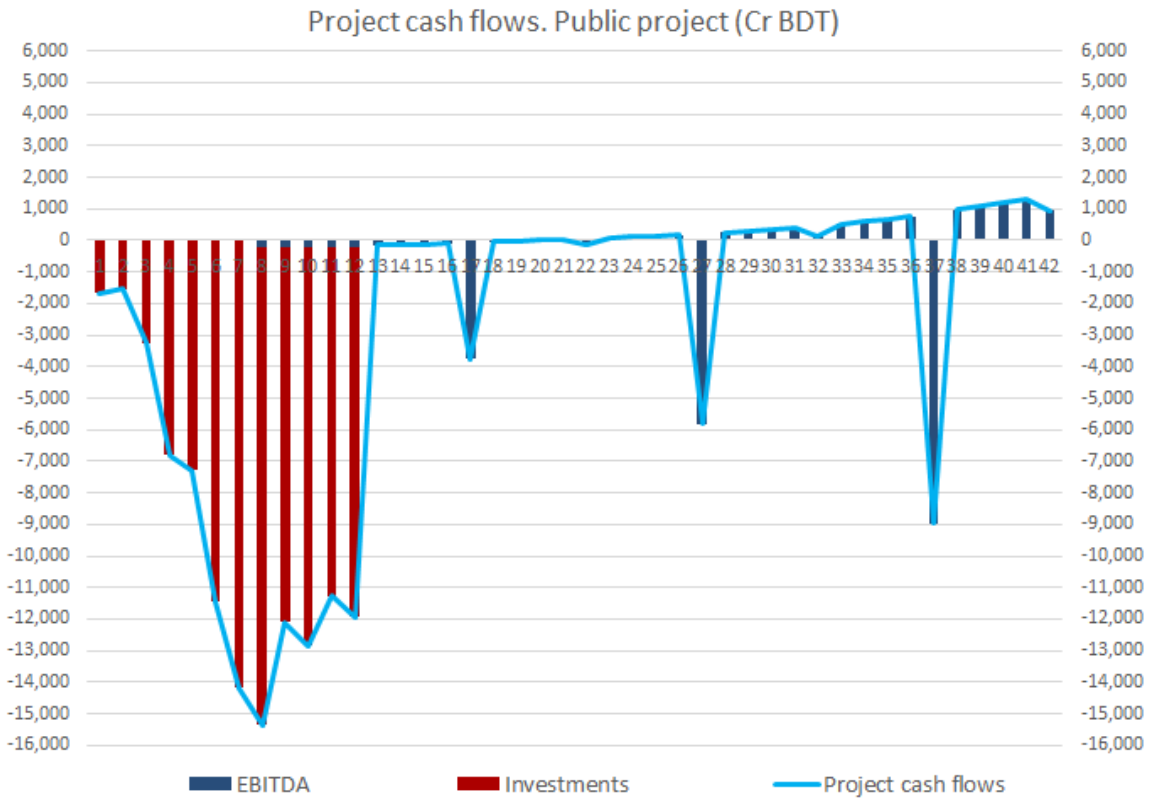

Figure 63. Projected cash flows. Public Project. Western Part-2. Option A

To view the flows with an appropriate scale, the following graph has been prepared, which contains only the results of the operating phase. Operating cash flows are positive during almost the whole period of analysis since operating revenues are higher than operating expenses, except years 17, 27 and 37, when certain extraordinary maintenance costs are considered, as shown in the following chart:

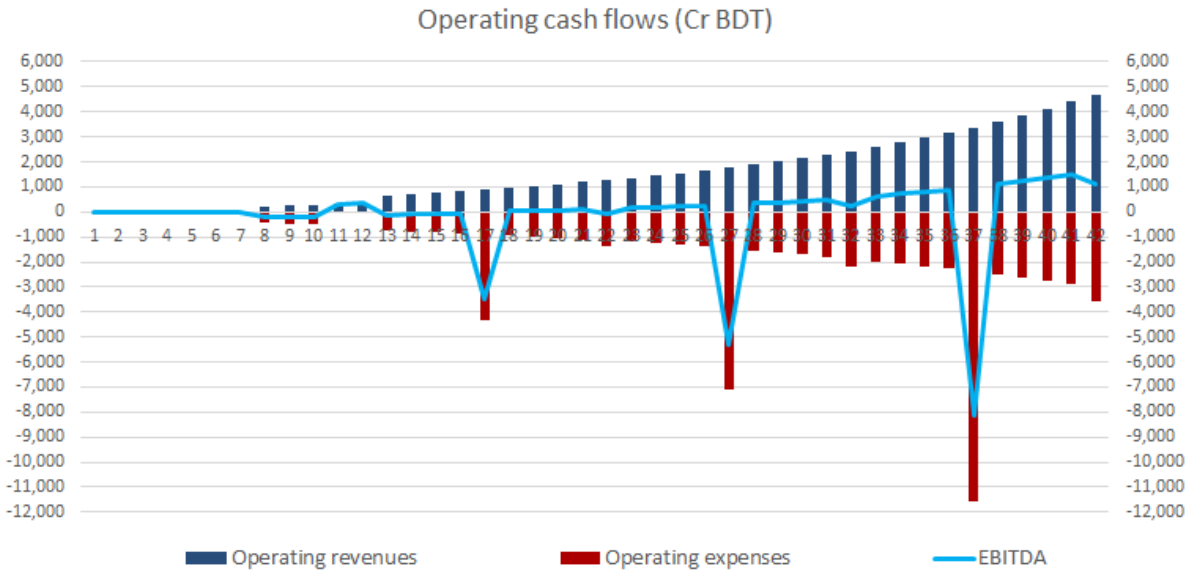

Figure 64. Projected cash flows. Public project. Western Part-2. Option A

- Western Part-2. Option B: The resulting Project Cash Flows are negative during the construction period for the amounts of the annual investments, as well as during the operation period:

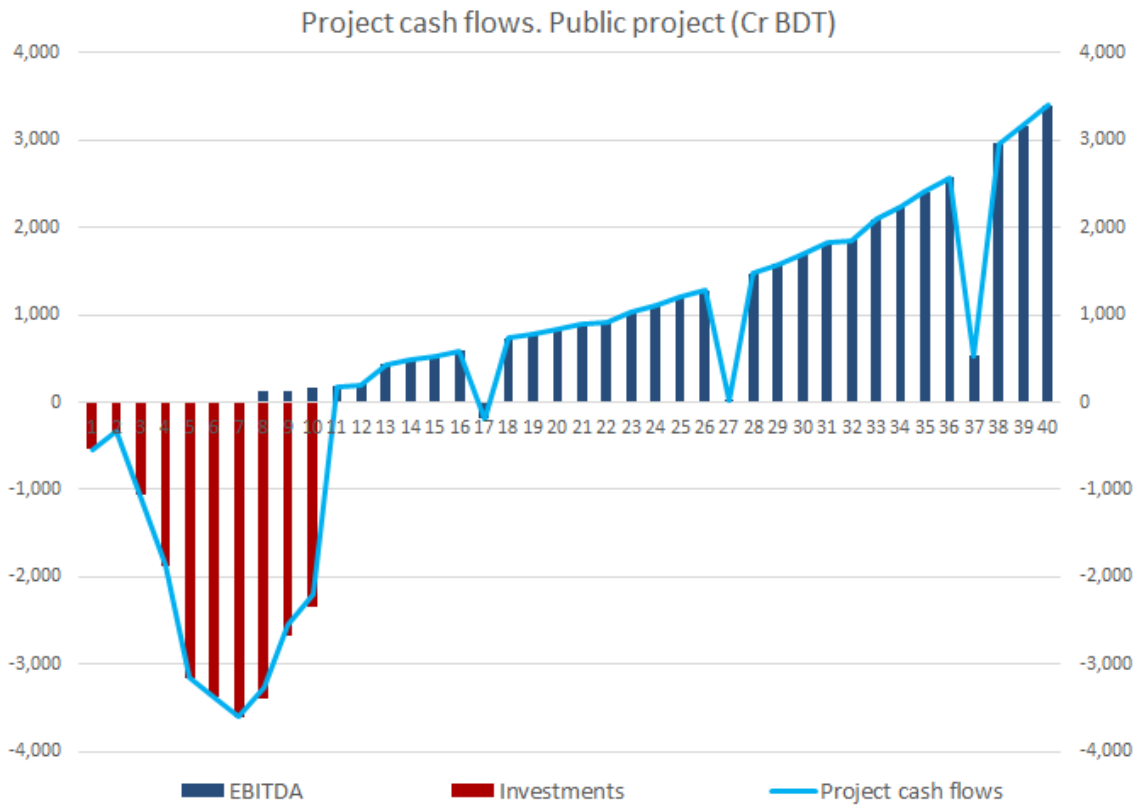

Figure 65. Projected cash flows. Public Project. Western Part-2. Option B

To view the flows with an appropriate scale, the following graph has been prepared, which contains only the results of the operating phase. Operating cash flows are positive during the whole period of analysis since operating revenues are higher than operating expenses, except year 17th when extraordinary maintenance costs are considered, and year 27th of the period of analysis, close to breakeven, as shown in the following chart:

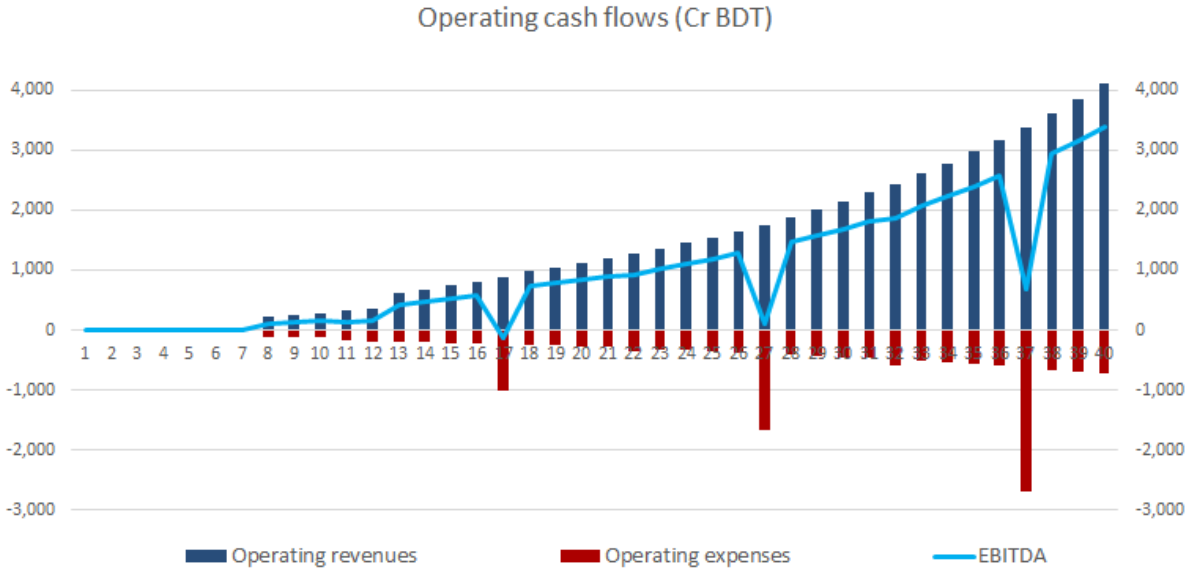

Figure 66. Projected cash flows. Public project. Western Part-2. Option B.

(d) Key Assumptions considered.

Table 69. General assumptions. Macroeconomic assumptions.

General assumptions	
Inflation rate	5.00%
Financial Discount Rate (Project). WACC	12.00% [15]
Exchange rate USD / BDT	110

Following Government regulation[16], financial discount rate ("FDR") is fixed at 12.00 %. It will be used as a financial discount rate to estimate the financial indicators in the financial analysis of all contract structures. Considering that the average FDR being used in this analysis is 12.00 %, a reasonable estimation of the cost of equity for investors could be around 16.00%.

[15] Nonetheless, in case of a traditional procurement (Public Project scheme) there are no private funds whereas the institutional funds (multilateral funds) complete funds from the GoB (budgetary contributions).
16 Memo no 20.804.014.00.00.014.027.18-177, dated 04/09/2018.

Table 70. General assumptions. Terms related assumptions. Eastern Part-1.

Terms	Years
Construction period (including Detail Design)	11
Operation	34
Analysis	40
Base year for analysis	2025
Starting year of operations (1st tranche)	2031
Starting year of full operations	2036

Table 71. General assumptions. Terms related assumptions. Western Part-2. Option A

Terms	Years
Construction period (including Detail Design)	12
Operation	30
Analysis	42
Base year for analysis	2028
Starting year of operations	2040

Table 72. General assumptions. Terms related assumptions. Western Part-2. Option B

Terms	Years
Construction period (including Detail Design)	10
Operation	33
Analysis	43
Base year for analysis	2033
Starting year of operations. First section	2040
Starting year of full operations	2043

Maintenance expenses have been estimated as an annual % over the respective investment amount, for ordinary maintenance. In the case of extraordinary maintenance, a percentage over the respective investment amount has been calculated every certain period, as detailed in the following table:

Table 73. Maintenance expenses. Assumptions. Eastern and Western parts.

Maintenance expenses	Over CAPEX
Structural works - Viaduct	
Ordinary	1.0%
Extraordinary (years 10, 20, 30, 40...)	4.0%
Road and drainage works	
Ordinary	1.0%
Extraordinary (years 10, 20, 30, 40...)	6.0%
Toll plaza and Electrical works & Traffic Management System	
Ordinary	2.0%
Extraordinary (years 15, 25, 35, 45...)	8.0%

From the point of view of the revenues, the assumptions considered are those related to the demand projections as well as the toll rates, as described below:

Table 74. Toll fares structure. Eastern Part-1.

Toll rates (BDT)	BDT (with VAT 2024)	BDT (w/o VAT 2024)	BDT (w/o VAT 2025)
Light vehicles	80.00	69.57	73.74
Buses	160.00	139.13	147.48
Trucks	360.00	313.04	331.83

Table 75. Toll fares structure. Western Part-2. Option A

Toll rates (BDT)	BDT (with VAT 2024)	BDT (w/o VAT 2024)	BDT (w/o VAT 2028)
Light vehicles	80.00	69.57	85.02
Buses	160.00	139.13	170.05
Trucks	360.00	313.04	382.61

Table 76. Toll fares structure. Western Part-2. Option B

Toll rates (BDT)	BDT (with VAT 2024)	BDT (w/o VAT 2024)	BDT (w/o VAT 2033)
Light vehicles	80.00	69.57	108.52
Buses	160.00	139.13	217.03
Trucks	360.00	313.04	488.32

(e) Financial indicators and results:

Above cash flows generate the following financial indicators for the Project,

(i) Public Project or Traditional procurement

The following table shows the financial indicators for the Traditional procurement structure for Eastern Part-1 and Western Part-2, respectively:

Table 77. Financial outcomes. Traditional procurement. Eastern Part-1.

FINANCIAL RESULTS	After Grants
Project F-IRR (unlevered)	-1.78%
Project F-NPV (@ 12.0%). Cr BDT (unlevered)	-28,524.21
GoB F-IRR (levered)	< 0%
GoB net contributions (Cr BDT) (levered)	-10,046.78
Financial Benefit-Cost ratio (F-BCR)	0.13
Term of multilateral loan (drawdown + repayment)	41 years

As detailed in the table above, the Project cash flows after GoB contributions generate a negative Project FIRR and a negative FNPV (-28,524.21 Cr BDT). Total net GoB contribution to the Project, in discounted BDT is estimated in -10,047 Cr BDT. As a conclusion, the Project does not reach the financial feasibility target values considering the FDR of 12.00%.

Table 78. Financial outcomes. Traditional procurement. Western Part-2. Option A

FINANCIAL RESULTS	After Grants
Project F-IRR (unlevered)	-11.44%
Project F-NPV (@ 12.0%). Cr BDT (unlevered)	-53,271.29
GoB F-IRR (levered)	< 0
GoB net contributions (Cr BDT) (levered	-20,903.91
Financial Benefit-Cost ratio (F-BCR)	0.06
Term of multilateral loan (drawdown + repayment)	42 years

As detailed in the table above, the Project cash flows after GoB contributions generate a negative Project FIRR and a negative FNPV (-53,271.29 Cr BDT). Total net GoB contribution to the Project, in discounted BDT is estimated in -20,903.91 Cr BDT. As a conclusion, the Project does not reach the financial feasibility target values considering the FDR of 12.00%.

Table 79. Financial outcomes. Traditional procurement. Western Part-2. Option A

FINANCIAL RESULTS	After Grants
Project F-IRR (unlevered)	2.48%
Project F-NPV (@ 12.0%). Cr BDT (unlevered)	-10,067.07
GoB F-IRR (levered)	2.58%
GoB net contributions (Cr BDT) (levered)	-2,977.30
Financial Benefit-Cost ratio (F-BCR)	0.25
Term of multilateral loan (drawdown + repayment)	40 years

As detailed in the table above, the Project cash flows after GoB contributions generate a negative Project FIRR and a negative FNPV (-10,067.07 Cr BDT). Total net GoB contribution to the Project, in discounted BDT is estimated in -2,977.30 Cr BDT. As a conclusion, the Project does not reach the financial feasibility target values considering the FDR of 12.00%.

(ii) PPP Contract

Considering the above explanation about the operating cash flows and negative project cash flows during a big portion of the period of analysis in both Eastern and Western parts of DEICR, the PPP contract alternative cannot be recommended since it would require a very high amount of grants, exceeding by far the maximum limit by law of 40%. Consequently, this contract alternative is not analysed.

(iii) Value for Money (VfM)

The VfM involves estimating the net cost to the GOB of implementing and operating the project in two alternative processes:

- Alternative A: the Project is developed as a public project with the resulting CAPEX and OPEX payments by the BBA as well as the corresponding toll revenues to be collected.
- Alternative B: the Project is developed as a PPP contract, with the resulting VGF payments by the BBA. In this case, neither CAPEX nor OPEX are costs for the GoB, but for the PPP project company. Furthermore, the operating revenues from tolls are also revenues from the PPP project company rather than GoB revenues.

As explained above, PPP Contract alternative is not analysed neither in Eastern part nor in Western part, since the project cash flows are negative and PPP contract would require a very high amount of grants, exceeding by far the maximum limit by law of 40%. Hence, VfM is not analysed.

(iv) Factors of potential financial improvement

Even though the Project shows financial results that indicate that it is not financially viable, there are a few factors that may have a positive influence on such indicators and, therefore, could facilitate financial viability. These factors have been classified into two types: endogenous and exogenous.

- Endogenous factors: One of the most relevant factors is the tax treatment of the Project, which could favour its profitability. Furthermore, other endogenous factors of the Project are potential activities to be operated by the tolled infrastructure operator itself, such as service areas, parking areas (mainly for truck and buses), etc.
- Exogenous factors: These factors are mainly related to the economic development of towns and poles in the Project's area of influence, which would favour the movement of people and goods and, therefore, increase the demand for the use of the infrastructure.

The conclusions arisen from the financial assessment are the following ones for the Eastern part:

- The projected demand is mainly coming from the light vehicles (45%), followed by buses (31%), but their revenues come mainly from trucks (54%), followed by buses (27%).
- Operating expenses come mainly from maintenance of the infrastructure and installations, with several years of particularly high extraordinary maintenance costs (years 21, 31 and 41 of the period of analysis).
- Operating cash flows are negative until year 16 of the period of analysis, then becoming positive but close to breakeven until year 26th of the period of analysis, and then positive and increasing values until the end of the period.
- The Project would require a so high amount of GoB grants to reach the target FDR of 12.00% in case of PPP Contract, that it would exceed by far the 40% maximum limit of VGF (over 70%). Hence, PPP contract alternative has not been analysed.
- Financial indicators, with the Public Project contract structure, show a Project with a negative FIRR, which is lower the FDR (12.00%), representing that the total net GoB contributions to the Project during the period analysed are -10,047 Cr BDT (discounted @12%), with a negative FNPV of -28,524.21 Cr BDT.
- Since it is observed that the cash flows are negative during the operation period, requiring high amounts of grants, VfM analysis is not provided.

- There are several factors that can make the project more attractive to private investors by increasing the economic activity in the zone and, consequently, increasing the demand of the tolled expressway. Besides, there are fiscal issues which could increase Project's profitability.

Concerning the Western part Option A, the conclusions arisen from the financial assessment are the following ones:

- The projected demand is mainly coming from the light vehicles (46%), followed by buses (38%), but their revenues are different, being the largest share for buses (39%), followed by trucks (37%).
- Operating expenses come mainly from maintenance of the infrastructure and installations, with several years of particularly high extraordinary maintenance costs (years 10, 20 and 30 of operation).
- Operating result (EBITDA) is expected to be positive during the whole period of analysis, with several years of quite negative EBITDA due to the high extraordinary maintenance costs (years 10, 20 and 30 of operation).
- The Project would require a so high amount of GoB grants to reach the target FDR of 12.00% in case of PPP Contract, that it would exceed by far the 40% maximum limit of VGF (over 80%). Hence, PPP contract alternative has not been analysed.
- Financial indicators, with the Public Project contract structure, show a Project with a negative FIRR, which is lower the FDR (12.00%), representing that the total net GoB contributions to the Project during the period analysed are -20,904 Cr BDT (discounted @12%), and a negative FNPV of -53,271 Cr BDT.
- Since it is observed that the cash flows are negative during the operation period, requiring high amounts of grants, VfM analysis is not provided.
- There are several factors that can make the project more attractive to private investors by increasing the economic activity in the zone and, consequently, increasing the demand of the tolled expressway. Besides, there are fiscal issues which could increase Project's profitability.

Concerning the Western part Option B, the conclusions arisen from the financial assessment are the following ones:

- The projected demand is mainly coming from buses (53%), followed by the light vehicles (41%), and toll revenues from buses show the largest share (61%).
- Operating expenses come mainly from maintenance of the infrastructure and installations, with several years of particularly high extraordinary maintenance costs (years 10, 20 and 30 of operation).
- Operating result (EBITDA) is expected to be positive during the whole period of analysis, with several years of lower EBITDA due to the high extraordinary maintenance costs (years 10, 20 and 30 from starting operation).
- The Project would require a high amount of GoB grants to reach the target FDR of 12.00% in case of PPP Contract, exceeding the 40% maximum limit of VGF (56.82%). Hence, PPP contract alternative is not suitable.
- Financial indicators, with the Public Project contract structure, show a Project with a positive FIRR (2.48%), but is lower the FDR (12.00%), representing that the total net GoB contributions

to the Project during the period analysed are -2,977 Cr BDT (discounted @12%), and a negative FNPV of -10,067 Cr BDT.

- VfM analysis estimates a potential gain for the GoB of 1,862 Cr BDT in case the project is implemented with a PPP contract, but this option is not suitable following VGF rules.
- There are several factors that can make the project more attractive to private investors by increasing the economic activity in the zone and, consequently, increasing the demand of the tolled expressway. Besides, there are fiscal issues which could increase Project's profitability.

8. INSTITUTIONAL AND PROCUREMENT ANALYSIS

The essential purpose of any development is social investment. A planned project is an idea for an intended future condition regarding social and economic activities, their locations and linkages, and the development of essential land, structures, and mechanisms. Viewed from the implementation angle, however, a planned project is a program of action and pre-determined coordination of legislative, fiscal, and administrative measures designed to achieve the transition from the present situation to that represented by the model. It should be noted that the essential features of both of this situation are as follows:

- A commitment to improve the human condition through economic development and social change.
- Close integration of socio-economic and environmental development in harmony with accepted development strategies. And the complete interdependence between economic, social, and environmental planning on the one hand, and legislative, fiscal, administrative, and political action planning on the other, which together make a truly comprehensive plan.

When addressing the approach considerations for a specific procurement strategy plan, the following aspects of a project need to be carefully examined:

- Expediting the procurement process is a key aspect.
- Cost Uncertainty: Rates and construction cost estimate certainty is a challenging matter given today the current global macro-economic environment of high inflation and raw materials scarcity. In any case during the forecasting stages of the financial model implemented it has been taken into consideration this level of possible prices escalation.
- Time certainty for completion of the project (Client and the Contractor/Concessionaire). Minimum time over-run should be a key fact to be considered within the type of contract being implemented. Schedule constraints and responsibility to be very well determined in the type of contract (delay damages/penalty clauses).
- Design aspects: the Detailed Design to be provided by the BBA to the awarded contractor. The Ability to contractually cope and to technically accommodate design changes in the final set of shop drawings at construction phase shall be considered within the type of contract.
- Responsibility: throughout the project's life, each party's accountability must be very critically stipulated within the contract documents.
- Complexity: Client may involve a specific innovative component to be executed or finally design. The option of awarding the project to a joint venture, led by a top worldwide

international contractor together with domestic subcontractors for some sections of the project is a recommended.

- Quality Assurance: Client may involve an independent agency to regulate and monitor Quality Controls during execution and maintenance of work.
- Risk Allocation: Clearly defined areas of risk allocation, a thorough risk assessment to be implemented before tendering the project. Main risks could be considered the following ones: construction risks (cost or time overrun risk, geotechnical risk) and demand risk.

From a financial perspective, the project cannot reach by itself operating or financial sustainability, which leads to a financial issue, requiring therefore an important support from Government contributions or grants.

In the case of PPP mode, the estimated level of required grant appears to be much higher than 40.00%, which means that a toll-based **PPP Concession Agreement**, cannot be a recommended option.

On the other hand, a **Public Government Project Contract** following an open international bidding process for construction (Tier 1 International Contractor tender process) is also a possible recommended scheme to be adopted, including a guarantee period of 1-2 years. In this case, demand risk should be retained by the Government, avoiding that this relevant risk poses a higher cost in the case that it is transferred to a private operator (PPP scheme).

The classic risk sharing format for such a contract shall be as follows.

Table 80. Risk sharing format

BBA-Government	Contractor
Arrange for funding	Design review and proof checking
Land Acquisition	Construction and timely completion
Open bidding process and contract award for Construction	Guarantee Period of 1-2 years

Two main factors must not be overlooked while preparing the bidding documents.

1. Proof checking of structural design by an independent consultant selected by the BBA/ Government.
2. The successful bidder shall carry out his own Geo Technical investigation to confirm the accuracy of the data furnished in the feasibility studies. Design work to proceed only after such confirmation in writing by the successful bidder.

BBA may provide a supervision consultant to ensure monitoring of the quality, progress, and cost of the project during construction.

9. CONCLUSION

9.1.1. General

The today highly dense city of Dhaka, along with the overgrown population burden, stands in urgent need to implement relevant improvements in the metropolitan road transportation systems. These initiatives should be adopted within an integrated planning and financing scheme. Only in this way, system sustainability, an effective coordination of modes, and the affordable provision for the general mass, would be assured.

The BBA has undertaken the DEICR project implementation along the riversides of Buriganga, Shitalakya, Balu and Turag by initiating the first stage, a Feasibility Study.

The essential purpose of any investment is the socio-economic development and growth. In this regard, any feasibility study assesses a proposed plan for an intended future condition considering social and economic activities, their locations and linkages, and the development of essential land, structures and other components.

For a long time, the city of Dhaka population has suffered the absence of an efficient transport network to move from one part to another part of the city. The consequences are clear, traffic congestion, and a chaotic situation on the streets leading to a wastage of working hours, an increase in air pollution and the impact on human health.

The integration with other transport modes shall be achieved in a sensitive manner that recognizes the right of mode choice for the traveler. Under this situation, the different concerned agencies have introduced some transport projects in the Dhaka area (RAJUK, DCCs, LGRD, RHD, BWDB, BIWTA, BR and BBA); moreover, WB, ADP, JICA and others are also engaged to implement BRT, MRT, elevated expressways and other transport infrastructure projects. The DEICR project and its setting along the city rivers requires integration and specific coordination with other concerned agencies and organizations building capacities and its technicalities, whilst keeping in mind that other agencies also implement their projects along the same or nearby route.

Viewed from the implementation standpoint and as a summarizing outcome derived from this feasibility study, considering all technical, social, and environmental standpoints, it may be concluded that the project, located and circumvallating the city of Dhaka, consisting of 84 km and divided in two separated main parts, Eastern Part-1 and Western Part-2, would be feasible. The socio-economic and financial viability studies provide a particular conclusion for each one of the parts or analyzed options, that shall be separately scrutinized to maximize the overall benefit for the country by implementing the optimum strategy in each case.

The analysis for this study has been split in two main parts, each one with independent findings, implementation strategy and proposed timeline and approach. The implementation of the Eastern Part-1 has been proposed to include four phases/sections to be staggered to enable an earlier start of the operation in service of the first stage and subsequent sections. The implementation calendar to be adopted at the Western Part-2 has been based on two study cases (this approach is explained in

detail further in this conclusion section: option a) including the whole alignment of 57.02 km and option b) including a 14.10 km reduced section covering Dhour-Diabari-Gabtoli).

The **Eastern Part-1** covers **26.98 km from Demra to Abdullapur** (counterclockwise) through an area where mainly no current main infrastructure is being or planned to be developed and where the level of priority and investment justification has been set as high for the improvement of the Dhaka City area traffic conditions and socio-economic growth. A total of seven junctions have been adopted along the alignment.

The **Western Part-2** covers **57.02 km from Abdullapur to Demra** (counterclockwise) through a very congested and dense urban area where a series of other infrastructure projects are also being developed. This part is studied and proposed under the assumptions of considering it as a future enhancement of the existing and/or planned to be build infrastructures. A total of ten junctions have been adopted along the alignment.

The proposed alignment at both parts, was selected after an iteration process by optimizing alignment options, aiming to minimize the impact on land acquisition costs mainly, as well as social and environmental impacts.

Regarding the **Eastern Part-1**, the Consultant recommends the proposed elevated structure solution, to be implemented by the BBA, as it would provide sound social and economic progress and benefits to the population living in the RAJUK area. It would also promote and enhance potential socio-economic growth for the region and the entire country.

In the **Western Part-2**, given the existence of ongoing or planned projects, and the availability of space constrains, in the zones where the conditions of the RHD project allows, it was designed an elevated structure with piers allocated in the median of the at-grade RHD expressway. In other cases, where technical conditions impeded this approach to be followed, the route was designed separately from the RHD alignment. In the latter case, with the drawback of posing a higher impact in terms of land acquisition.

It is worthwhile to remark that, where the alignment has been assumed to share the median or other sections of the previously expected to be implemented project by RHD, the land acquisition impact has been considered as part of the RHD project expenditure and not in this BBA project capex.

The environmental assessment has been carried out accordingly with the current DOE guidelines, recommendations and approved ToR. Falling the project under red category, its risks would be duly mitigated through the implementation of the proper Environmental Impact Assessment (EIA) and Environmental management Plan (EMP) during the construction phase.

Social safeguard aspects have been assessed following the current legislation and guidelines, and the project impact, that would require resettlement of part of the affected areas, would be mitigated to the implementation of the Social Impact Assessment Action Plan, including LAP and RAP. Consultation to the community of the affected areas was carried out with a positive response from both local authorities and population. It has been estimated that a total of 323.45 acres of land would be needed to be acquired at the Eastern Part-1 which additionally considering the affection to structures, trees,

resettlement and other items would total an estimated cost of 10,396 Cr BDT. At the Western Part-2, the impact in terms of land acquisition and others would be lower, totalling 272.70 acres and a total estimated cost of 7,570.77 Cr BDT.

9.1.2. Eastern Part-1 proposed timeline and economic/financial studies' conclusion

The completion of the Eastern Part-1 project construction has been estimated in 9 years (108 months of construction phase, 2027-2035) after 2 years of pre-construction activities, totalling 11 years of investment (2025 to 2035). The implementation of the project has been proposed to include four phases/sections to be staggered to enable an earlier start of the operation in service of the first stage and subsequent sections.

According to this scheme, the first section (S1 Demra-Madani Avenue) would enter in operation in 2031 after 4 years of construction. Subsequent sections (S2 Madani Avenue-Mastul), (S3 Mastul-Teromukh) and (S4 Teromukh-Abdullahpur) would enter in operation in 2033, 2034 and 2036 respectively after 2 years of construction each. One additional year has been included for S4 (2035) to complete the whole project snagging list and all necessary issues prior to the project's finalization.

In sum, at the Eastern Part-1, the project operation phase is estimated to start in 2031 (S1 Demra-Madani Avenue) and end in 2064 totalling 34 years. The project total period including investment and operation phases is proposed to be from 2025 to 2064, totalling 40 years.

The estimated cost investment is **38,835.82 Cr BDT (**sections breakdown as follows: 15,534 Cr BDT S1 **-** 5,825 Cr BDT S2 - 5,825 Cr BDT S3 - 11,651 Cr BDT S4).

The traffic studies forecast for the final year of operation (2064) is estimated as **52,291 vehicles**.

The economic Cost-Benefit Analysis (CBA) has been assessed running the traffic scenario with the following results: **EIRR 13.74 %, ENPV 4,289 Cr BDT, C/B ratio 1.21**, **pay-back year 2053**.

The Eastern Part-1 project impact on the national GDP during the years of operation period of the infrastructure has been estimated as 1.62%.

The Financial indicators, in the case of Public Project contract structure, show an unlevered **FIRR** of -1.78%. The Project does not reach the financial feasibility target values considering the FDR of 12.00%. Net GoB total cash flow is estimated in **-10,046.78 Cr BDT**, as net contribution from the GoB during the life of the Project.

The Project cannot be recommended under a PPP structure as it would require a grant representing a VGF higher than 40% set up by law for PPP contract structures.

9.1.3. Western Part-2 proposed timeline and economic/financial studies' conclusion

The implementation calendar to be adopted at the Western Part-2, shall be managed today in a scenario of some uncertainty, contingent on third parties' projects and on a critical stakeholders' related coordination. Overall, a joint strategic decision shall be taken in the following years, at the highest Ministry of Transport level, seeking for the optimum strategy for the country. Despite the level

of uncertainty, an estimated calendar for the implementation of this part has been outlined and considered into the economic and financial model appraisal.

The approach has been based on two study cases: option a) including the whole alignment of 57.02 km and option b) including a 14.10 km reduced section covering Dhour-Diabari-Gabtoli, 10.90 km+3.32 km long, (8W-11W and 7W-8W). Relying, the factual implementation schedule, on the factual conditions and demand derived from the level of operation of the project implemented by RHD, an approach by sections might be reasonable and arguably appears to be the optimum solution for this part of the DEICR.

Option a)

The schedule for the completion of this whole part, is based on 9 years (108 months) of construction phase, hence 11 years of investment followed of 30 years of operation, for economic and financial viability study purposes.

The estimated cost investment for option a) covering 57.02 km is **53,496.52 Cr BDT.**

The traffic studies forecast for the final year of operation (2069) is estimated as **28,515 vehicles**

The Economic Cost-Benefit Analysis (CBA) has been assessed running the traffic scenario. The results obtained from the economic model are: **EIRR 9.18 %, ENPV -9,547.46 Cr BDT, C/B ratio 0.63**.

The Western Part-2 option a) project impact on the national GDP during the years of operation period of the infrastructure has been estimated as 2.99%.

The Financial indicators, in the case of Public Project contract structure, show an unlevered **FIRR** of **-**11.44%. The Project does not reach the financial feasibility target values considering the FDR of 12.00%. Net GoB total cash flow is estimated in **-20,903.91 Cr BDT**, as net contribution from the GoB during the life of the Project.

Option b)

A reduced scope and length alternative option has been studied covering 14.10 km section from Dhour-Diabari-Gabtoli, with the assumption of starting operation in 2040. The estimated cost investment for this part is **11,785.01 Cr BDT**.

The traffic studies forecast for the final year of operation (2072) is estimated as **42,353 vehicles**

The Economic Cost-Benefit Analysis (CBA) has been assessed running the traffic scenario. The results obtained from the economic model are: **EIRR 15.55 %, ENPV 3,866.89 Cr BDT, C/B ratio 1.49, pay-back year 2055.**

The Western Part-2 option b) project impact on the national GDP during the years of operation period of the infrastructure has been estimated as 0.67%.

The Financial indicators, in the case of Public Project contract structure, show an unlevered **FIRR** of **2.48**%. The Project does not reach the financial feasibility target values considering the FDR of 12.00%.

Net GoB total cash flow is estimated in **-2,977.30 Cr BDT**, as net contribution from the GoB during the life of the Project. This shorter option b) financial indicators improve the previous option a).

Western Part-2 Project, in both, a and b options, cannot be recommended under a PPP structure as it would require a grant representing a VGF higher than 40% set up by law for PPP contract structures.

9.1.4. Conclusion Summary

As a summarizing outcome derived from this feasibility study, considering all technical, social, and environmental standpoints, it may be concluded that the long-time demanded project, circumvallating the city of Dhaka, consisting of 84.01 km and divided in two separated main parts, Eastern Part-1 and Western Part-2, would be technically and socio-economically feasible.

The financial viability shall be assessed thoroughly in each case, to find and decide on the optimum approach to maximize the overall benefit for the country, for the people of the RAJUK area and the whole country. Socio-economic benefits of each one of the study cases analyzed were determined and found to be sound and relevant. Financial appraisal conclusions were determined for each case scenario. The investment scheme considered assumptions and implementation approach shall be thoroughly assessed and decided at further stages of the project for an optimum financial outcome of each one of the phases of the project.

Given the size and complexity of the project, the high level of investment that would be necessary, the extent of uncertainty at some project interfaces and the needed coordination amongst related agencies at some parts of the alignment, the Consultant strongly supports the proposed prioritization and phasing approach that is included within this FS. This conclusion is supported by the outcome obtained from the engineering, the project planning and the economic/financial appraisals.

Annexure 01 – Economic and Financial Model Calculation Sheets Eastern Part-1

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Economic Analysis

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FEASIBILITY STUDY OF DEICR, EASTERN PART - 1		2025	2026	2027	2028	2029
		Year 1	Year 2	Year 3	Year 4	Year 5
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**18,241.84**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
User passenger time savings	18,246.09	0.00	0.00	0.00	0.00	0.00
User freight time savings	347.53	0.00	0.00	0.00	0.00	0.00
Vehicle Operating Costs (VOC) savings	-351.78	0.00	0.00	0.00	0.00	0.00
Variation in Externalities	**6,276.03**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Accidents	3,309.68	0.00	0.00	0.00	0.00	0.00
Emissions	2,578.72	0.00	0.00	0.00	0.00	0.00
Air polution	1,516.54	0.00	0.00	0.00	0.00	0.00
Climate change	1,062.18	0.00	0.00	0.00	0.00	0.00
Well to tank	387.63	0.00	0.00	0.00	0.00	0.00
TOTAL ECONOMIC BENEFITS (Cr BDT)	**24,517.88**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-18,790.13**	**-338.67**	**-1,693.33**	**-3,386.67**	**-3,386.67**	**-3,386.67**
Residual value	**190.37**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Renovation works	**-831.93**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Change in Producer Surplus:	**-797.18**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Producers costs savings for the system	-797.18	0.00	0.00	0.00	0.00	0.00
TOTAL ECONOMIC COSTS (Cr BDT)	**-20,228.87**	**-338.67**	**-1,693.33**	**-3,386.67**	**-3,386.67**	**-3,386.67**
NET BENEFITS (Cr BDT)	**4,289.01**	**-338.67**	**-1,693.33**	**-3,386.67**	**-3,386.67**	**-3,386.67**

IRR (%)	**13.74%**
NPV (Cr BDT)	**4,289.01**
Pay Back	**2,053**
Benefit / Cost	**1.21**

CBA

FEASIBILITY STUDY OF DEICR, EASTERN PART - 1		2030	2031	2032	2033	2034
		Year 6	Year 7	Year 8	Year 9	Year 10
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**18,241.84**	**0.00**	**377.04**	**402.07**	**1,177.05**	**1,855.81**
User passenger time savings	18,246.09	0.00	360.85	384.44	1,154.11	1,846.92
User freight time savings	347.53	0.00	4.03	4.28	21.47	32.14
Vehicle Operating Costs (VOC) savings	-351.78	0.00	12.16	13.35	1.47	-23.24
Variation in Externalities	**6,276.03**	**0.00**	**1,204.29**	**1,239.74**	**1,271.00**	**1,302.27**
Accidents	3,309.68	0.00	652.14	667.90	679.97	691.21
Emissions	2,578.72	0.00	480.90	497.84	514.28	531.52
Air polution	1,516.54	0.00	282.83	292.76	302.41	312.70
Climate change	1,062.18	0.00	198.07	205.08	211.87	218.82
Well to tank	387.63	0.00	71.25	74.00	76.75	79.54
TOTAL ECONOMIC BENEFITS (Cr BDT)	**24,517.88**	**0.00**	**1,581.33**	**1,641.81**	**2,448.05**	**3,158.08**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-18,790.13**	**-3,386.67**	**-4,402.67**	**-4,402.67**	**-4,741.33**	**-2,370.67**
Residual value	**190.37**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Renovation works	**-831.93**	**0.00**	**-81.29**	**-81.29**	**-127.24**	**-151.98**
Change in Producer Surplus:	**-797.18**	**0.00**	**-16.92**	**-16.23**	**-14.49**	**-29.83**
Producers costs savings for the system	-797.18	0.00	-16.92	-16.23	-14.49	-29.83
TOTAL ECONOMIC COSTS (Cr BDT)	**-20,228.87**	**-3,386.67**	**-4,500.88**	**-4,500.19**	**-4,883.07**	**-2,552.48**
NET BENEFITS (Cr BDT)	**4,289.01**	**-3,386.67**	**-2,919.55**	**-2,858.38**	**-2,435.02**	**605.60**

IRR (%)	**13.74%**
NPV (Cr BDT)	**4,289.01**
Pay Back	**2,053**
Benefit / Cost	**1.21**

CBA

FEASIBILITY STUDY OF DEICR, EASTERN PART - 1		2035	2036	2037	2038	2039
		Year 11	Year 12	Year 13	Year 14	Year 15
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**18,241.84**	**1,992.72**	**3,497.59**	**3,770.04**	**4,063.04**	**4,378.09**
User passenger time savings	18,246.09	1,983.78	3,526.88	3,795.63	4,084.41	4,394.66
User freight time savings	347.53	34.72	54.75	60.85	67.50	74.74
Vehicle Operating Costs (VOC) savings	-351.78	-25.79	-84.04	-86.44	-88.87	-91.31
Variation in Externalities	**6,276.03**	**1,348.87**	**1,311.65**	**1,331.05**	**1,350.76**	**1,370.77**
Accidents	3,309.68	711.88	688.27	698.02	707.91	717.95
Emissions	2,578.72	553.87	541.72	550.10	558.62	567.27
Air polution	1,516.54	325.87	318.57	323.51	328.53	333.64
Climate change	1,062.18	228.01	223.16	226.59	230.09	233.64
Well to tank	387.63	83.12	81.65	82.93	84.23	85.55
TOTAL ECONOMIC BENEFITS (Cr BDT)	**24,517.88**	**3,341.59**	**4,809.24**	**5,101.09**	**5,413.80**	**5,748.87**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-18,790.13**	**-2,370.67**	**0.00**	**0.00**	**0.00**	**0.00**
Residual value	**190.37**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Renovation works	**-831.93**	**-151.98**	**-176.73**	**-176.73**	**-176.73**	**-176.73**
Change in Producer Surplus:	**-797.18**	**-21.17**	**-174.57**	**-189.11**	**-204.80**	**-221.72**
Producers costs savings for the system	-797.18	-21.17	-174.57	-189.11	-204.80	-221.72
TOTAL ECONOMIC COSTS (Cr BDT)	**-20,228.87**	**-2,543.82**	**-351.29**	**-365.84**	**-381.53**	**-398.44**
NET BENEFITS (Cr BDT)	**4,289.01**	**797.76**	**4,457.94**	**4,735.25**	**5,032.27**	**5,350.43**

IRR (%)	**13.74%**
NPV (Cr BDT)	**4,289.01**
Pay Back	**2,053**
Benefit / Cost	**1.21**

CBA

FEASIBILITY STUDY OF DEICR, EASTERN PART - 1		2040	2041	2042	2043	2044
		Year 16	Year 17	Year 18	Year 19	Year 20
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**18,241.84**	**4,716.84**	**5,030.76**	**5,364.01**	**5,717.72**	**6,093.10**
User passenger time savings	18,246.09	4,727.97	5,043.21	5,377.85	5,733.00	6,109.89
User freight time savings	347.53	82.63	88.51	94.81	101.57	108.79
Vehicle Operating Costs (VOC) savings	-351.78	-93.76	-100.96	-108.65	-116.85	-125.58
Variation in Externalities	**6,276.03**	**1,391.10**	**1,393.66**	**1,396.22**	**1,398.80**	**1,401.39**
Accidents	3,309.68	728.14	729.31	730.48	731.66	732.84
Emissions	2,578.72	576.07	577.25	578.45	579.65	580.85
Air polution	1,516.54	338.82	339.51	340.19	340.89	341.58
Climate change	1,062.18	237.25	237.75	238.25	238.76	239.27
Well to tank	387.63	86.89	87.09	87.29	87.50	87.70
TOTAL ECONOMIC BENEFITS (Cr BDT)	**24,517.88**	**6,107.94**	**6,424.42**	**6,760.23**	**7,116.52**	**7,494.49**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-18,790.13**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Residual value	**190.37**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Renovation works	**-831.93**	**-465.61**	**-176.73**	**-340.01**	**-264.65**	**-176.73**
Change in Producer Surplus:	**-797.18**	**-239.95**	**-252.70**	**-266.10**	**-280.19**	**-294.99**
Producers costs savings for the system	-797.18	-239.95	-252.70	-266.10	-280.19	-294.99
TOTAL ECONOMIC COSTS (Cr BDT)	**-20,228.87**	**-705.55**	**-429.42**	**-606.11**	**-544.83**	**-471.72**
NET BENEFITS (Cr BDT)	**4,289.01**	**5,402.39**	**5,994.99**	**6,154.12**	**6,571.68**	**7,022.77**

IRR (%)	**13.74%**
NPV (Cr BDT)	**4,289.01**
Pay Back	**2,053**
Benefit / Cost	**1.21**

CBA

FEASIBILITY STUDY OF DEICR, EASTERN PART - 1		2045	2046	2047	2048	2049
		Year 21	Year 22	Year 23	Year 24	Year 25
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**18,241.84**	**6,491.42**	**6,914.02**	**7,362.33**	**7,837.86**	**8,342.18**
User passenger time savings	18,246.09	6,509.77	6,934.00	7,384.00	7,861.25	8,367.37
User freight time savings	347.53	116.54	124.83	133.71	143.22	153.40
Vehicle Operating Costs (VOC) savings	-351.78	-134.89	-144.81	-155.37	-166.62	-178.59
Variation in Externalities	**6,276.03**	**1,403.99**	**1,406.60**	**1,409.22**	**1,411.85**	**1,414.50**
Accidents	3,309.68	734.03	735.22	736.41	737.61	738.82
Emissions	2,578.72	582.06	583.27	584.50	585.72	586.96
Air polution	1,516.54	342.28	342.98	343.69	344.40	345.11
Climate change	1,062.18	239.78	240.29	240.81	241.33	241.85
Well to tank	387.63	87.90	88.11	88.31	88.52	88.72
TOTAL ECONOMIC BENEFITS (Cr BDT)	**24,517.88**	**7,895.40**	**8,320.62**	**8,771.55**	**9,249.71**	**9,756.67**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-18,790.13**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Residual value	**190.37**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Renovation works	**-831.93**	**-284.06**	**-176.73**	**-187.70**	**-182.63**	**-176.73**
Change in Producer Surplus:	**-797.18**	**-310.55**	**-326.90**	**-344.08**	**-362.14**	**-381.10**
Producers costs savings for the system	-797.18	-310.55	-326.90	-344.08	-362.14	-381.10
TOTAL ECONOMIC COSTS (Cr BDT)	**-20,228.87**	**-594.62**	**-503.63**	**-531.78**	**-544.77**	**-557.83**
NET BENEFITS (Cr BDT)	**4,289.01**	**7,300.79**	**7,816.99**	**8,239.77**	**8,704.94**	**9,198.85**

IRR (%)	**13.74%**
NPV (Cr BDT)	**4,289.01**
Pay Back	**2,053**
Benefit / Cost	**1.21**

CBA

FEASIBILITY STUDY OF DEICR, EASTERN PART - 1		2050	2051	2052	2053	2054
		Year 26	Year 27	Year 28	Year 29	Year 30
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**18,241.84**	**8,876.98**	**9,360.43**	**9,870.73**	**10,409.42**	**10,978.11**
User passenger time savings	18,246.09	8,904.00	9,383.35	9,888.73	10,421.59	10,983.43
User freight time savings	347.53	164.31	180.15	197.52	216.57	237.45
Vehicle Operating Costs (VOC) savings	-351.78	-191.33	-203.07	-215.52	-228.74	-242.77
Variation in Externalities	**6,276.03**	**1,417.15**	**1,463.98**	**1,512.91**	**1,564.07**	**1,617.54**
Accidents	3,309.68	740.03	762.47	785.88	810.32	835.81
Emissions	2,578.72	588.19	609.26	631.32	654.41	678.58
Air polution	1,516.54	345.83	358.20	371.16	384.73	398.94
Climate change	1,062.18	242.37	251.06	260.16	269.68	279.64
Well to tank	387.63	88.93	92.24	95.71	99.34	103.15
TOTAL ECONOMIC BENEFITS (Cr BDT)	**24,517.88**	**10,294.13**	**10,824.41**	**11,383.65**	**11,973.48**	**12,595.65**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-18,790.13**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Residual value	**190.37**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Renovation works	**-831.93**	**-471.51**	**-176.73**	**-340.01**	**-264.65**	**-176.73**
Change in Producer Surplus:	**-797.18**	**-401.02**	**-419.93**	**-439.68**	**-460.28**	**-481.77**
Producers costs savings for the system	-797.18	-401.02	-419.93	-439.68	-460.28	-481.77
TOTAL ECONOMIC COSTS (Cr BDT)	**-20,228.87**	**-872.54**	**-596.66**	**-779.68**	**-724.92**	**-658.50**
NET BENEFITS (Cr BDT)	**4,289.01**	**9,421.59**	**10,227.75**	**10,603.97**	**11,248.56**	**11,937.15**

IRR (%)	**13.74%**
NPV (Cr BDT)	**4,289.01**
Pay Back	**2,053**
Benefit / Cost	**1.21**

CBA

FEASIBILITY STUDY OF DEICR, EASTERN PART - 1		2055	2056	2057	2058	2059
		Year 31	Year 32	Year 33	Year 34	Year 35
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**18,241.84**	**11,578.53**	**12,212.49**	**12,881.93**	**13,588.89**	**14,335.54**
User passenger time savings	18,246.09	11,575.84	12,200.50	12,859.19	13,553.78	14,286.23
User freight time savings	347.53	260.35	285.45	312.98	343.16	376.25
Vehicle Operating Costs (VOC) savings	-351.78	-257.66	-273.47	-290.24	-308.04	-326.94
Variation in Externalities	**6,276.03**	**1,673.44**	**1,731.90**	**1,793.03**	**1,856.96**	**1,923.83**
Accidents	3,309.68	862.43	890.22	919.23	949.52	981.16
Emissions	2,578.72	703.88	730.38	758.13	787.20	817.63
Air polution	1,516.54	413.81	429.39	445.71	462.81	480.71
Climate change	1,062.18	290.07	300.99	312.42	324.39	336.92
Well to tank	387.63	107.13	111.30	115.67	120.24	125.03
TOTAL ECONOMIC BENEFITS (Cr BDT)	**24,517.88**	**13,251.97**	**13,944.39**	**14,674.96**	**15,445.85**	**16,259.37**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-18,790.13**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Residual value	**190.37**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Renovation works	**-831.93**	**-284.06**	**-176.73**	**-187.70**	**-182.63**	**-176.73**
Change in Producer Surplus:	**-797.18**	**-504.19**	**-527.56**	**-551.91**	**-577.28**	**-603.70**
Producers costs savings for the system	-797.18	-504.19	-527.56	-551.91	-577.28	-603.70
TOTAL ECONOMIC COSTS (Cr BDT)	**-20,228.87**	**-788.25**	**-704.28**	**-739.61**	**-759.92**	**-780.42**
NET BENEFITS (Cr BDT)	**4,289.01**	**12,463.72**	**13,240.11**	**13,935.35**	**14,685.94**	**15,478.95**

IRR (%)	**13.74%**
NPV (Cr BDT)	**4,289.01**
Pay Back	**2,053**
Benefit / Cost	**1.21**

CBA

FEASIBILITY STUDY OF DEICR, EASTERN PART - 1		2060	2061	2062	2063	2064
		Year 36	Year 37	Year 38	Year 39	Year 40
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**18,241.84**	**15,124.18**	**15,957.25**	**16,837.33**	**17,767.16**	**18,749.65**
User passenger time savings	18,246.09	15,058.65	15,873.22	16,732.27	17,638.25	18,593.76
User freight time savings	347.53	412.53	452.31	495.92	543.74	596.17
Vehicle Operating Costs (VOC) savings	-351.78	-346.99	-368.28	-390.86	-414.84	-440.29
Variation in Externalities	**6,276.03**	**1,993.78**	**2,066.95**	**2,143.52**	**2,223.63**	**2,307.46**
Accidents	3,309.68	1,014.22	1,048.75	1,084.83	1,122.53	1,161.93
Emissions	2,578.72	849.51	882.90	917.88	954.53	992.91
Air polution	1,516.54	499.46	519.11	539.70	561.27	583.86
Climate change	1,062.18	350.05	363.79	378.18	393.26	409.05
Well to tank	387.63	130.05	135.30	140.81	146.58	152.62
TOTAL ECONOMIC BENEFITS (Cr BDT)	**24,517.88**	**17,117.96**	**18,024.20**	**18,980.84**	**19,990.79**	**21,057.12**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-18,790.13**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Residual value	**190.37**	**0.00**	**0.00**	**0.00**	**0.00**	**15,815.96**
Renovation works	**-831.93**	**-471.51**	**-176.73**	**-340.01**	**-264.65**	**-176.73**
Change in Producer Surplus:	**-797.18**	**-631.19**	**-659.79**	**-689.53**	**-720.43**	**-752.52**
Producers costs savings for the system	-797.18	-631.19	-659.79	-689.53	-720.43	-752.52
TOTAL ECONOMIC COSTS (Cr BDT)	**-20,228.87**	**-1,102.71**	**-836.52**	**-1,029.53**	**-985.08**	**14,886.71**
NET BENEFITS (Cr BDT)	**4,289.01**	**16,015.25**	**17,187.69**	**17,951.31**	**19,005.71**	**35,943.82**

IRR (%)	**13.74%**
NPV (Cr BDT)	**4,289.01**
Pay Back	**2,053**
Benefit / Cost	**1.21**

Financial Analysis-Project and Government Cash Flows

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DEICR, EASTERN PART – 1

	2025 Year 1	2026 Year 2	2027 Year 3	2028 Year 4	2029 Year 5	2030 Year 6	2031 Year 7
Construction period	1	1	1	1	1	1	1
Operation period	0	0	0	0	0	0	0
Term of analysis	1	1	1	1	1	1	1
Price indexation	1.00	1.05	1.10	1.16	1.22	1.28	1.34

PROJECT CASH FLOWS (Cr BDT)	2025 Year 1	2026 Year 2	2027 Year 3	2028 Year 4	2029 Year 5	2030 Year 6	2031 Year 7
Operating revenues	**0**	**0**	**0**	**0**	**0**	**0**	**313**
Toll revenues	0	0	0	0	0	0	313
Other commercial revenues	0	0	0	0	0	0	0
Operation & Maintenance expenses	**0**	**0**	**0**	**0**	**0**	**0**	**-93**
Maintenance & Overhaul	0	0	0	0	0	0	-90
Operation	0	0	0	0	0	0	-3
Net Cash Flows due to Operations	**0**	**0**	**0**	**0**	**0**	**0**	**220**
Cash Flows due to Investments	**-623**	**-2,132**	**-4,507**	**-4,811**	**-5,131**	**-5,468**	**-7,453**
Initial CAPEX	-623	-2,132	-4,507	-4,811	-5,131	-5,468	-7,453
Other CAPEX	0	0	0	0	0	0	0
Residual Value of Investments	0	0	0	0	0	0	0
Project cash flows	**-623**	**-2,132**	**-4,507**	**-4,811**	**-5,131**	**-5,468**	**-7,233**

GOVERNMENT CASH FLOWS (Cr BDT)	2025 Year 1	2026 Year 2	2027 Year 3	2028 Year 4	2029 Year 5	2030 Year 6	2031 Year 7
Outflows	**-623**	**-2,132**	**-4,507**	**-4,811**	**-5,131**	**-5,468**	**-7,547**
Project Development (Initial CAPEX)	-398	-2,088	-4,384	-4,604	-4,834	-5,076	-6,928
Financing Fees	-225	-44	-123	-207	-297	-393	-525
Operating expenses	0	0	0	0	0	0	-93
Loan Repayments							
Interest	0	0	0	0	0	0	0
Principal Repayments	0	0	0	0	0	0	0
Inflows	**506**	**1,549**	**3,342**	**3,645**	**3,966**	**4,303**	**6,252**
Borrowings	506	1,549	3,342	3,645	3,966	4,303	5,939
Operating revenues	0	0	0	0	0	0	313
Future Developments	0	0	0	0	0	0	0
Government cash flows	**-117**	**-583**	**-1,165**	**-1,165**	**-1,165**	**-1,165**	**-1,295**

DEICR, EASTERN PART – 1

	2032 Year 8	2033 Year 9	2034 Year 10	2035 Year 11	2036 Year 12	2037 Year 13	2038 Year 14
Construction period	1	1	1	1	0	0	0
Operation period	0	0	0	0	1	1	1
Term of analysis	1	1	1	1	1	1	1
Price indexation	1.41	1.48	1.55	1.63	1.71	1.80	1.89

PROJECT CASH FLOWS (Cr BDT)	2032 Year 8	2033 Year 9	2034 Year 10	2035 Year 11	2036 Year 12	2037 Year 13	2038 Year 14
Operating revenues	**305**	**331**	**599**	**641**	**686**	**734**	**786**
Toll revenues	305	331	599	641	686	734	786
Other commercial revenues	0	0	0	0	0	0	0
Operation & Maintenance expenses	**-98**	**-206**	**-216**	**-227**	**-357**	**-375**	**-394**
Maintenance & Overhaul	-94	-198	-208	-218	-344	-361	-379
Operation	-4	-8	-8	-8	-13	-14	-15
Net Cash Flows due to Operations	**207**	**125**	**383**	**414**	**329**	**359**	**392**
Cash Flows due to Investments	**-7,941**	**-9,054**	**-5,232**	**-5,539**	**0**	**0**	**0**
Initial CAPEX	-7,941	-9,054	-5,232	-5,539	0	0	0
Other CAPEX	0	0	0	0	0	0	0
Residual Value of Investments	0	0	0	0	0	0	0
Project cash flows	**-7,734**	**-8,929**	**-4,849**	**-5,125**	**329**	**359**	**392**

GOVERNMENT CASH FLOWS (Cr BDT)	2032 Year 8	2033 Year 9	2034 Year 10	2035 Year 11	2036 Year 12	2037 Year 13	2038 Year 14
Outflows	**-8,039**	**-9,259**	**-5,448**	**-5,766**	**-3,084**	**-3,062**	**-3,041**
Project Development (Initial CAPEX)	-7,274	-8,226	-4,319	-4,534	0	0	0
Financing Fees	-666	-828	-914	-1,005	0	0	0
Operating expenses	-98	-206	-216	-227	-357	-375	-394
Loan Repayments							
Interest	0	0	0	0	-1,599	-1,559	-1,520
Principal Repayments	0	0	0	0	-1,128	-1,128	-1,128
Inflows	**6,731**	**7,753**	**5,016**	**5,365**	**686**	**734**	**786**
Borrowings	6,426	7,423	4,417	4,724	0	0	0
Operating revenues	305	331	599	641	686	734	786
Future Developments	0	0	0	0	0	0	0
Government cash flows	**-1,308**	**-1,506**	**-433**	**-401**	**-2,398**	**-2,328**	**-2,255**

DEICR, EASTERN PART – 1

	2039 Year 15	2040 Year 16	2041 Year 17	2042 Year 18	2043 Year 19	2044 Year 20	2045 Year 21
Construction period	0	0	0	0	0	0	0
Operation period	1	1	1	1	1	1	1
Term of analysis	1	1	1	1	1	1	1
Price indexation	1.98	2.08	2.18	2.29	2.41	2.53	2.65

PROJECT CASH FLOWS (Cr BDT)	2039 Year 15	2040 Year 16	2041 Year 17	2042 Year 18	2043 Year 19	2044 Year 20	2045 Year 21
Operating revenues	**837**	**893**	**951**	**1,014**	**1,081**	**1,153**	**1,229**
Toll revenues	837	893	951	1,014	1,081	1,153	1,229
Other commercial revenues	0	0	0	0	0	0	0
Operation & Maintenance expenses	**-413**	**-434**	**-456**	**-479**	**-502**	**-528**	**-2,589**
Maintenance & Overhaul	-398	-418	-439	-461	-484	-508	-2,569
Operation	-15	-16	-17	-18	-19	-20	-21
Net Cash Flows due to Operations	**424**	**458**	**496**	**536**	**579**	**625**	**-1,361**
Cash Flows due to Investments	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Initial CAPEX	0	0	0	0	0	0	0
Other CAPEX	0	0	0	0	0	0	0
Residual Value of Investments	0	0	0	0	0	0	0
Project cash flows	**424**	**458**	**496**	**536**	**579**	**625**	**-1,361**

GOVERNMENT CASH FLOWS (Cr BDT)	2039 Year 15	2040 Year 16	2041 Year 17	2042 Year 18	2043 Year 19	2044 Year 20	2045 Year 21
Outflows	**-3,021**	**-3,003**	**-2,985**	**-2,968**	**-2,953**	**-2,938**	**-4,961**
Project Development (Initial CAPEX)	0	0	0	0	0	0	0
Financing Fees	0	0	0	0	0	0	0
Operating expenses	-413	-434	-456	-479	-502	-528	-2,589
Loan Repayments							
Interest	-1,480	-1,441	-1,401	-1,362	-1,322	-1,283	-1,243
Principal Repayments	-1,128	-1,128	-1,128	-1,128	-1,128	-1,128	-1,128
Inflows	**837**	**893**	**951**	**1,014**	**1,081**	**1,153**	**1,229**
Borrowings	0	0	0	0	0	0	0
Operating revenues	837	893	951	1,014	1,081	1,153	1,229
Future Developments	0	0	0	0	0	0	0
Government cash flows	**-2,184**	**-2,110**	**-2,033**	**-1,954**	**-1,871**	**-1,786**	**-3,732**

DEICR, EASTERN PART – 1

	2046 Year 22	2047 Year 23	2048 Year 24	2049 Year 25	2050 Year 26	2051 Year 27	2052 Year 28
Construction period	0	0	0	0	0	0	0
Operation period	1	1	1	1	1	1	1
Term of analysis	1	1	1	1	1	1	1
Price indexation	2.79	2.93	3.07	3.23	3.39	3.56	3.73

PROJECT CASH FLOWS (Cr BDT)	2046 Year 22	2047 Year 23	2048 Year 24	2049 Year 25	2050 Year 26	2051 Year 27	2052 Year 28
Operating revenues	**1,310**	**1,397**	**1,490**	**1,608**	**1,736**	**1,874**	**2,025**
Toll revenues	1,310	1,397	1,490	1,608	1,736	1,874	2,025
Other commercial revenues	0	0	0	0	0	0	0
Operation & Maintenance expenses	**-582**	**-611**	**-641**	**-673**	**-869**	**-742**	**-780**
Maintenance & Overhaul	-560	-588	-617	-648	-842	-715	-751
Operation	-22	-23	-24	-25	-26	-28	-29
Net Cash Flows due to Operations	**729**	**786**	**849**	**934**	**867**	**1,132**	**1,245**
Cash Flows due to Investments	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Initial CAPEX	0	0	0	0	0	0	0
Other CAPEX	0	0	0	0	0	0	0
Residual Value of Investments	0	0	0	0	0	0	0
Project cash flows	**729**	**786**	**849**	**934**	**867**	**1,132**	**1,245**

GOVERNMENT CASH FLOWS (Cr BDT)	2046 Year 22	2047 Year 23	2048 Year 24	2049 Year 25	2050 Year 26	2051 Year 27	2052 Year 28
Outflows	**-2,913**	**-2,903**	**-2,894**	**-2,887**	**-3,042**	**-2,877**	**-2,874**
Project Development (Initial CAPEX)	0	0	0	0	0	0	0
Financing Fees	0	0	0	0	0	0	0
Operating expenses	-582	-611	-641	-673	-869	-742	-780
Loan Repayments							
Interest	-1,204	-1,164	-1,125	-1,085	-1,046	-1,007	-967
Principal Repayments	-1,128	-1,128	-1,128	-1,128	-1,128	-1,128	-1,128
Inflows	**1,310**	**1,397**	**1,490**	**1,608**	**1,736**	**1,874**	**2,025**
Borrowings	0	0	0	0	0	0	0
Operating revenues	1,310	1,397	1,490	1,608	1,736	1,874	2,025
Future Developments	0	0	0	0	0	0	0
Government cash flows	**-1,603**	**-1,506**	**-1,404**	**-1,279**	**-1,307**	**-1,002**	**-850**

DEICR, EASTERN PART – 1

	2053 Year 29	2054 Year 30	2055 Year 31	2056 Year 32	2057 Year 33	2058 Year 34	2059 Year 35
Construction period	0	0	0	0	0	0	0
Operation period	1	1	1	1	1	1	1
Term of analysis	1	1	1	1	1	1	1
Price indexation	3.92	4.12	4.32	4.54	4.76	5.00	5.25

PROJECT CASH FLOWS (Cr BDT)	2053 Year 29	2054 Year 30	2055 Year 31	2056 Year 32	2057 Year 33	2058 Year 34	2059 Year 35
Operating revenues	**2,188**	**2,366**	**2,559**	**2,768**	**2,997**	**3,245**	**3,515**
Toll revenues	2,188	2,366	2,559	2,768	2,997	3,245	3,515
Other commercial revenues	0	0	0	0	0	0	0
Operation & Maintenance expenses	**-818**	**-859**	**-4,218**	**-947**	**-995**	**-1,045**	**-1,097**
Maintenance & Overhaul	-788	-827	-4,184	-912	-958	-1,006	-1,056
Operation	-30	-32	-34	-35	-37	-39	-41
Net Cash Flows due to Operations	**1,370**	**1,506**	**-1,659**	**1,821**	**2,002**	**2,200**	**2,418**
Cash Flows due to Investments	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Initial CAPEX	0	0	0	0	0	0	0
Other CAPEX	0	0	0	0	0	0	0
Residual Value of Investments	0	0	0	0	0	0	0
Project cash flows	**1,370**	**1,506**	**-1,659**	**1,821**	**2,002**	**2,200**	**2,418**

GOVERNMENT CASH FLOWS (Cr BDT)	2053 Year 29	2054 Year 30	2055 Year 31	2056 Year 32	2057 Year 33	2058 Year 34	2059 Year 35
Outflows	**-2,874**	**-2,875**	**-6,194**	**-2,884**	**-2,892**	**-2,903**	**-2,915**
Project Development (Initial CAPEX)	0	0	0	0	0	0	0
Financing Fees	0	0	0	0	0	0	0
Operating expenses	-818	-859	-4,218	-947	-995	-1,045	-1,097
Loan Repayments							
Interest	-928	-888	-849	-809	-770	-730	-691
Principal Repayments	-1,128	-1,128	-1,128	-1,128	-1,128	-1,128	-1,128
Inflows	**2,188**	**2,366**	**2,559**	**2,768**	**2,997**	**3,245**	**3,515**
Borrowings	0	0	0	0	0	0	0
Operating revenues	2,188	2,366	2,559	2,768	2,997	3,245	3,515
Future Developments	0	0	0	0	0	0	0
Government cash flows	**-686**	**-510**	**-3,636**	**-116**	**104**	**342**	**599**

DEICR, EASTERN PART – 1

	2060 Year 36	2061 Year 37	2062 Year 38	2063 Year 39	2064 Year 40	2065 Year 41
Construction period	0	0	0	0	0	0
Operation period	1	1	1	1	1	1
Term of analysis	1	1	1	1	1	1
Price indexation	5.52	5.79	6.08	6.39	6.70	7.04

PROJECT CASH FLOWS (Cr BDT)	2060 Year 36	2061 Year 37	2062 Year 38	2063 Year 39	2064 Year 40	2065 Year 41
Operating revenues	**3,809**	**4,129**	**4,477**	**4,857**	**5,271**	**5,722**
Toll revenues	3,809	4,129	4,477	4,857	5,271	5,722
Other commercial revenues	0	0	0	0	0	0
Operation & Maintenance expenses	**-1,415**	**-1,209**	**-1,270**	**-1,333**	**-1,400**	**-6,871**
Maintenance & Overhaul	-1,372	-1,164	-1,223	-1,284	-1,348	-6,816
Operation	-43	-45	-47	-50	-52	-55
Net Cash Flows due to Operations	**2,394**	**2,919**	**3,207**	**3,524**	**3,871**	**-1,149**
Cash Flows due to Investments	**0**	**0**	**0**	**0**	**0**	**1,637**
Initial CAPEX	0	0	0	0	0	0
Other CAPEX	0	0	0	0	0	0
Residual Value of Investments	0	0	0	0	0	1,637
Project cash flows	**2,394**	**2,919**	**3,207**	**3,524**	**3,871**	**488**

GOVERNMENT CASH FLOWS (Cr BDT)	2060 Year 36	2061 Year 37	2062 Year 38	2063 Year 39	2064 Year 40	2065 Year 41
Outflows	**-3,194**	**-2,949**	**-2,970**	**-2,994**	**-3,021**	**-8,452**
Project Development (Initial CAPEX)	0	0	0	0	0	0
Financing Fees	0	0	0	0	0	0
Operating expenses	-1,415	-1,209	-1,270	-1,333	-1,400	-6,871
Loan Repayments						
Interest	-651	-612	-572	-533	-493	-454
Principal Repayments	-1,128	-1,128	-1,128	-1,128	-1,128	-1,128
Inflows	**3,809**	**4,129**	**4,477**	**4,857**	**5,271**	**5,722**
Borrowings	0	0	0	0	0	0
Operating revenues	3,809	4,129	4,477	4,857	5,271	5,722
Future Developments	0	0	0	0	0	0
Government cash flows	**615**	**1,180**	**1,507**	**1,863**	**2,250**	**-2,730**

Annexure 02 – Economic and Financial Model Calculation Sheets Western Part-2, Option A

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Economic Analysis

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FEASIBILITY STUDY OF DEICR, WESTERN PART - 2, OPTION A		2028 Year 1	2029 Year 2	2030 Year 3	2031 Year 4	2032 Year 5
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**12,391.85**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Existing traffic	**12,391.85**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
User passenger time savings	12,515.14	0.00	0.00	0.00	0.00	0.00
User freight time savings	255.23	0.00	0.00	0.00	0.00	0.00
Vehicle Operating Costs (VOC) savings	-378.52	0.00	0.00	0.00	0.00	0.00
Variation in Externalities	**4,072.09**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Accidents	2,126.36	0.00	0.00	0.00	0.00	0.00
Emissions	1,691.66	0.00	0.00	0.00	0.00	0.00
Air polution	996.74	0.00	0.00	0.00	0.00	0.00
Climate change	694.92	0.00	0.00	0.00	0.00	0.00
Well to tank	254.06	0.00	0.00	0.00	0.00	0.00
TOTAL ECONOMIC BENEFITS (Cr BDT)	**16,463.93**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-26,043.99**	**-1,031.28**	**-1,031.28**	**-2,062.55**	**-4,125.11**	**-4,125.11**
Residual value	**245.19**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Renovation works	**-885.24**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Change in Producer Surplus:	**672.64**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Producers costs savings for the system	672.64	0.00	0.00	0.00	0.00	0.00
TOTAL ECONOMIC COSTS (Cr BDT)	**-26,011.39**	**-1,031.28**	**-1,031.28**	**-2,062.55**	**-4,125.11**	**-4,125.11**
NET BENEFITS (Cr BDT)	**-9,547.46**	**-1,031.28**	**-1,031.28**	**-2,062.55**	**-4,125.11**	**-4,125.11**

IRR (%)	**9.18%**
NPV (Cr BDT)	**-9,547.46**
Pay Back	**0**
Benefit / Cost	**0.63**

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FEASIBILITY STUDY OF DEICR, WESTERN PART - 2, OPTION A		2033 Year 6	2034 Year 7	2035 Year 8	2036 Year 9	2037 Year 10
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**12,391.85**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Existing traffic	**12,391.85**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
User passenger time savings	12,515.14	0.00	0.00	0.00	0.00	0.00
User freight time savings	255.23	0.00	0.00	0.00	0.00	0.00
Vehicle Operating Costs (VOC) savings	-378.52	0.00	0.00	0.00	0.00	0.00
Variation in Externalities	**4,072.09**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Accidents	2,126.36	0.00	0.00	0.00	0.00	0.00
Emissions	1,691.66	0.00	0.00	0.00	0.00	0.00
Air polution	996.74	0.00	0.00	0.00	0.00	0.00
Climate change	694.92	0.00	0.00	0.00	0.00	0.00
Well to tank	254.06	0.00	0.00	0.00	0.00	0.00
TOTAL ECONOMIC BENEFITS (Cr BDT)	**16,463.93**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-26,043.99**	**-6,187.66**	**-7,218.94**	**-7,218.94**	**-5,156.38**	**-5,156.38**
Residual value	**245.19**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Renovation works	**-885.24**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Change in Producer Surplus:	**672.64**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Producers costs savings for the system	672.64	0.00	0.00	0.00	0.00	0.00
TOTAL ECONOMIC COSTS (Cr BDT)	**-26,011.39**	**-6,187.66**	**-7,218.94**	**-7,218.94**	**-5,156.38**	**-5,156.38**
NET BENEFITS (Cr BDT)	**-9,547.46**	**-6,187.66**	**-7,218.94**	**-7,218.94**	**-5,156.38**	**-5,156.38**

IRR (%)	**9.18%**
NPV (Cr BDT)	**-9,547.46**
Pay Back	**0**
Benefit / Cost	**0.63**

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FEASIBILITY STUDY OF DEICR, WESTERN PART - 2, OPTION A		2038	2039	2040	2041	2042
		Year 11	Year 12	Year 13	Year 14	Year 15
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**12,391.85**	**0.00**	**0.00**	**3,126.34**	**3,318.07**	**3,521.27**
Existing traffic	**12,391.85**	**0.00**	**0.00**	**3,126.34**	**3,318.07**	**3,521.27**
User passenger time savings	12,515.14	0.00	0.00	3,160.66	3,354.31	3,559.44
User freight time savings	255.23	0.00	0.00	47.28	52.46	58.13
Vehicle Operating Costs (VOC) savings	-378.52	0.00	0.00	-81.60	-88.70	-96.31
Variation in Externalities	**4,072.09**	**0.00**	**0.00**	**1,654.17**	**1,667.28**	**1,680.45**
Accidents	2,126.36	0.00	0.00	867.66	873.88	880.14
Emissions	1,691.66	0.00	0.00	683.84	689.82	695.84
Air polution	996.74	0.00	0.00	402.66	406.24	409.84
Climate change	694.92	0.00	0.00	281.17	283.58	286.00
Well to tank	254.06	0.00	0.00	102.68	103.57	104.47
TOTAL ECONOMIC BENEFITS (Cr BDT)	**16,463.93**	**0.00**	**0.00**	**4,780.51**	**4,985.34**	**5,201.72**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-26,043.99**	**-4,125.11**	**-4,125.11**	**0.00**	**0.00**	**0.00**
Residual value	**245.19**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Renovation works	**-885.24**	**0.00**	**0.00**	**-312.43**	**-312.43**	**-312.43**
Change in Producer Surplus:	**672.64**	**0.00**	**0.00**	**-186.29**	**-140.17**	**-88.80**
Producers costs savings for the system	672.64	0.00	0.00	-186.29	-140.17	-88.80
TOTAL ECONOMIC COSTS (Cr BDT)	**-26,011.39**	**-4,125.11**	**-4,125.11**	**-498.73**	**-452.60**	**-401.24**
NET BENEFITS (Cr BDT)	**-9,547.46**	**-4,125.11**	**-4,125.11**	**4,281.78**	**4,532.74**	**4,800.48**

IRR (%)	**9.18%**
NPV (Cr BDT)	**-9,547.46**
Pay Back	**0**
Benefit / Cost	**0.63**

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FEASIBILITY STUDY OF DEICR, WESTERN PART - 2, OPTION A		2043	2044	2045	2046	2047
		Year 16	Year 17	Year 18	Year 19	Year 20
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**12,391.85**	**3,736.61**	**3,964.82**	**4,206.64**	**4,462.89**	**4,734.41**
Existing traffic	**12,391.85**	**3,736.61**	**3,964.82**	**4,206.64**	**4,462.89**	**4,734.41**
User passenger time savings	12,515.14	3,776.74	4,006.88	4,250.64	4,508.78	4,782.15
User freight time savings	255.23	64.35	71.15	78.60	86.74	95.64
Vehicle Operating Costs (VOC) savings	-378.52	-104.47	-113.22	-122.59	-132.63	-143.38
Variation in Externalities	**4,072.09**	**1,693.69**	**1,706.99**	**1,720.36**	**1,733.79**	**1,747.29**
Accidents	2,126.36	886.42	892.73	899.08	905.45	911.85
Emissions	1,691.66	701.89	707.97	714.08	720.23	726.40
Air polution	996.74	413.46	417.09	420.74	424.42	428.11
Climate change	694.92	288.43	290.88	293.34	295.81	298.30
Well to tank	254.06	105.38	106.28	107.20	108.12	109.04
TOTAL ECONOMIC BENEFITS (Cr BDT)	**16,463.93**	**5,430.30**	**5,671.81**	**5,927.00**	**6,196.68**	**6,481.71**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-26,043.99**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Residual value	**245.19**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Renovation works	**-885.24**	**-312.43**	**-312.43**	**-312.43**	**-312.43**	**-312.43**
Change in Producer Surplus:	**672.64**	**-31.79**	**31.33**	**101.02**	**177.80**	**262.20**
Producers costs savings for the system	672.64	-31.79	31.33	101.02	177.80	262.20
TOTAL ECONOMIC COSTS (Cr BDT)	**-26,011.39**	**-344.22**	**-281.11**	**-211.42**	**-134.64**	**-50.23**
NET BENEFITS (Cr BDT)	**-9,547.46**	**5,086.07**	**5,390.70**	**5,715.58**	**6,062.04**	**6,431.48**

IRR (%)	**9.18%**
NPV (Cr BDT)	**-9,547.46**
Pay Back	**0**
Benefit / Cost	**0.63**

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FEASIBILITY STUDY OF DEICR, WESTERN PART - 2, OPTION A		2048 Year 21	2049 Year 22	2050 Year 23	2051 Year 24	2052 Year 25
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**12,391.85**	**5,022.11**	**5,326.93**	**5,649.88**	**6,015.45**	**6,404.70**
Existing traffic	**12,391.85**	**5,022.11**	**5,326.93**	**5,649.88**	**6,015.45**	**6,404.70**
User passenger time savings	12,515.14	5,071.62	5,378.12	5,702.64	6,071.65	6,464.55
User freight time savings	255.23	105.37	116.00	127.60	136.40	145.80
Vehicle Operating Costs (VOC) savings	-378.52	-154.88	-167.19	-180.36	-192.59	-205.65
Variation in Externalities	**4,072.09**	**1,760.86**	**1,774.50**	**1,788.20**	**1,821.40**	**1,855.23**
Accidents	2,126.36	918.28	924.74	931.23	948.46	966.00
Emissions	1,691.66	732.61	738.85	745.12	758.99	773.12
Air polution	996.74	431.82	435.55	439.29	447.44	455.75
Climate change	694.92	300.79	303.30	305.83	311.55	317.38
Well to tank	254.06	109.97	110.91	111.85	113.95	116.10
TOTAL ECONOMIC BENEFITS (Cr BDT)	**16,463.93**	**6,782.97**	**7,101.42**	**7,438.08**	**7,836.86**	**8,259.93**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-26,043.99**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Residual value	**245.19**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Renovation works	**-885.24**	**-312.43**	**-1,511.07**	**-312.43**	**-312.43**	**-312.43**
Change in Producer Surplus:	**672.64**	**354.83**	**456.29**	**567.25**	**606.39**	**648.23**
Producers costs savings for the system	672.64	354.83	456.29	567.25	606.39	648.23
TOTAL ECONOMIC COSTS (Cr BDT)	**-26,011.39**	**42.39**	**-1,054.78**	**254.82**	**293.96**	**335.80**
NET BENEFITS (Cr BDT)	**-9,547.46**	**6,825.36**	**6,046.65**	**7,692.90**	**8,130.81**	**8,595.73**

IRR (%)	**9.18%**
NPV (Cr BDT)	**-9,547.46**
Pay Back	**0**
Benefit / Cost	**0.63**

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FEASIBILITY STUDY OF DEICR, WESTERN PART - 2, OPTION A		2053 Year 26	2054 Year 27	2055 Year 28	2056 Year 29	2057 Year 30
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**12,391.85**	**6,819.16**	**7,260.45**	**7,730.33**	**8,230.64**	**8,763.36**
Existing traffic	**12,391.85**	**6,819.16**	**7,260.45**	**7,730.33**	**8,230.64**	**8,763.36**
User passenger time savings	12,515.14	6,882.90	7,328.35	7,802.65	8,307.66	8,845.39
User freight time savings	255.23	155.85	166.59	178.07	190.34	203.46
Vehicle Operating Costs (VOC) savings	-378.52	-219.59	-234.48	-250.39	-267.36	-285.50
Variation in Externalities	**4,072.09**	**1,889.69**	**1,924.81**	**1,960.58**	**1,997.03**	**2,034.16**
Accidents	2,126.36	983.88	1,002.09	1,020.65	1,039.55	1,058.81
Emissions	1,691.66	787.52	802.19	817.14	832.37	847.88
Air polution	996.74	464.20	472.82	481.60	490.55	499.66
Climate change	694.92	323.32	329.37	335.53	341.82	348.22
Well to tank	254.06	118.29	120.52	122.80	125.11	127.47
TOTAL ECONOMIC BENEFITS (Cr BDT)	**16,463.93**	**8,708.85**	**9,185.26**	**9,690.91**	**10,227.67**	**10,797.52**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-26,043.99**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Residual value	**245.19**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Renovation works	**-885.24**	**-312.43**	**-363.91**	**-312.43**	**-312.43**	**-312.43**
Change in Producer Surplus:	**672.64**	**692.96**	**740.78**	**791.89**	**846.53**	**904.94**
Producers costs savings for the system	672.64	692.96	740.78	791.89	846.53	904.94
TOTAL ECONOMIC COSTS (Cr BDT)	**-26,011.39**	**380.53**	**376.87**	**479.46**	**534.10**	**592.51**
NET BENEFITS (Cr BDT)	**-9,547.46**	**9,089.38**	**9,562.13**	**10,170.37**	**10,761.77**	**11,390.03**

IRR (%)	**9.18%**
NPV (Cr BDT)	**-9,547.46**
Pay Back	**0**
Benefit / Cost	**0.63**

CBA

FEASIBILITY STUDY OF DEICR, WESTERN PART - 2, OPTION A		2058 Year 31	2059 Year 32	2060 Year 33	2061 Year 34	2062 Year 35
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**12,391.85**	**9,330.59**	**9,934.56**	**10,577.65**	**11,262.41**	**11,991.54**
Existing traffic	**12,391.85**	**9,330.59**	**9,934.56**	**10,577.65**	**11,262.41**	**11,991.54**
User passenger time savings	12,515.14	9,417.95	10,027.61	10,676.75	11,367.96	12,103.95
User freight time savings	255.23	217.49	232.48	248.50	265.63	283.94
Vehicle Operating Costs (VOC) savings	-378.52	-304.86	-325.53	-347.60	-371.18	-396.35
Variation in Externalities	**4,072.09**	**2,072.00**	**2,110.55**	**2,149.82**	**2,189.84**	**2,230.61**
Accidents	2,126.36	1,078.42	1,098.41	1,118.77	1,139.51	1,160.65
Emissions	1,691.66	863.69	879.80	896.22	912.94	929.99
Air polution	996.74	508.95	518.41	528.05	537.87	547.88
Climate change	694.92	354.74	361.39	368.17	375.07	382.10
Well to tank	254.06	129.88	132.33	134.83	137.38	139.97
TOTAL ECONOMIC BENEFITS (Cr BDT)	**16,463.93**	**11,402.58**	**12,045.10**	**12,727.47**	**13,452.25**	**14,222.15**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-26,043.99**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Residual value	**245.19**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Renovation works	**-885.24**	**-312.43**	**-1,511.07**	**-312.43**	**-312.43**	**-312.43**
Change in Producer Surplus:	**672.64**	**967.38**	**1,034.13**	**1,105.48**	**1,181.76**	**1,263.30**
Producers costs savings for the system	672.64	967.38	1,034.13	1,105.48	1,181.76	1,263.30
TOTAL ECONOMIC COSTS (Cr BDT)	**-26,011.39**	**654.95**	**-476.94**	**793.05**	**869.32**	**950.86**
NET BENEFITS (Cr BDT)	**-9,547.46**	**12,057.53**	**11,568.16**	**13,520.52**	**14,321.57**	**15,173.01**

IRR (%)	**9.18%**
NPV (Cr BDT)	**-9,547.46**
Pay Back	**0**
Benefit / Cost	**0.63**

CBA

FEASIBILITY STUDY OF DEICR, WESTERN PART - 2, OPTION A		2063 Year 36	2064 Year 37	2065 Year 38	2066 Year 39	2067 Year 40
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**12,391.85**	**12,767.90**	**13,594.58**	**14,474.82**	**15,412.10**	**16,410.12**
Existing traffic	**12,391.85**	**12,767.90**	**13,594.58**	**14,474.82**	**15,412.10**	**16,410.12**
User passenger time savings	12,515.14	12,887.62	13,722.07	14,610.60	15,556.70	16,564.11
User freight time savings	255.23	303.51	324.43	346.79	370.69	396.24
Vehicle Operating Costs (VOC) savings	-378.52	-423.22	-451.92	-482.57	-515.29	-550.24
Variation in Externalities	**4,072.09**	**2,272.15**	**2,314.47**	**2,357.59**	**2,401.53**	**30.03**
Accidents	2,126.36	1,182.18	1,204.11	1,226.46	1,249.23	0.16
Emissions	1,691.66	947.35	965.04	983.07	1,001.44	26.00
Air polution	996.74	558.08	568.47	579.05	589.84	16.53
Climate change	694.92	389.27	396.58	404.02	411.60	9.48
Well to tank	254.06	142.62	145.31	148.06	150.86	3.87
TOTAL ECONOMIC BENEFITS (Cr BDT)	**16,463.93**	**15,040.05**	**15,909.05**	**16,832.41**	**17,813.63**	**16,440.15**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-26,043.99**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Residual value	**245.19**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Renovation works	**-885.24**	**-312.43**	**-363.91**	**-312.43**	**-312.43**	**-312.43**
Change in Producer Surplus:	**672.64**	**1,350.46**	**1,443.64**	**1,543.24**	**1,649.72**	**1,763.54**
Producers costs savings for the system	672.64	1,350.46	1,443.64	1,543.24	1,649.72	1,763.54
TOTAL ECONOMIC COSTS (Cr BDT)	**-26,011.39**	**1,038.02**	**1,079.73**	**1,230.81**	**1,337.28**	**1,451.11**
NET BENEFITS (Cr BDT)	**-9,547.46**	**16,078.08**	**16,988.77**	**18,063.22**	**19,150.91**	**17,891.26**

IRR (%)	**9.18%**
NPV (Cr BDT)	**-9,547.46**
Pay Back	**0**
Benefit / Cost	**0.63**

CBA

FEASIBILITY STUDY OF DEICR, WESTERN PART - 2, OPTION A		2068 Year 41	2069 Year 42
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**		
Change in Consumer Surplus	**12,391.85**	**17,472.82**	**18,604.40**
Existing traffic	**12,391.85**	**17,472.82**	**18,604.40**
User passenger time savings	12,515.14	17,636.82	18,779.05
User freight time savings	255.23	423.56	452.75
Vehicle Operating Costs (VOC) savings	-378.52	-587.55	-627.39
Variation in Externalities	**4,072.09**	**30.69**	**31.35**
Accidents	2,126.36	0.20	0.24
Emissions	1,691.66	26.54	27.08
Air polution	996.74	16.86	17.21
Climate change	694.92	9.67	9.87
Well to tank	254.06	3.95	4.03
TOTAL ECONOMIC BENEFITS (Cr BDT)	**16,463.93**	**17,503.51**	**18,635.75**
SOCIO ECONOMIC COSTS (Cr BDT)			
Project initial investments	**-26,043.99**	**0.00**	**0.00**
Residual value	**245.19**	**0.00**	**25,553.23**
Renovation works	**-885.24**	**-312.43**	**-1,511.07**
Change in Producer Surplus:	**672.64**	**1,885.22**	**2,015.29**
Producers costs savings for the system	672.64	1,885.22	2,015.29
TOTAL ECONOMIC COSTS (Cr BDT)	**-26,011.39**	**1,572.78**	**26,057.45**
NET BENEFITS (Cr BDT)	**-9,547.46**	**19,076.29**	**44,693.21**

IRR (%)	**9.18%**
NPV (Cr BDT)	**-9,547.46**
Pay Back	**0**
Benefit / Cost	**0.63**

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Financial Analysis-Project and Government Cash Flows

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DEICR, WESTERN PART – 2, OPTION A

	2028 Year 1	2029 Year 2	2030 Year 3	2031 Year 4	2032 Year 5	2033 Year 6	2034 Year 7
Construction period	1	1	1	1	1	1	1
Operation period	0	0	0	0	0	0	0
Term of analysis	1	1	1	1	1	1	1
Price indexation	1.00	1.05	1.10	1.16	1.22	1.28	1.34

PROJECT CASH FLOWS (Cr BDT)	2028 Year 1	2029 Year 2	2030 Year 3	2031 Year 4	2032 Year 5	2033 Year 6	2034 Year 7
Operating revenues	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Toll revenues	0	0	0	0	0	0	0
Other commercial revenues	0	0	0	0	0	0	0
Operation & Maintenance expenses	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Maintenance & Overhaul	0	0	0	0	0	0	0
Operation	0	0	0	0	0	0	0
Net Cash Flows due to Operations	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Cash Flows due to Investments	**-1,663**	**-1,544**	**-3,242**	**-6,811**	**-7,276**	**-11,458**	**-14,172**
Initial CAPEX	-1,663	-1,544	-3,242	-6,811	-7,276	-11,458	-14,172
Other CAPEX	0	0	0	0	0	0	0
Residual Value of Investments	0	0	0	0	0	0	0
Project cash flows	**-1,663**	**-1,544**	**-3,242**	**-6,811**	**-7,276**	**-11,458**	**-14,172**

GOVERNMENT CASH FLOWS (Cr BDT)	2028 Year 1	2029 Year 2	2030 Year 3	2031 Year 4	2032 Year 5	2033 Year 6	2034 Year 7
Outflows	**-1,663**	**-1,544**	**-3,242**	**-6,811**	**-7,276**	**-11,458**	**-14,172**
Project Development (Initial CAPEX)	-1,418	-1,489	-3,126	-6,565	-6,893	-10,857	-13,299
Financing Fees	-245	-55	-116	-246	-383	-602	-873
Operating expenses	0	0	0	0	0	0	0
Loan Repayments							
Interest	0	0	0	0	0	0	0
Principal Repayments	0	0	0	0	0	0	0
Inflows	**1,342**	**1,223**	**2,600**	**5,527**	**5,992**	**9,533**	**11,925**
Borrowings	1,342	1,223	2,600	5,527	5,992	9,533	11,925
Operating revenues	0	0	0	0	0	0	0
Future Developments	0	0	0	0	0	0	0
Government cash flows	**-321**	**-321**	**-642**	**-1,284**	**-1,284**	**-1,926**	**-2,247**

DEICR, WESTERN PART – 2, OPTION A

	2035 Year 8	2036 Year 9	2037 Year 10	2038 Year 11	2039 Year 12	2040 Year 13	2041 Year 14
Construction period	1	1	1	1	1	0	0
Operation period	0	0	0	0	0	1	1
Term of analysis	1	1	1	1	1	1	1
Price indexation	1.41	1.48	1.55	1.63	1.71	1.80	1.89

PROJECT CASH FLOWS (Cr BDT)	2035 Year 8	2036 Year 9	2037 Year 10	2038 Year 11	2039 Year 12	2040 Year 13	2041 Year 14
Operating revenues	**236**	**254**	**286**	**318**	**344**	**624**	**679**
Toll revenues	236	254	286	318	344	624	679
Other commercial revenues	0	0	0	0	0	0	0
Operation & Maintenance expenses	**-473**	**-497**	**-522**	**-548**	**-575**	**-781**	**-820**
Maintenance & Overhaul	-461	-484	-508	-533	-560	-760	-798
Operation	-13	-13	-14	-15	-15	-21	-22
Net Cash Flows due to Operations	**-238**	**-243**	**-235**	**-229**	**-231**	**-157**	**-142**
Cash Flows due to Investments	**-15,124**	**-11,850**	**-12,604**	**-11,039**	**-11,707**	**0**	**0**
Initial CAPEX	-15,124	-11,850	-12,604	-11,039	-11,707	0	0
Other CAPEX	0	0	0	0	0	0	0
Residual Value of Investments	0	0	0	0	0	0	0
Project cash flows	**-15,362**	**-12,094**	**-12,839**	**-11,269**	**-11,939**	**-157**	**-142**

GOVERNMENT CASH FLOWS (Cr BDT)	2035 Year 8	2036 Year 9	2037 Year 10	2038 Year 11	2039 Year 12	2040 Year 13	2041 Year 14
Outflows	**-17,798**	**-14,548**	**-15,327**	**-13,788**	**-14,484**	**-5,794**	**-5,756**
Project Development (Initial CAPEX)	-13,964	-10,473	-10,997	-9,237	-9,699	0	0
Financing Fees	-1,160	-1,377	-1,607	-1,802	-2,008	0	0
Operating expenses	-473	-497	-522	-548	-575	-781	-820
Loan Repayments							
Interest	0	0	0	0	0	-2,812	-2,735
Principal Repayments	-2,201	-2,201	-2,201	-2,201	-2,201	-2,201	-2,201
Inflows	**13,113**	**10,499**	**11,286**	**10,074**	**10,768**	**624**	**679**
Borrowings	12,877	10,245	10,999	9,755	10,424	0	0
Operating revenues	236	254	286	318	344	624	679
Future Developments	0	0	0	0	0	0	0
Government cash flows	**-4,686**	**-4,049**	**-4,041**	**-3,714**	**-3,716**	**-5,170**	**-5,077**

DEICR, WESTERN PART – 2, OPTION A

	2042 Year 15	2043 Year 16	2044 Year 17	2045 Year 18	2046 Year 19	2047 Year 20	2048 Year 21
Construction period	0	0	0	0	0	0	0
Operation period	1	1	1	1	1	1	1
Term of analysis	1	1	1	1	1	1	1
Price indexation	1.98	2.08	2.18	2.29	2.41	2.53	2.65

PROJECT CASH FLOWS (Cr BDT)	2042 Year 15	2043 Year 16	2044 Year 17	2045 Year 18	2046 Year 19	2047 Year 20	2048 Year 21
Operating revenues	**740**	**810**	**888**	**975**	**1,041**	**1,112**	**1,187**
Toll revenues	740	810	888	975	1,041	1,112	1,187
Other commercial revenues	0	0	0	0	0	0	0
Operation & Maintenance expenses	**-862**	**-905**	**-4,655**	**-997**	**-1,047**	**-1,100**	**-1,154**
Maintenance & Overhaul	-838	-880	-4,630	-970	-1,019	-1,070	-1,123
Operation	-23	-24	-26	-27	-28	-30	-31
Net Cash Flows due to Operations	**-121**	**-95**	**-3,767**	**-22**	**-6**	**12**	**32**
Cash Flows due to Investments	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Initial CAPEX	0	0	0	0	0	0	0
Other CAPEX	0	0	0	0	0	0	0
Residual Value of Investments	0	0	0	0	0	0	0
Project cash flows	**-121**	**-95**	**-3,767**	**-22**	**-6**	**12**	**32**

GOVERNMENT CASH FLOWS (Cr BDT)	2042 Year 15	2043 Year 16	2044 Year 17	2045 Year 18	2046 Year 19	2047 Year 20	2048 Year 21
Outflows	**-5,720**	**-5,686**	**-9,360**	**-5,625**	**-5,598**	**-5,573**	**-5,551**
Project Development (Initial CAPEX)	0	0	0	0	0	0	0
Financing Fees	0	0	0	0	0	0	0
Operating expenses	-862	-905	-4,655	-997	-1,047	-1,100	-1,154
Loan Repayments							
Interest	-2,658	-2,581	-2,504	-2,427	-2,350	-2,273	-2,196
Principal Repayments	-2,201	-2,201	-2,201	-2,201	-2,201	-2,201	-2,201
Inflows	**740**	**810**	**888**	**975**	**1,041**	**1,112**	**1,187**
Borrowings	0	0	0	0	0	0	0
Operating revenues	740	810	888	975	1,041	1,112	1,187
Future Developments	0	0	0	0	0	0	0
Government cash flows	**-4,980**	**-4,877**	**-8,472**	**-4,650**	**-4,556**	**-4,461**	**-4,364**

DEICR, WESTERN PART – 2, OPTION A

	2049 Year 22	2050 Year 23	2051 Year 24	2052 Year 25	2053 Year 26	2054 Year 27	2055 Year 28
Construction period	0	0	0	0	0	0	0
Operation period	1	1	1	1	1	1	1
Term of analysis	1	1	1	1	1	1	1
Price indexation	2.79	2.93	3.07	3.23	3.39	3.56	3.73

PROJECT CASH FLOWS (Cr BDT)	2049 Year 22	2050 Year 23	2051 Year 24	2052 Year 25	2053 Year 26	2054 Year 27	2055 Year 28
Operating revenues	**1,267**	**1,353**	**1,444**	**1,542**	**1,646**	**1,757**	**1,876**
Toll revenues	1,267	1,353	1,444	1,542	1,646	1,757	1,876
Other commercial revenues	0	0	0	0	0	0	0
Operation & Maintenance expenses	**-1,415**	**-1,273**	**-1,336**	**-1,403**	**-1,473**	**-7,583**	**-1,624**
Maintenance & Overhaul	-1,383	-1,239	-1,301	-1,366	-1,434	-7,541	-1,581
Operation	-33	-34	-36	-38	-40	-42	-44
Net Cash Flows due to Operations	**-148**	**80**	**108**	**138**	**172**	**-5,825**	**252**
Cash Flows due to Investments	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Initial CAPEX	0	0	0	0	0	0	0
Other CAPEX	0	0	0	0	0	0	0
Residual Value of Investments	0	0	0	0	0	0	0
Project cash flows	**-148**	**80**	**108**	**138**	**172**	**-5,825**	**252**

GOVERNMENT CASH FLOWS (Cr BDT)	2049 Year 22	2050 Year 23	2051 Year 24	2052 Year 25	2053 Year 26	2054 Year 27	2055 Year 28
Outflows	**-5,735**	**-5,515**	**-5,502**	**-5,492**	**-5,485**	**-11,517**	**-5,482**
Project Development (Initial CAPEX)	0	0	0	0	0	0	0
Financing Fees	0	0	0	0	0	0	0
Operating expenses	-1,415	-1,273	-1,336	-1,403	-1,473	-7,583	-1,624
Loan Repayments							
Interest	-2,118	-2,041	-1,964	-1,887	-1,810	-1,733	-1,656
Principal Repayments	-2,201	-2,201	-2,201	-2,201	-2,201	-2,201	-2,201
Inflows	**1,267**	**1,353**	**1,444**	**1,542**	**1,646**	**1,757**	**1,876**
Borrowings	0	0	0	0	0	0	0
Operating revenues	1,267	1,353	1,444	1,542	1,646	1,757	1,876
Future Developments	0	0	0	0	0	0	0
Government cash flows	**-4,468**	**-4,163**	**-4,058**	**-3,950**	**-3,839**	**-9,760**	**-3,606**

DEICR, WESTERN PART – 2, OPTION A

	2056 Year 29	2057 Year 30	2058 Year 31	2059 Year 32	2060 Year 33	2061 Year 34	2062 Year 35
Construction period	0	0	0	0	0	0	0
Operation period	1	1	1	1	1	1	1
Term of analysis	1	1	1	1	1	1	1
Price indexation	3.92	4.12	4.32	4.54	4.76	5.00	5.25

PROJECT CASH FLOWS (Cr BDT)	2056 Year 29	2057 Year 30	2058 Year 31	2059 Year 32	2060 Year 33	2061 Year 34	2062 Year 35
Operating revenues	**2,003**	**2,138**	**2,283**	**2,437**	**2,602**	**2,778**	**2,966**
Toll revenues	2,003	2,138	2,283	2,437	2,602	2,778	2,966
Other commercial revenues	0	0	0	0	0	0	0
Operation & Maintenance expenses	**-1,706**	**-1,791**	**-1,881**	**-2,305**	**-2,073**	**-2,177**	**-2,286**
Maintenance & Overhaul	-1,660	-1,743	-1,830	-2,252	-2,018	-2,118	-2,224
Operation	-46	-48	-51	-53	-56	-59	-61
Net Cash Flows due to Operations	**297**	**347**	**402**	**132**	**529**	**601**	**680**
Cash Flows due to Investments	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Initial CAPEX	0	0	0	0	0	0	0
Other CAPEX	0	0	0	0	0	0	0
Residual Value of Investments	0	0	0	0	0	0	0
Project cash flows	**297**	**347**	**402**	**132**	**529**	**601**	**680**

GOVERNMENT CASH FLOWS (Cr BDT)	2056 Year 29	2057 Year 30	2058 Year 31	2059 Year 32	2060 Year 33	2061 Year 34	2062 Year 35
Outflows	**-5,486**	**-5,494**	**-5,507**	**-5,855**	**-5,545**	**-5,572**	**-5,604**
Project Development (Initial CAPEX)	0	0	0	0	0	0	0
Financing Fees	0	0	0	0	0	0	0
Operating expenses	-1,706	-1,791	-1,881	-2,305	-2,073	-2,177	-2,286
Loan Repayments							
Interest	-1,579	-1,502	-1,425	-1,348	-1,271	-1,194	-1,117
Principal Repayments	-2,201	-2,201	-2,201	-2,201	-2,201	-2,201	-2,201
Inflows	**2,003**	**2,138**	**2,283**	**2,437**	**2,602**	**2,778**	**2,966**
Borrowings	0	0	0	0	0	0	0
Operating revenues	2,003	2,138	2,283	2,437	2,602	2,778	2,966
Future Developments	0	0	0	0	0	0	0
Government cash flows	**-3,483**	**-3,356**	**-3,224**	**-3,417**	**-2,943**	**-2,794**	**-2,638**

DEICR, WESTERN PART – 2, OPTION A

	2063 Year 36	2064 Year 37	2065 Year 38	2066 Year 39	2067 Year 40	2068 Year 41	2069 Year 42
Construction period	0	0	0	0	0	0	0
Operation period	1	1	1	1	1	1	1
Term of analysis	1	1	1	1	1	1	1
Price indexation	5.52	5.79	6.08	6.39	6.70	7.04	7.39

PROJECT CASH FLOWS (Cr BDT)	2063 Year 36	2064 Year 37	2065 Year 38	2066 Year 39	2067 Year 40	2068 Year 41	2069 Year 42
Operating revenues	**3,167**	**3,381**	**3,610**	**3,854**	**4,115**	**4,393**	**4,691**
Toll revenues	3,167	3,381	3,610	3,854	4,115	4,393	4,691
Other commercial revenues	0	0	0	0	0	0	0
Operation & Maintenance expenses	**-2,400**	**-12,351**	**-2,646**	**-2,778**	**-2,917**	**-3,063**	**-3,755**
Maintenance & Overhaul	-2,336	-12,284	-2,575	-2,704	-2,839	-2,981	-3,669
Operation	-65	-68	-71	-75	-78	-82	-86
Net Cash Flows due to Operations	**767**	**-8,970**	**964**	**1,076**	**1,198**	**1,330**	**935**
Cash Flows due to Investments	**0**	**0**	**0**	**0**	**0**	**0**	**2,038**
Initial CAPEX	0	0	0	0	0	0	0
Other CAPEX	0	0	0	0	0	0	0
Residual Value of Investments	0	0	0	0	0	0	2,038
Project cash flows	**767**	**-8,970**	**964**	**1,076**	**1,198**	**1,330**	**2,974**

GOVERNMENT CASH FLOWS (Cr BDT)	2063 Year 36	2064 Year 37	2065 Year 38	2066 Year 39	2067 Year 40	2068 Year 41	2069 Year 42
Outflows	**-5,641**	**-15,515**	**-5,733**	**-5,788**	**-5,850**	**-5,919**	**-6,534**
Project Development (Initial CAPEX)	0	0	0	0	0	0	0
Financing Fees	0	0	0	0	0	0	0
Operating expenses	-2,400	-12,351	-2,646	-2,778	-2,917	-3,063	-3,755
Loan Repayments							
Interest	-1,040	-963	-886	-809	-732	-655	-578
Principal Repayments	-2,201	-2,201	-2,201	-2,201	-2,201	-2,201	-2,201
Inflows	**3,167**	**3,381**	**3,610**	**3,854**	**4,115**	**4,393**	**4,691**
Borrowings	0	0	0	0	0	0	0
Operating revenues	3,167	3,381	3,610	3,854	4,115	4,393	4,691
Future Developments	0	0	0	0	0	0	0
Government cash flows	**-2,474**	**-12,134**	**-2,123**	**-1,934**	**-1,735**	**-1,526**	**-1,843**

Annexure 03 – Economic and Financial Model Calculation Sheets Western Part-2, Option B

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Economic Analysis

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FEASIBILITY STUDY OF DEICR, WESTERN PART - 2		2033	2034	2035	2036	2037
		Year 1	Year 2	Year 3	Year 4	Year 5
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**10,646.17**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Existing traffic	**10,646.17**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
User passenger time savings	10,789.80	0.00	0.00	0.00	0.00	0.00
User freight time savings	102.64	0.00	0.00	0.00	0.00	0.00
Vehicle Operating Costs (VOC) savings	-246.27	0.00	0.00	0.00	0.00	0.00
Variation in Externalities	**1,055.57**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Accidents	544.99	0.00	0.00	0.00	0.00	0.00
Emissions	444.61	0.00	0.00	0.00	0.00	0.00
Air polution	263.43	0.00	0.00	0.00	0.00	0.00
Climate change	181.18	0.00	0.00	0.00	0.00	0.00
Well to tank	65.97	0.00	0.00	0.00	0.00	0.00
TOTAL ECONOMIC BENEFITS (Cr BDT)	**11,701.73**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-7,594.86**	**-269.82**	**-269.82**	**-809.45**	**-1,349.08**	**-2,158.53**
Residual value	**79.52**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Renovation works	**-442.19**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Change in Producer Surplus:	**122.68**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Producers costs savings for the system	122.68	0.00	0.00	0.00	0.00	0.00
TOTAL ECONOMIC COSTS (Cr BDT)	**-7,834.85**	**-269.82**	**-269.82**	**-809.45**	**-1,349.08**	**-2,158.53**
NET BENEFITS (Cr BDT)	**3,866.89**	**-269.82**	**-269.82**	**-809.45**	**-1,349.08**	**-2,158.53**

IRR (%)	**15.55%**
NPV (Cr BDT)	**3,866.89**
Pay Back	**2,055**
Benefit / Cost	**1.49**

CBA

FEASIBILITY STUDY OF DEICR, WESTERN PART - 2		2038	2039	2040	2041	2042
		Year 6	Year 7	Year 8	Year 9	Year 10
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**10,646.17**	**0.00**	**0.00**	**1,103.17**	**1,179.92**	**1,261.66**
Existing traffic	**10,646.17**	**0.00**	**0.00**	**1,103.17**	**1,179.92**	**1,261.66**
User passenger time savings	10,789.80	0.00	0.00	1,122.72	1,199.86	1,281.96
User freight time savings	102.64	0.00	0.00	7.58	8.37	9.23
Vehicle Operating Costs (VOC) savings	-246.27	0.00	0.00	-27.14	-28.31	-29.53
Variation in Externalities	**1,055.57**	**0.00**	**0.00**	**238.34**	**240.75**	**243.16**
Accidents	544.99	0.00	0.00	123.44	124.67	125.91
Emissions	444.61	0.00	0.00	99.93	100.96	101.99
Air polution	263.43	0.00	0.00	59.00	59.62	60.24
Climate change	181.18	0.00	0.00	40.93	41.34	41.75
Well to tank	65.97	0.00	0.00	14.97	15.12	15.26
TOTAL ECONOMIC BENEFITS (Cr BDT)	**11,701.73**	**0.00**	**0.00**	**1,341.51**	**1,420.67**	**1,504.81**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-7,594.86**	**-2,158.53**	**-2,158.53**	**-1,888.71**	**-1,349.08**	**-1,079.27**
Residual value	**79.52**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Renovation works	**-442.19**	**0.00**	**0.00**	**-72.18**	**-72.18**	**-72.18**
Change in Producer Surplus:	**122.68**	**0.00**	**0.00**	**-19.64**	**-14.66**	**-9.14**
Producers costs savings for the system	122.68	0.00	0.00	-19.64	-14.66	-9.14
TOTAL ECONOMIC COSTS (Cr BDT)	**-7,834.85**	**-2,158.53**	**-2,158.53**	**-1,980.53**	**-1,435.92**	**-1,160.58**
NET BENEFITS (Cr BDT)	**3,866.89**	**-2,158.53**	**-2,158.53**	**-639.03**	**-15.26**	**344.23**

IRR (%)	**15.55%**
NPV (Cr BDT)	**3,866.89**
Pay Back	**2,055**
Benefit / Cost	**1.49**

CBA

FEASIBILITY STUDY OF DEICR, WESTERN PART - 2		2043	2044	2045	2046	2047
		Year 11	Year 12	Year 13	Year 14	Year 15
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**10,646.17**	**1,799.72**	**1,919.55**	**2,046.93**	**2,182.32**	**2,326.20**
Existing traffic	**10,646.17**	**1,799.72**	**1,919.55**	**2,046.93**	**2,182.32**	**2,326.20**
User passenger time savings	10,789.80	1,823.57	1,944.53	2,073.06	2,209.64	2,354.74
User freight time savings	102.64	17.40	18.90	20.53	22.30	24.21
Vehicle Operating Costs (VOC) savings	-246.27	-41.26	-43.88	-46.66	-49.61	-52.75
Variation in Externalities	**1,055.57**	**246.35**	**248.60**	**250.85**	**253.10**	**255.36**
Accidents	544.99	126.86	127.98	129.09	130.21	131.33
Emissions	444.61	104.02	105.02	106.02	107.03	108.03
Air polution	263.43	61.62	62.23	62.85	63.46	64.08
Climate change	181.18	42.41	42.79	43.18	43.56	43.95
Well to tank	65.97	15.47	15.60	15.73	15.87	16.00
TOTAL ECONOMIC BENEFITS (Cr BDT)	**11,701.73**	**2,046.07**	**2,168.15**	**2,297.78**	**2,435.42**	**2,581.56**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-7,594.86**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Residual value	**79.52**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Renovation works	**-442.19**	**-97.88**	**-97.88**	**-97.88**	**-97.88**	**-97.88**
Change in Producer Surplus:	**122.68**	**1.03**	**6.75**	**13.03**	**19.90**	**27.41**
Producers costs savings for the system	122.68	1.03	6.75	13.03	19.90	27.41
TOTAL ECONOMIC COSTS (Cr BDT)	**-7,834.85**	**-96.85**	**-91.12**	**-84.85**	**-77.98**	**-70.47**
NET BENEFITS (Cr BDT)	**3,866.89**	**1,949.22**	**2,077.02**	**2,212.93**	**2,357.45**	**2,511.09**

IRR (%)	**15.55%**
NPV (Cr BDT)	**3,866.89**
Pay Back	**2,055**
Benefit / Cost	**1.49**

CBA

FEASIBILITY STUDY OF DEICR, WESTERN PART - 2		2048	2049	2050	2051	2052
		Year 16	Year 17	Year 18	Year 19	Year 20
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**10,646.17**	**2,479.10**	**2,641.56**	**2,814.15**	**2,995.45**	**3,188.45**
Existing traffic	**10,646.17**	**2,479.10**	**2,641.56**	**2,814.15**	**2,995.45**	**3,188.45**
User passenger time savings	10,789.80	2,508.89	2,672.63	2,846.54	3,030.53	3,226.41
User freight time savings	102.64	26.28	28.52	30.95	32.56	34.25
Vehicle Operating Costs (VOC) savings	-246.27	-56.07	-59.60	-63.34	-67.63	-72.22
Variation in Externalities	**1,055.57**	**257.62**	**259.89**	**262.15**	**264.63**	**267.14**
Accidents	544.99	132.45	133.57	134.69	136.10	137.52
Emissions	444.61	109.04	110.05	111.06	111.99	112.94
Air polution	263.43	64.70	65.32	65.94	66.49	67.05
Climate change	181.18	44.34	44.73	45.12	45.50	45.89
Well to tank	65.97	16.14	16.27	16.41	16.54	16.67
TOTAL ECONOMIC BENEFITS (Cr BDT)	**11,701.73**	**2,736.72**	**2,901.44**	**3,076.31**	**3,260.08**	**3,455.58**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-7,594.86**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Residual value	**79.52**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Renovation works	**-442.19**	**-97.88**	**-316.95**	**-97.88**	**-97.88**	**-200.97**
Change in Producer Surplus:	**122.68**	**35.59**	**44.50**	**54.20**	**57.79**	**61.61**
Producers costs savings for the system	122.68	35.59	44.50	54.20	57.79	61.61
TOTAL ECONOMIC COSTS (Cr BDT)	**-7,834.85**	**-62.29**	**-272.44**	**-43.68**	**-40.09**	**-139.35**
NET BENEFITS (Cr BDT)	**3,866.89**	**2,674.44**	**2,629.00**	**3,032.63**	**3,219.99**	**3,316.23**

IRR (%)	**15.55%**
NPV (Cr BDT)	**3,866.89**
Pay Back	**2,055**
Benefit / Cost	**1.49**

CBA

FEASIBILITY STUDY OF DEICR, WESTERN PART - 2		2053	2054	2055	2056	2057
		Year 21	Year 22	Year 23	Year 24	Year 25
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**10,646.17**	**3,393.89**	**3,612.58**	**3,845.38**	**4,093.20**	**4,357.00**
Existing traffic	**10,646.17**	**3,393.89**	**3,612.58**	**3,845.38**	**4,093.20**	**4,357.00**
User passenger time savings	10,789.80	3,434.97	3,657.02	3,893.43	4,145.13	4,413.12
User freight time savings	102.64	36.04	37.91	39.88	41.96	44.14
Vehicle Operating Costs (VOC) savings	-246.27	-77.12	-82.35	-87.93	-93.89	-100.26
Variation in Externalities	**1,055.57**	**269.68**	**272.25**	**274.86**	**277.51**	**280.19**
Accidents	544.99	138.97	140.44	141.93	143.45	144.98
Emissions	444.61	113.90	114.87	115.85	116.84	117.85
Air polution	263.43	67.62	68.19	68.77	69.36	69.96
Climate change	181.18	46.28	46.67	47.07	47.48	47.89
Well to tank	65.97	16.81	16.94	17.08	17.22	17.36
TOTAL ECONOMIC BENEFITS (Cr BDT)	**11,701.73**	**3,663.56**	**3,884.83**	**4,120.24**	**4,370.71**	**4,637.20**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-7,594.86**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Residual value	**79.52**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Renovation works	**-442.19**	**-97.88**	**-110.35**	**-97.88**	**-97.88**	**-103.75**
Change in Producer Surplus:	**122.68**	**65.69**	**70.04**	**74.67**	**79.61**	**84.87**
Producers costs savings for the system	122.68	65.69	70.04	74.67	79.61	84.87
TOTAL ECONOMIC COSTS (Cr BDT)	**-7,834.85**	**-32.18**	**-40.31**	**-23.21**	**-18.27**	**-18.88**
NET BENEFITS (Cr BDT)	**3,866.89**	**3,631.38**	**3,844.52**	**4,097.04**	**4,352.44**	**4,618.31**

IRR (%)	**15.55%**
NPV (Cr BDT)	**3,866.89**
Pay Back	**2,055**
Benefit / Cost	**1.49**

CBA

FEASIBILITY STUDY OF DEICR, WESTERN PART - 2		2058	2059	2060	2061	2062
		Year 26	Year 27	Year 28	Year 29	Year 30
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**10,646.17**	**4,637.83**	**4,936.78**	**5,255.01**	**5,593.79**	**5,954.42**
Existing traffic	**10,646.17**	**4,637.83**	**4,936.78**	**5,255.01**	**5,593.79**	**5,954.42**
User passenger time savings	10,789.80	4,698.45	5,002.24	5,325.69	5,670.06	6,036.72
User freight time savings	102.64	46.44	48.86	51.40	54.08	56.89
Vehicle Operating Costs (VOC) savings	-246.27	-107.06	-114.32	-122.07	-130.35	-139.19
Variation in Externalities	**1,055.57**	**282.91**	**285.67**	**288.46**	**291.29**	**294.16**
Accidents	544.99	146.54	148.12	149.72	151.34	152.99
Emissions	444.61	118.87	119.90	120.94	122.00	123.07
Air polution	263.43	70.56	71.17	71.78	72.41	73.04
Climate change	181.18	48.31	48.73	49.16	49.59	50.03
Well to tank	65.97	17.51	17.65	17.80	17.95	18.10
TOTAL ECONOMIC BENEFITS (Cr BDT)	**11,701.73**	**4,920.74**	**5,222.44**	**5,543.47**	**5,885.08**	**6,248.58**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-7,594.86**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Residual value	**79.52**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Renovation works	**-442.19**	**-97.88**	**-316.95**	**-97.88**	**-97.88**	**-200.97**
Change in Producer Surplus:	**122.68**	**90.47**	**96.44**	**102.80**	**109.58**	**116.81**
Producers costs savings for the system	122.68	90.47	96.44	102.80	109.58	116.81
TOTAL ECONOMIC COSTS (Cr BDT)	**-7,834.85**	**-7.41**	**-220.50**	**4.93**	**11.71**	**-84.16**
NET BENEFITS (Cr BDT)	**3,866.89**	**4,913.33**	**5,001.94**	**5,548.40**	**5,896.78**	**6,164.42**

IRR (%)	**15.55%**
NPV (Cr BDT)	**3,866.89**
Pay Back	**2,055**
Benefit / Cost	**1.49**

CBA

FEASIBILITY STUDY OF DEICR, WESTERN PART - 2		2063	2064	2065	2066	2067
		Year 31	Year 32	Year 33	Year 34	Year 35
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**10,646.17**	**6,338.33**	**6,747.02**	**7,182.09**	**7,645.25**	**8,138.30**
Existing traffic	**10,646.17**	**6,338.33**	**6,747.02**	**7,182.09**	**7,645.25**	**8,138.30**
User passenger time savings	10,789.80	6,427.11	6,842.77	7,285.33	7,756.53	8,258.23
User freight time savings	102.64	59.85	62.97	66.24	69.69	73.32
Vehicle Operating Costs (VOC) savings	-246.27	-148.63	-158.71	-169.48	-180.97	-193.24
Variation in Externalities	**1,055.57**	**297.07**	**300.02**	**303.01**	**306.04**	**309.11**
Accidents	544.99	154.67	156.37	158.09	159.84	161.61
Emissions	444.61	124.15	125.25	126.36	127.48	128.62
Air polution	263.43	73.68	74.33	74.98	75.65	76.32
Climate change	181.18	50.47	50.92	51.38	51.84	52.30
Well to tank	65.97	18.25	18.40	18.56	18.72	18.88
TOTAL ECONOMIC BENEFITS (Cr BDT)	**11,701.73**	**6,635.40**	**7,047.04**	**7,485.10**	**7,951.29**	**8,447.41**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-7,594.86**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Residual value	**79.52**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Renovation works	**-442.19**	**-97.88**	**-110.35**	**-97.88**	**-97.88**	**-103.75**
Change in Producer Surplus:	**122.68**	**124.50**	**132.70**	**141.44**	**150.74**	**160.66**
Producers costs savings for the system	122.68	124.50	132.70	141.44	150.74	160.66
TOTAL ECONOMIC COSTS (Cr BDT)	**-7,834.85**	**26.63**	**22.35**	**43.56**	**52.87**	**56.91**
NET BENEFITS (Cr BDT)	**3,866.89**	**6,662.03**	**7,069.39**	**7,528.66**	**8,004.15**	**8,504.32**

IRR (%)	**15.55%**
NPV (Cr BDT)	**3,866.89**
Pay Back	**2,055**
Benefit / Cost	**1.49**

CBA

FEASIBILITY STUDY OF DEICR, WESTERN PART - 2		2068	2069	2070	2071	2072
		Year 36	Year 37	Year 38	Year 39	Year 40
SOCIO ECONOMIC BENEFITS (Cr BDT)	**NPV**					
Change in Consumer Surplus	**10,646.17**	**8,663.19**	**9,221.96**	**9,816.81**	**10,450.08**	**11,124.24**
Existing traffic	**10,646.17**	**8,663.19**	**9,221.96**	**9,816.81**	**10,450.08**	**11,124.24**
User passenger time savings	10,789.80	8,792.40	9,361.15	9,966.72	10,611.50	11,298.02
User freight time savings	102.64	77.13	81.15	85.37	89.81	94.49
Vehicle Operating Costs (VOC) savings	-246.27	-206.34	-220.34	-235.28	-251.23	-268.27
Variation in Externalities	**1,055.57**	**312.23**	**315.39**	**318.59**	**321.84**	**1.87**
Accidents	544.99	163.41	165.24	167.09	168.97	-4.30
Emissions	444.61	129.78	130.94	132.13	133.33	5.70
Air polution	263.43	77.00	77.69	78.39	79.09	4.23
Climate change	181.18	52.78	53.26	53.74	54.23	1.47
Well to tank	65.97	19.04	19.20	19.37	19.54	0.47
TOTAL ECONOMIC BENEFITS (Cr BDT)	**11,701.73**	**8,975.42**	**9,537.35**	**10,135.40**	**10,771.92**	**11,126.10**
SOCIO ECONOMIC COSTS (Cr BDT)						
Project initial investments	**-7,594.86**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Residual value	**79.52**	**0.00**	**0.00**	**0.00**	**0.00**	**6,606.90**
Renovation works	**-442.19**	**-97.88**	**-316.95**	**-97.88**	**-97.88**	**-200.97**
Change in Producer Surplus:	**122.68**	**171.22**	**182.47**	**194.46**	**207.23**	**220.83**
Producers costs savings for the system	122.68	171.22	182.47	194.46	207.23	220.83
TOTAL ECONOMIC COSTS (Cr BDT)	**-7,834.85**	**73.34**	**-134.48**	**96.58**	**109.35**	**6,626.76**
NET BENEFITS (Cr BDT)	**3,866.89**	**9,048.76**	**9,402.87**	**10,231.99**	**10,881.27**	**17,752.86**

IRR (%)	**15.55%**
NPV (Cr BDT)	**3,866.89**
Pay Back	**2,055**
Benefit / Cost	**1.49**

Financial Analysis-Project and Government Cash Flows

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DEICR, WESTERN PART – 2, OPTION B

	2033 Year 1	2034 Year 2	2035 Year 3	2036 Year 4	2037 Year 5	2038 Year 6	2039 Year 7
Construction period	1	1	1	1	1	1	1
Operation period	0	0	0	0	0	0	0
Term of analysis	1	1	1	1	1	1	1
Price indexation	1.00	1.05	1.10	1.16	1.22	1.28	1.34

PROJECT CASH FLOWS (Cr BDT)	2033 Year 1	2034 Year 2	2035 Year 3	2036 Year 4	2037 Year 5	2038 Year 6	2039 Year 7
Operating revenues	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Toll revenues	0	0	0	0	0	0	0
Other commercial revenues	0	0	0	0	0	0	0
Operation & Maintenance expenses	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Maintenance & Overhaul	0	0	0	0	0	0	0
Operation	0	0	0	0	0	0	0
Net Cash Flows due to Operations	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Cash Flows due to Investments	**-536**	**-339**	**-1,063**	**-1,871**	**-3,158**	**-3,374**	**-3,601**
Initial CAPEX	-536	-339	-1,063	-1,871	-3,158	-3,374	-3,601
Other CAPEX	0	0	0	0	0	0	0
Residual Value of Investments	0	0	0	0	0	0	0
Project cash flows	**-536**	**-339**	**-1,063**	**-1,871**	**-3,158**	**-3,374**	**-3,601**

GOVERNMENT CASH FLOWS (Cr BDT)	2033 Year 1	2034 Year 2	2035 Year 3	2036 Year 4	2037 Year 5	2038 Year 6	2039 Year 7
Outflows	**-536**	**-339**	**-1,063**	**-1,871**	**-3,158**	**-3,374**	**-3,601**
Project Development (Initial CAPEX)	-312	-327	-1,031	-1,804	-3,030	-3,182	-3,341
Financing Fees	-224	-12	-32	-68	-128	-192	-260
Operating expenses	0	0	0	0	0	0	0
Loan Repayments							
Interest	0	0	0	0	0	0	0
Principal Repayments	0	0	0	0	0	0	0
Inflows	**465**	**269**	**851**	**1,519**	**2,594**	**2,810**	**3,037**
Borrowings	465	269	851	1,519	2,594	2,810	3,037
Operating revenues	0	0	0	0	0	0	0
Future Developments	0	0	0	0	0	0	0
Government cash flows	**-71**	**-71**	**-212**	**-353**	**-564**	**-564**	**-564**

DEICR, WESTERN PART – 2, OPTION B

	2040 Year 8	2041 Year 9	2042 Year 10	2043 Year 11	2044 Year 12	2045 Year 13	2046 Year 14
Construction period	1	1	1	0	0	0	0
Operation period	0	0	0	1	1	1	1
Term of analysis	1	1	1	1	1	1	1
Price indexation	1.41	1.48	1.55	1.63	1.71	1.80	1.89

PROJECT CASH FLOWS (Cr BDT)	2040 Year 8	2041 Year 9	2042 Year 10	2043 Year 11	2044 Year 12	2045 Year 13	2046 Year 14
Operating revenues	**236**	**254**	**286**	**318**	**344**	**624**	**679**
Toll revenues	236	254	286	318	344	624	679
Other commercial revenues	0	0	0	0	0	0	0
Operation & Maintenance expenses	**-117**	**-123**	**-129**	**-135**	**-142**	**-193**	**-203**
Maintenance & Overhaul	-104	-109	-115	-121	-127	-172	-181
Operation	-13	-13	-14	-15	-15	-21	-22
Net Cash Flows due to Operations	**119**	**131**	**158**	**183**	**202**	**431**	**476**
Cash Flows due to Investments	**-3,393**	**-2,673**	**-2,345**	**0**	**0**	**0**	**0**
Initial CAPEX	-3,393	-2,673	-2,345	0	0	0	0
Other CAPEX	0	0	0	0	0	0	0
Residual Value of Investments	0	0	0	0	0	0	0
Project cash flows	**-3,274**	**-2,542**	**-2,188**	**183**	**202**	**431**	**476**

GOVERNMENT CASH FLOWS (Cr BDT)	2040 Year 8	2041 Year 9	2042 Year 10	2043 Year 11	2044 Year 12	2045 Year 13	2046 Year 14
Outflows	**-3,980**	**-3,266**	**-2,945**	**-1,207**	**-1,198**	**-1,232**	**-1,225**
Project Development (Initial CAPEX)	-3,069	-2,302	-1,934	0	0	0	0
Financing Fees	-323	-371	-412	0	0	0	0
Operating expenses	-117	-123	-129	-135	-142	-193	-203
Loan Repayments							
Interest	0	0	0	-601	-585	-568	-552
Principal Repayments	-471	-471	-471	-471	-471	-471	-471
Inflows	**3,134**	**2,574**	**2,350**	**318**	**344**	**624**	**679**
Borrowings	2,899	2,320	2,063	0	0	0	0
Operating revenues	236	254	286	318	344	624	679
Future Developments	0	0	0	0	0	0	0
Government cash flows	**-846**	**-692**	**-595**	**-889**	**-853**	**-608**	**-546**

DEICR, WESTERN PART – 2, OPTION B

	2047 Year 15	2048 Year 16	2049 Year 17	2050 Year 18	2051 Year 19	2052 Year 20	2053 Year 21
Construction period	0	0	0	0	0	0	0
Operation period	1	1	1	1	1	1	1
Term of analysis	1	1	1	1	1	1	1
Price indexation	1.98	2.08	2.18	2.29	2.41	2.53	2.65

PROJECT CASH FLOWS (Cr BDT)	2047 Year 15	2048 Year 16	2049 Year 17	2050 Year 18	2051 Year 19	2052 Year 20	2053 Year 21
Operating revenues	**740**	**810**	**888**	**975**	**1,041**	**1,112**	**1,187**
Toll revenues	740	810	888	975	1,041	1,112	1,187
Other commercial revenues	0	0	0	0	0	0	0
Operation & Maintenance expenses	**-213**	**-223**	**-1,073**	**-246**	**-259**	**-272**	**-285**
Maintenance & Overhaul	-190	-199	-1,048	-219	-230	-242	-254
Operation	-23	-24	-26	-27	-28	-30	-31
Net Cash Flows due to Operations	**528**	**586**	**-185**	**729**	**783**	**840**	**902**
Cash Flows due to Investments	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Initial CAPEX	0	0	0	0	0	0	0
Other CAPEX	0	0	0	0	0	0	0
Residual Value of Investments	0	0	0	0	0	0	0
Project cash flows	**528**	**586**	**-185**	**729**	**783**	**840**	**902**

GOVERNMENT CASH FLOWS (Cr BDT)	2047 Year 15	2048 Year 16	2049 Year 17	2050 Year 18	2051 Year 19	2052 Year 20	2053 Year 21
Outflows	**-1,219**	**-1,213**	**-2,046**	**-1,203**	**-1,199**	**-1,195**	**-1,192**
Project Development (Initial CAPEX)	0	0	0	0	0	0	0
Financing Fees	0	0	0	0	0	0	0
Operating expenses	-213	-223	-1,073	-246	-259	-272	-285
Loan Repayments							
Interest	-535	-519	-502	-486	-469	-453	-437
Principal Repayments	-471	-471	-471	-471	-471	-471	-471
Inflows	**740**	**810**	**888**	**975**	**1,041**	**1,112**	**1,187**
Borrowings	0	0	0	0	0	0	0
Operating revenues	740	810	888	975	1,041	1,112	1,187
Future Developments	0	0	0	0	0	0	0
Government cash flows	**-478**	**-403**	**-1,158**	**-227**	**-157**	**-83**	**-5**

DEICR, WESTERN PART – 2, OPTION B

	2054 Year 22	2055 Year 23	2056 Year 24	2057 Year 25	2058 Year 26	2059 Year 27	2060 Year 28
Construction period	0	0	0	0	0	0	0
Operation period	1	1	1	1	1	1	1
Term of analysis	1	1	1	1	1	1	1
Price indexation	2.79	2.93	3.07	3.23	3.39	3.56	3.73

PROJECT CASH FLOWS (Cr BDT)	2054 Year 22	2055 Year 23	2056 Year 24	2057 Year 25	2058 Year 26	2059 Year 27	2060 Year 28
Operating revenues	**1,267**	**1,353**	**1,444**	**1,542**	**1,646**	**1,757**	**1,876**
Toll revenues	1,267	1,353	1,444	1,542	1,646	1,757	1,876
Other commercial revenues	0	0	0	0	0	0	0
Operation & Maintenance expenses	**-360**	**-314**	**-330**	**-347**	**-364**	**-1,748**	**-401**
Maintenance & Overhaul	-328	-280	-294	-309	-324	-1,706	-357
Operation	-33	-34	-36	-38	-40	-42	-44
Net Cash Flows due to Operations	**907**	**1,038**	**1,114**	**1,195**	**1,282**	**9**	**1,475**
Cash Flows due to Investments	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Initial CAPEX	0	0	0	0	0	0	0
Other CAPEX	0	0	0	0	0	0	0
Residual Value of Investments	0	0	0	0	0	0	0
Project cash flows	**907**	**1,038**	**1,114**	**1,195**	**1,282**	**9**	**1,475**

GOVERNMENT CASH FLOWS (Cr BDT)	2054 Year 22	2055 Year 23	2056 Year 24	2057 Year 25	2058 Year 26	2059 Year 27	2060 Year 28
Outflows	**-1,251**	**-1,189**	**-1,188**	**-1,188**	**-1,189**	**-2,556**	**-1,193**
Project Development (Initial CAPEX)	0	0	0	0	0	0	0
Financing Fees	0	0	0	0	0	0	0
Operating expenses	-360	-314	-330	-347	-364	-1,748	-401
Loan Repayments							
Interest	-420	-404	-387	-371	-354	-338	-321
Principal Repayments	-471	-471	-471	-471	-471	-471	-471
Inflows	**1,267**	**1,353**	**1,444**	**1,542**	**1,646**	**1,757**	**1,876**
Borrowings	0	0	0	0	0	0	0
Operating revenues	1,267	1,353	1,444	1,542	1,646	1,757	1,876
Future Developments	0	0	0	0	0	0	0
Government cash flows	**16**	**164**	**256**	**354**	**457**	**-799**	**683**

DEICR, WESTERN PART – 2, OPTION B

	2061 Year 29	2062 Year 30	2063 Year 31	2064 Year 32	2065 Year 33	2066 Year 34	2067 Year 35
Construction period	0	0	0	0	0	0	0
Operation period	1	1	1	1	1	1	1
Term of analysis	1	1	1	1	1	1	1
Price indexation	3.92	4.12	4.32	4.54	4.76	5.00	5.25

PROJECT CASH FLOWS (Cr BDT)	2061 Year 29	2062 Year 30	2063 Year 31	2064 Year 32	2065 Year 33	2066 Year 34	2067 Year 35
Operating revenues	**2,003**	**2,138**	**2,283**	**2,437**	**2,602**	**2,778**	**2,966**
Toll revenues	2,003	2,138	2,283	2,437	2,602	2,778	2,966
Other commercial revenues	0	0	0	0	0	0	0
Operation & Maintenance expenses	**-421**	**-442**	**-464**	**-587**	**-512**	**-538**	**-564**
Maintenance & Overhaul	-375	-394	-414	-534	-456	-479	-503
Operation	-46	-48	-51	-53	-56	-59	-61
Net Cash Flows due to Operations	**1,582**	**1,696**	**1,819**	**1,850**	**2,090**	**2,241**	**2,402**
Cash Flows due to Investments	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Initial CAPEX	0	0	0	0	0	0	0
Other CAPEX	0	0	0	0	0	0	0
Residual Value of Investments	0	0	0	0	0	0	0
Project cash flows	**1,582**	**1,696**	**1,819**	**1,850**	**2,090**	**2,241**	**2,402**

GOVERNMENT CASH FLOWS (Cr BDT)	2061 Year 29	2062 Year 30	2063 Year 31	2064 Year 32	2065 Year 33	2066 Year 34	2067 Year 35
Outflows	**-1,197**	**-1,201**	**-1,207**	**-1,313**	**-1,222**	**-1,231**	**-1,241**
Project Development (Initial CAPEX)	0	0	0	0	0	0	0
Financing Fees	0	0	0	0	0	0	0
Operating expenses	-421	-442	-464	-587	-512	-538	-564
Loan Repayments							
Interest	-305	-288	-272	-255	-239	-222	-206
Principal Repayments	-471	-471	-471	-471	-471	-471	-471
Inflows	**2,003**	**2,138**	**2,283**	**2,437**	**2,602**	**2,778**	**2,966**
Borrowings	0	0	0	0	0	0	0
Operating revenues	2,003	2,138	2,283	2,437	2,602	2,778	2,966
Future Developments	0	0	0	0	0	0	0
Government cash flows	**806**	**937**	**1,076**	**1,124**	**1,381**	**1,548**	**1,725**

DEICR, WESTERN PART – 2, OPTION B

	2068 Year 36	2069 Year 37	2070 Year 38	2071 Year 39	2072 Year 40
Construction period	0	0	0	0	0
Operation period	1	1	1	1	1
Term of analysis	1	1	1	1	1
Price indexation	5.52	5.79	6.08	6.39	6.70

PROJECT CASH FLOWS (Cr BDT)	2068 Year 36	2069 Year 37	2070 Year 38	2071 Year 39	2072 Year 40
Operating revenues	**3,167**	**3,381**	**3,610**	**3,854**	**4,115**
Toll revenues	3,167	3,381	3,610	3,854	4,115
Other commercial revenues	0	0	0	0	0
Operation & Maintenance expenses	**-593**	**-2,847**	**-653**	**-686**	**-720**
Maintenance & Overhaul	-528	-2,779	-582	-611	-642
Operation	-65	-68	-71	-75	-78
Net Cash Flows due to Operations	**2,574**	**534**	**2,956**	**3,168**	**3,394**
Cash Flows due to Investments	**0**	**0**	**0**	**0**	**464**
Initial CAPEX	0	0	0	0	0
Other CAPEX	0	0	0	0	0
Residual Value of Investments	0	0	0	0	464
Project cash flows	**2,574**	**534**	**2,956**	**3,168**	**3,858**

GOVERNMENT CASH FLOWS (Cr BDT)	2068 Year 36	2069 Year 37	2070 Year 38	2071 Year 39	2072 Year 40
Outflows	**-1,253**	**-3,491**	**-1,281**	**-1,297**	**-1,315**
Project Development (Initial CAPEX)	0	0	0	0	0
Financing Fees	0	0	0	0	0
Operating expenses	-593	-2,847	-653	-686	-720
Loan Repayments					
Interest	-189	-173	-156	-140	-124
Principal Repayments	-471	-471	-471	-471	-471
Inflows	**3,167**	**3,381**	**3,610**	**3,854**	**4,115**
Borrowings	0	0	0	0	0
Operating revenues	3,167	3,381	3,610	3,854	4,115
Future Developments	0	0	0	0	0
Government cash flows	**1,914**	**-110**	**2,329**	**2,557**	**2,800**

Annexure 04 – National GDP Impact – Eastern Part-1

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The GDP impact calculation has been carried out following international methodology for economic impact estimation studies and as implemented in previous international projects. It has been estimated as a sum of the three impacts: direct, indirect and induced, as follows:

GDP IMPACT CALCULATION		Cr BDT
GDP economic impact. Direct Impact		**145,003**
Personnel expenses. Construction	22%	105,901
Personnel expenses. Operation	65%	0
EBITDA. Construction & Maintenance	8%	38,799
EBITDA. Operation	15%	304
GDP economic impact. Indirect Impact		**339,487**
Suppliers. Construction	70%	339,487
Suppliers. Operation	20%	0
GDP economic impact. Induced Impact		**326,567**
Infrastructure activity		105,901
Induced activity of the infrastructure		220,667

- Right-hand column shows the addition of all the economic projections generated, in constant BDT (not considering inflation)
- Direct impact is the impact generated by the project itself and is similar to the Gross Added Value, which means the addition of personnel expenses and EBITDA both in the implementation phase and in the operation phase.
- Indirect impact is the impact generated by the suppliers of the project, also in both the implementation phase and the operation phase.
- Induced impact is the impact generated by all the personnel expenses with the money spent on any other activity in the region / country. It has been calculated as the induced impact of the infrastructure activity, based on the personnel expenses of the infrastructure itself (in construction and in operation), and the induced impact of the activity of the infrastructure, based on the personnel expenses of the indirect impact multiplied by the 65% estimated of personnel expenses of any service activity.

In summary, it is the sum of the effects generated by the infrastructure, either by its construction or by its operation, both directly and those produced by each of the activities derived from the infrastructure itself:

Total impact on GDP (Cr BDT 2022)	811,057
Direct impact	145,003
Indirect impact	339,487
Induced impact	326,567
GDP Bangladesh (million USD 2022)	453.852
GDP Bangladesh (Cr BDT 2022)	49.923.720
Project impact on GDP	1.62%

Annexure 05 – National GDP Impact – Western Part-2. Option A

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The GDP impact calculation has been carried out following international methodology for economic impact estimation studies and as implemented in previous international projects. It has been estimated as a sum of the three impacts: direct, indirect and induced, as follows:

GDP IMPACT CALCULATION		Cr BDT
GDP economic impact. Direct Impact		**267,008**
Personnel expenses. Construction	22%	195,164
Personnel expenses. Operation	65%	0
EBITDA. Construction & Maintenance	8%	71,371
EBITDA. Operation	15%	473
GDP economic impact. Indirect Impact		**624,494**
Suppliers. Construction	70%	624,494
Suppliers. Operation	20%	0
GDP economic impact. Induced Impact		**601,085**
Infrastructure activity		195,164
Induced activity of the infrastructure		405,921

- Right-hand column shows the addition of all the economic projections generated, in constant BDT (not considering inflation)
- Direct impact is the impact generated by the project itself and is similar to the Gross Added Value, which means the addition of personnel expenses and EBITDA both in the implementation phase and in the operation phase.
- Indirect impact is the impact generated by the suppliers of the project, also in both the implementation phase and the operation phase.
- Induced impact is the impact generated by all the personnel expenses with the money spent on any other activity in the region / country. It has been calculated as the induced impact of the infrastructure activity, based on the personnel expenses of the infrastructure itself (in construction and in operation), and the induced impact of the activity of the infrastructure, based on the personnel expenses of the indirect impact multiplied by the 65% estimated of personnel expenses of any service activity.

In summary, it is the sum of the effects generated by the infrastructure, either by its construction or by its operation, both directly and those produced by each of the activities derived from the infrastructure itself:

Total impact on GDP (Cr BDT 2022)	1,492,587
Direct impact	267,008
Indirect impact	624,494
Induced impact	601,085
GDP Bangladesh (million USD 2022)	453,852
GDP Bangladesh (Cr BDT 2022)	49,923,720
Project impact on GDP	2.99%

Annexure 06 – National GDP Impact – Western Part-2. Option B

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The GDP impact calculation has been carried out following international methodology for economic impact estimation studies and as implemented in previous international projects. It has been estimated as a sum of the three impacts: direct, indirect and induced, as follows:

GDP IMPACT CALCULATION		Cr BDT
GDP economic impact. Direct Impact		**59,519**
Personnel expenses. Construction	22%	43,114
Personnel expenses. Operation	65%	0
EBITDA. Construction & Maintenance	8%	15,956
EBITDA. Operation	15%	449
GDP economic impact. Indirect Impact		**139,612**
Suppliers. Construction	70%	139,612
Suppliers. Operation	20%	0
GDP economic impact. Induced Impact		**133,862**
Infrastructure activity		43,114
Induced activity of the infrastructure		90,748

- Right-hand column shows the addition of all the economic projections generated, in constant BDT (not considering inflation)
- Direct impact is the impact generated by the project itself and is similar to the Gross Added Value, which means the addition of personnel expenses and EBITDA both in the implementation phase and in the operation phase.
- Indirect impact is the impact generated by the suppliers of the project, also in both the implementation phase and the operation phase.
- Induced impact is the impact generated by all the personnel expenses with the money spent on any other activity in the region / country. It has been calculated as the induced impact of the infrastructure activity, based on the personnel expenses of the infrastructure itself (in construction and in operation), and the induced impact of the activity of the infrastructure, based on the personnel expenses of the indirect impact multiplied by the 65% estimated of personnel expenses of any service activity.

In summary, it is the sum of the effects generated by the infrastructure, either by its construction or by its operation, both directly and those produced by each of the activities derived from the infrastructure itself:

Total impact on GDP (Cr BDT 2022)	332,992
Direct impact	59,519
Indirect impact	139,612
Induced impact	133,862
GDP Bangladesh (million USD 2022)	453,852
GDP Bangladesh (Cr BDT 2022)	49,923,720
Project impact on GDP	0.67%