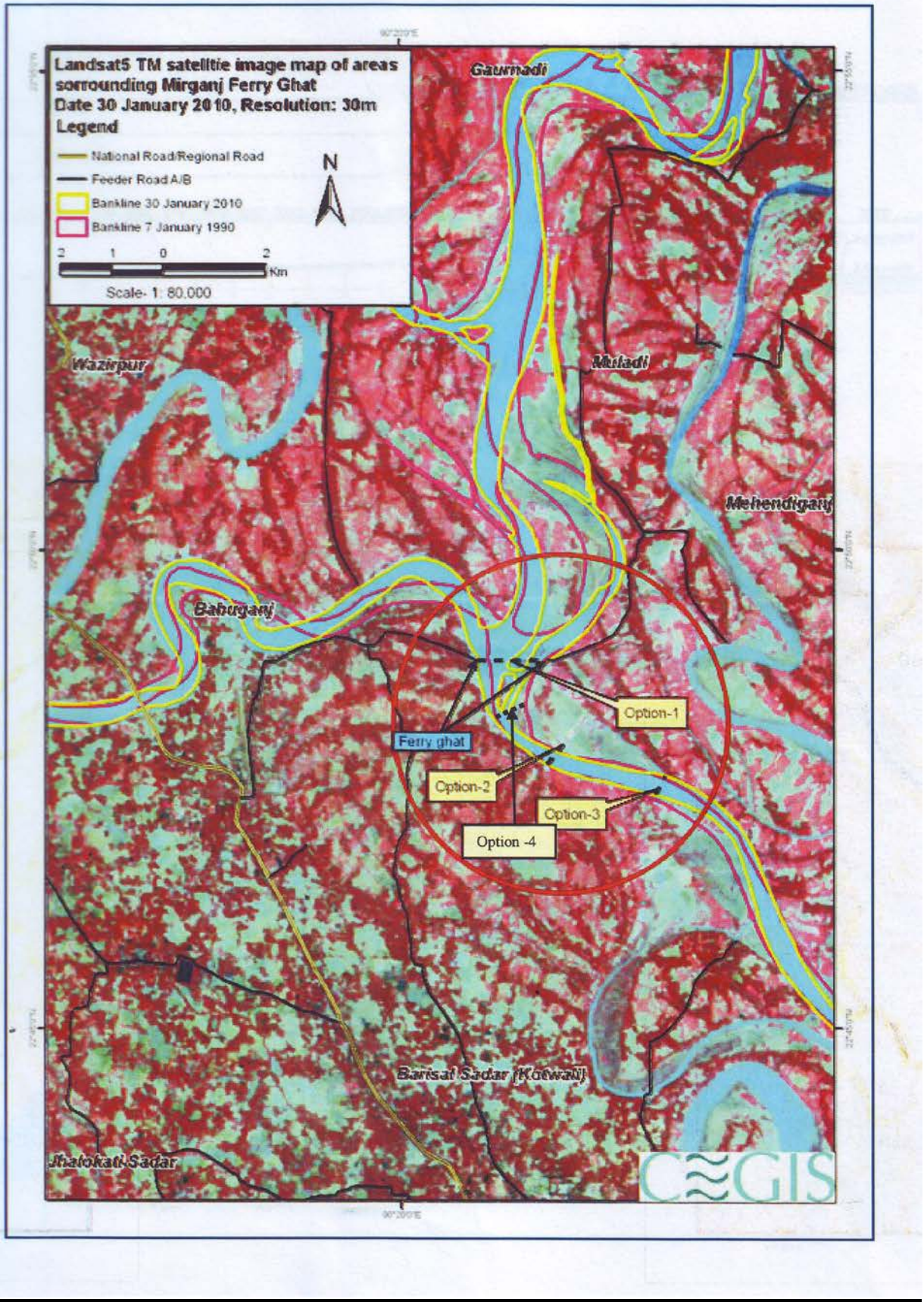
**Figure – Alternative Alignments**



## OUT LINE OF THE PROJECT

| | | |
|---|---|---|
| ❖ Project site | : | Proposed Bridge Site is at Ferry Location at 8th km. on Rahmatpur-Babuganj- Muladia- Hizalkok Road(Z8034). |
| ❖ Bridge | : | Total length of the bridge is 1590.0mThe Main bridge and Viaduct are as follows;<br>Main Bridge is 300.0m long consist of segmental pre-stressed post tensioned box girder.<br>Structural forms : 2x50+2x100 =300.0m<br>Viaduct is1290m long consist of pre-stressed I section<br>Structural forms: 23x30+20x30 =1290.0m |
| ❖ Approach Road | : | Approx. 4800m |
| ❖ River Training Work (RTW) | : | River Bank protection works would be 100m upstream and 50m downstream of the bridge centre line on both sides of the river. |
| ❖ Project Cost | : | BDT 5049.15 Million |
| ❖ Construction Period | : | 2014 to 2017 ( 4 years) |
| ❖ NPV | : | BDT 932.36 Million |
| ❖ BCR | : | 1.31 |
| ❖ EIRR | : | 18.74% |
| ❖ Traffic Volume | : | Motorized Traffic 23,493 Veh /day at the Year 2047. |
| ❖ Indirect Benefit | : | Will increase the economic activity, educational activity and overall benefit of the region. |

# EXECUTIVE SUMMARY

## 01) Introduction

Govt. of Bangladesh, through Bangladesh Bridge Authority (BBA) as executing agency contracted JV of SARM Associates Ltd and BETS Consulting Engineers for carrying out Feasibility Study for constructing of bridges at 3 ferry locations namely

a) At Charkhali Ferry Ghat (R870) on Kocha River

b) At Galachipa Ferry Ghat (Z8806) on Golachipa River

c) At Mirganj Ferry Ghat (Z8034) on Arial khan (Branch)

The purpose of the Executive Summary is to highlight the Major findings of various studies and the conclusions and recommendations of the study team.

The Notification of Award for providing Consultancy Services was issued by the Chief Engineer on 28 June 2011. The Consultant has started their work from July 2011.The Consultant submitted the reports as following table;

| **Types of Report** | **Date of submission** |
|---|---|
| Inception Report | 27 July 2011 |
| Interim Report | 29 December 2011 |
| Draft Final Report | 04 April 2012 |
| Draft Final Report (Revised) | 06 June 2012 |

## 02) Project Background

*Reasons for the project*

Bangladesh is a country with innumerable rivers flowing across its territory. The Padma River is the mightiest of all these and ranks as the fifth largest river in the world in terms of volumetric discharge. The western part of deltaic Bangladesh is physically detached from northern and eastern part including capital city, until a massive bridge is built across the Padma River.
Ferry crossing at Ferry locations which are the major tidal stream, considerably hampers road communication particularly during flood season. The 3 (Three) bridges at those ferry locations as mentioned will grossly improve the road communications. These will improve the socio-economic condition and industrial development of the area.

***Construction of Bridge At Mirganj Ferry Ghat (Z8034) on Arial Khan (branch) river***

*Description of the River*

The main Arial Khan originates from Padma River at Sadarpur Upazia at Faridpur, falls in Tetulia River. This branch of the Arial Khan River passing through Muladi, Babuganj, Wzirpur, Babnaripara, Swarupkati, Kawakhali etc and fall into Kocha River. The Sugandha river passing through meets the Arial Khan River (branch) a small distance upstream and

then the combined flow passes by the ferry ghat.The Mirganj Ferryghat is located at downstream of confluence. The river is 7 – 12m depth at different places. The river is tidal one with tidal variation of about 2m.

*Importance and justification of the proposed bridge at 8th km on Rahmatpur- Babuganj-Muladi-Hizla Road (Z8034)*

The proposed bridge site is at 8 km from Rahmatpur on *Rahmatpur- Babuganj-Muladi-Hizla Road (Z8034).* The road connects Babuganj, Muladi and Hizla upazila with Barisal district. The proposed bridge will connect Muldi and Hizla upazila with Barisal, Dhaka and other parts of Bangladesh directly.

The ferry service at present is giving connectivity with other places. But at ferry points we have to wait average two hour or more. A huge amount of money is required especially for fuel and machinery for ferry service. If the bridge is constructed, the commercial vehicles will give more trips and working hour of people will be saved.

At the natural calamity the ferry services disrupts economic and social activities seriously. The Consultant found the construction of the bridge is economically viable. So construction of the bridge at the ferry location is justified.

## 03) Traffic Survey and Forecast

The main objective of traffic survey and analysis is to determine to extent of traffic demand on a road/bridge project. The result of this process will form the basis for traffic forecast and projection on the road/bridge project.

The summery of the study findings starting from traffic survey through traffic projection are follows;

- From traffic projection of total motorized traffic(Table 2.5.4, Volume – 1), it is found that AADT in the year 2047 is 23,493, veh / day (Normal traffic 9057 nos, generated traffic 8753 nos and diverted traffic 5683 nos) which is less than 35,000, the saturation capacity of two lane Bridge & 2 lane carriage way (Ref: ADB TA# 4821- BAN 2009).
- From traffic projection of total non-motorized traffic (Table 1.5.5, Volume – 1). it is found that AADT in terms of PCU / hr. in the year 2047 is 106 PCD / hr. which is far less than 400 PCU / hr, the minimum requirement of provision of NMV lane according to the Roads & Highways Department rule.
- From the traffic survey, it may be concluded that the Bridge with both side approach road is feasible for 2-lane carriage way.

The two lanes cost of bridge is found to be BDT 5049.15 Million whereas the cost of four lane bridge will be BDT 8736.91Million.

From above study based on traffic volume and cost of the bridge, it is seen that construction. The construction of four lane bridge is neither justified from traffic point of view nor from construction cost

## 04) Hydrological and Morphological Study

The Ferry Ghat is located at 8th km. of the above road on the river "Arial Khan" (branch) & the name of the ferry ghat is 'Mirganj Ferry Ghat' which connects Babuganj, Muladi, Hizla upazilas with Barisal district.

The Arial Khan River (Branch) is a tidal one with reported tidal variation of about 2m. The normal flow direction of the river is from north to south. BWDB has a tidal water level station at Babuganj (BWDB Tidal Water Level Station No. 318) very close to the Mirganj Ferry Ghat.

The Arial Khan River (branch) is observed to be narrowing in width as it moves south-ward from the ferry ghat. About 1-2km downstream it's width is narrowed down to about 1/3rd of its width at ferry ghat.

The following data and figures have been collected from field surveys:

- The river is a tidal one.
- High bank to high bank distance of the river Ferry ghat **:** 1362 m
- Average ground level on Barisal side: 2.74 mPWD
- Average ground level on Muladi side: 3.08 mPWD
- RL of the river at bank full stage: 2.40 mPWD
- Cross section area of the river at bank full level: 12,195 $m^2$
- Length of the proposed main bridge: 300m m
- Length of the proposed viaduct: 1290m
- Observed lowest bed level of the river: (-) 22.35 m PWD
- Mean High Water Spring at Barisal (as per BIWTA Tide Table)
  = 2.644 m in CD = 2.644 – (3.385 – 2.964) = 2.205 mPWD
- Mean Low Water Spring at Barisal (as per BIWTA Tide Table)
  = 0.434 m in CD = 0. 434 – (3.385 – 4.404) = (-) 0.005 mPWD

Review and analyses of the prevailing hydrological and morphological environment of the proposed Mirganj Bridge area leads to the following conclusions and recommendations:

- Design High Water Level: 4.5484 mPWD
- Design Low Water Level: ( - ) 0.55 mPWD
- Regime Width of the Arial Khan (branch) River at Bridge Site: 350m
- Anticipated Maximum Scour Level at Bridge Pier: upto (-) 27.73 mPWD
- Bridge Soffit Level over Navigable Portion of the Channel: 22.8484 mPWD
- Minimum Bridge Span Openings on Navigable Portion of the Channel: 76.22 m
- Bridge alignment: In the neighborhood of morphological analysis option – 2.

*River Training work*

At the Bridge location site, the width of the bridge from bank to bank at the centreline of the proposed is about 500m. The proposed bridge has been designed for a span length of 1580m. Thus from spanning of the bridge, it is evident that the bridge abutment are located at a safe distance from the main river channel. The river will be flowing normally under the bridge and no specific guide bank is required for the bridge.

Length of the river banks to be protected from site inspection and morphological study at the proposed bridge site it is seen that both river banks at the bridge site are stable. However, river bank protection works would be done for a length of about 100 m upstream and 50m downstream of the bridge centreline.

The river banks could be protected by stone pitching or by concrete blocks or by growing vegetative cover. Concrete blocks are costly. For this reason the Consultant suggests stone pitching work for river training work.

## 05) Bridge Location Study

Selection of a bridge alignment on a specified road network route depends mainly on river width, river geometry, navigational clearance requirement, historical change in the river course, required length of approach road for a specific alignment and availability of land and its acquisition are for the bridge approaches.

First of all a reconnaissance survey was conducted from the ferry location of mirganj ferry ghat to 1km U/S & 5.00 km D/S of river and 7 nos X- section were taken at different locations. After the screening of all the sections & from hydraulic considerations, the following 4 locations were considered:

- Option 1: Along the existing alignment of Mirganj ferry ghat. About 1.17 hac. Land will need to acquire. 2 nos. household, 27 nos. temporary structure will be affected in this alignment. The length of the approach road will be 360m.
- Option 2: the alignment is 2.25 km D/S from ferry ghat. About 1.46 hac. Land will need to acquire. 4 nos household , 32 nos structure will be affected in this alignment. The length of the approach road will be 4.80 km on both sides.
- Option 3:The alignment is 3.0 km D/S from ferry ghat. 2.41 hac. Land will need to acquire. 2 nos. structures will be affected in this alignment. The length of the approach road will be 7.0 km.
- Option 4: The alignment is 1.50 km U/S from Ferry ghat. 2.0 hac land will need to acquired. 1 nos. house hold, 3 nos. structures will be affected in this alignment. The length of the approach road will be 2.8 km on both sides.

The Option-4 is at the bend of the river, during big flood or cyclonic storm the banks of the river may be severely affected. The Option-2 is at about 2.25 downstream of ferry ghat where the river banks are stable, the side slope of river bank is mild & no significant bank shifting has occurred during last 20 years. However, this will involve nearly 4.8 km of approach road embankment & 81m of culverts through agricultural land homestead land.

Considering the above aspects, the Consultants suggest that the Alignment along Option-2 would be the most suitable location for the bridge. Therefore, Option-2 location has been suggested by the Consultant for the proposed bridge and approach roads location.

## 06) Selection of Final Bridge Alignment

The Consultant considered following bridges at the four options for selection of the final bridge alignment

The following 3 alternative locations were selected

a) Option -1

Main Bridge 2x50 + 7x100 =800 m

Viaduct. Muladia end:13x30 = 390m

Barisal end: 13x30 =390

Total length of the Bridge: **1590 m**

b) Option-2

Main Bridge 2x50 + 2x100 =300 m

Viaduct Muladia end:23x30 = 690m

Barisal end: 20x30 =600m

Total length of the Bridge: **1590 m**

c) Option-3

Main Bridge 2x50 + 3x100 =400 m

Viaduct. Muladia end:21x30 = 630m

Barisal end: 22x30 =660m

Total length of the Bridge: **1690 m**

d) Option-4

Main Bridge 2x50 + 3x100 =400 m

Viaduct. Muladia end: 22x30 = 660m

Barisal end: 18 x30 = 540m

Total length of the Bridge: **1600m**

The alternative alignments were then evaluated for technical & financial costs.
The final location of the bridge is Option -2.

**Comparative study of four Options of the bridge**

The Consultant performed detail study and prepared a comparative study of the four alternative options of the proposed bridge for social environmental and economic aspects for final selection. These are shown in the following table

*Table: Comparative Study of alternatives*

| Description | Option -1 | Option-2 | Option-3 | Option-4 |
|---|---|---|---|---|
| Construction Cost (BDT) | 4849.78 Million | 3931.67 Million | 4635.90 Million | 3828.33 Million |
| Project cost (BDT) | 6417.79 Million | 5049.15 Million | 6198.08 Million | 4878.60 Million |
| Length of the approach road | 720m | 4800m | 7000m | 2820m |
| Land Acquisition | 1.17 hac | 1.46 hac | 2.41 hac | 2.12 hac |
| Land Acquisition, Resettlement & EMP cost (Million BDT) | 3.11 | 44.51 | 60.54 | 35.31 |
| Environmental impact | Less land acquisition will result in environmental impact. | More land acquisition will result in environmental impact. | More land acquisition will result in environmental impact. | More land acquisition will result in environmental impact. |
| Affect on Household and structures | 2 nos. household and 27 nos. structures | 4 nos. house hold and 32 nos structures | 2 nos structures | 1 no. Household and 3 nos. Structures |
| Social Impact | Less land acquisition will result in less social impact | More land acquisition will result in social impact | More land acquisition will result in social impact | More land acquisition will result in social impact |

| | | | | |
|---|---|---|---|---|
| NPV (Million BDT) | 249.18 | 923.36 | 372.63 | 1032.02 |
| BCR | 1.07 | 1.31 | 1.10 | 1.36 |
| EIRR | 16.06% | 18.74% | 16.57% | 19.12% |
| Ranking | 4 | 1 | 3 | 2 |

The alignment along Option-4 is at the bend of the riverbank. During severe flood or cyclonic storm the river banks may be seriously affected and the bridge will be in danger. The Option -2 alignment would provide with maximum benefit for the techno-economic evaluation. Therefore, Option-2 location has been suggested by the Consultant for the proposed bridge and approach roads location.

### Selection of Structural Configuration

For structural configuration following two alternatives have been studied for the selected alignment

**Option-1: PSC Box Girder**
Main bridge - 2x100m + 2 x 50m in PSC box type = 300m
Viaduct - 23x30m + 20x 30m in PSC I - Girder type = 1290m
Total Length of bridge = 1590m
Total cost of the bridge: BDT 5049.15 Million

**Option-2: Extradosed PSC Box Girder**
Main bridge - 1x150m + 2 x 75m in Extradosed PSC box type = 300m
Viaduct - 20x30m + 21 x 30m in PSC I - Girder type = 1230m
Total Length of bridge = 1530m
Total cost of the bridge: BDT 5419.95Million

The bridge type selected through cost comparison between two options is PSC Box Girder.

## 07) Geotechnical Investigation for The Structure

Brownish gray to gray very soft silty clay exists upto 10.0m. From 10.0~20.0m grey loose to medium dense silt with trace of fine sand is found. At greater depth below 20.0m medium to dense fine sand exists.

## 08) Design Approach and Technical Standards

The Consultants preliminary designs are in accordance with international standards and procedures but are largely based on Roads and Highways Departments (RHD) standards for design of Bridges and geometric design standard. The principal international standards adopted are;

a) For approach roads and bridge alignment:-Guide lines for Design of Flexible Pavement, and Pavement Design Guide followed by Roads and Highways Department (RHD),Latest revision of AASHTO (1993), guide for Design of Pavement structure, presently in use in Bangladesh.

b) For the bridge: AASHTO latest revision applicable in use in Bangladesh on Standard Specifications for Highway Bridges.

c) For Material standard: AASHTO latest revision in use in Bangladesh.

## 09) Findings and Sum-up

The consultant has conducted the following surveys and investigation;

a) Extensive reconnaissance survey by the team members to select the possible locations of the bridge and associated approach roads/ link roads to existing roads.

b) River Crossing Traffic Survey to assess the Normal Traffic and their mode of crossing, over the proposed bridge.

c) Preliminary Social, Resettlement and Environmental impact study at the selected 3 possible bridge locations and approach roads.

d) Topographic Survey at the selected bridge location.

e) Hydrographic survey at the selected bridge location.

f) Geotechnical Investigations along the selected bridge and approach road alignment, and

g) Morphological (satellite imagery) studies over the last 20 year in the vicinity of the proposed bridge to assess the river bank shifting and requirement for bank protection work

In addition to the above Hydrological studies have been carried out including the study for Navigational clearance requirement.

## 10) Environmental Impact Assessments

*Potential Adverse Impact*

Among the physical negative environmental impact mainly on air quality may appear during construction of the bridge. During post –construction operational phase, the negative impacts on air quality will come from vehicle exhaust emission pollutants. As a result air will be deteriorated. The impacts on noise level may be increased during the time of construction. The impacts on biological environment will appear in cutting of some trees and plants on both side of the approach roads of the bridge. As a result roadside erosion and some negative impacts on ecology may be approved. Erosion may be appearing on both bank side earth work of the river during construction of the bridge. Some drainage congestion may arrive on the approach roadside of the bridges during construction phase. Some land acquisition and resettlement will be required. Navigation may be disrupted. Fish habitat may be affected. Quality of water may be affected.

*Mitigation measures*

Increase channel capacity to handle big barges and water crafts. Providing adequate Flood passage structures for fish migration and careful alignment of the bridge without disturbing fish habitat and fishing. Limiting works to dry Season. Carefully planning navigation bypass. Restoring and Rehabilitation navigation Channel for safe transport and storing construction materials. Spraying water to reduce dust hazards and limited use of machinery to reduce noise. Proper monitoring of soil erosion, navigation, chemical storage and use; site inspection, condition of construction camp, surface water quality, measurement of DO, BOD,SS. FECEL coli forms, drinking water quality, inspection of brick, bitumen & cement facilities as per methods/ procedures recommended by department of environment, checking noise and vibration and inspection of health and safety.

*Positive Impact*

In the long run the project will replace ferry services. Improve regional hydrology by cross drainage structures. Reduce dust pollution and improve water quality by bituminization of the pavement. Facilitate and improve access to markets for income generation. Allow easy movement of motorized and other traffic. Improve aesthetic quality of the region. Agricultural development will occur. Better access to growth center markets.

*Environmental Management Plan*

Environmental Management Plan (EMP) is suggested to avoid any adverse impact during construction of the bridge and operation maintenance phases and it will ensure environmental provisions and management for the bridge. The EMP cost will include river bank erosion on the approaches of the bridge, drainage congestion, air quality, noise level, removal of trees and plantation, water quality, land loss/ acquisition, homestead loss, agricultural and commercial loss, health and sanitation, traffic management and congestion.

- On critical review of the potential environmental impacts, the specific mitigation and monitoring measures proposed and the benefits described, the project will not lead to any long term irreversible adverse impact on the adjacent environmental quality and resources.
- Most of the potential impacts are short-term and minor in nature. The anticipated adverse effects could be greatly controlled / minimized or eliminated through adoption of suggested mitigation measures and implementation of the Environmental Management Plan.
- Considering the civil engineering requirements from environmental advantage point of view, the current location and functional route of the project is acceptable.

## 11) Operation & Maintenance:

In order to ensure long time durability and services of the bridge operation and maintenance of different components of main bridge, viaducts, services and other ancillary structures of the bridge will be an essential activity. These will include routine inspections at weekly or

monthly basis, general inspection after two year's time and principal inspection after every five year's time.

However, the Construction Company with due agreement and concurrence of supervision consultant and Manufacturer's specifications will prepare necessary Operation and Maintenance manual for the main bridge and Viaducts and connections, supports, services, and other ancillary structures . The qualified Operation and Maintenance Operator will follow the detail manuals in operation and maintenance work

## 12) Economic Evaluation

**Comparison of costs and Benefits.**

To arrive at the conclusion of economic appraisal of the project, it is necessary to compare the costs and benefits and find out Net Present Value (NPV) Benefit – Cost Ratio (BCR), and the Internal Rate of Return (IRR).

The costs and benefits were discounted initially at 15 percent (as prescribed by the Planning Commission) and based on the result, were further discounted at 10 percent to arrive at IRR. The following table provided the summary position of the economic analysis:

**Sensitivity Analysis:** Cost and Benefits of the project are based on estimates and projection. In reality it may vary with actual costs and available benefits. To test the worthiness of the project, it is considered that sensitivity analysis is carried out taking into account three alternative situations.

(i) With 10% increase in cost stream ;
(ii) With 10% decrease in benefit stream;
(iii) With combined effect of (i) and (ii)

The results of Sensitivity Analysis as per alternatives (i) (ii) and (iii). above are presented in the following table.

ECONOMIC ANALYSIS: NPV, BCR & IRR BASE CASE and Sensitivity Analysis

| **Sl No.** | **Economic Evaluation** | **NPV (Million Taka ) 15%** | **BCR** | **IRR (%)** |
|---|---|---|---|---|
| 01. | Base Case | 1032.36 | 1.31 | 18.74 |
| 02. | Benefit (10% reduced) | 534.11 | 1.19 | 17.59 |
| 03. | Cost (10% increased) | 626.44 | 1.17 | 17.46 |
| 04. | Combined effect of benefit 10% reduced and cost 10% increased | 237.19 | 1.07 | 16.12 |

The economic indicators for design options on the existing alignment justify the economic viability of the project.

## 13) Project Cost

The project Cost includes the following components of cost:

1. Total Construction Cost;
2. Engineering Cost
3. Land Acquisition, Resettlement
4. Administrative Cost;
5. Physical Contingencies.
6. Price Contingency
7. VAT,TAX And Duties.

The table below shows the cost of the components of the Project Cost:

**Total Project Cost (Mirgonj Bridge, Option - 2)**

| Sl No. | Description | Amount in Million BDT | Remarks |
|---|---|---|---|
| 1 | Construction Cost | | |
| | a) Bridge | BDT 3,154.27 | |
| | b) Approach Road | BDT 598.58 | |
| | c) River Bank Protection Work | BDT 178.82 | |
| | **Total Construction Cost** | BDT 3,931.67 | |
| 2 | Engineering Cost | | |
| | a) Detailed design | BDT 98.29 | 2.5% of Sl No. 01 |
| | b) Construction Supervision | BDT 137.61 | 3.5% of Sl No. 01 |
| 3 | Land Acquisition, Resettlement and EMP. | BDT 41.51 | |
| 4 | Administration Cost | BDT 27.74 | 10% of Sl No. 02 & 03 |
| 5 | Physical Contingencies | BDT 393.17 | 10%-15% of Sl No. 01 |
| 6 | Price Contingencies | BDT 237.87 | 2%-5% of Sl No. 01, 02 and 05 |
| 7 | VAT, TAX and DUTIES | BDT 181.29 | 14.5% for importation @ 30% of Sl No. 01 & 02 |
| **Total Project Cost** | | **BDT 5,049.15** | |

## 14) Conclusion from the Study

### 14.1 Structural Configuration

From the hydraulic (including navigational clearance requirement), topographical and Geotechnical studies and the acceptable (3.5%) longitudinal grade, the total length of the proposed bridge has come to 1590m, Comprising of the main bridge over the main river channel followed by viaduct on either bank covering the flood plain.

The main bridge has been suggested in **Option-2** comprising of post-tensioned pre-stress concrete Single Box Girder (PSC Box Girder) continuous with segmental cantilever construction with span of 100m. The viaduct portions comprise of pre-stress Girder of span 30 m. The total length of option-2 being 1590m comprises of (2x100+2x50+43x30)m.

### 14.2 Foundation Type Consideration

The foundation type of 100m span option-2, PSC box type bridge is quite common in Bangladesh with large diameter (1200mm) cast-in-situ RCC bored piles and that of viaduct span being with 1000mm diameter Cast-in-situ bored piles.

### 14.3 Social and Resettlement Impact Consideration

The survey was conducted in the immediate vicinity of the final bridge alignment and both side of approach roads. The land to be acquired mainly of agricultural category of land with some homestead & orchard category.

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### 14.4 Environmental Consideration

On critical review of the potential environmental impacts, the specific mitigative and monitoring measures proposed and the benefits to be derived, the project at the proposed alternative-2 location will not lend to any long term irreversible adverse impact on the adjacent environmental quality and resources.

### 14.5 Economic Justification

The economic analysis carried out for the proposed Bridge for 30 years evaluation period shows that from the point of view of all the economic parameters considered the project is economically viable and the investment is highly justified.

The NPV of the bridge at 15% discount rate is placed Tk. 1032.36 million.
The EIRR of the project at about 19.12% is above the 15% accounting rate of return considered for taking investment decision in Bangladesh. The benefit cost ratio is 1.35

## 15. Recommendations of the Study

The recommendations of the study for the proposed Mirgonj Bridge are as follows:
a) The bridge for the options -2 is found to be feasible from technical and economic consideration and may be taken up for construction.

b) The most suitable foundations of the piers in the waterway are found to be large diameter (1200mm for the 100m span PSC Box Girder) RCC cast-in-situ bored piles with permanent steel casing and that of the viaduct portion in 1000mm diameter RCC cast-in-situ bored piles with temporary casing.

d) The bridge may not be effective for traffic flow without the minimum improvement of the Z8034 road starting from National Highway N8 at Rahmatpur upto Hizla.

# Summary of Costs of Different Options At a Glance

| **Mirgonj Bridge** | Total Project Cost for 2 Lane Bridge (Mill BD) | Total Project Cost for 4 Lane Bridge (Mill BD) | Total Project Cost of Extra-dosed for 2 Lane Bridge (Mill BD) |
|---|---|---|---|
| Option – 1 | 6,417.79 | 11,728.85 | - |
| Option – 2 | 5,049.15 | 8,736.91 | 5,419.95 |
| Option – 3 | 6,198.08 | 10,188.22 | - |
| Option – 4 | 4878.60 | 8,829.87 | |

# SUMMARY OF COST OF TWO LANE BRIDGE

## Total Project Cost (Mirgonj Bridge, Option - 1)

| Sl No. | Description | Amount in Million BDT | Remarks |
|---|---|---|---|
| 1 | Construction Cost | | |
| | a) Bridge | BDT 4,634.96 | |
| | b) Approach Road | BDT 36.00 | |
| | c) River Bank Protection Work | BDT 178.82 | |
| | **Total Construction Cost** | BDT 4,849.78 | |
| 2 | Engineering Cost | | |
| | a) Detailed design | BDT 121.24 | 2.5% of Sl No. 01 |
| | b) Construction Supervision | BDT 169.74 | 3.5% of Sl No. 01 |
| 3 | Land Acquisition, Resettlement and EMP. | BDT 3.11 | |
| 4 | Administration Cost | BDT 29.41 | 10% of Sl No. 02 & 03 |
| 5 | Physical Contingencies | BDT 727.47 | 15% of Sl No. 01 |
| 6 | Price Contingencies | BDT 293.41 | 5% of Sl No. 01, 02 and 05 |
| 7 | VAT, TAX and DUTIES | BDT 223.62 | 14.5% for importation @ 30% of Sl No. 01 & 02 |
| **Total Project Cost** | | **BDT 6,417.79** | |

## Total Project Cost (Mirgonj Bridge, Option - 2)

| Sl No. | Description | Amount in Million BDT | Remarks |
|---|---|---|---|
| 1 | Construction Cost | | |
| | a) Bridge | BDT 3,154.27 | |
| | b) Approach Road | BDT 598.58 | |
| | c) River Bank Protection Work | BDT 178.82 | |
| | **Total Construction Cost** | BDT 3,931.67 | |
| 2 | Engineering Cost | | |
| | a) Detailed design | BDT 98.29 | 2.5% of Sl No. 01 |
| | b) Construction Supervision | BDT 137.61 | 3.5% of Sl No. 01 |
| 3 | Land Acquisition, Resettlement and EMP. | BDT 41.51 | |
| 4 | Administration Cost | BDT 27.74 | 10% of Sl No. 02 & 03 |
| 5 | Physical Contingencies | BDT 393.17 | 10%-15% of Sl No. 01 |
| 6 | Price Contingencies | BDT 228.04 | 5% of Sl No. 01, 02 and 05 |
| 7 | VAT, TAX and DUTIES | BDT 181.29 | 14.5% for importation @ 30% of Sl No. 01 & 02 |
| **Total Project Cost** | | **BDT 5,049.15** | |

## Total Project Cost (Mirgonj Bridge, Option - 3)

| Sl No. | Description | Amount in Million BDT | Remarks |
|---|---|---|---|
| 1 | Construction Cost | | |
| | a) Bridge | BDT 3,574.08 | |
| | b) Approach Road | BDT 883.00 | |
| | c) River Bank Protection Work | BDT 178.82 | |
| | **Total Construction Cost** | BDT 4,635.90 | |
| 2 | Engineering Cost | | |
| | a) Detailed design | BDT 115.90 | 2.5% of Sl No. 01 |
| | b) Construction Supervision | BDT 162.26 | 3.5% of Sl No. 01 |
| 3 | Land Acquisition, Resettlement and EMP. | BDT 60.54 | |
| 4 | Administration Cost | BDT 33.87 | 10% of Sl No. 02 & 03 |
| 5 | Physical Contingencies | BDT 695.39 | 15% of Sl No. 01 |
| 6 | Price Contingencies | BDT 280.47 | 5% of Sl No. 01, 02 and 05 |
| 7 | VAT, TAX and DUTIES | BDT 213.76 | 14.5% for importation @ 30% of Sl No. 01 & 02 |
| **Total Project Cost** | | **BDT 6,198.08** | |

## Total Project Cost (Mirgonj Bridge, Option - 4)

| Sl No. | Description | Amount in Million BDT | Remarks |
|---|---|---|---|
| 1 | Construction Cost | | |
| | a) Bridge | BDT 3299.2 | |
| | b) Approach Road | BDT 350.31 | |
| | c) River Bank Protection Work | BDT 178.82 | |
| | **Total Construction Cost** | BDT 3828.33 | |
| 2 | Engineering Cost | | |
| | a) Detailed design | BDT 95.70 | 2.5% of Sl No. 01 |
| | b) Construction Supervision | BDT 114.84 | 3.5% of Sl No. 01 |
| 3 | Land Acquisition, Resettlement and EMP. | BDT 35.31 | |
| 4 | Administration Cost | BDT 24.85 | 10% of Sl No. 02 & 03 |
| 5 | Physical Contingencies | BDT 382.8 | 10%-15% of Sl No. 01 |
| 6 | Price Contingencies | BDT 221.08 | 2%-5% of Sl No. 01, 02 and 05 |
| 7 | VAT, TAX and DUTIES | BDT 175.69 | 14.5% for importation @ 30% of Sl No. 01 & 02 |
| **Total Project Cost** | | **BDT 4878.60** | |

# SUMMARY OF COST OF FOUR LANE BRIDGE

## Total Project Cost (Mirgonj Bridge, Option - 1)

| Sl No. | Description | Amount in Million BDT | Remarks |
|---|---|---|---|
| 1 | Construction Cost | | |
| | a) Bridge | BDT 8,650.55 | |
| | b) Approach Road | BDT 36.00 | |
| | c) River Bank Protection Work | BDT 178.82 | |
| | **Total Construction Cost** | BDT 8,865.37 | |
| 2 | Engineering Cost | | |
| | a) Detailed design | BDT 221.63 | 2.5% of Sl No. 01 |
| | b) Construction Supervision | BDT 310.29 | 3.5% of Sl No. 01 |
| 3 | Land Acquisition, Resettlement and EMP. | BDT 3.11 | |
| 4 | Administration Cost | BDT 53.50 | 10% of Sl No. 02 & 03 |
| 5 | Physical Contingencies | BDT 1,329.81 | 15% of Sl No. 01 |
| 6 | Price Contingencies | BDT 536.35 | 5% of Sl No. 01, 02 and 05 |
| 7 | VAT, TAX and DUTIES | BDT 408.78 | 14.5% for importation @ 30% of Sl No. 01 & 02 |
| **Total Project Cost** | | **BDT 11,728.85** | |

## Total Project Cost (Mirgonj Bridge, Option - 2)

| Sl No. | Description | Amount in Million BDT | Remarks |
|---|---|---|---|
| 1 | Construction Cost | | |
| | a) Bridge | BDT 5,793.89 | |
| | b) Approach Road | BDT 598.58 | |
| | c) River Bank Protection Work | BDT 178.82 | |
| | **Total Construction Cost** | BDT 6,571.29 | |
| 2 | Engineering Cost | | |
| | a) Detailed design | BDT 164.28 | 2.5% of Sl No. 01 |
| | b) Construction Supervision | BDT 230.00 | 3.5% of Sl No. 01 |
| 3 | Land Acquisition, Resettlement and EMP. | BDT 41.51 | |
| 4 | Administration Cost | BDT 43.58 | 10% of Sl No. 02 & 03 |
| 5 | Physical Contingencies | BDT 985.69 | 15% of Sl No. 01 |
| 6 | Price Contingencies | BDT 397.56 | 5% of Sl No. 01, 02 and 05 |
| 7 | VAT, TAX and DUTIES | BDT 303.00 | 14.5% for importation @ 30% of Sl No. 01 & 02 |
| **Total Project Cost** | | **BDT 8,736.91** | |

## Total Project Cost (Mirgonj Bridge, Option - 3)

| Sl No. | Description | Amount in Million BDT | Remarks |
|---|---|---|---|
| 1 | Construction Cost | | |
| | a) Bridge | BDT 6,590.95 | |
| | b) Approach Road | BDT 883.00 | |
| | c) River Bank Protection Work | BDT 178.82 | |
| | **Total Construction Cost** | BDT 7,652.77 | |
| 2 | Engineering Cost | | |
| | a) Detailed design | BDT 191.32 | 2.5% of Sl No. 01 |
| | b) Construction Supervision | BDT 267.85 | 3.5% of Sl No. 01 |
| 3 | Land Acquisition, Resettlement and EMP. | BDT 60.54 | |
| 4 | Administration Cost | BDT 51.97 | 10% of Sl No. 02 & 03 |
| 5 | Physical Contingencies | BDT 1,147.92 | 15% of Sl No. 01 |
| 6 | Price Contingencies | BDT 462.99 | 5% of Sl No. 01, 02 and 05 |
| 7 | VAT, TAX and DUTIES | BDT 352.87 | 14.5% for importation @ 30% of Sl No. 01 & 02 |
| **Total Project Cost** | | **BDT 10,188.22** | |

## Total Project Cost (Mirgonj Bridge, Option - 4)

| Sl No. | Description | Amount in Million BDT | Remarks |
|---|---|---|---|
| 1 | Construction Cost | | |
| | a) Bridge | BDT 6,117.60 | |
| | b) Approach Road | BDT 350.31 | |
| | c) River Bank Protection Work | BDT 178.82 | |
| | **Total Construction Cost** | BDT 6,646.73 | |
| 2 | Engineering Cost | | |
| | a) Detailed design | BDT 166.17 | 2.5% of Sl No. 01 |
| | b) Construction Supervision | BDT 232.64 | 3.5% of Sl No. 01 |
| 3 | Land Acquisition, Resettlement and EMP. | BDT 35.31 | |
| 4 | Administration Cost | BDT 43.41 | 10% of Sl No. 02 & 03 |
| 5 | Physical Contingencies | BDT 997.01 | 15% of Sl No. 01 |
| 6 | Price Contingencies | BDT 402.13 | 5% of Sl No. 01, 02 and 05 |
| 7 | VAT, TAX and DUTIES | BDT 306.48 | 14.5% for importation @ 30% of Sl No. 01 & 02 |
| **Total Project Cost** | | **BDT 8,829.87** | |