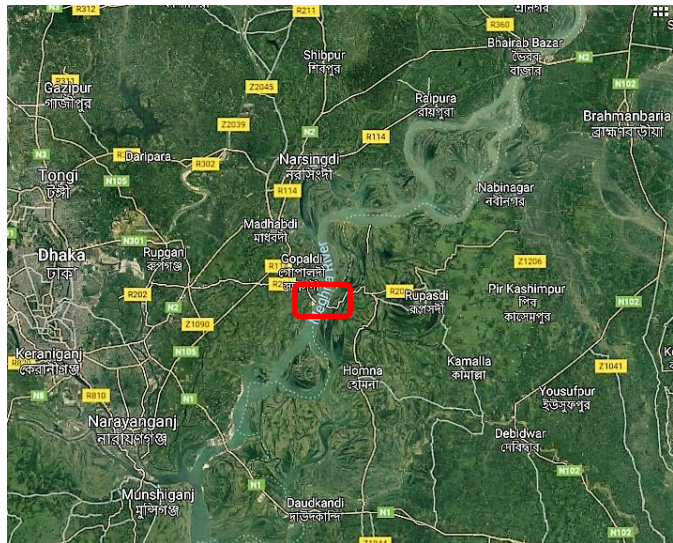


## EXECUTIVE SUMMARY

### 1. BACKGROUND INFORMATION AND PROJECT BRIEF

At present there are only two road bridges across Meghna River, spaced 80km apart that provides vehicular connectivity between central parts of Bangladesh including capital city Dhaka with the large eastern part. The bridge on Dhaka-Chittagong highway (N1) at Meghna Ghat to Daudkandi shows signs of severe traffic saturation. To alleviate this problem, **Bangladesh Bridge Authority (BBA)** decided to prepare a concept design for construction of a four lane bridge over **Meghna River** at the ferry crossings at Bhulta-Araihaazar-Bancharampur Road (R-203) along with the associated approach roads. This feasibility report presents the outcome of the study that has been carried out by the Consultants. The assignment has been carried out following the scope as provided by BBA in the Terms of Reference (ToR).



### 2. STUDY APPROACH AND TECHNICAL STANDARDS

The Consultants have 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:

- AASHTO LRFD 2014 specifications for Highway Bridges. This is currently being followed in Bangladesh. The bridge loading standard includes HL-93 trailer truck.
- Geometric Design Standard for Bridges and Approaches and Bridge Design Standard by RHD
- Material Standards – as per AASHTO LRFD 2014 Highway Bridge Design specification
- Euro Code 1990-1999 has also been used as reference, wherever found necessary.

### 3. STUDIES UNDERTAKEN

The Consultants have conducted the following Surveys, Investigation activity:

- Extensive **Reconnaissance Survey** by the Consultants team to identify a suitable alignment of the bridge as well as approach roads. It included field trip, collection and study of available secondary data, consultation with local officials and general public.
- Carry out detailed **Hydrological and Morphological** Investigation by appointing specialized agency. The agency, Institute of Water Modelling (IWM) carried out field investigation including discharge, velocity and water level measurement. With the help of historical satellite images, IWM studied the potential stability of river banks at the proposed alignment. IWM also established the hydraulic design parameters by Mathematical

- Modelling. The Design Discharge of Meghna River at the proposed bridge location has been estimated as 25372 cuM/sec.
- 3) **Topographic Survey** of the proposed bridge and the approach road alignments were carried out.
  - 4) Preliminary **Geotechnical Investigation** at the proposed bridge location and approach road alignment was carried out.
  - 5) **Traffic Survey** was undertaken to carry out **Traffic Forecast Study**.
  - 6) **Environmental Impact Study**. The project falls under RED category.
  - 7) Survey and study undertaken for preparation of Preliminary **Land Acquisition and Resettlement Plan**.

## 4. FINDINGS

### 4.1. Bridge Location and Approach Road Alignment

Based on reconnaissance survey, hydrological and morphological study, discussions with BBA officials, the bridge alignment was fixed at about a 100m from existing Ferry Ghats. The approach road on Narayanganj side was connected to Bostail Bus stand on Bostail-Araihazar-Narshingdi road with a junction with Bhulta-Araihazar road based on reconnaissance survey, public consultation as well as discussions with BBA official in order to provide proper wide four lane approach to the bridge on west side. The 4km long approach road on east side was finalized on Koraikandi Ferry Ghat, Bancharampur road at the existing Bhulta-Araihazar-Bancharampur (R-203) alignment. It may be mentioned that a separate feasibility study is being conducted by the Consultants to widen and strengthen the existing narrow R-203 from Bancharampur to Radhika on N-112 (Brahmanbaria-Comilla Highway).

### 4.2. Main Bridge

A number of bridge options from 110m span continuous post tensioned Box Girder options to 650m main span Cable stayed Bridge were examined. Each option has its advantage and difficulties besides cost. It was recognised that keeping the number of foundations within the river to minimum will greatly reduce the risks of uncertainty associated with pile installation. On the other hand, longer span bridges will be difficult to build as well as costlier. However, construction of one long span cable stayed bridge would significantly enhance the engineering capability of the country. Following two options were finally selected.

- **Option-1: 650m Main Span Cable stayed Bridge**

The cable stayed bridge with 650m span has a total length of 1320m. The balance portion is bridge by 110m+70m post tensioned box girder on either side

- **Option-2: 200m span Extradosed Concrete Box Girder Bridge**

It has a span arrangement of 120m + 7\*200m + 120m

The foundation for both the options will consist of 2.5m/ 3m diameter bored RCC piles of approximately 100m length. The piles will be base grouted. The option of driving steel tubes can also be examined at the time of execution design after carrying out detailed geotechnical investigation. The number of piles at the tower foundations of cable stayed bridge is expected to be between 24 and 30, while it is estimated that ten to twelve piles will be necessary for foundation of extradosed bridge.

The approach bridges on either bank will be almost half a kilometre long as 18.3m navigational clearance will have to be provided under the main bridge portion. It has been proposed to adopt

precast pre-tensioned U type girders of 38m span to make up that portion of the bridge, which will be supported on RCC piers and bored cast-in-situ pile foundation.

The Bank Protection Work has been designed by IWM following the standards of BWDB.

#### 4.3. Approach Road and Structures

The approach road has been designed as per RHD standard for four lane Highway. The associated minor bridges and culverts have been designed to AASHTO LRFD 2014 specification in compliance with RHD standards for Bridges.

#### 4.4. Traffic Forecast

The projected traffic (Motorised Traffic per Day) forecasted are as follows:

<u>Year</u>	<u>Traffic Volume</u>
2018	12,166
2033	25,293
2053	67,109

#### 4.5. Estimated Project Cost

As the types of bridge elements proposed are uncommon to Bangladesh, the project cost has been estimated based on International prices of similar projects rationally scaled to Bangladeshi condition.

	<u>BDT (Crore)</u>	<u>USD (Million)</u> <sup>*</sup>
Option-1 : Cable Stayed Bridge	9301	1107
Option-2: Extradosed Bridge	7194	856

\* 1 US\$ = 84 BDT

It may be noted that almost half the cost is due to the 22km long approach road with large number of minor bridges and the associated Land Acquisition and Resettlement expenses. Otherwise, it is suggested to select the Cable Stayed option so that the first true Long Span Bridge gets built in Bangladesh and associated advance technology and skill set accrue to local bridge professionals.

#### 4.6. Economic Analysis and Justification

The economic analysis and evaluation are as under:

##### Option-1 (Long Span Cable Stayed Bridge)

EIRR = 17.5%

= 13.6% with 15% higher cost and 15% lower benefit

NPV = 3560 Cr BDT

**Option-2 (200m span Extradosed Bridge)**

EIRR = 21.6%

= 17.6% with 15% higher cost and 15% lower benefit

NPV = 5150 Cr BDT

**5. CONCLUSION**

From the Techno-Economic analysis, it is observed that for both the options the EIRR value exceeds 15%, although the second option is economically more attractive as it costs less. However, considering the overall technical capacity development in building long bridges factor, it is felt that the first option i.e. the Long Span Cable Stayed Bridge option should be selected. The BBA officials also expressed their preference for selecting long span bridge. Considering all above, it is recommended that 650m Main Span Cable Stayed Bridge be selected for Design and Construction for the Meghna crossing at Araihaazar-Bancharampur road.