

EXECUTIVE SUMMARY

1. BACKGROUND INFORMATION AND PROJECT BRIEF

The Bhola island with an area of 3400 sq.km. and population of over 20 lakhs situated on the eastern side of Barisal division does not have any vehicular connectivity with main land Barisal. There is only one Ferry Crossing available on Highway N-809 (Barisal-Bhola-Lakshmipur Road). Almost all personnel and goods transportation to and from main land take place by boats and launches. This has seriously affected the social and economic development of Bhola. To alleviate this problem, **Bangladesh Bridge Authority (BBA)** decided to prepare a concept design for construction of a four lane bridge over the **Tentulia** river at a suitable location to connect **Bhola** with main land. 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). This included locating a proper alignment of the bridge along nearly thirty kilometer stretch of braided Tentulia river based on river characteristics and accessibility at both banks and thereafter engineering the bridge.



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:

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

3. STUDIES UNDERTAKEN

The Consultants have conducted the following Surveys, Investigation activity:

- 1) 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. Three locations spread over twenty kilometres were critically examined to arrive at the bridge alignment.
- 2) 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.

- 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 and public consultations, the bridge alignment was fixed at about a few 100m downstream of Bhedaria Ferry Ghat on Bhola side and Laaharhat Ferry Ghat on Barisal side on the existing Highway N-809. The total width of the crossing will be nearly 10km including the land spans. Out of this, about 3 km length will be in form of a high level road over Sripur Char that separates two channels of the braided river and the balance portion will be made of two high level bridges providing 18.3m navigational clearance. Extensive Bank Protection Work has been proposed around the Sripur Char.

4.2. Main Bridge

A number of bridge options from 110m span continuous post tensioned Box Girder options to 1000m main span Cable stayed Bridge and 1550m span Suspension 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. Taking all aspects into consideration, a 200m span Concrete Extradosed Bridge option was selected. The bridge configuration is as follows:

- a) 14 x 38m (Land Spans Barisal side)
- b) 120 + 16 x 200 + 120m (Extradosed Bridge on Arial Khan/ Kalabador Crossing)
- c) 14 x 38m (Land Spans on western side of Sripur Char)
- d) 3km Road on Sripur Char
- e) 14 x 38m (Land Spans on eastern side of Sripur Char)
- f) 120 + 5 x 200 + 120m (Extradosed Bridge on Ilisha/ Tentulia Crossing)
- g) 14 x 38m (Land Spans on Bhola side)

The foundation on the river 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. 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>
2024	6,990
2034	15,620
2054	56,701

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.

Estimated Project Cost has been worked out as **9922 Cr BDT**, which is equivalent to 1181 Million USD (based on 1 US\$ = 84 BDT).

4.6. Economic Analysis and Justification

The economic analysis and evaluation are as under:

EIRR = 22.54%
= 18.45% with 15% higher cost and 15% lower benefit

NPV = 14,371 Cr BDT

4.7. CONCLUSION

From the Techno-Economic analysis, it is observed that the bridge is economically viable. The EIRR value exceeds 15%. Completion of this project will bring enormous social and economic benefits to the people living in Bhola in particular and to southern part of the country in general. It is recommended that bridge project be taken up for execution at an early date.

