

EXECUTIVE SUMMARY

1. Project Overview and Description

This Draft Feasibility Study report has been prepared as required under the contract between Bangladesh Bridge authority (BBA) and STUP Consultants Pvt. Ltd. In joint venture with Development Design Consultants Ltd., DevConsultants Ltd. and COWI UK Ltd.

The report is one of four Draft Feasibility Study reports which is being prepared for this project. This report addresses the bridge on Bakergonj-Bauphal Upazila Road (Z8806 & Z8044) over Karkhana River and three separate reports address the bridge on (i) Patuakhali-Amtali-Barguna road (R-880) over Paira River (ii) Bhulta-Araihaazar-Bancharampur Road (R-203) over Meghna River and (iii) either Barisal-Bhola road over Kalabadar & Tentulia or Dhulia-Bhelu Miah Bazar over Tentulia River to develop direct connectivity from main land to Bhola Island.

The proposed Karkhana Bridge is located in the south-west region of Bangladesh. The bridge under this project will be constructed on the river Karkhana connecting Barisal and Patuakhali through the upazilas Bakerganj (Barisal) and Bauphal (Patuakhali). The project is designed to improve the road transportation networks in and around Barisal and Patuakhali districts and to connect the capital city, Dhaka with the southern region of Bangladesh. The alignment for the proposed bridge commences in the vicinity of Bakerganj (Piarpur Bridge) following Shiyalguni D.C Road- Faridpur - Kalisuri DC Road-Narainpara to Bauphal upazila crossing the Karkhana River at Shiyalguni point on one side and Faridpur point on opposite side of the river. Total length of the 'Karkhana Bridge' itself along with Approach Bridge /viaducts is 1850m with 780m on the river Karkhana.

The total length of the alignment for the proposed bridge from Bakerganj (Piarpur Bridge) following Shiyalguni D.C Road- Faridpur - Kalisuri DC Road-Narainpara to Bauphal upazila crossing the Karkhana River is 27 km.

2. Study Approach and Technical Standards

The Field Studies and Investigations, Hydrological and Morphological Mathematical Modelling Study, Preliminary Engineering, Schematic Designs and Techno-Economic Evaluations are in accordance with international standards and procedures but are largely based on Roads and Highways Departments (RHD's) established standards for design of Bridges and Geometric Design standards. The principal international and RHD standards adopted are:

- a) Analysis and design of Bridge – As per AASHTO LRFD presently use in Bangladesh (7th edition 2014) with its interim specification and correction of errors applicable at the time of design
- b) The design specification for live loading has been considered as per AASHTO LRFD HL93
- c) Geometric Design of the Bridge and Approach roads – as per RHD's approved Geometric Design Standard Manual (Revised), June 2005, and RHD's Bridge Design Standard, January 2004.
- d) Material Standard – AASHTO latest revision in use in Bangladesh.

3. Field Surveys and Investigation

- a) The Consultants have conducted the following field surveys and investigation:
- b) Extensive Reconnaissance surveys by the Consultants team members to identify the most probable bridge location and approach road alignment and possible alternative locations and alignments

- c) Morphological (satellite imagery) studies for river bank stability/shifting information for last 33 years (1985 to 2017), in the vicinity of the bridge location to identify alternative bridge location at stable bank locations with or without River Protection Work.
 - i. Hydrographic Survey of the river covering sufficient upstream and downstream of the proposed bridge alignment and navigational clearance requirement study.
 - ii. Topographic Survey of the proposed bridge locations and approach road alignments.
 - iii. Preliminary Land Acquisition and Resettlement and Environmental study at the proposed bridge location.
 - iv. Traffic Survey and Forecast Study
 - v. Preliminary Geotechnical Investigations at the proposed bridge locations.
- d) The Bridge location and Approach Road Alignment has been finalized from the above studies in the vicinity of Bakerganj (Piarpur Bridge) following Shiayalguni D.C Road-Faridpur - Kalisuri DC Road-Narainpara to Bauphal upazila crossing the Karkhana River at Shiayalguni point on one side and Faridpur point on opposite side of the river and the same has been accepted by BBA. This alignment provides the least cost techno-economic solution with minimum disturbances to the existing environment.

4. Structural Configuration and Foundation Type

For Karkhana bridge feasibility study keeping the ToR, the river cross-section, subsoil condition and data availability in mind, the Consultant has prepared 2 options for the bridge:

Option-1: PSC Box Girder

Main bridge	-	6x110m + 2 x 70m anchor span in PSC box type
		totalling = 800m
Approach Bridge	-	14x38m + 14 x 38m in PSC U - Girder type = 1064m
Total Length of bridge = 1864m		

Option-2: Extradosed PSC Box Girder

Main bridge	-	3x200m + 2 x 110m anchor span in Extradosed PSC box type
		=820m
Approach Bridge	-	14x38m + 14 x 38m in PSC U - Girder type =1064m
Total Length of bridge = 1884m		

Foundation

Foundation in the main river channel for option-1 (110m span) has been suggested as 3000mm diameter RCC Bored Cast-in-situ piles and that for option-2 (200m span) as 3000mm diameter RCC Bored Cast-in-situ piles. Each pier is supported by a 4.0m thick pile cap connected to 12 numbers of 3.0m diameter bored piles for option-2 and 8 numbers of 3.0m diameter bored piles for option-1. The pile length will be in the region of 100m.

Foundation for the approach bridge portion for both the options has been suggested as 1000mm diameter RCC Bored Cast-in-situ piles.

Approach Bridge (Viaduct)

For the viaduct portion where there is less horizontal forces and moments and less scour the estimated pile is 1000mm diameter RCC Bored Cast-in-situ piles both the options. The termination level of piles has been decided from the subsoil profile and scour level.

Abutments

The basic form of the abutment is standard wall type-in-situ RCC Abutments. The abutments height has been restricted to 5m to 6m on both sides of the approach road bridges and ease of maintenance. There is enough land around the wing walls. Reinforced Earth (RE) walls have been considered for the approach bridges.

An approach slab has been considered behind each abutment due to generally poor achievable compaction.

5. Traffic Forecast

Total forecast projected traffic (vehicles per day) at the selected years are as follows:

Year of Forecast	Significant Year	Motorized traffic per day
2024	1 st year of operation of the bridge	4,630
2053	Year of saturation of 2-lane traffic	35,937
2054	Last year of evaluation period (30 years after completion)	38,082

6. Estimated Project Cost

Project costs have been estimated based on a detailed quantity take-off from the feasibility level designs, mostly using the RHD rates schedule (2018). Where there is no rate in the RHD schedule the cost has been estimated based on the Consultant's assessment of market rate for that particular item. The estimates include an allowance of 3% for physical contingency and 6% for price contingency.

Sl. No	Item	Description	Quantity	Unit Cost	Cost (Cr. BDT)	Remarks
1	Site Establishment	General and Site Facilities	L.S.	-	50	
2	Main Bridge	Extradosed Bridge of Individual spans of 200m	820 m	100 lac BDT/m	820	
3	Approach Bridge	38m span U type precast girder and deck slab on Pile Foundation	1064 m	35 lac BDT/m	372	
4	Approach Road	Four Lane Approach Road. Includes all minor bridges and culverts on it.	8 KM	40 Cr/KM	320	

Sl. No	Item	Description	Quantity	Unit Cost	Cost (Cr. BDT)	Remarks
5	Bank Protection Work	around main bridge abutments	3 KM	150 Cr/KM	450	
A	Sub-total				2,012	
B	Provisional Sum for Physical Contingency = 3% of (A)				60	
C	Sub Total (A+B)				2,073	
D	Provisional Sum for Price Contingency = 6% of (C)				124	
E	Engineer's Estimate = (C+D)				2,197	
F	Land Acquisition and Resettlement Costs				200	
G	Design Cost = 3% of (A)				60	
H	Construction Supervision = 2% of (A)				40	
I	Estimated Project Cost = (E+F+G+H)				2,498	