

Gulshan Lake Bridge: Life and link between two Urban Communities

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Summary

The 799.00 meters long Gulshan Lake Bridge Project in Dhaka city, links Banani Road No. 11 with Gulshan Road Nos. 41, 43, 35A and 34. This necessitated a complex labyrinth-shaped layout of the road bridges for this project. The aesthetic issues arisen due to 40^0 skew crossing of the 90.00 meters long 4-lane main bridge has been solved by providing an elevated arch span for the middle span of the 3-span bridge. The tied bridge deck joints using stainless steel dowel bars are designed over the piers of the simply-supported interior spans, to distribute the horizontal forces due to earthquake loading, etc. to the adjacent spans. Buried joints are used to enhance the driving comforts. This paper gives the technical details of the above features.

Keywords: Link bridge; reinforced concrete; prestressed concrete; arch; curved beams, elastomeric bearings; expansion joints; landscaping; approach

1. Introduction

The linking of 18.30 meters wide Banani Road No. 11 with the 4 numbers Gulshan side roads, and the sharp skew angle of about 40^0 for its 90.00 meters long 3-span main lake crossing bridge required site specific innovative design. The challenges of aesthetics due to the above factors have been solved by providing a slender concrete arch span for the middle span of the 3-span main bridge. The design is explained in detail in the subsequent paragraphs.

2. Explanation of Design

The following Fig. 1 shows the photograph of the main bridge along with its 40.50 meters long arch span, viewed from the Gulshan end. It contains two dual carriageways, each of width 5.70 meters, separated by a 400 millimeters wide median. 1.50 meter wide sidewalks are provided projecting outwards of both sides' arches with gaps to enjoy the reflection of the bridge in the water. The Fig. 2 shows the 3D model of the arch span developed in STAAD/PRO. A pair of 125 millimeter diameter stainless steel pipe-encased grout in-filled high yield (HY) reinforcing bars is provided as suspenders for each cross girder, to enhance the safety factors against any unexpected bond failure.



Fig. 1: View of Main Bridge from Gulshan End

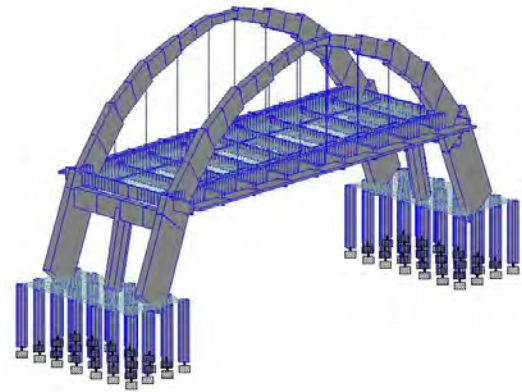


Fig. 2: STAAD/PRO Model of Arch

The design of the horizontally curved deck girders is explained with the example of the Span-1 at Banani end. Fig. 3 shows its STAAD/PRO model, with 8 nos. curved reinforced concrete (RC) longitudinal girders and 5 numbers of cross-girders. The curved length of the outer girder is 17.410 meters; and the radius of all the curved girders is kept 16.634 meters constant. 5 numbers cross-girders are provided to enhance the torsional stiffness of the deck. Tied bridge decks for the interior spans using 12 millimeters stainless steel dowels were designed to distribute the horizontal forces due to braking, earthquake loading etc. in the adjacent spans.

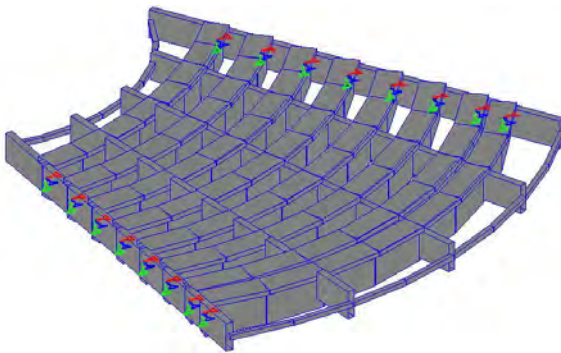


Fig. 3 The Girder Framing Plan of Span - 1

For geometric design of the roads, Roads & Highways Department (RHD) Guidelines for Geometric Design Standards, April 2005 was followed [1]. For the analysis and design of the bridges, AASHTO LRFD Bridge Design Specifications 2007 was followed [2]. STAAD/PRO was generally used to analyze the bridge components. For the wind and earthquake loadings, Bangladesh National Building Code, 1993 was followed [3].

4. Discussions

The construction stage changes in design by the Client although might improve the project concept, but creates immense difficulties in adjusting the design, and should be avoided, unless essential. The practical construction methodology should be conceived during the design process, and its effect should be accommodated during analysis and design detailing.

References

- [1] RHD, *Guidelines for Geometric Design Standards*, April, 2005
- [2] AASHTO, *LRFD Bridge Design Specifications*, 2007
- [3] HBRI, BSTI, *Bangladesh National Building Code*, 1993