

# Meghna and Gumti existing 2 lane bridge rehabilitation by removal of central hinge

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**ABSTRACT:** Dhaka-Chittagong National Highway N1 is the economic lifeline of Bangladesh. In this highway there are three major obstructions the Shitalakkha, the Meghna and the Gumti River. The Meghna and the Gumti Bridge was built by JICA assistance and was completed in the year 1990 and 1995. At that time these 2 lane bridges was sufficient to cater the traffic flow of Dhaka-Chittagong National Highway [N1]. During the last 20 years in this corridor the economic and traffic growth were increased above the prediction. To accommodate the current and the future traffic demand, GOB has implemented the construction of 4-lane Kanchpur, Meghna and Gumti 2<sup>nd</sup> bridges by the financial assistance from JICA. The new superstructure of 2<sup>nd</sup> Meghna bridges is comprised of narrow box steel girders monolithic with Steel Concrete Composite (SCC) deck slab. It has continuous 12-span bridge of total length of 930m with 9 spans having 87m maximum span, whereas the 2<sup>nd</sup> Gumti Bridge is separated into two parts: continuous 9-span and continuous 8-span bridge with an expansion joint in between, having 17-spans with a total length of 1,410m and maximum span of 87m. The foundations under severe scouring zone Steel Pipe Sheet Pile (SPSP) type foundation are provided. Therefore, application of these stated concepts in KMG Project will add a new dimension to the bridge construction industry in Bangladesh. One of the major components was to rehabilitation existing 2 Lane Bridge including removal of central hinges. The existing Meghna and Gumti are cantilever PC-box girder type bridges having center hinges and expansion joints. All the expansion joints were removed and the embedded space with hinges was fixed by filling concrete and placing PC cables at hinge section. In this paper rehabilitation of super-structure of existing 2 lane bridges including removal of central hinges will be discussed in a brief way.

## 1 SUPERSTRUCTURE REHABILITATION PLAN EXISTING MEGHNA AND GUMTI BRIDGES

The superstructure of old bridge was designed as a progressive cantilever box girder and central hinge at mid span. Existing 2 Lane Meghna and Gumti Bridge Cross Section are shown in figure 1. Rehabilitation of Meghna Existing Bridge consists of integration of superstructure and removal of expansion joint as well as replacement together with hinge parts (span P5-P6). The expansion joint will be removed however, expansion joint will be replaced at Span P6~P6, Abutment A1 & pier P11. Superstructure activities will be carried out at both Monolithic Area 1 & Area 2. The rehabilitation works include replacing the damaged expansion joints in Meghna and Gumti Bridges, and fixing of all damaged hinges except that at the center of P5-P6 span in Meghna Bridge and that at the center of P4-P5 and P8-P9 span in Gumti Bridge. The central hinge will transfer the shear, thermal shrinkage and creep. Centre hinges and expansion joints are fails frequently and induced more vibration to the bridges. To overcome all these it was decided to convert the super structure of a continuous bridge. The Meghna Bridge will be divided into two and Gumti Bridge into three continuous bridge segment. As the two bridges was design as a progressive cantilever box girder and central hinge at mid span the pier shaft was monolithic with the super structure connected by vertical Mc-Loyed dowel bar. These three hinges (pot bearings) will be replaced by new with complete set. However, the process of fixing the center hinge will follow the subsequent sequences listed below and shown in Figure 2:

- Removal of expansion join.
- Casting concrete and having confirmed hardened concrete strength, PC bar will be connected.
- Stressing the external PC cable and adhere carbon sheet on bottom slab.

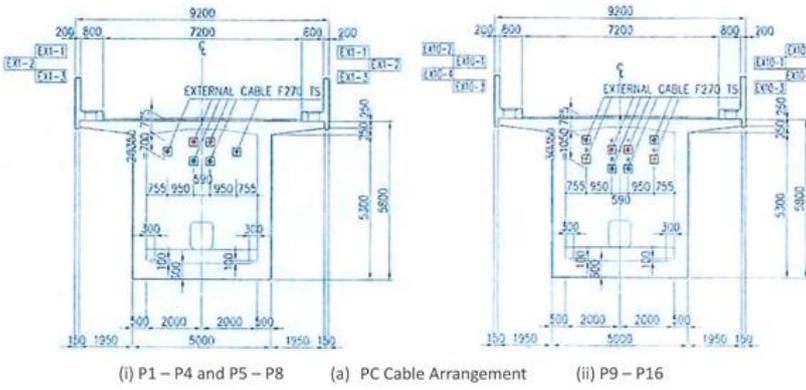


Figure 1. Existing 2 lane Meghna and Gumti Bridge cross section.

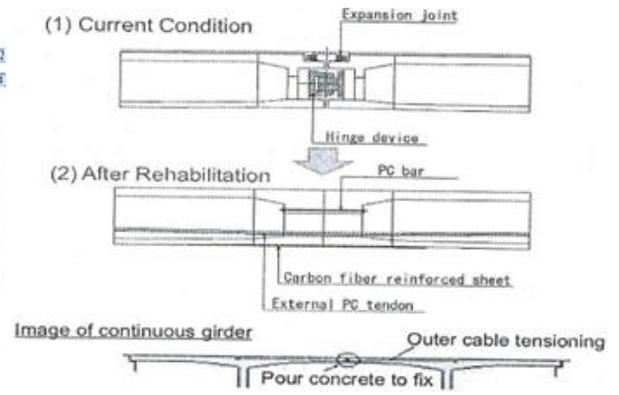


Figure 2. Existing damaged hinge to be fixed and repaired (Meghna and Gumti).

It was decided that the horizontal cables will be go through the top and bottom of PC box girder in between the vertical Mc-Loyed bars. But during the rehabilitation work it was found that vertical bars are almost attached to each other. So there was no way to stretched longitudinal cables individually in between the vertical bars. The arrangement of the external cable was set so that the drilling does not interfere with the PC steel bar of the crossbeam. The verification is bending stress and reinforcement of CFRP.

After examining different option it was tried and found bunch of spaces in between vertical bars. Instead of single cable a group of longitudinal cables was proposed supported by sufficient calculation and executed i.e. stretched longitudinally in between bunch of spaces. CFRP sheet was wrapped around the each joint; half portion of the joint is shown in Figure 4.

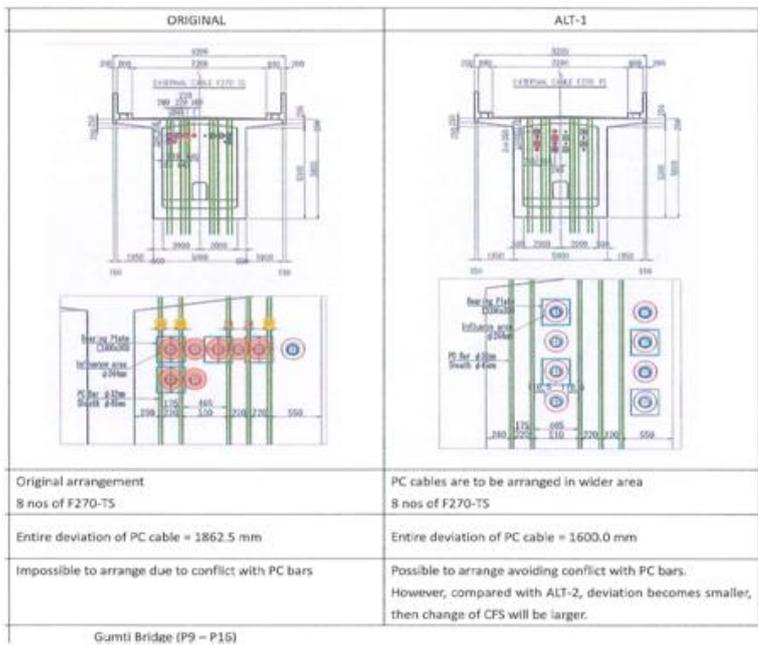


Figure 3. Alternate proposal was submitted and accepted.

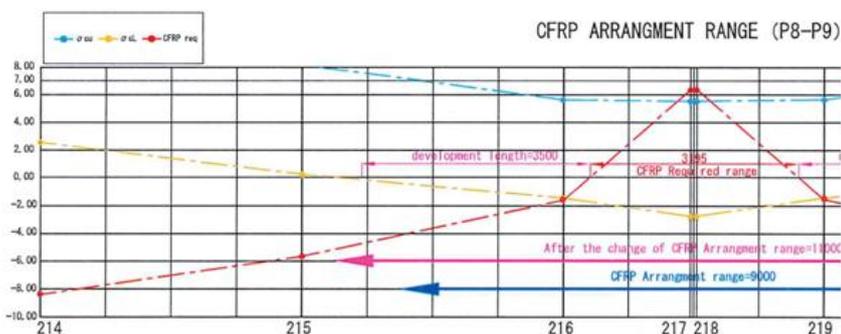


Figure 4. Half portion of the joint wrapped by CFRP is shown.

## 2 DISCUSSIONS AND CONCLUDING REMARKS

Currently GOB has implemented the widening of Dhaka-Chittagong National Highway N1 into 4-lane so as to cope with higher traffic demand. By these time the existence of three major structures on N1, namely Kanchpur, Meghna and Gumti Bridges has been completed with the financial assistance from JICA, GOB and open for traffic on 2nd January 2020. Computer based soft ware was used to check the stress level at each joint.

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