

Construction of Kazirtack bridge: Precast pseudo box form in viaduct

M.H. Rahman Chowdhury

Roads and Highway Department, Dhaka, Bangladesh

K.M. Kamrul Ahsan

Kazirtack Bridge Construction Project Roads and Highway Department, Dhaka, Bangladesh

ABSTRACT: Bridge is the Seventh Bangladesh China friendship bridge. Its central portion is pre-stressed concrete box girder section and at the two ends precast post tensioned pseudo box viaducts. The precast pseudo box section is new in Bangladesh. It is an alternate of PC-I girder superstructure element. The paper also gives an overview of the project from the perspective of a project director and records the salient aspects of this milestone development for the engineers of the future. It is believed that the lessons learnt from the project as documented in the paper will be helpful for the future decision makers in maintaining the bridge and designing future life-links of this type.

1 INTRODUCTION

The location of Kazirtack Bridge is at 12th km of Madaripur – Shariatpur -Chandpur Road over the river Arial Khan. Alignment of the bridge is on west and east direction. Construction of this bridge will establish an improved transport link between Southern part of Bangladesh and Chittagong port and it connects Madaripur town and Shariatpur town locally. The bridge is 694.16m long and 13.3m wide.

The bridge type was selected on the principle of safe, usable, durable and economic point of view and considering topography, geology and navigational standards around the bridge area. In this project, the terrain of the bridge site is flat and the navigable standards of the river are not much high but the main channel is comparatively deep. The main bridge surface lies in a straight line, longitudinal section is a vertical curve and the radius of the vertical curve is 2500m. The ratios of slope of both sides are 3.00% and 3.58%. The slope of the bridge surface is a two-way cross slope with a ratio of 2%. The design speed of vehicle over the bridge is 60 km/h.

2 SUPERSTRUCTURE

The superstructure of the main bridge is consisted of three span pre-stressed continuous single cell concrete box girders with variable cross-section. The spans are 38.5 m, 70.0 m and 38.5 m and the total length of main bridge is 147m. There are simply supported precast post tensioned pseudo box via ducts at the west and east end. Approach viaducts are consisted of 10 and 8 equally spaced span of 30.0 m at west and east end respectively. The total length of approach via duct is 540 m (10 x 30 m + 8 x 30 m). The superstructure of the approach bridge adopts the precast post tensioned pseudo box girder which is simply supported and then continuous pre-stressed concrete box girder at the middle portion. The cross section of main bridge and approach via ducts are shown in Figure 1 and in Figure 2 respectively. Laminated rubber bearing was used for pseudo box Girder Bridge and pot bearing was used in the main bridge portion.

3 SUBSTRUCTURE

The pier of main bridge is box type. Its cross section is 6.30 m x 3.50 m and thicknesses are 0.65 m and 0.80 m of its long and short side respectively. Pier top and bottom is solid and the thicknesses are 1.5 m and 5.95 m at the top and bottom respectively. There are two rows of six bored piles with a diameter of 1.50 m at each pier. The transition piers are square and the cross section is 2.00 m x 2.00 m, the bearing platform is 2.8 m thick.

There are two rows of four bored piles with a diameter of 1.50 m at each transition pier. Other piers are direct extension of two 1.50 m diameter bored piles.

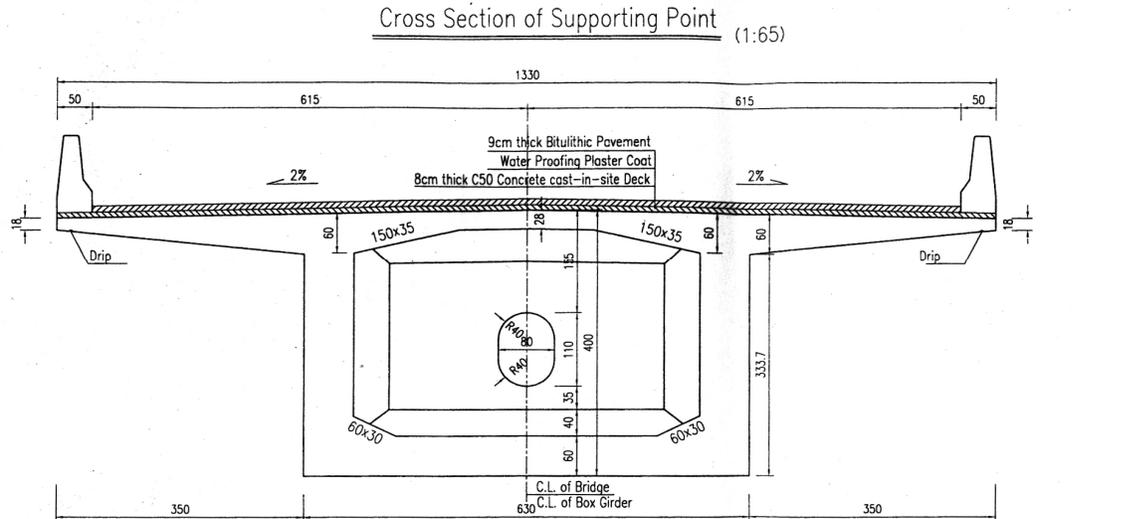


Figure 1. The Cross-Section of Main Bridge.

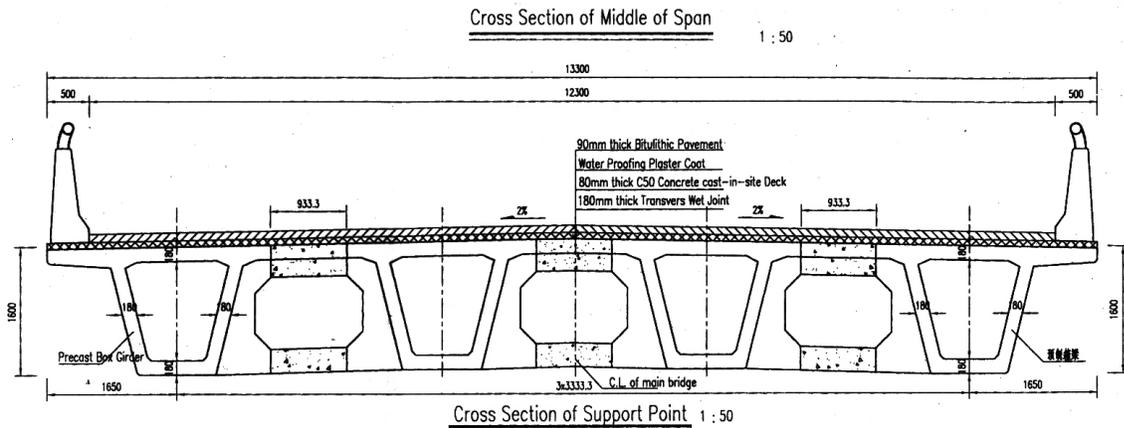


Figure 2. The Cross-Section of Approach via Ducts

4 PSEUDO BOX GIRDER

The structural behavior of the pseudo-box section is similar to that of a small multi-cellular box section. For spans in excess of 40 m, it becomes economical to use 'cellular' or 'box' sections as illustrated in Figure 3. These have a higher second moment of area per unit weight than voided slab or T-sections. However, they are only considered economical at higher spans as it is only then that the structural depth becomes sufficiently great (about 2.0 m) for personnel to enter the void to recover the shuttering and, when the bridge is in service, to inspect the inside of the void. Box sections can be constructed of in-situ or precast concrete or can be composite with a precast pre-tensioned U-section and an in-situ concrete slab as illustrated in Figure 4.

The U-beams are lifted by cranes and supported longitudinally between piers. The beams are placed parallel to each other with suitable spacing. Precast concrete plates, used as permanent formwork, are placed between the spacing and over the voids of the U-beams. Deck reinforcements are fixed with lapping to the exposed stirrups of the U-beams. The deck is made integral with the beams by in-situ concrete. The decks are usually simply supported on piers. They can also be made continuous by exposed reinforcement connection or post-tensioning. The use of precast beam in bridge construction is very common but there are obvious limitations in the length and weight of precast units which can be transported, so that only spans of less than 30m are commonly used. In approach via duct of Kazirtack Bridge 30.0 m pseudo box girder section was used.

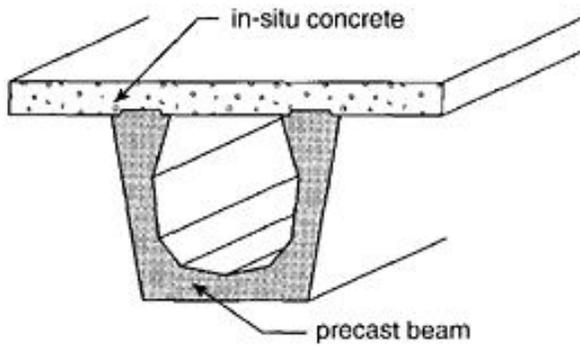


Figure 3. A Cross-Section of pseudo-box girder.

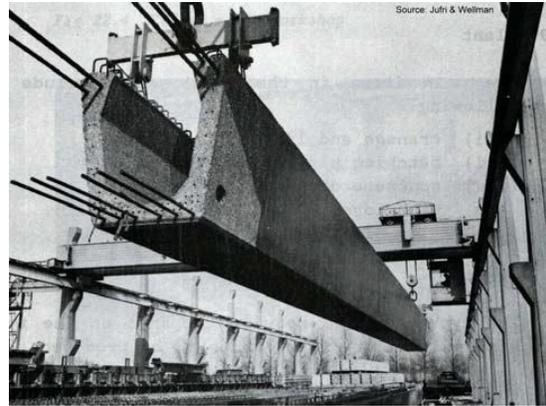


Figure 4. A Photograph of pseudo-box beam

5 FORESEEN AND UNFORESEEN CHALLENGES DURING PROJECT IMPLEMENTATION

The bridge is over the river Arial Khan which is a branch of the Padma River. The Arial Khan River is meandering and very unstable. The existing west side approach road was almost parallel to the river and there is a chance of alignment shifting of river so the existing location of the bridge has been shifted towards the downstream and a new approach road of 5.0 km is now being constructed. About 36 hector of private land has been acquired and utility lines like electric and telephone lines have been shifted. Many private homesteads on the new alignment and the owner of those have been compensated.

Since there is a big acquisition of land and many people are losing their homesteads and according to the law peoples are getting compensation for the land but they are not having proper rehabilitation. So there may be a social problem in future. On the other side this project will contribute a big role in the socio economic development of this area. Madaripur town is near to the project area, so in future the town will develop on both sides of the project.

6 LESSONS LEARNT FROM THIS PROJECT AND CONCLUSIONS

From the planning point of view the bridge is found appropriate with the present time and it could be more efficient if some thoughts were given in an integrated way to make the bridge area more beautiful and harmonized with the river bank. From the designing point of view the bridge design has been done in a prudent way. The precast pseudo box section is used in approach viaduct. It is an alternate to PC-I girder superstructure element and it is new in Bangladesh. From economic and sustainability point of view it saves money and coarse aggregates. The pseudo box section may be introduced in constructing new bridges in Bangladesh.