Construction and design features of the Bridge over the Danube River. Bulgaria

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keywords: precast concrete extradosed bridge, continuous bridge, railway and road bridge.

Summary

The main bridge over the Danube River between Vidin (Bulgaria) and Calafat (Calafat) has a total length of 1391 m. It has three different decks depending on the span lengths. The road bridge has a 80 m deck for the non-navigable part of the river and a 180 m deck for the navigable one, thus allowing two navigable channels of 150 m. The railway has 40 m span lengths with intermediate supports at one fourth over the road bridge on the 80 m spans. The span distribution is: 52.0 + 7x80.0 + 124.0 + 3x180.0 + 115.0 m. Expansion joints are included only in the three abutments, thus configuring an integral bridge of 1791 m.

The deck is a precast prestressed concrete single box girder with transversal struts, with a total width of 31.35 m and a depth of 4.50 m. In order to maintain the same deck all along the main bridge, an extradosed cable system and struts to reduce its overtensions are added for the 180 m long spans. The approach railway deck is 8.6 m wide, made of two lateral prestressed concrete girders 1.9 m deep joined by a 0.25 m slab.

The bridge deck was built by free cantilever system with matched precast segments in the central core of the section.

1. Introduction

For the design and construction of the bridge over the Danube River in Vidin some innovative aspects have been taken into account. Both the design of the bridge and the construction procedure have been considered in a unified way. The design and build contract allows this relationship in a proper way. The coordinated alignment design for the railway and railroad allows the construction of a unique bridge deck.

The same deck depth has been used for different span lengths across the Danube River using additional structural schemes like an extradosed cable stayed system. The intermediate struts reduce the stress variation on the stays due to the important live loads from the railway. The structural alternative to these struts would have been an increase of the deck depth at supports.

The deck is completely built in on these struts resulting an integral configuration of the bridge which allows resisting the horizontal forces due to braking and seismic loads on the main pier foundations. This also minimizes the number of joints in the bridge, designing a bridge with 1791 m without expansion joints; only three are included in each abutment.

The bridge deck has had an evolutional construction both longitudinally by balanced cantilever construction and transversely. The main core of the box girder has been completely precast. The lateral cantilevers have been cast in place for the 80 m span deck and partially on the construction yard for the 180 m span deck.

https://doi.org/10.2749/222137814814067590