Design & Construction of Ada Bridge across Tissa River in Serbia

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Summary

The paper deals with specific design and construction of Roadway Bridge across Tissa River in Ada town (autumn province of Vojvodina, republic of Serbia). The special task was to design and construct a new bridge across Tissa in Ada by using the donated dismantled steel structure, removed form the piers of former bridge across the Danube in Wilshoffen (Germany). The superstructure – steel structure of the former Wilshoffen bridge had structural system of continuous beam, with total length of ~258 m and modest spans: 4x25,8 + 64,5 + 3x25,8 + 12,9 m. The dismantled steel structure, cut in 6 large segments, was transported by barges downstream Danube through Danube-Tissa Channel and stored nearby Tissa River. These stored segments of steel structure should be incorporated in new bridge across Tissa River in Ada, taking into account the relevant local conditions: profile of river bed, geotechnical profile of soil, required river flow profile, required (larger) navigation clearance, water regime data; as well as other relevant circumstances: transport, erection & adoption of steel structure, economic aspects and aesthetic appearance. The larger main span was needed, that required the modifications of the steel structure stored segments. It was adopted the vertical alignment of the former Wilshoffen bridge, because of the undisturbed reconstruction of the orthotropic deck. The Ada bridge was preliminary designed as steel cable-stayed bridge, with spans: 2x25,8+90,3+4x25,8 m, having a steel A-pylon. The chosen design-built contractor Inter-Most Belgrade (subsidiary of Vinci Construction) modified the design into steel cable-stayed bridge, with only two spans: 77,4+167,7 m, having a concrete A-pylon (single river pier advantage due to foundation costs). The cable stays are constructed by Freyssinet. The building works, started in June 2006 and to be completed in June 2008, are presented in the paper as well.

Keywords: cable-stayed bridge; bridge design; bridge construction; steel structure; concrete pylon

1. Introduction

The Roadway Bridge over Tissa River, besides the local importance for the Serbian Banat area (autumn province of Vojvodina), has the significant role in the scope of the planned new transversal: from Banat in Romania, across north Serbia, to north-east Croatia and south Hungary.

The special task was to design a new Danube bridge at Ada by using the parts of dismantled steel structure, removed from the piers of former bridge across the Danube in Wilshoffen.

The steel structure of the Danube Bridge from Germany was the donation to Vojvodina in 2002, after the destruction of Serbian bridges across the Danube by NATO air strikes in 1999.

The superstructure – steel structure of the former bridge in Wilshoffen had structural system of continuous beam, with total length of ~258 m and spans: 4x25,8 + 64,5 + 3x25,8 +12,9 m. The deck has two plate girders, of 1,5 m depth, with top orthtotropic plate. The crossbeams are spaced on 4,3 m. All splices are welded. The dismantled steel structure should be incorporated in new bridge across Tissa River at Ada, taking into account the relevant local conditions. The larger main span was needed, that required the modifications of the original steel structure, stored in segments nearby Channel link to Tissa, 30 km downstream Tissa from Ada.

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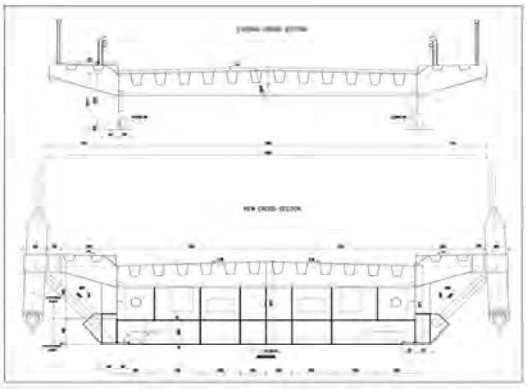
2. Design and construction of Ada Bridge

The Ada bridge was preliminary designed as steel cable-stayed bridge, with following spans: 2x25,8+90,3+4x25,8 m, having a steel A-pylon. The chosen design-built contractor Inter-Most Belgrade (subsidiary of Vinci Construction) modified the design into steel cable-stayed bridge, with only two spans: 77,4+167,7 m, having a concrete A-pylon (single river pier advantage due to foundation costs) with the height of 60 m from the carriageway level. The bridge girder passes through pylon legs.

The bridge width is ~ 11,0 m, according to the width of the bridge structure from Wilshoffen. The carriageway width is 7,10 m. The both-sided walkways have the width of 1,0 m, each. The both-sided safety strips have the width of 0,50 m, each.



The increase of the bridge spans to 77,4+167,7 m, caused a significant modification of the existing steel structure of bridge girder (Fig. 1).

It is solved by longitudinal cutting of the webs over the bottom flange; where it is welded the additional web plate of 0,6 m height (girder depth increased from ~1,4 to ~2,0 m) and the bottom flange plates are redistributed according to the coverage of new moment diagram.

The transverse bracings and bottom longitudinal bracings are added primary to enlarge the torsional stiffness of bridge deck.

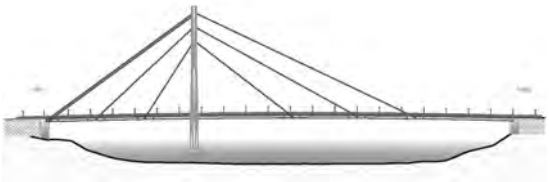
Fig. 1: Cross sections: a) Original bridge structure b) Ada Bridge structure

The bridge structure is supported by six pairs of stays. The first pair of stays consists of twin cables (for both stays), that it is caused by the safety against the sudden removal of one cable. The other stays consist of one single cable for each stay. The stay cable connection to bridge deck is enabled by the anchor tube welded in anchor box - as the edge deck beam.The active anchorage of stay cable is in the bridge deck. The passive anchorage of stay cable is in the pylon.

The building works started in June 2006 by Inter-Most Belgrade, as the design-built contractor. The cable stays, the bearings and the expansion joints are constructed by Freyssinet. The design review and the supervision of works are undertaken by Euro Gardi Group Novi Sad. The client is the community of Ada. The investor is the public enterprise Serbian Roads from Belgrade. The completion of Ada Bridge is planned to be realized in June 2008.

3. Final comments

The architectural appearance of Ada Bridge, with its well-balanced proportions including the stay cable layout, can be perceived from a side view visualization (Fig. 2).



This paper presents a successful adoption of steel structure from another beam-type bridge – former Wilshoffen Bridge across the Danube with modest main span (64,5 m), by its reconstruction to a new modern cable-stayed bridge, that is Ada Bridge across Tissa River in Serbia having much larger main span (167,7 m).

Fig. 2: Side view visualization of Ada Bridge