Reconstruction of an arch bridge across Ohře river, Loket, Czech Republic

Jaroslav KORBELÁŘ
Civil Engineer
VPÚ DECO PRAHA a.s.
Karlovy Vary, Czech Rep.
Jaroslav.Korbelar@seznam.cz

Miroslav KROUPAR
Civil Engineer
VPÚ DECO PRAHA a.s.
Prague, Czech Rep.
kroupar@vpupraha.cz

Pavel RYJÁČEK
Civil Engineer
VPÚ DECO PRAHA a.s.
Prague, Czech Rep.
ryjacek@vpupraha.cz

Jiří SCHINDLER
Civil Engineer
VPÚ DECO PRAHA a.s.
Prague, Czech Rep.
schindler@vpupraha.cz

Summary

This paper describes the design and construction of a unique widening of a concrete arch bridge across Ohře River by using a light steel superstructure. The bridge reconstruction formed part of a wider reconstruction of the road I/6 including its transformation from a two to four-lane highway near Loket between Nové Sedlo and Sokolov in the North-West part of the Czech Republic. Details about the erection of the steel structure and strengthening of the concrete arch and piers are also given.

Keywords: reconstruction, concrete arch, steel bridge, launching.

1. Reasons for the reconstruction

The reconstruction of the state road I/6 from two to four lanes significantly improves the capacity of the road connection between Prague and western Bohemia. Between Nové Sedlo and Sokolov, the road has to cross a deep valley of the Ohře river. This valley is a peaceful nature area, where karst cavities and fossil remains are highly protected by law. It was necessary to design a reconstruction of the existing concrete arch bridge in a way that it has no negative impact on the area and its nature. The problem was solved by placing of a new light and wide steel superstructure on the existing concrete arch bridge.

The existing concrete bridge of span of 126 m was built in 1976 and is one of the biggest concrete arch bridges in the Czech Republic. The total length of the bridge is 296,3 m. It consists of 10 spans. Five spans are located over the arch and 2+3 spans are placed on the river banks. The old concrete superstructure was made of 9 concrete pre-cast pre-stressed I-beams “I-67”, and of a reinforced concrete arch, which was cast in sections on a self-supporting welded reinforcement. The piers and abutments are made from reinforced concrete. During its existence, the bridge was twice partly repaired.

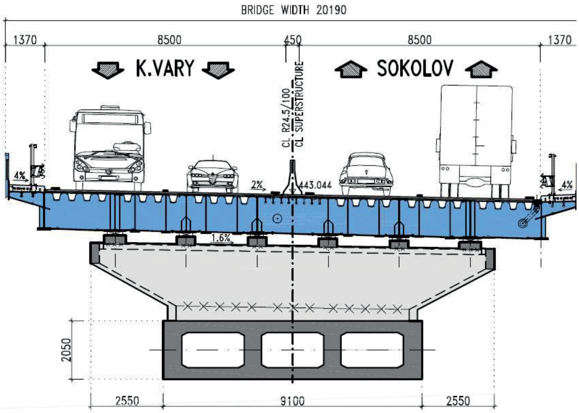

Fig. 1: Cross section – after reconstruction

2. The bridge technical design

The main idea of the reconstruction consists in unloading of the arch bridge by removing the old heavy concrete pre-stressed bridge deck and by replacing it with a new light steel

https://doi.org/10.2749/222137813806548479

superstructure, which provides sufficient load capacity not only for the superstructure itself, but also for the four lanes of traffic live load. However, limited load capacity of the bridge led to the necessity to reduce the width of the highway (from 24 m to 17.45 m), which was achieved by reducing the width of the road shoulders and replacing the central kerb with a concrete crash barrier.

The new steel superstructure is a continuous girder with 10 spans. It consists of 8 main girders and an orthotropic plated deck, see Fig. 1. The plated deck is reinforced with longitudinal trapezoidal stiffeners and I crossbeams. Six inner beams are supported directly by bearings, two outer beams are supported by cantilever crossbeams.

It was necessary to verify the condition of the concrete arch foundation by a geological survey. The survey found a deterioration of the subsoil. Therefore, grouting of the foundation subsoil was designed, with a total thickness of 3,0 m.

The existing piers were significantly damaged by long-lasting leakage through expansion joints. The concrete degradation of piers resulted in the necessity to reinforce piers P1, P8 and P9 by adding a new reinforced concrete layer of 0.28 m thickness. Both abutments were demolished and built completely new. The abutment P10 had to be reinforced with four micro piles to resist the load from the steel superstructure during its launching. The rest of the substructure and the arch were repaired by using a surface concrete repair system, see Fig. 2.

A very complex and detailed structural analysis had to be done to verify whether the existing concrete structure had sufficient capacity to carry the new superstructure. A very important analysis was also done to check whether the existing arch can carry not only the new superstructure during the process of erection, but also the load from the demolition process of the concrete bridge deck with the use of extremely heavy cranes.

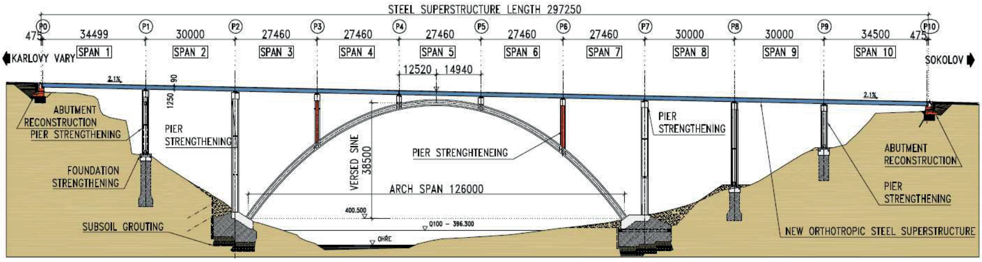

Fig. 2: Elevation – after reconstruction

3. The erection process

Initially, the reconstruction was supposed to be done in two phases: while half of the bridge is replaced; the second half is operated by traffic. However, the general contractor succeeded to close the bridge completely for a period of 12 months. This complete closure greatly simplified the removal of the existing concrete structure and the erection of the new steel structures. However, it imposed much higher demands on the time efficiency of all reconstruction works. There were also a number of adjustments in the technology of the construction of the bridge.

Because of the climatic condition, most of the demolition and erection works had to be done in a period of app. 7 months. Thus, it was necessary to use heavy cranes for the demolition of the old structure, and to incrementally launch the new steel superstructure (completed on one of the banks).

4. Conclusion

The reconstruction of the Loket Bridge was a serious challenge for both designers and the construction companies. The design and technology of the reconstruction helped to finish the reconstruction in a very short time and, at the same time, helped to significantly reduce the impact of the construction works on the unique nature of the natural reserve in the Ohře valley.