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Autor: Kominek, Milan
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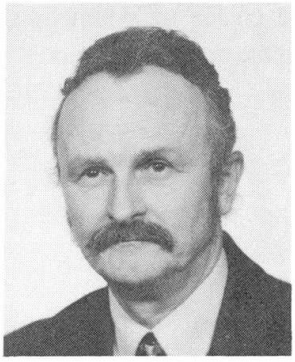
Cable-Stayed Bridge with a Single Pylon in the Czech Republic

Milan KOMINEK
Civil Eng.
CityPlan Ltd
Prague, Czech Republic



Milan Kominek, born in 1947, received his civil eng. degree from the Czech Techn. Univ. in Pragues in 1970. He is currently the head of the bridge and transportation dept. of CityPlan Ltd.

Summary

Ústí nad Labem is a city with 100.000 residents. It is located about 100 km north of Prague, the capital of the Czech Republic. The Labe (Elbe) is the largest river in the country and separates the city into two parts. The only road bridge is an old arch bridge in poor condition. It was the only bridge for 30 km around Ústí across the Labe. Any disruption of the bridge's function could lead to a state of emergency in the whole region. Since this situation was no longer acceptable, in 1993 city officials decided to build a new bridge. The Czech Commercial Bank provided a financing scheme that made the City of Ústí nad Labem the first large-scale municipal infrastructure investor in the Czech Republic after WWII. The City Council and the Department of Urban Development made a conscious choice in favour of a dominant shape and made the necessary funds available. The new bridge will be completed and ready to use in June of 1998.

1. Philosophy of the Solution

One of the most important aspects for city representatives when they began to consider the construction of a new bridge was its aesthetic impact. The only possible location for the new bridge was right up against the Marian Rock, which with its huge mass led to the idea of the maximum lightening of the bridge and the ramps below the Marian Rock and to the relocation of all structurally necessary masses on the opposite river bank. This decision was further supported by the terrain configuration, the shallowness of the river bed and geological formations at the Strekov side of the river, which was ideal for the pylon location. Together with the complicated traffic situation on the right (Strekov) side, the above conditions led the authors of the project, Milan Komínek and Roman Koucký, to the idea of shaping the bridge as an asymmetrical suspended construction without counter suspension in the shortened back span and with the system of the couple of suspension planes in the main span. The idea of the back span without suspensions had an impact on the pylon's design, because it was obvious that the pylon's shape must logically follow the course of internal forces, to take over bending stress and to eliminate the negative reaction in the end support as much as possible. The concept that was followed from the beginning was the idea of the shortened back span where the pylon is a part of this bridge as the stabilizing part of the structure and from which the curve of the main suspended span originated and spanned the river. This fixed part of the bridge was considered from the beginning an important condition for the method of construction to serve after its erection as the base from which the remaining superstructure of the main span would be constructed because the only available space for the building yards was on the right (Strekov) bank.

The new cable-stayed bridge has a single inclined pylon with two planes of 15 cables in a modified harp arrangement supporting the suspended deck, with a main span of 123,3 m, with no back stay.

2. Technical Solution and Construction

The shape of the pylon is designed to transfer the load of the main suspended span by its flexural rigidity with the help of the parapet beams of the back span into which the system of the perpendicular girders is fixed. In the cross-section, the use of the pylon led to the choice of symmetrical twins of the vertical masses, converging due to the anchoring of the suspenders in the upper part of the structure.

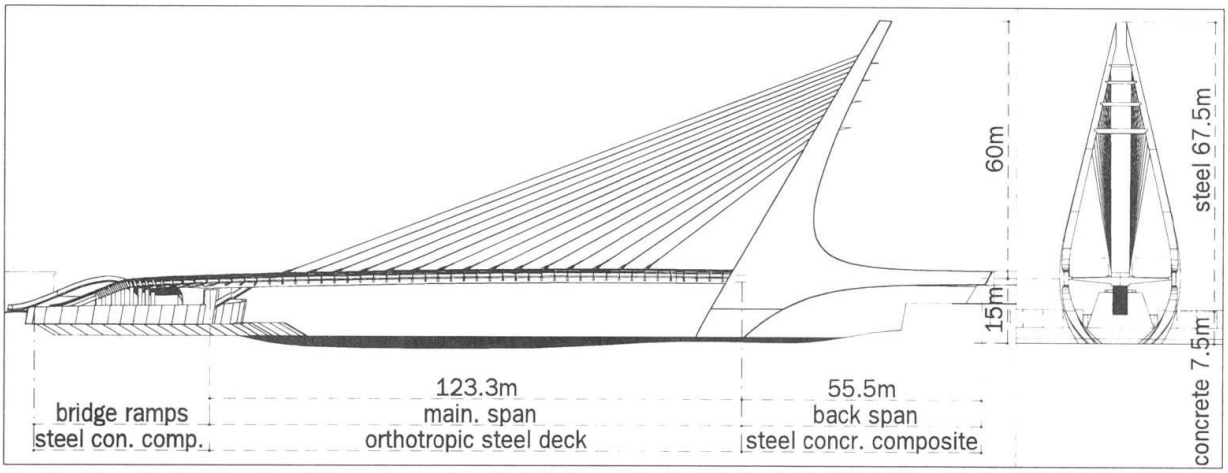


Fig. 1 Longitudinal view and cross-view-section

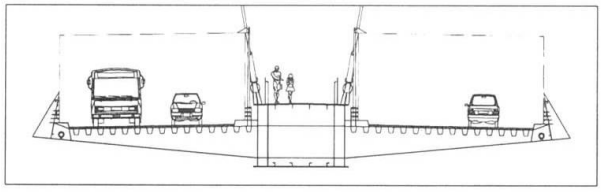


Fig. 2 Main span cross section

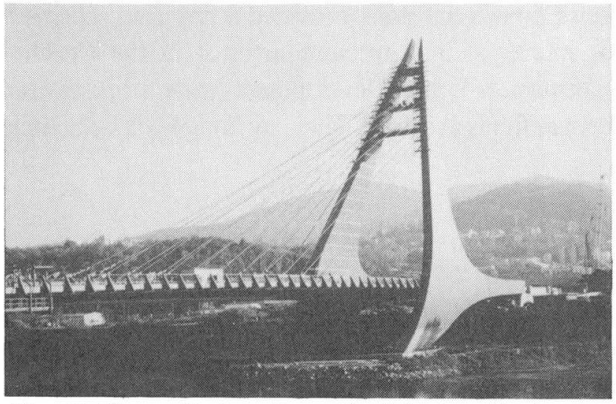


Fig. 3 Overall view from the Marian Rock

Fig. 4 Overall view toward the Marian Rock

This upper part is also reinforced by cross beams in the shape of wings. Both walls of the pylon further envelop the horizontal load-bearing structure with additional cross-reinforcement at the level of the bridge deck and both walls converge again below the deck and are anchored into the foundation.

The horizontal load-bearing structure of the main span was designed as a very light one-chambered beam with a height of 3,0 m and a width of 4,2 m, with the 10,95 m consoles in the lower part that is carrying the 4-lane roadway. The upper part of the main girder (in the middle section of the cross-section) is designed to carry pedestrian and bicycle traffic. This design used to its advantage the necessary structural height of the main beam and at the same time used the space between the suspenders (4,2 m pitch). The suspender pitch is for static purposes designed to solve the construction stress in the cross direction including torsion. The concept and design of the bridge is the result of the very intensive cooperation between the bridge engineer Milan Komínek, the architect Roman Koucký, and traffic engineer Jiří Landa. The construction drawings are the teamwork of the above mentioned engineers, as well as others. The whole project was made possible by the sustained effort of the city officials to provide their city with the infrastructure for the world of the 21 st century.