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The bridge over Chomutovka river valley erected by balanced cantilevers method – design, construction, long term monitoring

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ABSTRACT

The most important part of new bypass of Velemysleves village situated in the north part of Bohemia is the bridge structure over wide and deep Chomutovka valley with total length more than 538 m. Due to the configuration of the terrain and vertical alignment of road bypass is the maximum height of the road above the ground level about 36 m. Superstructure is designed as one continuous beam. In its central part at the point of maximum height above the ground level (place of crossing river Chomutovka) superstructure is designed as a continuous frame with a rigid connection between superstructure and piers formed as a pair of pillar sheets. The superstructure is symmetrical with axis in the middle of main span. The length of main span is 120 m, then the length of next spans is 90 m. The length of external spans is 45 m, respectively 65 m.
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1. INTRODUCTION

The new bypass of the road I / 27 near Velemyšleves was built in order to make all transit traffic on this road outside the village. The solution of the totally inappropriate height and ground-level road alignment in the area of the village and the Chomutovka valley has increased the security and fluency in this important communication linking the regions.

The new road was realized in category S 11,5 / 80, the total length of the current route is cca 2,600 m. The new road begins in the previously realized crossing Vysočany with the D7 motorway. From the existing communications, the relay deflects with a right-angled arc and enters the original farmland. It gradually turns into a significant bulkhead, from which it continues directly to the bridge structure passing

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through the wide and deep valley of the Chomutovka River. When leaving the bridge, the communication is guided in a decreasing notch, from which it extends to the point of connection to the original route.

2. BRIDGE STRUCTURE

The superstructure is designed as a continuous girder of C35 / 45 monolithic pre-stressed concrete. The structure is divided into 7 fields of 45 + 65 + 90 + 120 + 90 + 65 + 45 m lengths. After the bearing axes at the site of the extreme supports, the construction continues with an overhang of 0.8 m outside the bridge. The total length of the load-bearing structure is 521.6 m. The superstructure is made of a box girder cross-section of variable height. In the first, second, sixth and seventh spans, the height of the superstructure is 2.6 m. Towards the P3, P6 is designed for a parabolic rise of cross section height from 2.6 m to 3.75 m. As with P2 (or P7), P3 (or P6) also increases the thickness of the walls and the bottom plate. Crossbars are designed above the pillars to provide sufficient structural stiffness at the place of bearing.

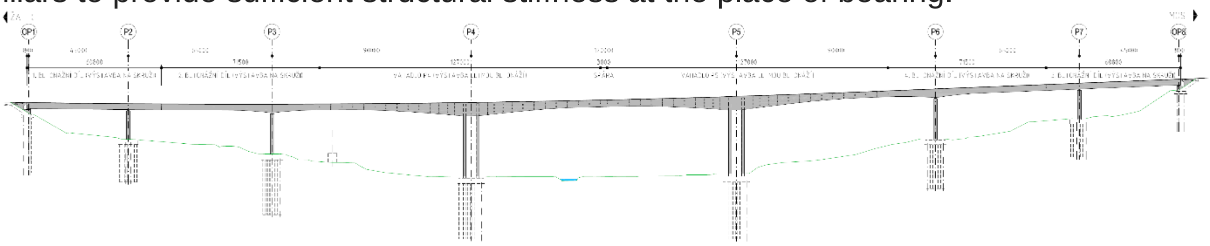

Fig. 1 Longitudinal section of the bridge

The main part of the superstructure crossing the Chomutovka River is designed as a composite frame with a rigid connection of the supporting structure and the pillars P4 and P5. This part of the load-bearing structure was realized by the technology of balanced cantilevers, which was adapted to its shape solution. At the site of the connection of the frame stands to the support structure, a seat is formed by means of the extension head into which the chamber cross section is seated. The walls of the frame stands penetrate inside the chamber, creating a very rigid connection to ensure the transfer of stress between the supporting structure and supports. The height of the chamber in this part of the support structure is 6 m (Fig. 3), it decreases continuously to the main field P4 - P5 up to 3 m. Outside the main field (in the field P3 - P4 and in the field P5 - P6) To reduce the height of the chamber to 2.6 m.

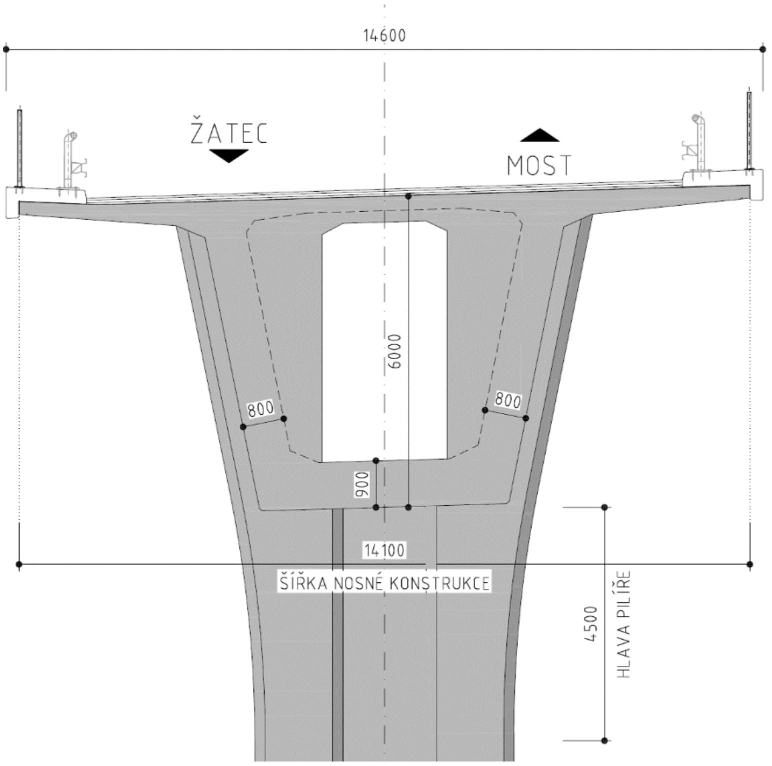

Fig. 2 Cross section above the piers

The supports OP1 and OP8 and the pillars P2, P3, P6 and P7 are supported on the double bearing. All bearings are designed as a longitudinally sliding, fixed point against the longitudinal displacement of the structure is defined by the bending stiffness of the frame piers P4 and P5. Due to their very similar height, the fixed point is approximately half the length of the main field P4 - P5. The half of the bearings (each one on each support) is designed to fix the displacement of the support structure in the transverse direction. The bearings are oriented in the tangent to the roadway on the supports. This, however, results in the formation of transverse forces on which the bearings are to be designed, on the other hand, this arrangement clearly defines the direction of the bridge movement at the outer supports and thus the movement of the bridge bridges. Therefore, it is not necessary to design bridge bridges for combinations of longitudinal and transverse displacements.

The Freyssinet system was used for prestressing of the superstructure. The bridge is completely pre-tensioned with 19-core tendons with a strength class of 1640/1860 MPa. The whole system of prestressing the superstructure is divided into three basic groups:

- cantilevers tendons - virtually straight tendons led to the upper surface of the load-bearing structure applied during cantilevers stages to cover tensile stresses in the cantilever construction process. For each lamella is designed a pair of tendons, except for the 7th and 8th lamellas for which four tendons are used.
- Lower tendons - tendons situated close to the lower surface of the support structure in the fields P3 - P4, P4 - P5 and P5 - P6, anchored in the anchor elements at the bottom plate and the walls to eliminate the tensile stress in the lower part of the supporting structure In the middle of these spans.

- Tendons of continuity - Parabolic tendons passing through walls of the entire load-bearing structure to ensure the continuous behavior of the whole structure and its forces (equivalent load) leading to the deformation of the supporting structure.

Fig. 3 Overall view of the bridge during construction process

3. CONCLUSIONS

The bypass was put into operation in November 2016. It was possible to realize a high-quality significant bridge structure that can become a dignified business card of all construction participants. As a designer, we appreciate the close cooperation with the contractor.