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Construction of Slančíková Bridge and Wilson riverside in Nitra

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Abstract

This presentation introduces a new structure of road hanging bridge. The structure has some particularities especially a solution of lateral walkways for cyclists and pedestrians from steel and wood. Another attraction is a balancing hinges anchorage into the support No. 1 by manner of hinges prestressing by means of hydraulic presses and pressure concreting of columns and the rare part of main girders. The bridge construction had built beside an actual hanging footbridge which was removed after the bridge completion.

The bridge was dedicated on June 11th, 2011. Total weight of a steel structure is 250 tons.

Keywords: Type your keywords here, separated by semicolons;

1. Characteristics of the bridge

The bridge is designed as one independent unit. From static point of view, this is two-fields hanging bridge with three parallel hinges in the point of longer span and two balancing hinges in the point of shorter span. Free width 10.0 ms is firm. (free width is a distance between the crash barriers). Right guidance is forthright. Level of longitudinal profile is at highest point of arc. The cross slope of carrier structures is 2.0%, it is roof-shaped and constant through the whole length of bridge. Total width of the bridge is 21 158 mms. Particularity of the bridge is the walkways from locust wood fixed on steel brackets. Bottom part of bridge is created by end supports No. 1 and No. 3 and intermediate support No. 2. A dead plate with thickness 300 mms is fixed to the end supports. The bridge foundation is designed at piles. Manner of foundation and piles length was designed on the basis of performed geological research. Bedding of the framework at a down building is designed by means of the pot-shaped bearings. The bridge was designed according to the new european standards [1-4], which are valid from 01.04.2010.

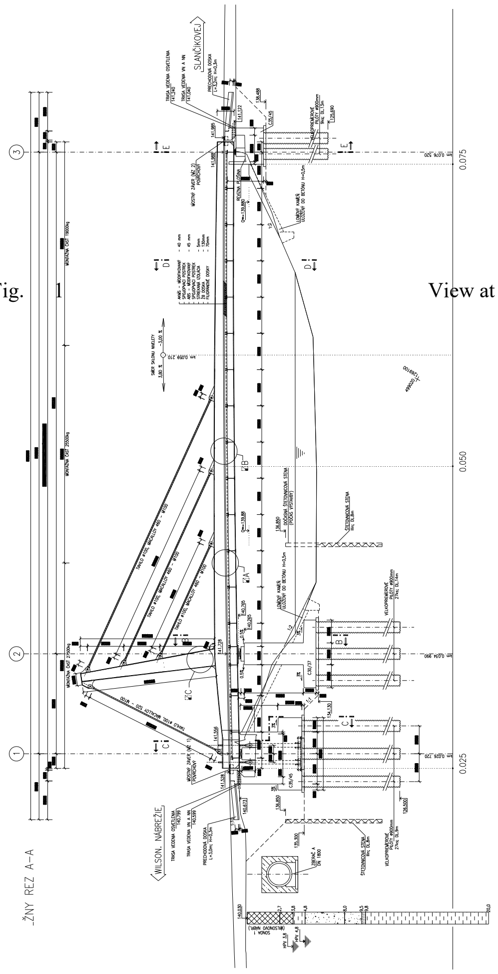
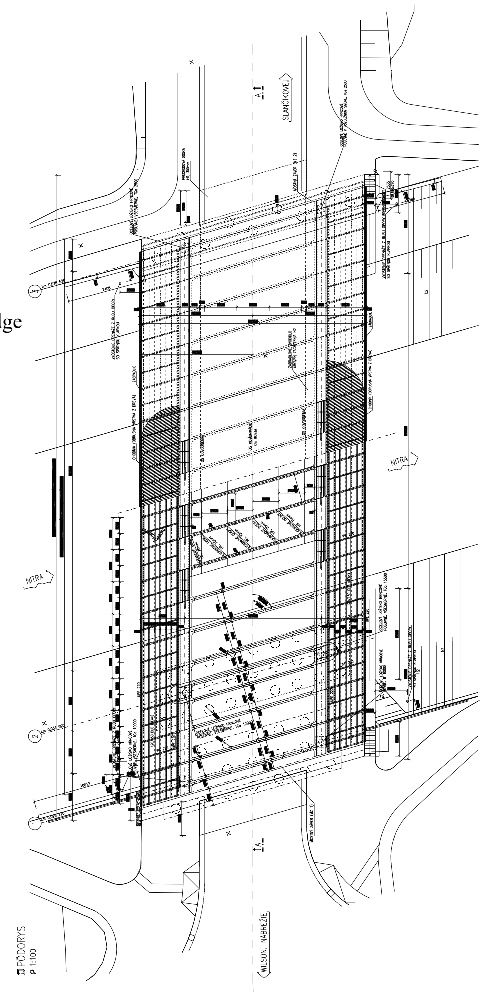


Fig. 1 View at completed bridge



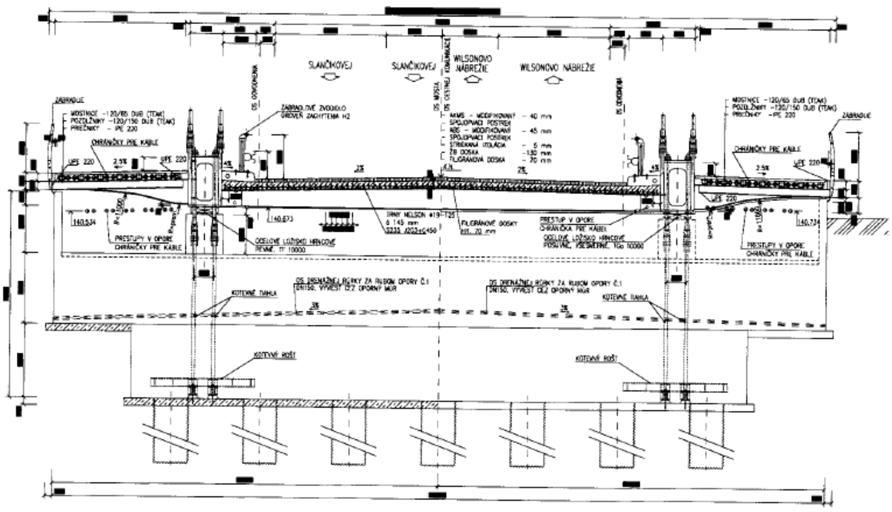


Fig. 2 (a) longitudinal section of the bridge; (b) bridge's ground plan

Fig. 3 Lateral section above the axis No.1

2. Description of bridge's steel structure

From a static point of view, this is a hanging bridge consisting with two fields with theoretic span 8.27 ms + 41,53 ms. Total length of bearing structure is 51,85 ms.

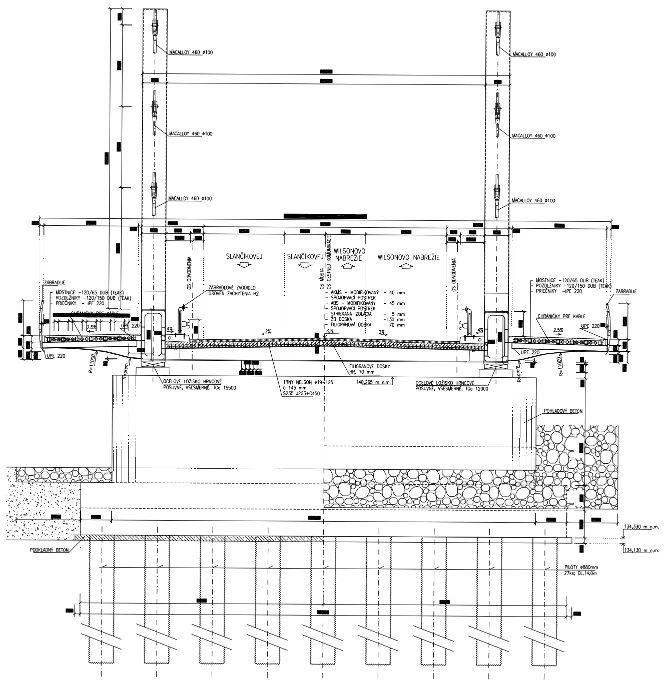


Fig. 4 Cross-section above the support No.2

2.1. Main girders

Bearing steel structure of the bridge consists of two parallel box girders with 12.7 ms distance between the axes. Height of main girder cross-section is considered as linear variable in the static calculation. This variable has a value 1400 mms in the point above both supports and in the point above a column has the value 1900 mms. But in a matter of fact low table is parallel with longitudinal profile and upper table has a shape of common curve came out from architectonic solution. So in fact the height of main girder's cross-section is equal or higher through whole its length than the cross section from the static calculation in same point. The upper and lower tables have constant thickness 36 mms and the walls are constantly 16mms thick. The box columns and welded cross beams are fixed in the main girders. From the reason of trouble free maintenance of inaccessible and unventilated places, the cross-section of main girder in its shorter field and also the cross-section of column are filled with a concrete of strength class C20/25. Concrete is included to carrying capacity. These parts are also equipped by longitudinal braces which provide cross-section's shape when concreting work runs.

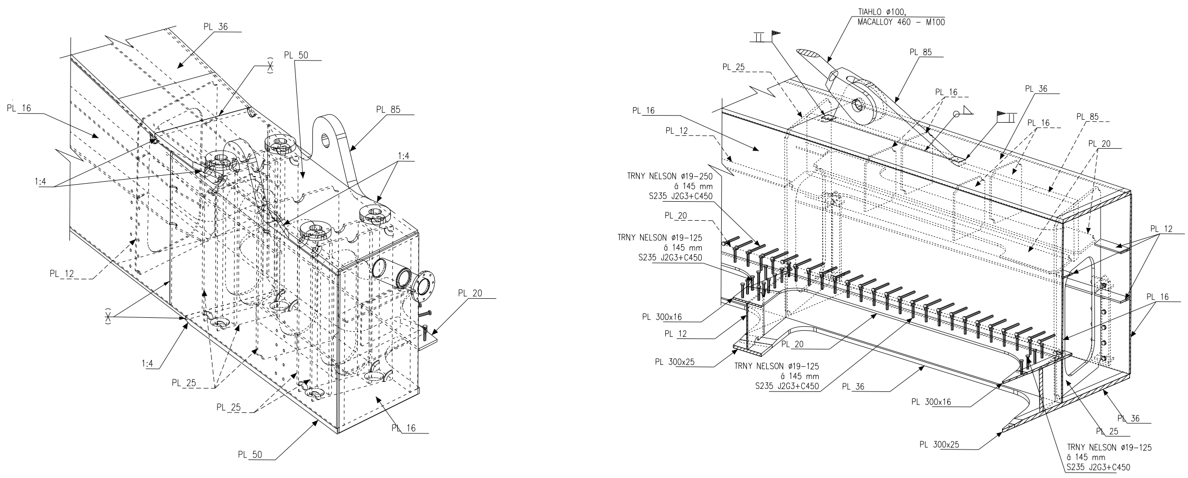


Fig. 5 Main box girders

2.2. Crossbeams and the tie bars of girders

Crossbeams have a variable cross-section and they are welded from steel sheets placed in the distance 3.0 ms between axes. Crossbeams follow ground slant of the bridge 74° in ground plan. They are fixed to main girders by means of starter frames, which are created by lower table of main girder with thickness 36mms and steel sheet with thickness 20mms which divides a wall of main girder. Lower table of crossbeams is horizontal, upper table follows a saddle lateral slope of pavement 2.0%. Dimensions of upper table, wall and dimensions of lower table are 16x300mms, 12x(450 – 568)mms and 25x300mms. Lateral hatch diaphragms with thickness 12mms are welded in the points of crossbeams because of requested box girder's shape has to be ensured. These diaphragms are 25mms thick in the points of rod's anchoring blocks and in the place of the support No. 3.

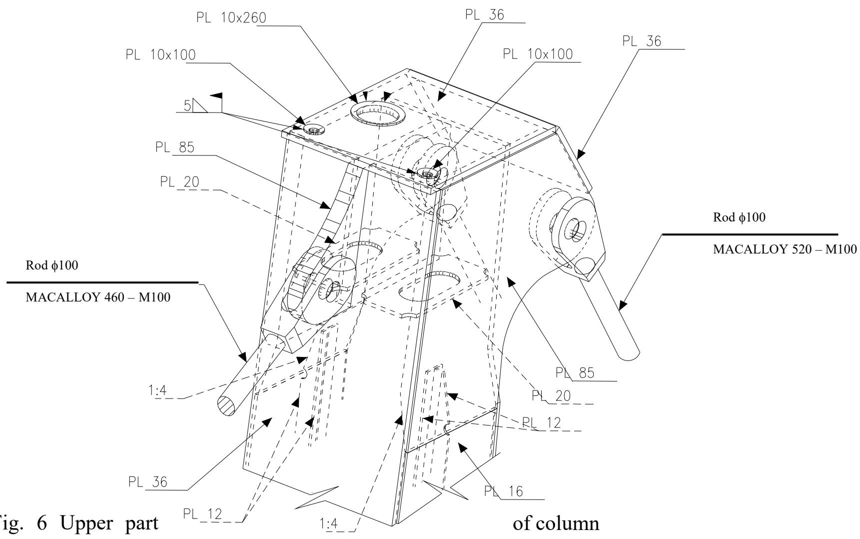


Fig. 6 Upper part of column

2.3. Columns

Height of column's cross-section is linear variable with theoretical height 1500mms in the axe of main girder and height 700mms on the top of column. Outside width of column is 900mms as well as the main girder's cross-section. Thickness of tables and walls is constant through their height and it has the value 36 mms for tables and value 16mms for the walls. So the cross-section of column fluently ties up to the main girder. An aperture in upper part of column served for concreting and it was closed by steel round covers after concreting.

3. Bridge deck from reinforced concrete

Bearing structure of bridge deck from reinforced concrete consists of precast reinforced concrete desks 70mms thick and monolithic reinforced concrete table with thickness of 130 mms. Reinforced concrete desks simultaneously create a sacrificial formwork for monolithic table.

3.1. Reinforced concrete desks

Reinforced concrete desks are designed as the prefabricated desks from reinforced concrete with thickness 70mms which are produced in concrete plant. Carrying direction of the desk is in longitudinal direction and the desks are placed like that. Bearing stiffener is designed and produced from reinforcing bars with diameters 16 and 20 mms. Shear spatial reinforcement is from steel bars with 7 mms diameter. The apertures with minimum diameter DN80 are made in end desks so that protecting tube with joint diameter 76 mms for lighting and protecting tube for illumination could be thread through. The openings with minimum diameter DN 54 mms are also designed for dewatering elements. Reinforced concrete desks are laid on cross beams and their positions are fixed by structural welds to the interlock thorns so that possible unwanted offset would be prevented in a concreting process. Places of mutual joints as well as the places of reinforced concrete desks bedding are sealed with the mortar BASF Repafix so that a cement grout does not leak in. Reinforced concrete desks are from material specified as STN-EN 206-1-C45/55-XC3, XF2(SK)-CI0,4-Dmax16-S3 and concrete stiffeners type B 500 B.

3.2. Steel concrete deck

Steel concrete deck is a monolithic table with thickness of 130mms between the axis of drainage and variable thickness of 130-190mms from the axes of drainage to the front of main girder. Slope of bridge deck is 2% from the center to a drainage axis and slope 4% from the axes of drainage to the face of main girder. Reinforcement is created by steel in reinforced concrete desks and also with additional steel bars with diameter 20mms. Linkage of monolithic bridge desk and steel structure of the bridge is provided by NELSON interlock pins with diameter 19mms and lengths 125mm and 145mms. Material of the pins is S235 J2G3+C450. Protection tubes, drainage elements and insulation have to be embedded with concreting works. Concreting works have to be made in parts, in more chessboarded working steps. Technological method of concreting has to be discussed with a technologist. Material focused for bridge deck is the concrete STN-EN 206-1-C30/37-XA1, XF1(SK)-CI, 4-Dmax16-S3 and concrete stiffeners B 500 B [2] .

3.3. Carrying rods

Three parallel carrying rods Macalloy M100 460 are moored in the longer field of main girder through the gusset plates 85mms thick into the axis of main girder and column. Pair of balancing rods Macalloy M100 520 is moored on the shorter field into the walls of main girder and column.

3.4. Pavement brackets and the pavements

Steel brackets with variable cross-section welded from steel plates are fixed into the main girders on the both sides of bridge. The brackets create a steel structure of pavements. The brackets are mounted through bolted connections. Pavement steel structure is supplemented by the beams with cross-section IPE220 placed always in the middle between two pavement's brackets and parallel with them. These beams are further laid at longitudinal beams UPE220 which are on the brackets. Wearing course of pavements is designed from hard wood – black locust, with cross-section H=65mms, B=120mms. The elements are equipped by antiskid treatment. Calculation counted with D30 strength class of timber. Bearing wood structure is designed from hard wood – black locust, with cross-section H= 150 mms, B=120mms. The wooden billets are anchored by steel galvanized studs Ø 10mms with strength 8.8 to the upper strip of steel brackets. Distance between axes of wooden billets in lateral direction is 520mms. Static point of view considers wooden billets as the double fielded continuous beams laid at steel brackets with intermediate support on the girders IPE220.

References

[1] STN EN 1991-2 Traffic Loads on Bridges
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[5] STN EN 206-1: 2000. Concrete. Specification, performance, production and conformity