Steel/reinforced concrete structures in cable-stayed bridges

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Steel/Reinforced Concrete Structures in Cable-Stayed Bridges

Eléments en acier et en béton armé dans les ponts haubanés

Stahl- und Stahlbetonelemente bei Schrägseilbrücken

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A new Southern bridge passage across the Dnieper river having about 4 km long artificial structures has been built in Kiev. Of a special interest is a cable-stayed part of the bridge across the Dnieper which is a combination of steel and reinforced concrete as it is shown in Fig. 1.

Fig. 1

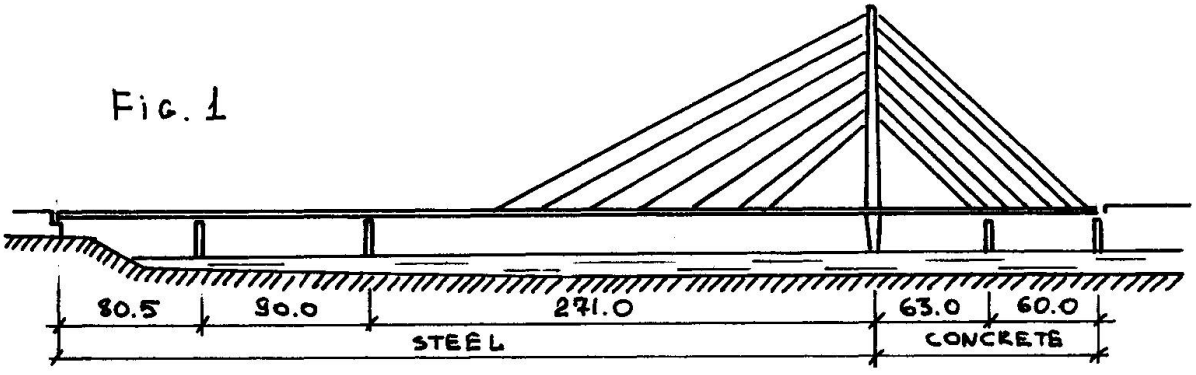
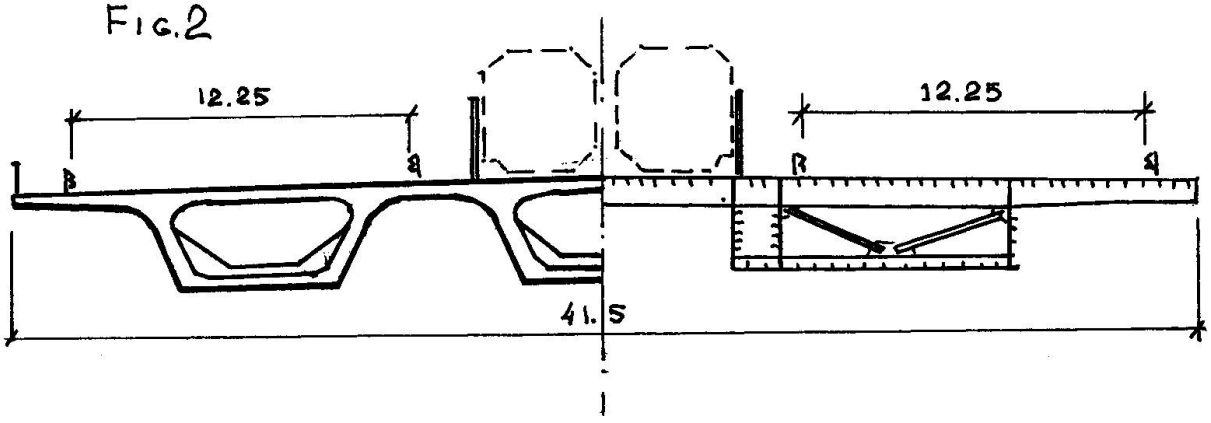


Fig. 2



The bridge is designed to carry six motor traffic lines, two underground railway lines and communications - pipelines of large diameter. The cross section of the concrete and steel part of the bridge you can see in Fig. 2.

A triple steel stiffening girder of 80,5, 90 and 268 m spans is hinged on the pylon by means of 24 bearings, with 18 of which taking the outward thrust on cable stays. Worthy of notice a new design of an orthotropic slab to carry the underground train, having the longitudinal and cross ribs spaced apart on different sides of the deck sheet. Longitudinal auxiliarry girders are arranged on cantilevers. Factory-made boxes contain the cable stays anchoring units. The member joints are welded and held by means of high strength bolts. The girder was assembled at the shore with a strut frame and launching girder and set in place by means of two temporary piers mounted within a large span.

A prestressecd reinforced concrete precast and cast-in-place beam with a central prop (counterweight) rests on the pier in a way similar to that used for the steel beam and prestressed by cables to compensate for the design break-off force. No negative arise on piers at the proof loads. The beam is made of precast box blocks employed on the bridge flyover part following a ninespan continuous design. Only ducts have been added in the blocks and stops on the upper plate for the transverse stress reinforcement. The cable stays anchor joints are arranged in the cast-in-situ concrete of longitudinal joints and in the above box concrete. The high strength reinforcement penetrating through anchor joints of cable stays comnbines them with the precast blocks. In the longitudinal direction the cast-in-situ concrete is crimped with 36 300t tendoms. Turning of blocks allowed placement of additional concrete making it possible to locate in it the high strength reinforcement and to increase the span weight. Struts are made along the box lower parts having cast iron loads placed above them.

The double-pillar reinforced concrete pylon of 110 m elevation above the roadway is precast. The pylon pillars are located on the separation line in one plane with cable stays.

The cable stays are made from twisted zink-coated ropes of 62b mm in diameter. The cold-filled wedge anchors are mounted on cables.

A complex adjustment of the stay cable system, allowing to level the stay cable force and to create the required stressed state of the stiffening girder and pylon, was carried out. The design adjustment algorithm consisted in solution of the system of linear equations having an excessive number of equations by the method of midsquare with introduction of the weight coefficient matrix.