Prestressed reinforced cable-stayed bridge with stiffening slab

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Prestressed Reinforced Cable-Stayed Bridge with Stiffening Slab

Pont à haubans avec dalle en béton armé

Stahlbeton-Schrägseilbrücke mit massiver Fahrbahnplatte

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A bridge connecting the new public and cultural centre with an island park was erected in Krasnojarsk, Eastern Siberia. In the context of the increased requirements toward the architectural expressiveness a version with a cable-stayed superstructure has been adopted. The bridge was erected from precast prestressed reinforced concrete elements. The bridge has the total length of 600 m and consists of a cable-stayed superstructure with 76.55+157.1+76.55 m spans (Fig.1) and viaducts with 25.6 m spans.

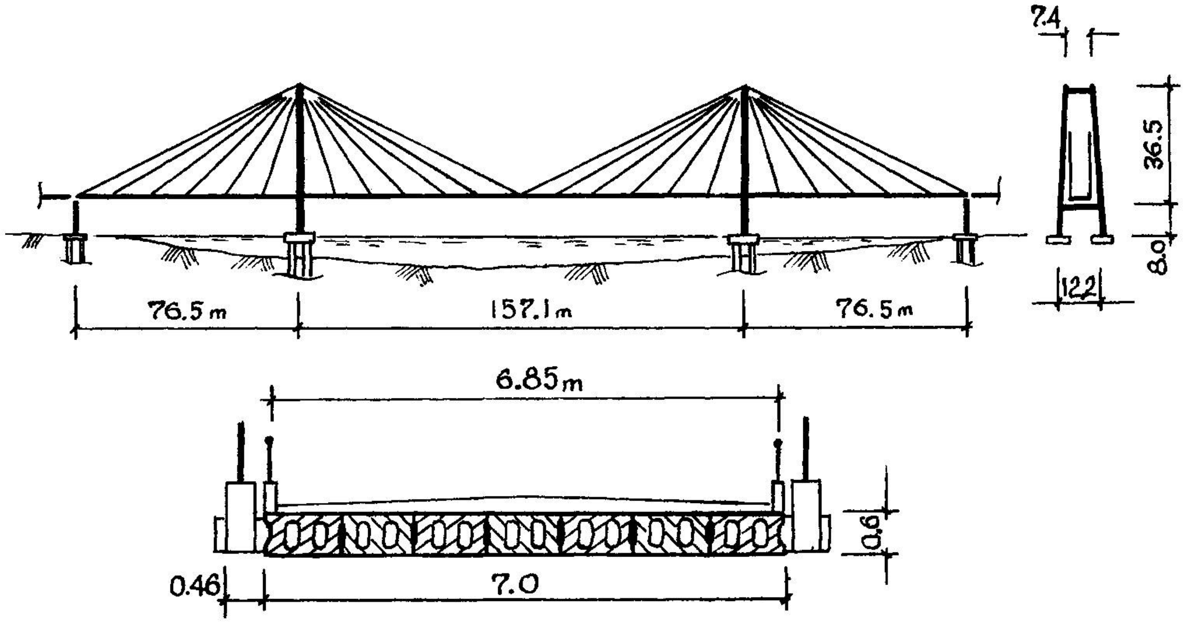

Fig. 1 General view and cross section of cable-stayed bridge

Two features differ the presented design from other examples of cable--stayed bridges. First of all, the cable-stayed bridge used the simpliest design of the form of cross section of the stiffening slab - the plate form. That is why the "stiffening slab" term is being used below. Application of the cross section plate form made it possible to obtain the record for the reinforced concrete cable-stayed bridges constraction elevation to span length 1/260 ratio. Secondly, for the main and viaduct spans use was made of a single-type precast element which is, essentially, a hollow plate block of 12 m length and 0.6 m thickness, series manufactured for the small-size motor-road bridges. The total dimensions of blocks were retained, with alterations connected with certain particulars of operation under load of cable-stayed bridge stiffening slab and viaduct continuous plate, introduced in the reinforcement design.

The blocks were combined into the stiffening slab in the transverse direction by concreted key joints, and in the longitudinal direction - by the cast-in-situ cross 1.0 m wide beams.

The stays consist of one or two spiral ropes of enclosed type dia.71.5 mm with 4.5 MN breaking load. Prior to erection, the stay ropes are subject to stretching until stabilization of the elasticity modulus. On pylons the stays are fixed in the saddle -type bearing supports. To fix stays to the stiffening slab cross beams, a new design of the unit (Fig.2) having the basic advantage of full unification within the super-structure limits independent of the stays inclination angles, has been developed.

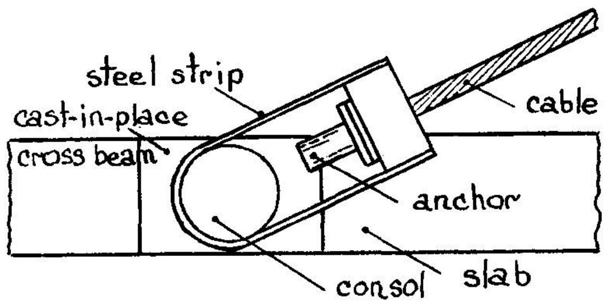

Fig. 2 Stay-to-stiffening slab attachment unit

The bridge pylons having the form of plane double cross-bar frames with inclined rectangular struts were concreted in situ in travelling forms. The foundations of all bridge piers were made on drilled cast-in-place piles of 1500 mm in diameter, with 8 posts concreted under each pylon. The stiffning slab was erected using temporary supports installed under stay attachment units.

To optimize the internal force distribution in the stiffening slab, regulation of the stay forces by method of additional tensioning was performed. For the three-dimensional and non-linear calculations of the cable-stayed superstructure, the computer programs making it possible to plot diagrams of efforts in the stiffening slab were produced. The stressed -deformed condition of the stiffening slab and stay-to-slab attachment units were studied on acrylic plastic models, reinforced gypsum and reinforced concrete models. The aerodynamic parameters of the cable-stayed superstructure were investigated in the wind tunnel using a model of the slab section.

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