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Road Bridge over the Severnaya Dvina River in Arkhangelsk

Pont-route sur la Dvina, Archangelsk

Strassenbrücke über die Dvina in Archangelsk

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Fig. Bridge diagram

1. INTRODUCTION

The designing and construction of the bridge over the Severnaya Dvina river have been completed. The Severnaya Dvina is the largest river in the European Northern part of the USSR. The depth of the river varies from 10 to 15 m, at some places reaching 20-30m. Engineering and geological conditions at the construction site are noted for their complexity. The bridge is located 47 km distant from the sea border of the river delta. The water level regime in the river bed is characterized by several specific features and is rather complicated due to pileup, high-tide and low-tide events. The ice drift in the river is very powerful.

2. THE BRIDGE OVER THE RIGHT BRANCH OF THE RIVER

The bridge is designed as 105+5x147x105 structure with a four-lane roadway for traffic and two 1.5 m wide footways for pedestrians. Cross-section of the span structure is seen as consisting of two boxes combined at the top by an orthotropic plate and through cross bonds. Each box comprises two welded flanged main beams 3.6 m high and 21 m long. A block of the orthotropic plate is used to hold the beams together at the top, while at the bottom the beams are joined together with the help of a ribbed plate. Welding or high-strength bolts may be used for joining different elements of the span structure. It was for the first

in the native bridge building practice that a continuous beam span 946 m long weighing 8.4 thousand tons had been pulled over from one shore of the river to the other.

Intermediate supports are of prefabricated-monolithic structure. The footing of these is seen as a high pile foundation pat resting on reinforced-concrete hole piles 1.6 and 3 m in diameter. The piles are driven into the ground to the depth of up to 40 m, the entire length of the pile coming to 54 m. The body of supports consists of the contour reinforced-concrete blocks. Following from the local and climatic conditions, the above blocks are made of concrete B35 (strength) and F 400 (frost resistance).

3. THE BRIDGE OVER THE LEFT BRANCH OF THE RIVER

The bridge is designed as 63+170+84 (movable span) + 170+4x120 m. The 63 m span is made of reinforced-concrete steel while the other spans are all-metal structures. The 170 m bottom-road spans are of a combined system employing a stiffening girder which is reinforced with a flexible arch. The spans were assembled in the building berth, then were delivered to the construction site. Cross-section of the 4x120 span shows that it consists of 4 flanged main beams which are combined at the top by an orthotropic roadway plate and a system of through cross bonds. Welding and high-strength bolts may be used to join the elements of the span structure. The 4x120 span, reinforced by temporary strut frame, was installed by the longitudinal pull-over without using temporary supports.

The supports of the vertical-lift spans are the most sophisticated structures in the above bridges. The supports include solid-wall box-like metal towers which are fixed in the body of supports. The portion of the tower showing above the water level comes to 54 m. The supports of the movable span are located at the deepest places of the river bed. The foundations are designed to rest on the reinforced-concrete hole piles of 3 m in diameter. That portion of the pile which plays the role of an ice-breaker is 18 m long and is made of metal sections. This is caused by the necessity of driving the piles to the depth exceeding 50 m below the water level in order to reach practically incompressible ground layers so that to avoid the settling of supports and hence the deviation of the towers. The tube walls of the ice-breakers are 20 mm thick. As an experiment, two metal piles, 3 m in diameter and 54 m long, were submerged with one of the supports. The hole piles were driven using a powerful travelling bridge crane (with rated load capacity of 65 tons) and two vibratory pile drivers. The earth is excavated by a clamp bucket mounted on a special sluice hoist. The movable span is balanced by four counterweights connected to 64 carrying cables, the latter interacting with the pulleys of the hoisting winth. It takes 2 minutes to lift the span to the height of 25 m using the main drive, and 15 minutes when the reserve drive is used. The drive employed is of an electromechanical type.