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External Reinforcement Beams for Road Bridges

Poutres à armatures extérieures pour les ponts-routes

Beton-Strassenbrücken mit äusserer Stahllaschenbewehrung

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The standard superstructures for motor-road bridges of ordinary reinforced concrete that have lately received wide acceptance in the USSR possess reinforcing cages with multi-row arrangement of operating bar reinforcement in the beam bottom chord. The beams have a number of advantages. However, manufacture of reinforcing cages requires considerable labour input with the use of manual arc welding. Substitution of working external bar reinforcement with external sheet metal sheet reinforcement makes it possible to mechanize production of beams using a highly efficient welding equipment and save metal.

On basis of the performed research, new design-technological solution of beams, method of their calculation and design requirements have been developed. The beams consist of the non-stressed metal sheet located on the lower fibre without the concrete protective layer (see Fig). The combined operation concrete with sheet reinforcement is provided by vertical anchors from bar reinforcement. The anchor bars of the length close to the height of the beam rib simultaneously perform the role of transverse reinforcement assigned by calculation of inclined sections on the cross force effect. The anchor bars are attached by tee butt automatic welding. On some sections along the beam length the sheet reinforcement may be strengthened by the bar one, located above the sheet inside the beam (combined reinforcement).

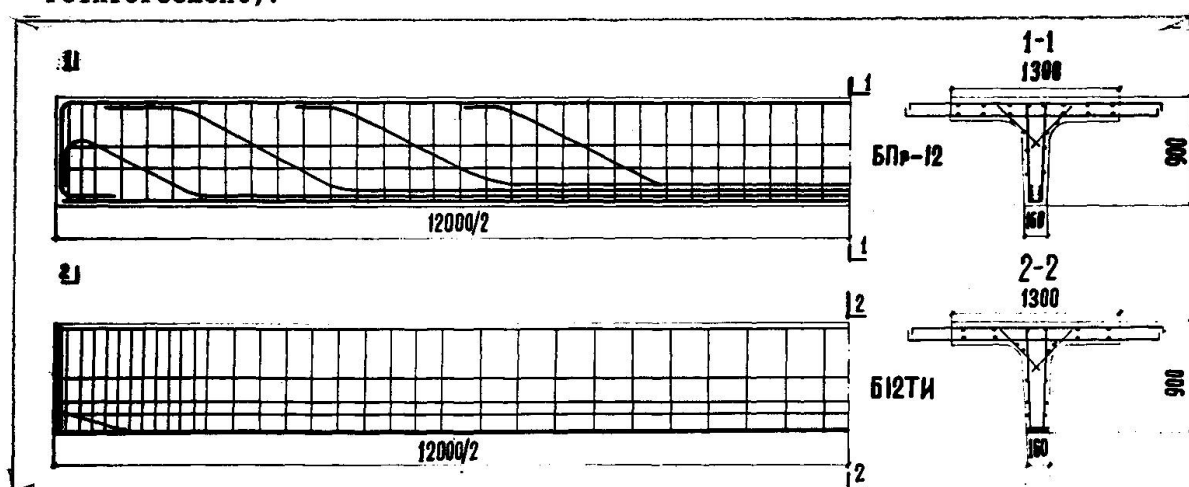


Fig. Beams of Motor-road Bridge Superstructures

- 1- standard, reinforced with bars;
- 2- with external sheet reinforcement.

The new design has found practical use in superstructures for bridges on roads in the oil-gas bearing area of Western Siberia. Application of beams of new design allows lowering of labour consumption in

manufacture of a rib frame by 2,8 times as compared with the standard and the total labour consumption in manufacture of a single beam up to 1,5 times.

Investigation of bridges of 12 m long beams erected in Western Siberia and in the Urals has revealed that condition of beams with external reinforcement does not differ from that of the standard beams.

Having considered advantages of the external reinforcement beams, improvement of labour conditions at manufacture, as well as the positive results of operating bridge investigations, four designs of 12 to 18 m long external reinforcement superstructures of various cross sections (arch plate, T-beams with and without diaphragms, arch beams with small external cantilevers). To study operation of the designed structures comparison tests with a static load of two 12 m long T-beams without diaphragms were carried out. One beam had an external sheet reinforcement, the other was according to the standard design with the bar reinforcement. The tests have revealed higher properties of the structure with external reinforcement. No violation of external reinforcement sheet-to-concrete contact at all loading stages were detected.

The new design-technological solution can find further development in the railroad bridge beams in the form of composite constructions with external sheet reinforcement and internal stressed bar one or cables.