

Hardanger Suspension Bridge

Design and construction

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ABSTRACT

Detailed design of the Hardanger Suspension Bridge with a main span of 1310 meters is completed and construction is in progress. A structural design giving reliable and durable bridge elements beneficial for inspection and maintenance has been crucial in the designing process. The stiffening girder is a very slender wedge shaped steel box, and the towers are performed in concrete cast in place. This presentation will briefly consider wind loads and section model investigations; dynamic analyses both in frequency domain and in time domain; wind stability limit (flutter); stiffening girder design, dehumidification system for the main cables and girder; inspection trolley for the girder (also accessible for rehabilitation work); limitation of expansion joint translations by a damper; vortex shedding vibrations and some pictures from the construction work.

The bridge crosses Eidfjord, which is an arm of the Hardanger Fjord in Norway. The bridge is carrying two traffic lanes, each with a width of 4.5 m and a 3.25 m wide walkway.



Figure 1. Elevation of the bridge

The stiffening girder has the form of a wedge shaped steel box, where the outer geometry of the girder itself highly is a result of wind tunnel investigations.

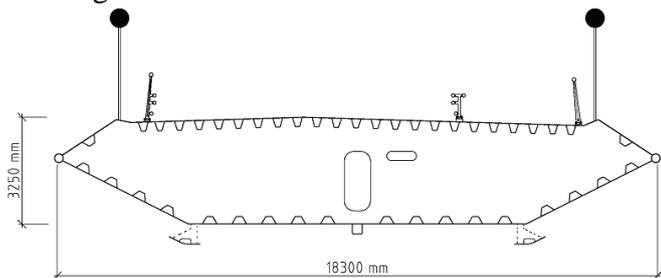


Figure 2. Cross section of box girder



The width of the cross section of the stiffening girder is 18.3 m and the depth of the girder is 3.25 m. In general the steel grade used in the box girder is S355N. Thickness of the outer steel plates of the box is 8 and 12 mm, and the thickness of the trapezoidal stiffeners inside the box girder is 6 mm. The circular tubes at the outer edges of the box girder are 270 mm in diameter and the steel thickness is 12.5 mm. These circular tubes will have a function as runway for the inspection trolley.

Corrosion protection of the outside surface of the box girder is done by a duplex system which consists of cleaning by sandblasting, metallization by zinc, tie coat, one layer of epoxy paint and a top layer of polyurethane.

The inside of the box girder is not painted except for shop priming of the steel plates. Corrosion protection is performed by a dehumidification system which is integrated with the dehumidification system for the main cables.

Erection of the main cables is performed by the method of aerial spinning. Each main cable is assembled by 19 cables each consisting of 528 round galvanized wires of diameter 5.30 mm. Nominal tensile strength of the wires subsequent to galvanization shall be 1570 MPa, where the tolerance range is from 0 to 260 MPa. Thickness of the zinc coating of the wires shall be not less than 275 g/m². Horizontal distance between the main cables is 14.5 m, and the sag is 121 m.

Construction is performed at several locations around the world. Construction of large suspension bridges is a world wide process.