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Detailed Design of the Cable Stayed Bridge for the Öresund Link

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Abstract

The 7.7 km long Øresund bridge is a major part of the Öresund Link between Denmark and Sweden. The most significant element of the entire Link is the cable stayed high bridge spanning the navigation channel. The bridges were tendered on a design-built basis leaving the responsibility for the design with contractor. Sundlink was awarded the contract to built the bridges in 1995 and subcontracted the design to CV Joint Venture, comprising COWI from Denmark and VBB from Sweden. This article describes the detailed design of the High Bridge.

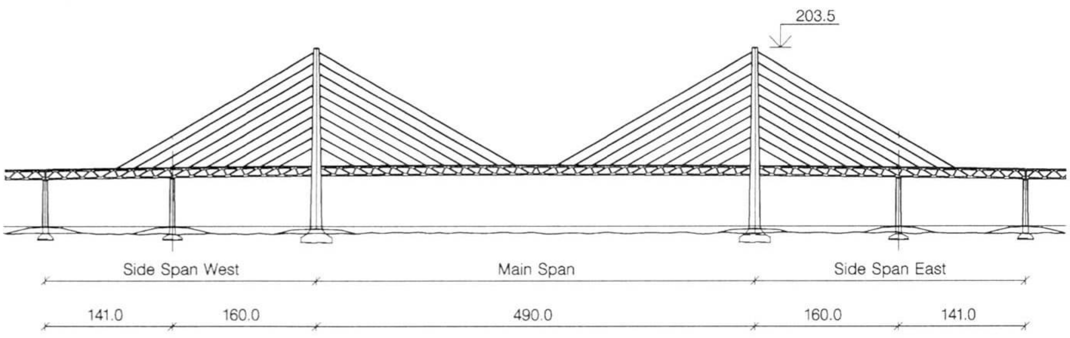

Fig. 1 *High level bridge, Elevation*

The bridge will carry a four lane motorway with emergency lanes and dual tracks for a high speed railway, and will when completed be the longest cable-stayed bridge for high speed railway. The traffic is arranged in two levels with the roadway on the upper deck and the railway on the lower deck. The rails are laid in ballast over the entire length of the bridge.

1 Pylons

Rising 203.5 m above the sea level, the pylons of the cable-stayed bridge will be the landmark of the entire link. The pylons are designed as clean Hs without an upper cross beam. This resulted in almost 150 m free standing legs in the transverse direction of the bridge alignment, which lead to heavy vertical reinforcement above the cross beams of the legs where the pylon legs are designed to resist an accidental impact load of 8 MN in any direction.

The pylons are founded directly on Copenhagen limestone in level -17 m and level -18.5 for the east and west pylon, respectively. The foundation structures are cellular caissons with a footprint of 35 m x 37 m. The dimensions have been governed by ship collision

One of the key issues in the design has been to keep the dimensions and the weight of the caissons as low as possible because of the size of the available dry-dock facilities and the available draft during tow-out.

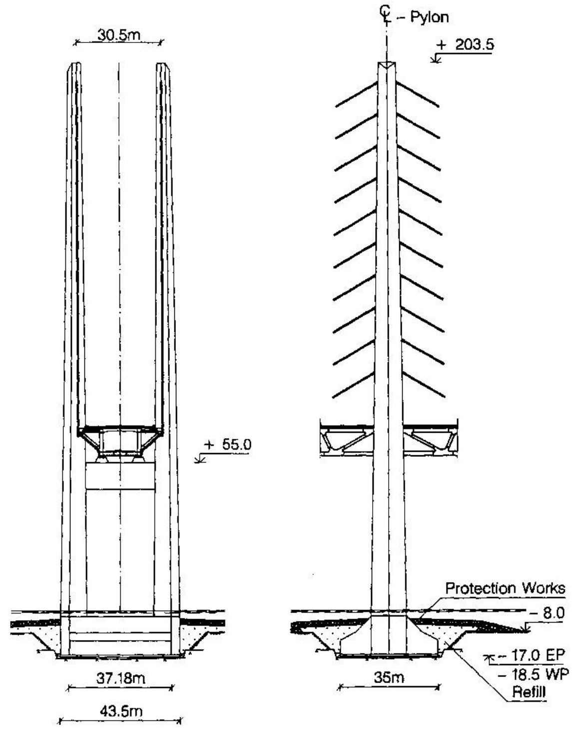

Fig. 2 Pylon, elevation

2 Bridge Girder

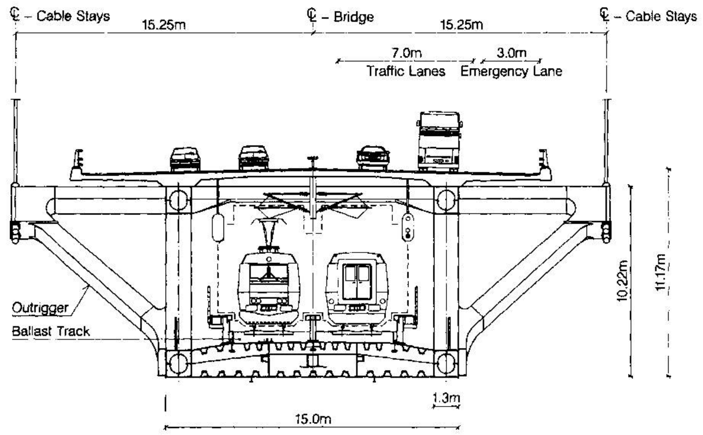

Fig. 3 High Bridge girder, cross section

The bridge girder for the high bridge is arranged as a steel truss girder with an upper transversely post-tensioned concrete roadway deck and a lower deck for the railway, designed as a closed steel box. The inclination of the truss members is arranged with approximately 30° and 60°, respectively. The cables are anchored to the girder on outriggers with the same inclination as for the flat diagonals and the stay cables. Diagonals, chords and the railway deck are in steel grade S420 (EN10113) except for the secondary elements inside the railway deck which are designed in S355 (EN10113).

3 Cables

The cables (PWS) are arranged in a harp system with all cable stays in parallel. The effects from buffeting, vortex shedding, forced vibrations of the supports and rain/wind induced vibrations have been investigated analytically. The cables are designed with an outer PE-sheeting with helical ribs as a countermeasure for rain/wind induced vibrations.