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Autor: Fuzier, J.P. / Stubler, J. / Grattepanche, D.
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The Øresund Stay Cables: Design for Fatigue Resistance and Easy Maintenance

J.P. FUZIER

Scientific Director
Freyssinet International
Vélizy, France

J. STUBLER

Technical Director
Freyssinet International
Vélizy, France

D. GRATTEPANCHE

Øresund Site Engineer
Freyssinet International
Vélizy, France

Abstract

The 16 km Øresund fixed link across the shallow channel between Denmark and Sweden includes a 7-8 km long bridge. The double-deck cable-stayed bridge with its 490 m main span appears to be the masterpiece of this viaduct.

1. Technology description

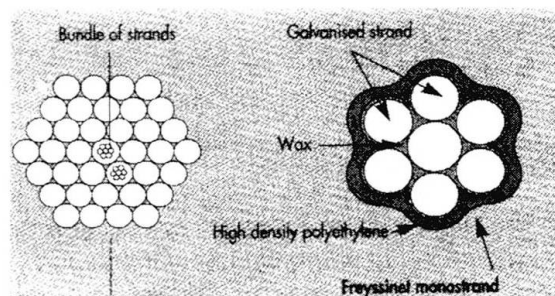
The cables supplied and installed on the Øresund bridge meet following requirements :

- high fatigue resistance, high stiffness and mechanical strength
- excellent corrosion protection, simplicity of installation
- easy maintenance and replacement without any traffic disruption.

The stay cable system consists of parallel individually protected seven wire strands with wedge anchorages and additional corrosion protection system consisting of an outer HDPE pipe. The stay cable design is such that the replacement of any cable can be done, if required, strand by strand, in order to reduce to a minimum any traffic disruption. The anchorages are filled with wax.

The strands are individually protected as follows :

- hot dip galvanization before wire drawing ;
- extrusion around the strand of a high density polyethylene sheath (i.e. 1.5 mm thick minimum) after coating the wires with wax.



The Freyssinet monostrand

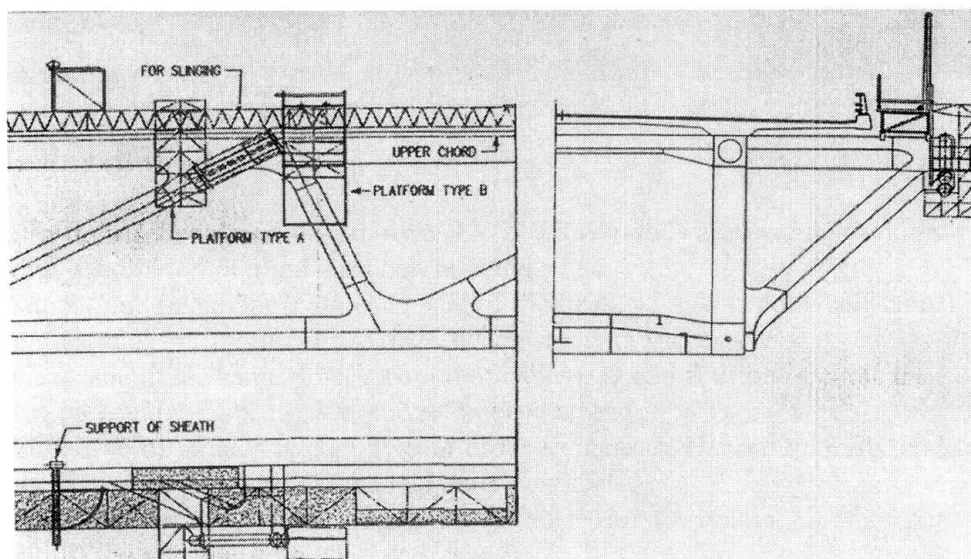
The streamlined sheaths covering the stays expose to the wind a cylindrical surface covered with two criss-crossed helical ribs in order to limit the rain and wind vibrations. In addition provisions have been taken to install, at a later stage if required, visco-elastic internal dampers.



2. Cable installation

Because of a tight schedule requesting that 2 x 73 HD15 stays are installed on a 6 days cycle, the following installation method has been selected :

- supply and installation, on each side of the deck, of a 40 m long self launching access platform. This platform provides access to two successive stay cables allowing to carry out, at the same time, erection of cable n+1 and finition of cable n ;
- lifting of HDPE sheath with the referenced strand ;
- threading of strands two by two in order to increase the productivity and to reduce the risk of delay in case of bad weather conditions ;
- the strand uncoilers are equipped with an hydraulic braking system permitting to adjust the tension of the threaded strand ;
- stressing strand by strand thanks to the patented Isotension system. A computer software allows the installator to provide a complete history of the cables.



Self launching access platform

2.1 Corrosion protection

The strands in the free zone are galvanized, waxed with Injectelf and individually protected with an HDPE sheath. The top anchorage is injected with petroleum Injectelf wax. The bottom anchorages use the same dehumidification system already set up for the internal corrosion protection of the steel truss.