

**Tunneling****Reference Details:****Owner**

Øresundkonsortient +++

Engineer and

Contractor Øresund Tunnel Contractor I/S, Denmark +++

Consultant Symonds

Travers Morgan +++

Drilling Amec Piling

DSI Services Supply of 2350 double corrosion protected DYWIDAG permanent single bar anchors. Delivery from DSI United Kingdom Supply and installation of 2000 t DYWIDAG multistrand tendons type 19-0.62".



Øresund Link, Copenhagen, Denmark and Malmö, Sweden 16 km of concrete and steel the millennium link between Sweden and Denmark made possible with DYWIDAG technology

Largest prefabricated concrete tunnel

The Øresund Link, the project connecting Copenhagen, Denmark and Malmö, Sweden, was completed at an impressive pace. The bridge which was under construction from the Swedish coast, was soon far out in the straits. The tunnel, built from the Danish coast in Copenhagen, was equally well advanced.

The tunnel was built by Øresund Tunnel Contractors, a Joint Venture of five large companies from Sweden, Denmark, France, Great Britain and the Netherlands.

The total length of the Øresund Link is 16 km. The 4 km long tunnel under the Drogden Channel in the Øresund strait is the longest immersed tunnel in the world.

The tunnel carries 2 roadways, 2 railways and one service route. The 20 prefabricated concrete elements are being built in a casting yard in Copenhagen harbour under ideal conditions. Each element is 176m long, 42m wide, and 9m tall with a total weight of 55,000 t. The elements were constructed using an incremental launching method where each element was cast in 8 sections and pushed out of the factory on teflon bearings with the help of hydraulic jacks. Outside the factory building the sections were stressed for continuity using the DYWIDAG multistrand system 19-0.62". A total of 24 tendons per element provide sufficient stiffness during transport and handling. After mounting temporary watertight bulkheads in the opening, the dock was flooded, and the tunnel elements were tugged out to their final location.

The elements were carefully positioned and lowered down to a prepared gravel bed in an excavated trench on the sea bottom. The elements were connected under water and the temporary bulkheads were removed. The installation work progressed parallel to the construction of a stone carpet for protection of the tunnel against collision with ships.

The two tunnel portals link the Copenhagen airport with a new artificial island known as the "Pepperholm" south of Saltholm Island.

Approach ramps to the Øresund Link

The Øresund Link includes an immersed tube tunnel with approach ramps at either end. The reinforced concrete ground slab consists of several reinforced U-box structures carrying the motorway and railway construction.

Vertical ground anchors were required on the project to hold down the water tight reinforced U-formed concrete slabs which are subjected to varying uplift pressures as the tide rises and falls.

Recognizing the extreme marine conditions under which the anchors would work, the designer demanded a ground anchor system with comprehensive corrosion protection to give a service life of 100 years.

DYWIDAG permanent single bar anchors were selected to satisfy these high demands.

2,350 DYWIDAG single bar anchors Ø 36 mm St 1080/1230 up to 17m long were assembled in once piece, shop pregouted by DSI United Kingdom at Southam, England. The anchors were shipped to site on extended flat bed trailers over a 10 month period from October 1997 to July 1998.

The ultimate THREADBAR[®] strength of 1232 kN exceeded the service load with a safety factor of 2 meeting the British Standard BS 8081.

The Øresund project was successfully completed in 2000.

www.dywidag-systems.com