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The Warnow Tunnel

Client: Bouygues Travaux Publics S.A.
Location: Rostock, Germany
Period: 2000-2002

Introduction

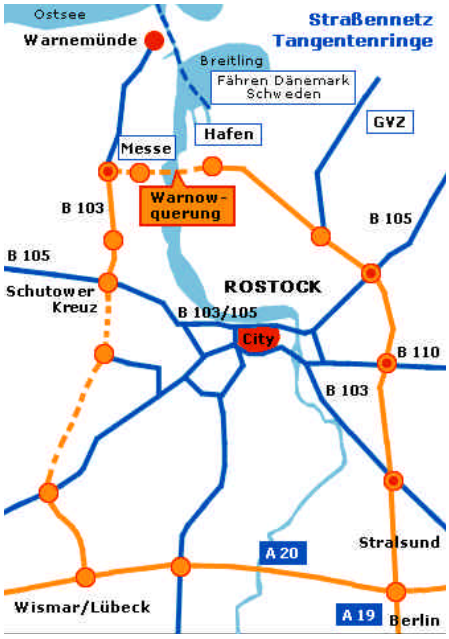
The Warnow Tunnel is located in Rostock, Germany, at the old mouth of the river Warnow in the Baltic Sea. In the DDR period this area grew out to bethe main harbour of East-Germany. After the "turn" (die Wende) in 1989 theport more or less died. Goods came cheaper and quicker from Rotterdam, Bremen and Hamburg by rail.

A new industry developed and now it is avery busy Ferry Terminal. Since the early 90's traffic-jams in the city of Rostock (B105 - B103) caused disturbance of the development of the cityand outer region.
The solution to this problem was found inbuilding a motorway ring road aroundRostock, formed by A19 Berlin-Rostock-Hafen and the A20 L¿beck-Stralsund. For this, the ring road had to cross the riverWarnow at the north of Rostock. Out of several possibilities for crossing the Warnow, the Immersed Tunnel alternative was selected.

The Tunnel Design And Works

The tunnel cross section comprises two parallel 2-lane motorways, with a total width of 23.1 metres. and a height of 8.3 metres. Longitudinal, the tunnel consists of 6 elements of each 120 metres. Boskalis was involved in the engineering and execution of the Marine Works:

- Dredging works;
- Immersion of the elements;
- Installation of the foundation bed;
- Backfilling and rock protection;
- Hydrograpic and immersion surveys.



The Project Realisation

The project was realised as a Design, Construct, Finance and Operate Contract. The main contractor (Bouygues TravauxPublics S.A.) subcontracted Boskalis for the dredging, backfilling and rock protection. The immersion of the elements and the installation of the foundation bed was carried out by the Joint Venture Volker Stevin and Boskalis.

Dredging Works

The dredging works were carried out with a Backhoe Dredger and a Bucket Dredger. A 400 metres float-out channel has been dredged to connect the building dock to the deepest part of the river. The trench was dredged to a maximum depth of 22 metres, with dredging tolerances of +/- 20 cm. A total amount of 700,000 m3 has been removed.

Immersion of the elements

In the dry-dock only two elements at the same time could be built. The first four elements were moored at temporary storage areas. Six weeks before completion of element number 5 and 6,the immersion of element 1 commenced. First, the water tanks were partly filled and the element was lowered and placed on temporary supports. After immersion a sand foundation bed was placed and final ballasting of the element took place. The six elements were immersed in the prepared trench within a period of nine weeks.

Installation of the foundation bed

After immersion each element was underfilled with sand. Approximately 5,000 m3sand has beenpumped from the shore to the underfillpontoon and from there through pipes to the element. The pressure of the sandwater mixture was controlled accurately toprevent uplift of the element. Within 48 hours each element was underfilled.

After immersion and placing the foundation, the tunnel trench was backfilled. 400,000 m3 sea sand was necessary to cover the tunnel. The TSHD 'Coastway' dredged the sand 20 km offshore, then sailed to the tunnel location, connected to a floating pipeline, which was connected to a spreader pontoon. The sand was built up carefully in layers of 2 metres at both sides of the tunnel. After the backfill operation the roof of the tunnel in the shipping channel was protected with a filter layer and a layer of armour stone.

During dredging several hydrographic surveys were carried out. The trench was dredged with a tolerance of +/- 20 cm. Before immersion of the tunnel elements, two towers were installed on top of each element. One tower consisted of a pipe with a diameter of 1.2 metre, which was used as a temporary element entrance shaft. Tower two was used for survey purposes only. By determining the position of three points(one point on tower one, two points ontower two) above the water, the position of the entire tunnel element under water could be calculated. At the Warnow tunnel project the GPS/RTK system was used for positioning of the tunnel elements.