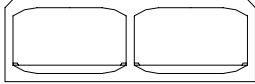


TUNNEL NAME/LOCATION/DATE COMPLETED: Limfjord Tunnel; Aalborg, Denmark; 1969		T.35 - Limfjord	
			
TUNNEL TYPE AND USE: Reinforced concrete box elements; Vehicular tunnel		LANES/TRACKS: Two tubes; three lanes each	
NO OF ELEMENTS: 5	LENGTH: 102 m	HEIGHT: 8.54 m	WIDTH: 27.4 m
TOTAL IMMERSED LENGTH: 510 m		DEPTH AT BOTTOM OF STRUCTURE: 20.8 m	
UNUSUAL FEATURES:	Surcharged sandfill replacing existing soil was used to support immersed tunnel. Tension piles were used to support and hold down open approach and cut-and-cover sections of tunnel		
FABRICATION METHOD: Cast in a casting basin excavated for the purpose, about 10 km from the tunnel site. Elements were cast in 12.8 m long sections - first the bottom; then the walls; and, last, the roof. The sections were separated by a 1.8 m gap into which rebars protruded. These gaps were filled after concrete shrinkage had taken place	OUTFITTING: Elements were outfitted at a pier after floating with temporary steel foundation blocks at the free end, two alignment towers and two sets of sinking rigs, each consisting of two 150 ton pontoons connected by steel girders	JOINT TYPE: Gina type. Special gasketed end closure plates allowed connection to submerged face of cast-in-place northern tunnel. Immersed tunnel is monolithic, with a contraction joint between it and the cast-in-place northern tunnel and a combined expansion contraction joint between it and the north portal building. The joints are made watertight with rubber gaskets.	
WATERPROOFING METHOD:	The elements are waterproofed with a 2 mm butyl membrane, protected on the bottom by a 9 cm layer of reinforced concrete and on the top by a 20 cm layer of reinforced concrete, and glued to the bottom protection and to the walls and roof of the tunnel by a PVC cement slurry.		
PLACEMENT METHOD:	Four straddling placement barges were used. Horizontal alignment was accomplished by lines connected at the top of the element		
FOUNDATION METHOD: Sandjetting	DREDGING METHOD: Dredging was taken down to -31 m and backfilled to grade with clean sand because of soft mud layers in the river bed. The sand was surcharged with additional sand to a load equal to the tunnel weight to cause early settlement to take place. The sand was removed shortly before placing the elements.		
VENTILATION TYPE: Longitudinal; jet fans	COVER AND TYPE: No cover provided. 20 cm of reinforced concrete is the only protection to the waterproofing layer.		
ADDITIONAL INFORMATION: The tunnel is designed to be unmanned, with automatic ventilation and lighting controls, and automatic and remote control used for traffic control. Aluminium sunscreens are used at the approaches. An acoustic suspended ceiling is provided. OWNER: Ministry of Public Works DESIGNER: Christiani & Nielsen A/S CONTRACTOR: The tunnel elements by NYBYG; approaches by Monberg & Thorsen A/S; Christiani & Nielsen A/S carried out the installation of the elements, including sandjetting.			