Zeitschrift: IABSE structures = Constructions AIPC = IVBH Bauwerke

Band: 6 (1982)

Heft: C-21: Recent structures

Artikel: Vejlefjord Bridge (Denmark)

Autor: Dejgaard, O.

DOI: https://doi.org/10.5169/seals-17588

9. Vejlefjord Bridge (Denmark).

Owner:	*The Danish Road Directorate*
Design and supervision:	*Cowiconsult, Consulting Engineers and Planners AS, Copenhagen*
Aesthetics:	*P. Hvidt & O. Mølgaard Nielsen, Architects M.A.A., Copenhagen*
Contractors:	*Consortium of:* *– Monberg & Thorsen A/S, Copenhagen* *– A. Jespersen & Son A/S, Copenhagen* *– Dyckerhoff & Widmann AG, Hamburg, Germany.*
Works duration:	*58 months*
Opened to traffic:	*1980*

Main quantities of material

Reinforced concrete (excl. piles):	67,000 m³
Mild steel reinforcement:	7,000 t
Prestressing steel:	1,800 t
Total length of driven RC piles:	44,000 m
Total length of bored piles:	900 m

Introduction

The Vejlefjord bridge forms part of the motorway E4 through Jutland, Denmark. The E4 will lead the major traffic around the larger towns along the Jutland East Coast, among these the town of Vejle.

The Vejlefjord bridge carries the four-lane motorway across the fjord 45 m above water level. The bridge is 1710 m long and has an effective width of 26.6 m. The span lengths are 68 + 14 x 110 + 69 + 33 m.

In the bridge design considerable attention has been given to fit the bridge structure into the very delicate landscape along the fjord.

Substructure

In the fjord the water depth is small, generally 2.5-3.5 m. The fjord piers have been founded on RC piles driven through 8-12 m of mud into the deeper layers of post-glacial deposits of sand and gravel or further down into firm and homogeneous moraine clay. Pile lengths thus vary from 18 to 38 m.

All the piles used for the fjord section of the bridge are hexagonal RC piles with a cross section of 2,000 cm². The piles have an ultimate load capacity per pile of min. 385 t. Under each pier footing 125-135 piles have been driven as one in four raker piles.

On the southern side of the fjord the approx. 55 m high slope is built up of tertiary layers of micaceous fine sand interbedded by overconsolidated mica clay and topped by glacial boulder clay. For reasons of stability, pile driving had to be avoided here, and the foundation on this shore has, therefore, been carried out on bored piles, with lengths of 22-30 m and diameter 150 cm. Testloading of 3 bored piles has been performed demonstrating an ultimate load capacity per pile of approx. 1600 ton.

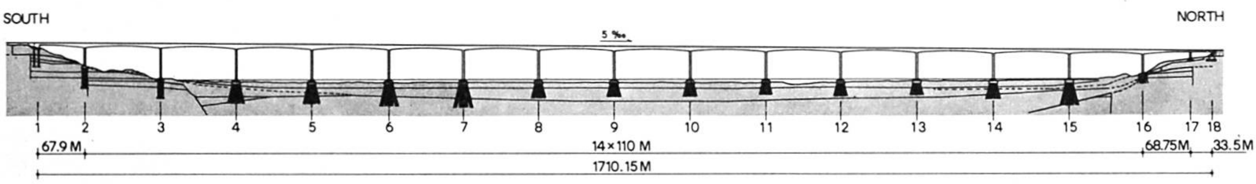
The pier foundations have all been carried out in dry pits. In the fjord an open movable steel casing was applied in combination with under water concreting of a 1.50 m thick plug.

The pier footings, each comprising approx. 1200 m³ of concrete, were cast continuously, a blast-furnace cement being used for reasons of heat developing characteristics.

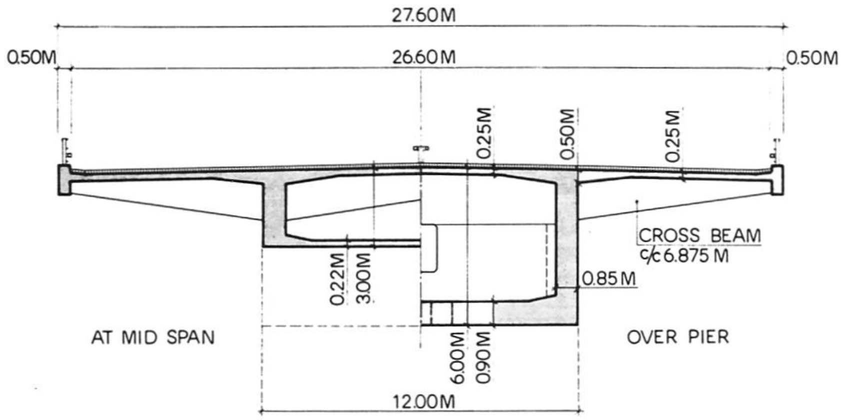
The bridge piers were designed as hollow rectangular columns 12.0 x 2.6 m with a central partition wall. Piers were cast in slip form to a max. pier height of 44 m.

Superstructure

The superstructure is a prestressed structure cast in-situ by cantilevering successively from the piers towards the middle of the neighbouring spans. The superstructure is divided into 4 dilatation sections of approx. 400 m length, the expansion joints being placed at end piers and in centre of spans, where also shear locks are provided.



Elevation



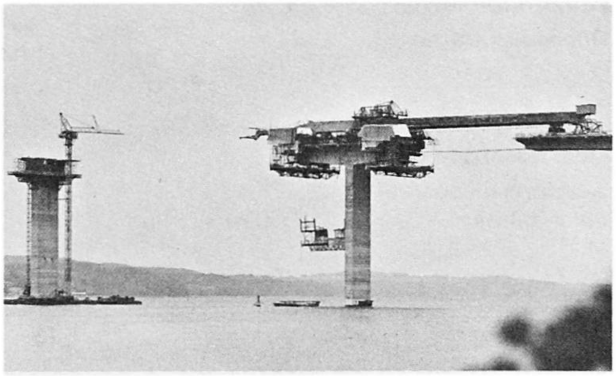
Cross section over pier and at midspan

Prestressing of the cross beams was done by Dywidag bars Ø 36 mm. For longitudinal prestressing Dywidag's 12 strand Ø 0.6" system was used, consisting of 1) cantilever cables, 2) continuity cables for prestressing the deck slab over a full span length, and 3) continuity cables for the bottom slab at centre of bridge spans. For the concrete a 35 MPa strength was specified.

For the cantilevering operations two launching steel girders of 105 m length were used, working from either end of the bridge. The girder had the functions of 1) stabilizing the structure during construction, 2) transportation of materials and equipment to the working site, and 3) rendering access for the working crew.

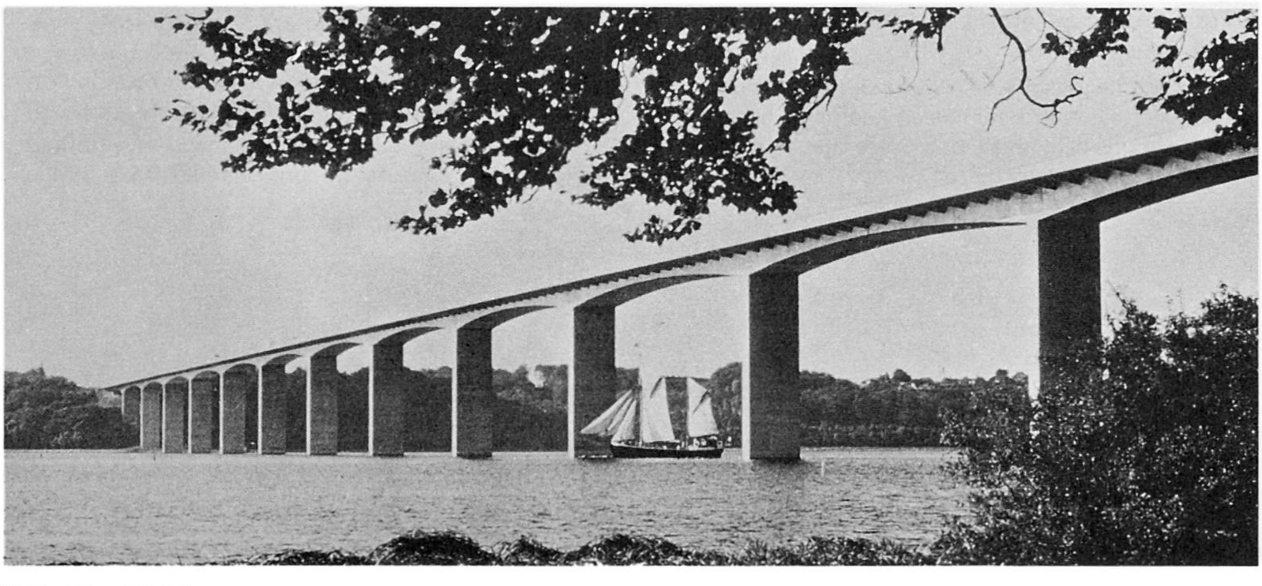
The superstructure was cast in segments of 3.44 m in the full width of the bridge. The total time spent in casting two alternate segments was 4-5 days.

Tensioning of cables and removal of form was carried out approx. 30 hours after casting. In order to counteract adverse effects from excessive temperature gradients, a special insulation carriage was introduced to cover 1½ segments of the newly cast concrete behind the casting forms.



105 m launching steel girders were used for the cantilevering operation

(O. Dejgaard)



Vejle Fjord Bridge