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Artikel: The Norrströmmen Bridge, Nauvo (Finland)

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1. The Norrströmmen Bridge, Nauvo (Finland)

Owner:	*Finnish Roads and Waterways Administration (RWA)*
Construction designer:	*Y-S Engineering*
Contractor:	*Lemminkäinen Ltd.*
Works' duration:	*19 months*
Commissioning year:	*1986*
Span dimensions:	*30.0 + 80.0 + 135.0 + 65.0 = 310.0 m*
Effective width:	*8.5 m*
Structural height:	*at support 7600 mm, at midspan 3092 mm*

Material quantities

concrete, substructures	831 m^3
concrete, superstructure	2400 m^3
reinforcement, substructures	112000 kg
reinforcement, superstructure	300000 kg
prestressing steel	89700 kg

The Norrströmmen bridge is located in south-western Finland, in the Archipelago of Turku. Together with another, smaller bridge, this bridge replaces two public road ferries. The total costs of the road replacing the ferries amounted to FIM 24 million, of which the share of the Norrströmmen bridge was FIM 11 million. The mere operating costs of the withdrawn ferries were FIM 2 million annually, i.e. the project was a very profitable one economically. In the design of the bridge, it has been attempted to protect the sensitive landscape of the archipelago by making the bridge so long that it crosses the entire water area as fluently and flowingly as possible.

The bridge is for its main parts built according to the balanced cantilever method, starting from the two intermediate supports. Of these intermediate supports, one is rigidly attached to the bridge deck. The other one is provided with bearings. During the cantilever works, it was temporarily rigidly attached to the bridge deck by means of a reinforced concrete collar. Before the bridge deck was joined in the middle of the bridge, the concrete collar was sawn off. The 40 meters long part of the bridge running on dry land was built in a conventional way, with scaffolding supported onto ground.

At the end of the cantilever stage, a light auxiliary support of steel construction was used under the cantilever on the land side, to decrease the unbalance moment affecting the column. The auxiliary support was always released after the symmetrical piece had been cast.

During the works, the cantilevers' deflections developed according to the plan prepared in advance, and no changes were required in the plan.

The prestressing steels of the cantilever stage were anchored at the joints of the deck flange and the web. The prestressing steels of the lower flange were anchored to bosses near the web. The webs have not been pretensioned. The web's shear stress by full effective load is 3.0 MPa and the maximum principal tensile stress is 1.2 MPa.

The first one of the bridge's two cantilever sections was built during summer. The other one had to be built in winter. The project schedule required for the deck casting to progress by two pieces a week, which meant that the concrete had to cure to the 28 MPa strength required by prestressing in 3 days. In order to achieve this rate also at a temperature of up to −20°C, a heat-insulated envelope was built around the cantilever formworks. The envelope was needed to protect the workers as well, in the severe winter conditions. The prestressing steels stressed in winter were not grouted till in the summer, after the outdoor temperature had permanently risen to over +5°C. The steels were then temporarily protected against corrosion with a water-soluble protective agent.

Due to difficult communications, it did not pay to bring the concrete to the construction site from a permanent concrete station, but a separate concrete station including laboratories was established at the site for the duration of the works. The fresh water required in the production of the concrete was obtained from ground water. For this purpose wells had to be drilled into the bedrock on both shores.

(Jouni Nieminen, Juhani Karri)

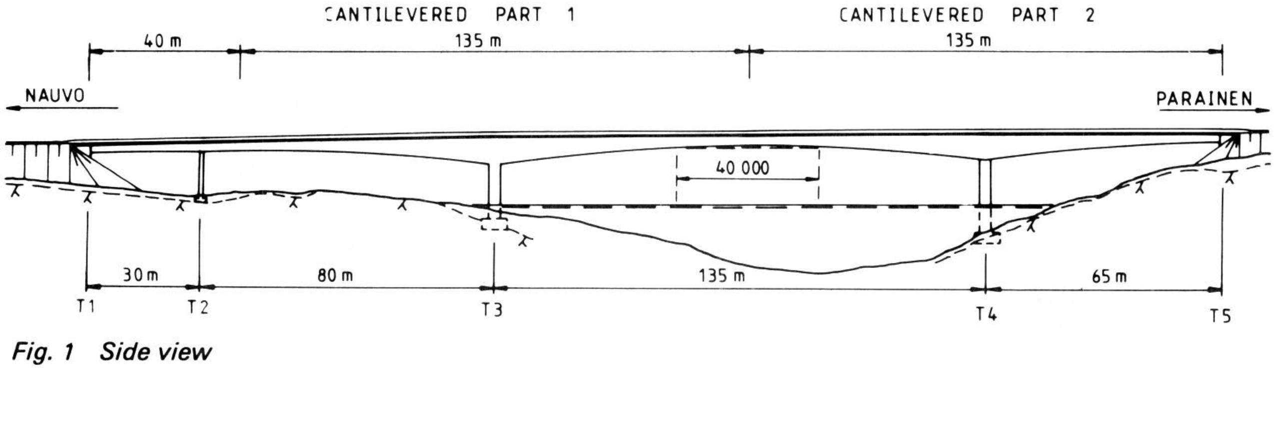

Fig. 1 Side view

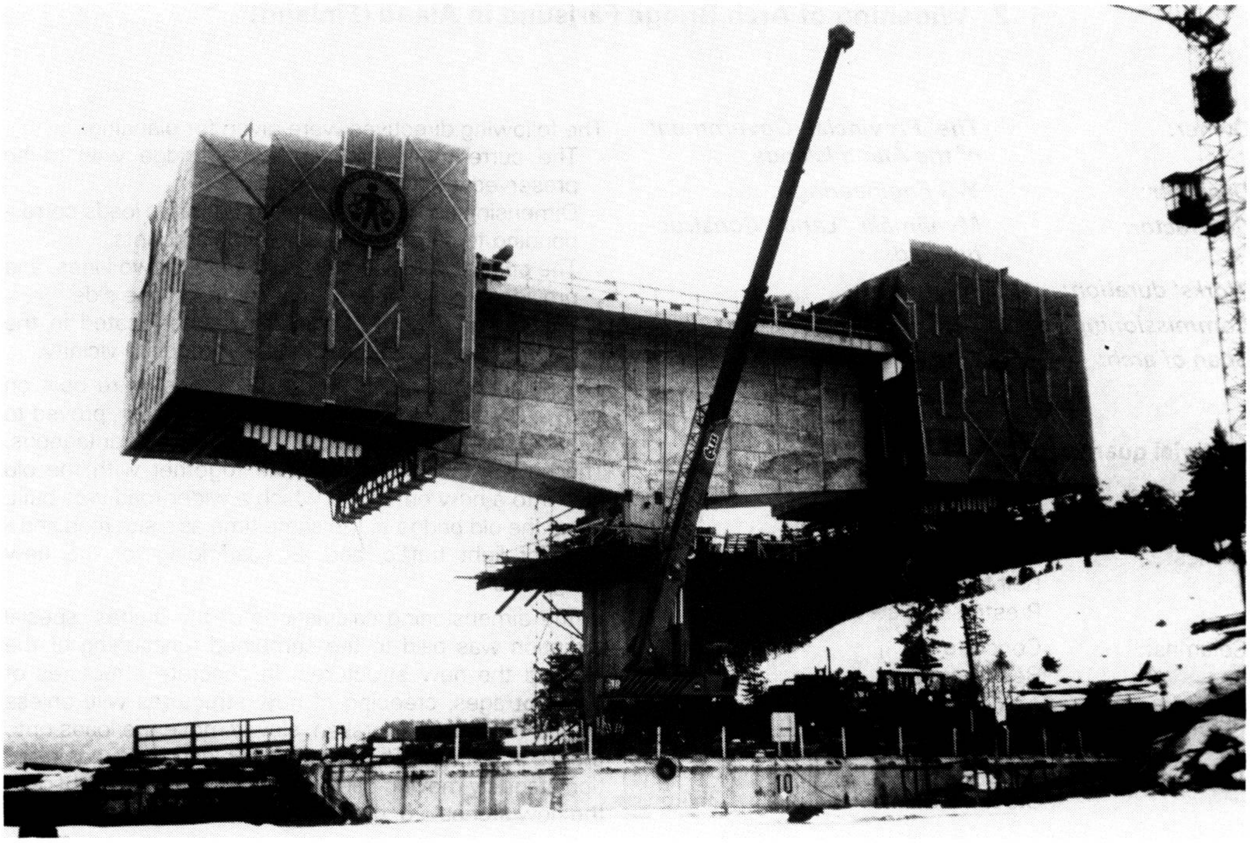

Fig. 2 Cantilever formworks with heat insulation

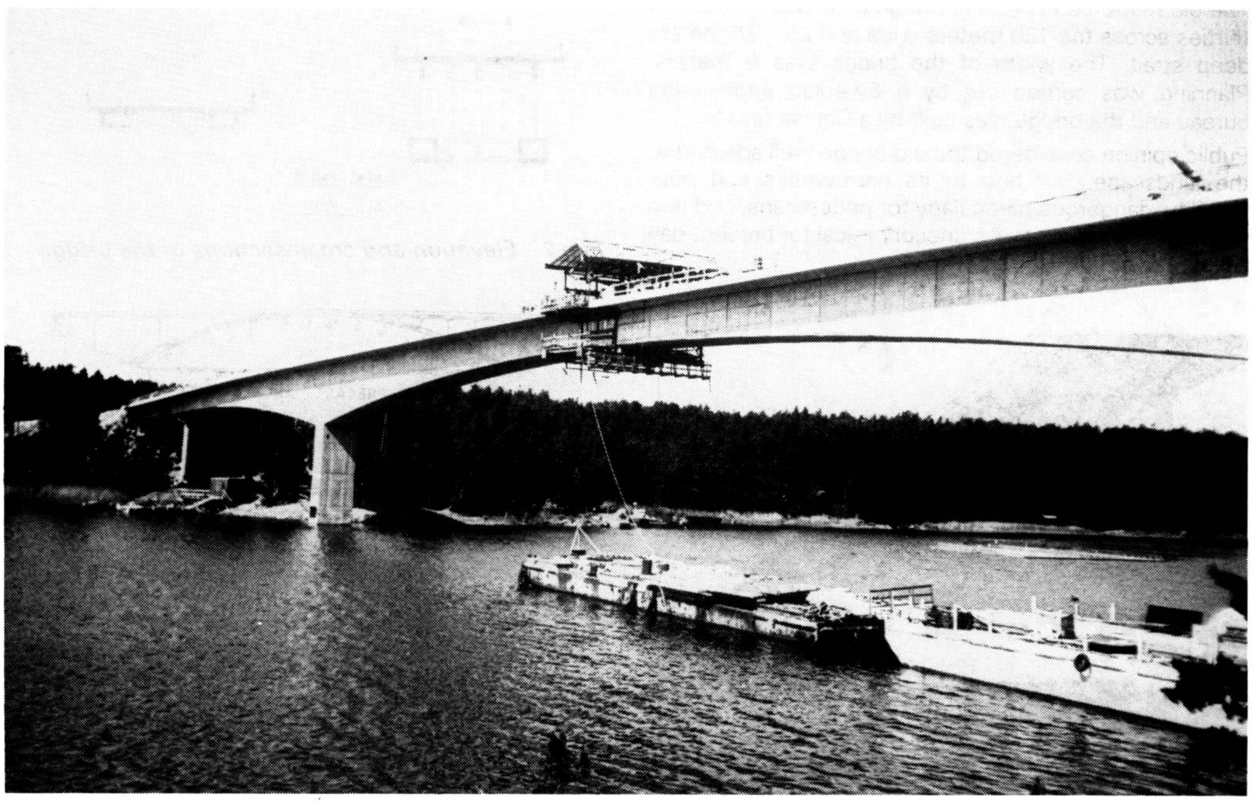

Fig. 3 The keying segment ready to be concreted in the middle of the bridge