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4. Kaitavesi Bridge, Tampere (Finland)

Owner:	*Finnish Roads and Waterways Administration (RWA)*
Design:	*RWA and Insinööritoimisto Pontek Ky*
Contractor:	*Perusyhtymä Oy*
Construction Work Duration:	*10.5 months*
Completion:	*1983*

Aunessilta bridge, constructed in 1899, situated 25 km northeast from the center of the town of Tampere, is one of the most beautiful stone vault bridges in Finland. Its span is 19.0 m wide at water level and the clear headway at midspan is 6.0 m from flood level. The bridge is in very good condition, however, it was too narrow for the present traffic. Its horizontal clearance is only 4.6 m, and sight distances at the bridge are too short due to the bulging shape of the upper surface of the bridge.

Since a widening of the bridge would have destroyed its appearance, the plans for this were abandoned. Hence it was decided that a new bridge, the Kaitavesi bridge, would be built at a distance of 110 m from the old bridge. The old bridge was left for the use of light traffic only. It was rehabilitated and declared a historic bridge. About 2 km of new road had to be constructed.

Since the bridge had to harmonize well with the landscape as well as with the old bridge, appearance requirements for the new bridge were high. Of several alternatives a reinforced concrete combined slab and open spandrel arch bridge was chosen. Its total length is 110.8 m and the arch spans 73.5 m. At one end the slab spans are 3 × 14.0 m and 3 × 13 m at the other. At midspan, the slab and arch join, forming a monolithic structure for a distance of 23.4 m. The horizontal clearance is 10.5 m. The rise-span ratio of the arch is only 1:7.3.

The cost of a reinforced concrete box girder bridge spanning 27.0 + 50.0 + 27.0 m, as well as that of a steel composite girder bridge with the same size spans would have been 5% lower. However, the appearance of the arch bridge was considered so much better, that a decision in its favour was made in spite of the slightly higher cost.

A structural model based on a monolithic structure, consisting of the arch, its foundations, spandrel columns and deck slab, was used for the design of the bridge. The influence of uniformly distributed loads was analysed using a plane frame model corresponding to the real structure. The influence of eccentric traffic loads was analysed using a corresponding space frame model.

The abutments as well as the arch are founded on rock. The structural solution of the abutments is dictated by the great variations in the rock surface levels. At one side it was necessary to blast away the deteriorated surface layers of the rock, and even to determine the rock quality below these layers through sample borings. All foundations were concreted in the open air inside earth dams or steel sheet piling.

Construction of the scaffolding was very exacting work. The arch scaffolding was founded on wooden piles. An opening was left in the scaffolding to facilitate waterborne traffic. At this point, the formwork was supported by steel beams. At mid-arch a 93 mm camber was needed due to dead load and creep. Settlement and elastic compressive strain of the scaffolding as well as deflection of the steel beams were also taken into account.

At the arch springings 4.0 m long stripes were left to be concreted during the last work phase. This was done in order to minimize the secondary stresses in the arch, the influence of shrinkage and of the settlement of the scaffolding.

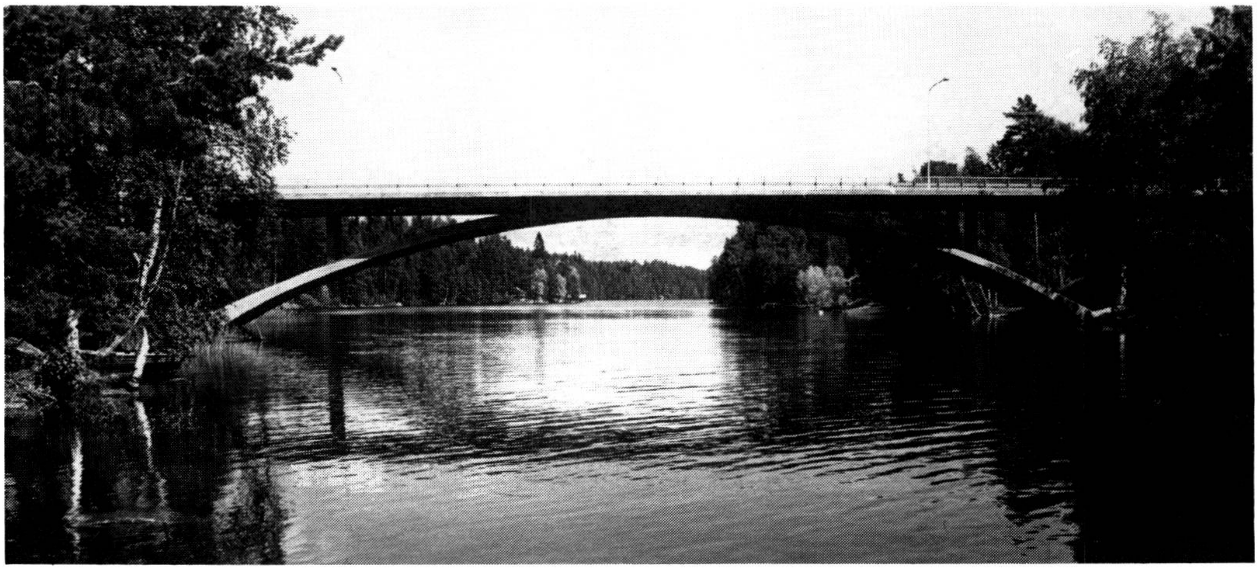

Fig. 1 Kaitavesi bridge

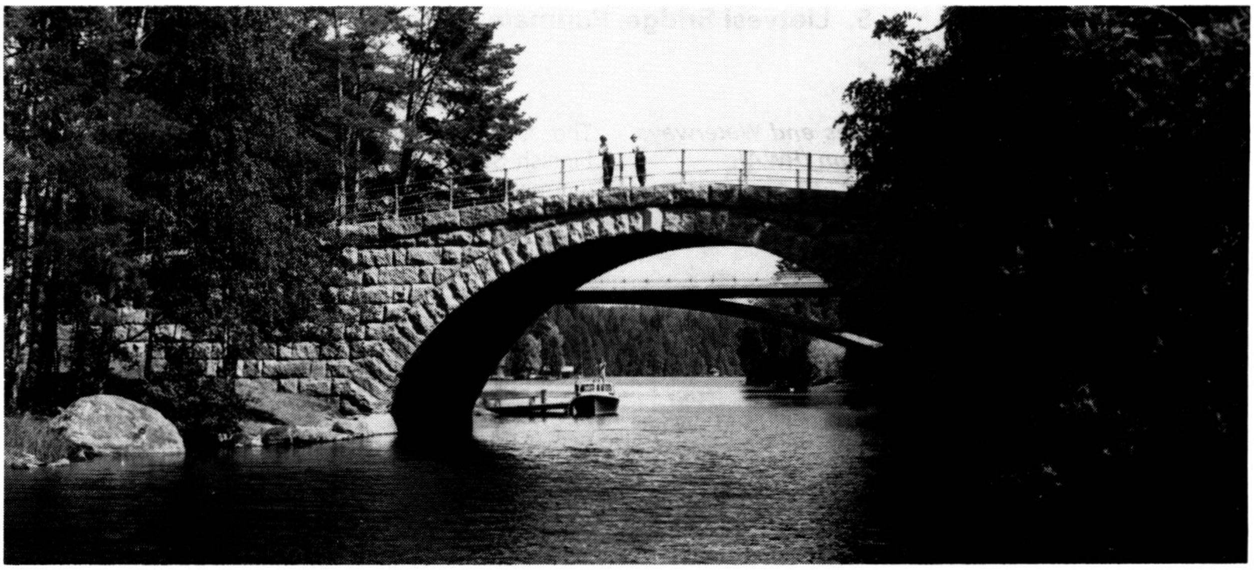

Fig. 2 The old Aunessilta bridge. Kaitavesi bridge is in the background

The construction schedule was wery tight: the work was started at the beginning of 1983, and the bridge was opened in November 1983. For the construction work 1800 m^3 of concrete and 200000 kg of reinforcing steel were used.

Much attention was paid to giving the environment a good finishing touch. The old Aunessilta bridge was rehabilitated into its original shape. Lots of seeded grass and planted bushes were used for slope and slope cone revetments. The areas next to the bridges and the adjacent picnic site were landscaped, however, utilizing and retaining the original nature of the place.

(O. Karola)