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## 7. Kellosalmi Self-Service Bascule Bridge, Padasjoki (Finland)

**Owner:** Finnish Roads and Waterways Administration (RWA)  
**Contractor:** Insinööritoimisto Syväraakenne Oy  
**Consulting Engineers:** Insinööritoimisto Pontek Ky  
**Construction Work**  
**Duration:** 11 months  
**Completion:** 1987

Kellosalmi Bridge is one of three movable bridges, for which opening and closing are controlled by an automatically operated system. Operation of the system is started by the seafarer. The bridge does not need any operating personnel. Service as well as operating failures are seen to by service personnel trained for this task. Failure alarms are automatically sent to the maintenance firm by a telephone-robot.

The bridge consists of two parts, a movable single-leaf bascule bridge and a two-span fixed bridge. The fixed part is a composite girder bridge with a reinforced concrete deck. Its spans are 24 m + 18 m. The leaf spans 12.0 m. The horizontal navigation clearance is 8.6 m, and the clear headway 3.5 m. The horizontal clearance of the bridge itself is 6.5 m.

The leaf is a grid structure formed by two main girders, cross girders at c/c 2 m, and a deck plate with longitudinal stiffeners.

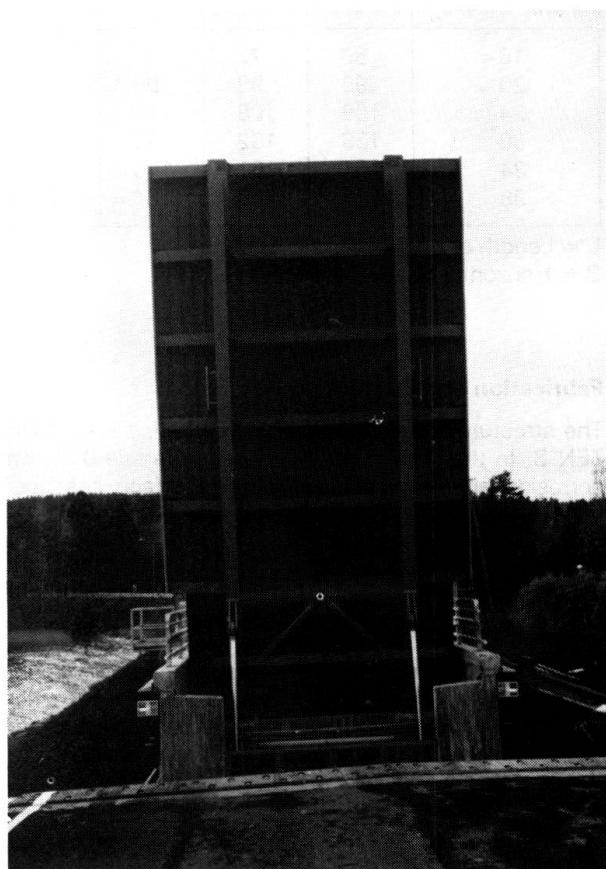


Fig. 2 View of the orthotropic steel deck of the leaf



Fig. 1 Bridge in the «open»-position, view from the channel



Fig. 3 General view of the bridge

The forward end of the leaf rests on an elastomeric pad-bearing and at the abutment end it is supported by two fixed spherical trunnions (steel spherical sliding bearings). In addition to the trunnions, the leaf is, in the opening and closing stage, supported by hydraulic cylinders at each main girder. The cylinders are fixed at a point situated at 1.8 m distance from the trunnion axis. The maximum opening angle is 81 degrees.

A hydraulic drive unit run by an electric motor supplies the operating force for the cylinder. Operations are induced with the aid of electrically controlled directional valves. Additionally, in the system, there are manually operated valves for returning the leaf into the closed position in case of operation disturbances. A hand driven pump is used for this purpose. When in its upper position, the leaf is hydraulically locked. The system is additionally safeguarded so that the leaf cannot fall down due to power failure, tube or pipe failure. When in its «down» position, the leaf is freely supported by its bearings, and the hydraulic drive is not running. During the sailing season, the temperature of the hydraulic oil is kept at or above a minimum of +20°C by a heater equipped with a thermostat.

Six limit switches control the operation of the leaf. One is situated at the front end of the leaf for control of the «closed»-position. The other five are situated on the fixing plate of the abutment. The operation of these is controlled by a control rod moving with the leaf.

Operation control of the bascule bridge, the booms as well as the traffic lights for both road and water-borne traffic is automatic. It may also, if necessary, be manually controlled from a control board situated at the top flight of the stairs leading to the machine room. The sailor induces the request for opening the leaf by using a single push-button or pull-string operating device situated at the far end of the fender. After the opening request all operations are automatic until the leaf has closed again. It is also possible to install a receiver which may be operated by radio signals. The automatic operation of the bridge may in this case be started by signals sent from the vessel approaching the bridge.

Operation schedule:  
free passage for road traffic (basic option)  
road traffic is stopped  
booms close  
bridge opens  
free passage for water-borne traffic  
water-borne traffic is stopped  
bridge closes  
booms open  
free passage for road traffic

The period during which the bridge is open and the lengths of time for the various phases may freely be adjusted to the prevailing need. Experience has shown that a period of 3 minutes for the «open»-position is appropriate, in which case the entire operating cycle takes 8 minutes. It is possible to reopen the bridge at the earliest 5 minutes after the cycle has run.

The experiences gained from three self-service bascule bridges, of which one has been in use for five years, have mainly been good. Only a few operating disturbances have been recorded, and actual accidents have not occurred. The operating costs for this kind of an unattended moveable bridge are low. It is well suited for bridge sites where both the road and the water-borne traffic are small.

(M. Kuusivaara)



Fig. 4 Hydraulic cylinder