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Rehabilitation of Post-Tensioned Bridge Deck

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The bridge was constructed in 1967 and hereafter regular routine inspections were carried out. In 1981 a major examination took place. Larger zones of deteriorated concrete were found in one of the cantilevered flanges, especially in areas near the abutments.

The bridge deck surface has a cross slope of 6% and consequently damage had only taken place in the lower cantilever, and fortunately not in the central part of the girder where the longitudinal main tendons are positioned. This distribution of the damage made repair possible. A full replacement of the superstructure would have resulted in an expenditure of more than 250% of the repair cost and almost total closure of one of the major motorways in Denmark.

The deterioration had started due to a leak in the waterproofing membrane. Unfortunately, the underneath concrete was not resistant against alkaline reactions.

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After removal of the bridge deck pavement and water proofing, the deteriorated areas were surveyed by core drilling.

The deteriorated concrete was removed, however, in such a way that the reinforcement and prestressing tendons were not harmed. In this context it was very important that the transverse prestressing in the cantilevers could be reestablished. The transverse prestressing tendons consist of 12 dia. 5 mm wires. In order to protect these wires, the original sheath and grout were not removed until just before the new sheathing was ready to be installed. As it can be seen from the original transverse tendon arrangement, it was not possible to reuse the existing anchorages.

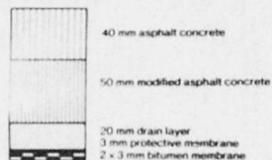
A new system was developed by Skandinavisk Spændbeton. A simple bar anchorage with thread and nut was connected to the wires. The details are shown on the poster. After casting the deck the wires were re-stressed and grouted.

Due to the repair work the longitudinal prestressing forces were lost in the cantilever. Consequently, it was necessary to place some additional ordinary reinforcement in the longitudinal direction, especially at the end of the bridge deck.

REHABILITATION OF POST-TENSIONED BRIDGE DECK

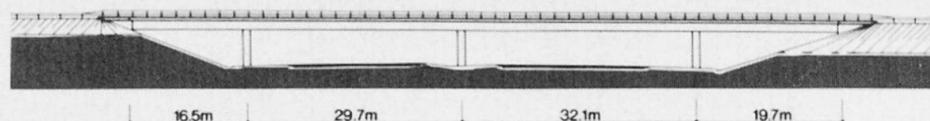
Bridge data

Year of construction: 1967
 Year of repair: 1982
 Post-tensioned concrete superstructure:
 Ultimate cylinder strength, $\sigma_c \geq 45$ MPa
 Longitudinal prestressing:
 12 x 0.5" strands, grade 160/180
 Transverse prestressing:
 12 x 5 mm wires, grade 150/170
 System Freyssinet
 New waterproofing and pavement:

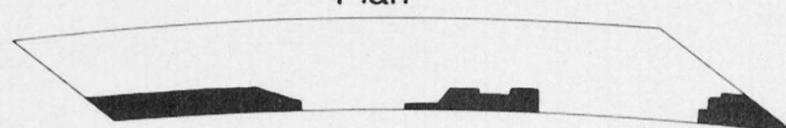


Deteriorated concrete has been removed

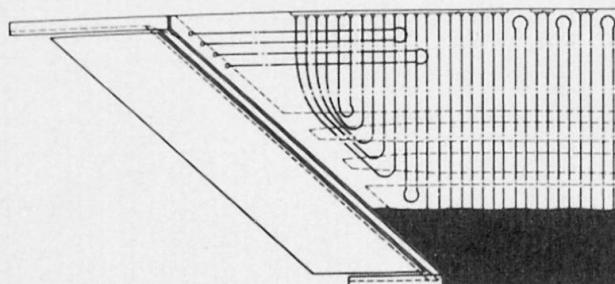
Motorway Bridge, Denmark



Plan

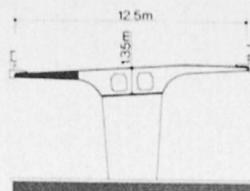


Plan section

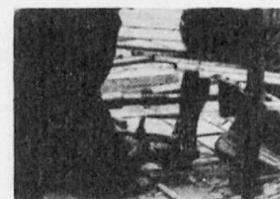


Existing transverse and longitudinal prestressing. The 12 x 5 mm transverse prestressing wires were re-used, but cut off at the edge of the bridge deck.

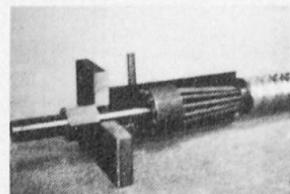
Cross section



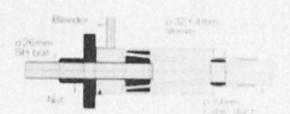
Cantilever section



After cut-off, the 12 x 5 mm bars were prepared for coupling with simple bar anchorages. The 5 mm bars were provided with button heads on site.



Re-established transverse prestressing.



Coupler and anchorage principle. (System developed by Skandinavisk Spædbeton).

Section through coupler and anchorage.