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*Fig. 1 Elevation (Iwaide Bridge)*

## Case 2 Repair by reinforced concrete lining; Natori Bridge, Miyagi

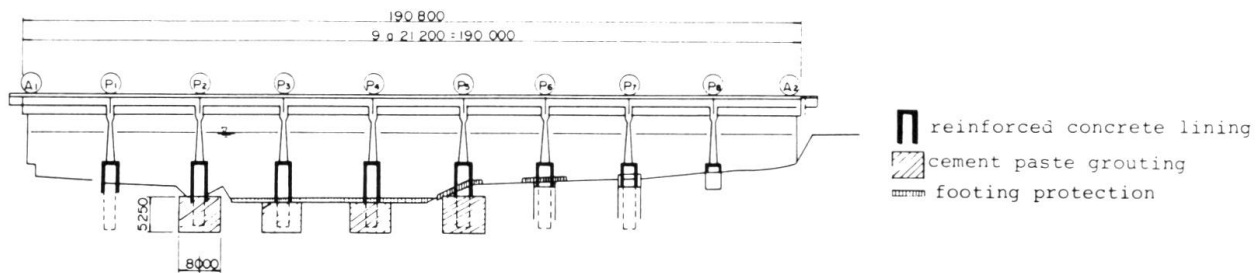


Fig. 4 Location of repair (Natori Bridge)

**Owner:** Ministry of Construction  
**Contractor:** Endo Construction  
**Work's duration:** phase 1: 5 months,  
phase 2: 2 years and 1 month  
**Date of repair:** phase 1: 1974 – 1975  
phase 2: 1981 – 1983

The Natori bridge, completed in 1932, has 190.8 m bridge length and 7.5 m road width (Fig. 4). The superstructure is a 9 span steel plate simple girder. The substructure consists of a rigid frame reinforced concrete pier and caisson.

The substructure on this bridge was repaired due to the following problems:

- 1) Exposed steel reinforcements at top of the caisson.
- 2) Bridge pier endangered of toppling due to scouring at the caisson causing differential settlement and loss of strength in the surrounding foundation.
- 3) The connection between caisson and pier has been deteriorated from shear force.
- 4) Furthermore, due to its old design, its ability to resist today's load has been questioned.

The repair job was carried out in two phases. Phase 1 was the repair job on severely damaged piers and phase 2 was for the remaining piers.

The repair job was carried out by following four methods (Fig. 5, 6 and 7):

- 1) The bridge pier structure was repaired with a reinforced concrete lining added as a seismic protection wall.
- 2) The caisson was reinforced by connecting the top of the caisson with a connecting beam and adding a reinforced concrete lining to its exterior.
- 3) Cement paste grouting of foundations surrounding the caisson.
- 4) To protect the pier from scouring, piers located on the minor footing protections were placed and for piers located on the major bed, sheet piles were placed.

This repair job was carried out under limited clearance below bridge girder and had to be done during the dry season. In view of these conditions, the methods described above were considered to be effective in this repair job. The reinforced concrete lining was economical and the required duration of work was short. The cement paste grout has greatly increased the bearing capacity of the foundation and was also found to be effective in the river bed.

(Norio Morinaga)

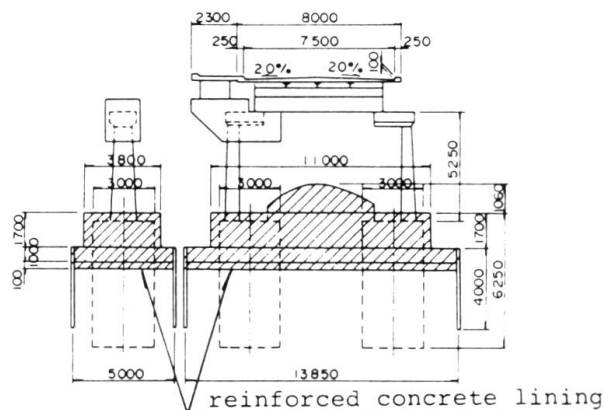


Fig. 5 Repair method (Natori Bridge)

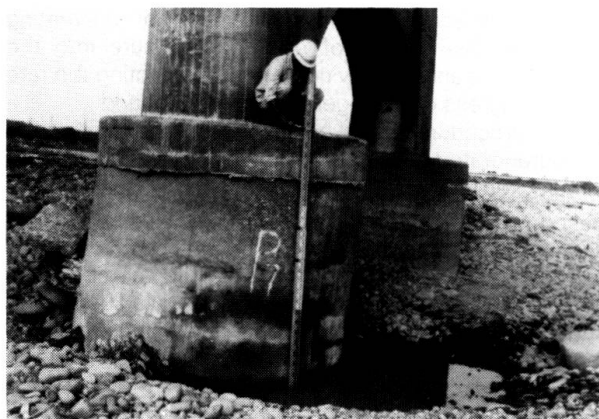


Fig. 6 Before repair (Natori Bridge)



Fig. 7 After repair (Natori Bridge)