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Artikel: Rehabilitation of Girna Bridge (India)

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11. Rehabilitation of Girna Bridge (India)

General Details

Girna Bridge is located near Chalisgaon town in Dhulia District of Maharashtra State on a State Highway. It has been constructed across river Girna by Public Works Department of Government of Maharashtra in the year 1965.

Structural Details

The Bridge is founded on twin well foundation. The wells are of 4.27 metre diameter. The masonry piers of about 9 metre height are supported on wells.

The superstructure of 247 metre length is of Balanced Cantilever type and consists of 3 beam system with reinforced concrete decking on top. The main spans are 27.4 metre length with 6.86 metre long cantilevers on either side. Suspended spans of 13.7 metre length have been provided between cantilever tips.

The main beams are supported on steel rocker and roller bearings on piers and the suspended beams rest on plate bearings at articulation points.

Nature of Distress and causes

The distress mainly was in the superstructure. In the year 1980, it was observed that the concrete in the zone of articulation is substantially damaged (see Fig. 1). The factors contributing to the damages are outlined below:

i) Plate bearings could not function due to jamming and absence of expansion gap.
ii) The main reinforcement in the cantilever portion was found having excessive cover.
iii) Concrete in the articulation zone was not of adequate quality.

In a particular span (No. 6), distress noticed in suspended span at articulation was of higher magnitude. Large chunks of concrete were found separated in the span from the cantilever tips and the suspended span had therefore settled by about 40 mm. In most of the articulation tips, wide cracks had developed.

Fig. 1 Distress at articulation

It was observed that the distress was slowly increasing. As such, traffic was suspended over the bridge to prevent any untoward happening. The traffic was diverted from the temporary adjoining bridge.

Remedial Measures

Replacement of steel plate bearings by Neoprene Bearings and repairs to damaged concrete portion at the articulation were considered essential. For this purpose, it was necessary to lift the suspended spans and re-concrete the cantilever tips. Lifting of suspended spans was required to be done from the deck level since height of the superstructure was about 15 metres from river bed (see Fig. 2).

Fabricated steel girders were placed in line with reinforced concrete beams over articulation portion. These steel girders were connected to reinforced concrete beams by means of Alloy steel suspenders at two locations. The hydraulic jacks were placed under the projecting portion of steel girders over the cantilever beams. All hydraulic jacks were connected to a common hydraulic circuit.

Lifting of the suspended span could be achieved by pressurizing the hydraulic circuit. It was possible to obtain almost uniform lifting, by controlling the valves on the circuitry. The span was raised by about 40 cms. Specially fabricated light weight platform was suspended from the deck for providing access to the articulation zone. Damaged concrete was removed by using pneumatic tools. Additional reinforcement was welded to the existing reinforcement (see Fig. 3) and re-concreting was done by using epoxy bond layer at the interface of old and new concrete. At this face, subsequently, epoxy was injected through the inlets provided at the time of concreting.

In one span, external prestressing rods were provided to prevent separation of old concrete to new concrete besides other measures.

Neoprene Bearings were placed in position and the span was lowered onto these bearings after the new concrete has attained minimum strength for dead load reaction. The prestressing rods were grouted after 3 months or so, to enable monitoring at articulation during this period. These rods were restressed to make up slight loss of prestress and then grouting was carried out.

All the suspended spans were repaired in the same manner except that external prestressing rods were not considered necessary in remaining spans.

Experience gained

This type of rehabilitation has focussed the attention of the engineers on the need for proper detailing and meticulous execution at articulation of the bridges. This experience will be useful for planning similar structures.

(P. Y. Manjure, M. R. Rohra)

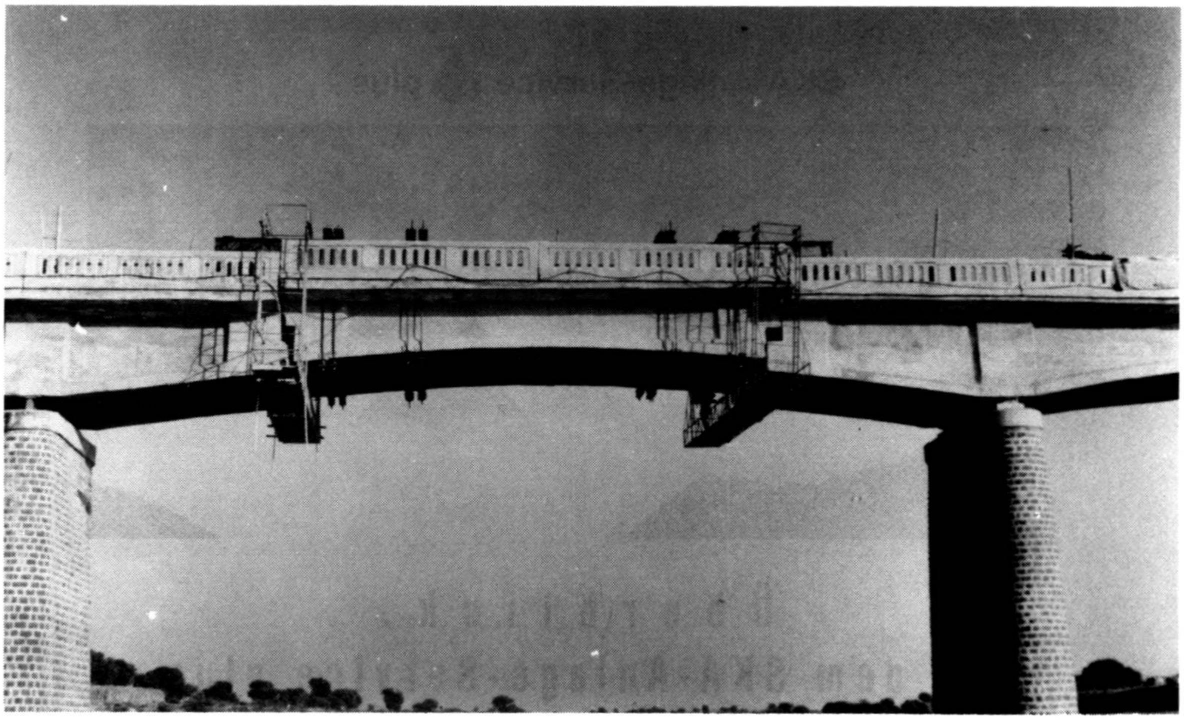

Fig. 2 Lifting arrangement for suspended span

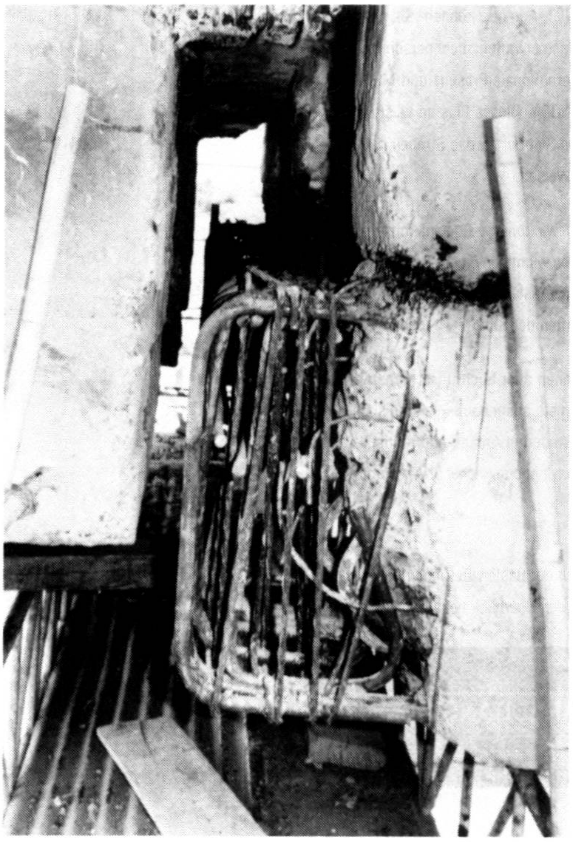

Fig. 3 Cantilever tip is broken and additional reinforcement is provided