Zeitschrift: IABSE congress report = Rapport du congrès AIPC = IVBH Kongressbericht

Band: 14 (1992)

Artikel: Railway bridges constructed by precast segmental construction method

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DOI: https://doi.org/10.5169/seals-853201

Railway Bridges Constructed by Precast Segmental Construction Method

Ponts-rails construits à l'aide de voussoirs préfabriqués

Eisenbahnbrücken aus vorgefertigten Elementen

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1. GENERAL FEATURES

Railway bridges in India have so far been predominantly constructed using structural steel and only over the last decade or so prestressed concrete has come to be used as a construction material for superstructure of railway bridges. For three railway bridges located over marine backwaters near Cochin spread over about 5 Km length, prestressed concrete box girders constructed by precast segmental construction were adopted. The three bridges had 29, 5 and 4 simply supported spans respectively of 30.5 m length. Lack of adequate space and other site constraints restricted any major casting work at or near the site. Hence conventional cast in-situ working or precasting at site or elsewhere and launching the girders were ruled out. A system of precast segmental construction was adopted for these railway bridges for the first time in India.

2. PRECASTING

The girders were precast in seven segments by the match-cast long line system at a centralised precasting yard located about five kilometers from the site. Shear keys were provided on the matching faces. A travelling portal gantry was provided in the yard to handle the segments from casting bed to stacking beds and then on to a launching jetty supported on pipe piles. From there the segments were taken to the different sites on a pontoon towed by a tug. The maximum weight of a segment was about 35 t. Concrete brackets were provided to facilitate lifting of the girder in future to replace the neoprene bearings. Provisions for adding cables in future, if required, have been made.

3. ASSEMBLING

A travelling assembly truss system consisting of two independent rectangular trusses of about one and one-third span length was adopted for assembling the segments. Underslung cross trusses spanning between the main trusses supported the segments. An overhead crab travelling over the top of the main trusses picked up the segments from the pontoon below and placed them on the cross trusses. All segments were thus placed on the assembly truss with gaps in between. After applying an epoxy formulation on the match-cast faces, the segments were pressed together using temporary prestressing to cure the epoxy under pressure. Temporary prestressing was applied using HTS strands on top of deck slab and on soffit slab of the box girder. Thereafter permanent cables were threaded through, stressed and grouted. After assembling one span the

trusses were shifted to the next span, with the front end resting over a trestle mounted pontoon and the rear end resting on a trolley moving over the previously erected span. After completing one bridge the assembly trusses were partially dismantled and taken to the next bridge. Thereafter finishing operations were carried out on the girders.

4. CONCLUSION

The precast segmental construction system proved to be the optimum solution for this site. A maximum speed of one span per week could be achieved with this methodology. The owners of the project are Southern Railways and the contractors, M/s. Bhagheeratha Engineering Ltd. M/s. STUP Consultants Limited provided design and construction consultancy services to the contractor.

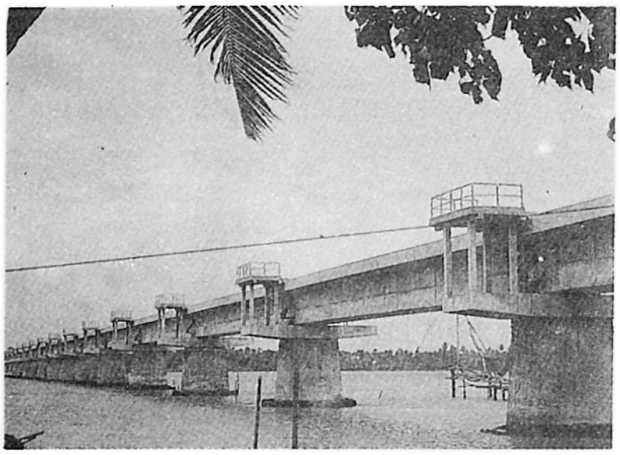

Fig. 1 Bridge at Aroor-Kumbalam

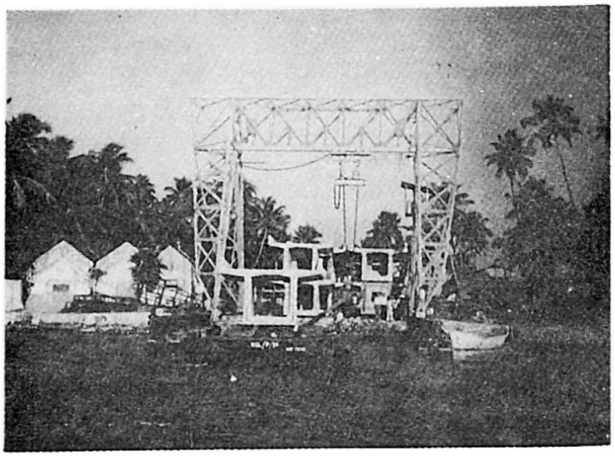

Fig. 2 Casting Yard

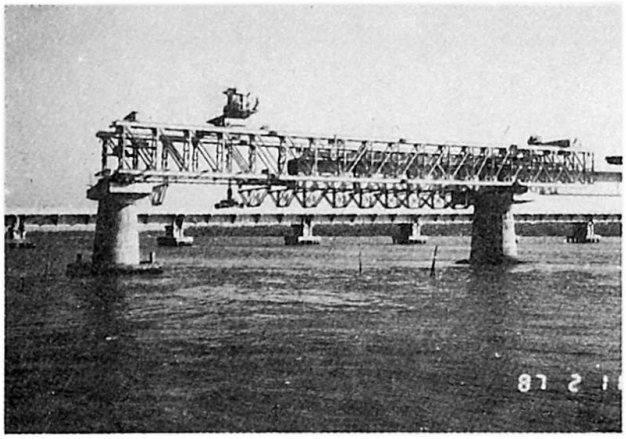

Fig. 3 Assembly of Segment

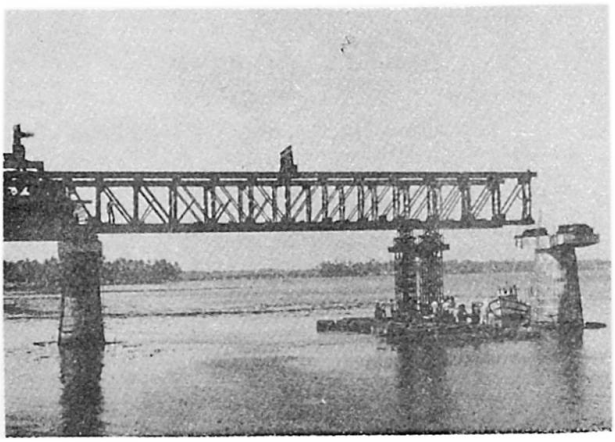

Fig. 4 Movement of Assembly Truss