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Yamuna Cable Stayed Bridge at Allahabad/Naini, India

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Abstract

Most of the major river crossings in India have been designed as haunched concrete box girders constructed by the free cantilevering method, typically with spans of approximately 120m.

A feasibility study carried out for a new bridge across the Yamuna river at Allahabad has revealed that introduction of larger cable stayed spans are more cost effective than the traditional haunched girders. Therefore, a cable stayed bridge with a main span of 260m has been adopted for the deep portion of the river in the final design of the bridge (see figure 1).

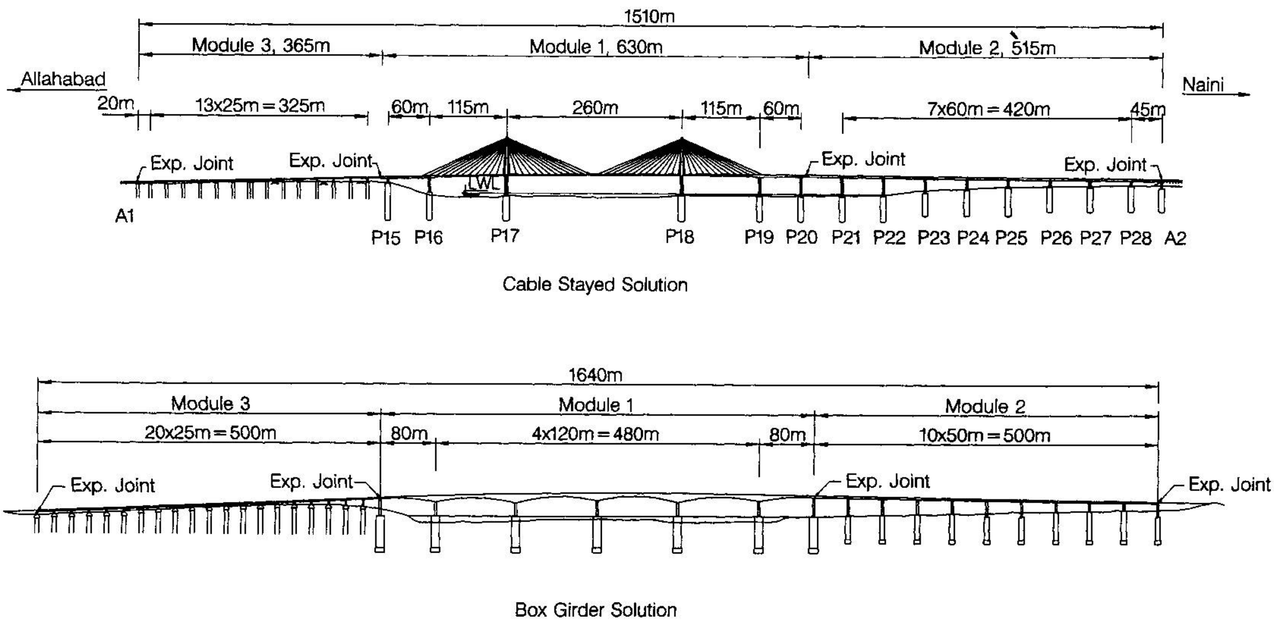

Figure 1. General Arrangement of Cable Stayed Solution and Box Girder solution

Design criteria applicable for the cable stayed bridge superstructure has been developed especially for the present project based on CBE-FIP Model Code 1990, as the Indian Codes are not suitable for design of this type of structure.

However, traffic and wind loads are in accordance with Indian Standards. The basic wind speed (peak gust velocity for 100 years return period averaged over about 3 sec. in 10m height) is 47 m/s. As a special case an accidental crowd loading of 5 kN/m^2 has been considered to act over the entire bridge deck due to religious festivals where millions of pilgrims gather at the confluence of Yamuna and Ganga rivers near the bridge site.

The final design of the bridge is illustrated in figure 2 and 3.

The 26m wide deck has two longitudinal girders and a 250mm thick slab supported per 5m on cross beams post-tensioned from one side by two tendons having 12ø 15.7mm strands.

In the central part of the main span each longitudinal girder has 12 tendons of 19ø 15.7mm strands and in the side span near the anchor pier 10 tendons.

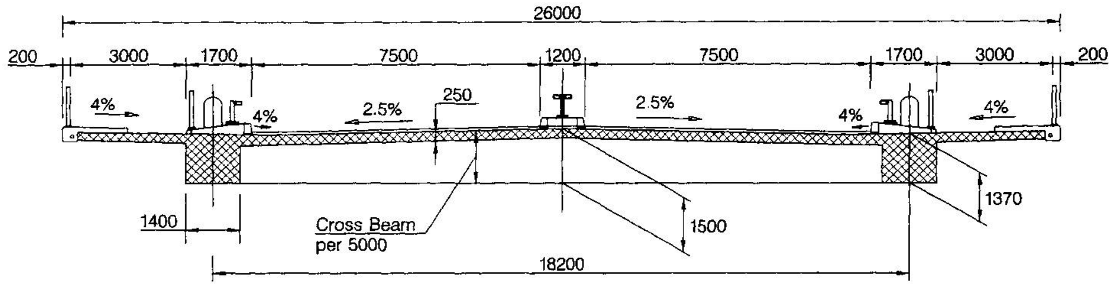

Figure 2. Section Through Cable Stayed Deck

The pylons have slender solid rectangular legs above the deck, while the lower part is hexagonal in shape.

The upper cross beam of the pylon is solid while the lower cross beam is hollow with a provision for access. Both cross beams are post-tensioned.

The cable stays are galvanised locked coil ropes with diameters between 76mm and 116mm and with minimum breaking load varying between 5.77 MN and 13.60 MN.

At the lower anchorage, the cable stays have sockets with thread and nut, and the stay forces are transferred to the longitudinal girders through steel plates.

At the top of the pylons, the stay cables are anchored by fork sockets to thick steel plates protruding from the pylon legs.

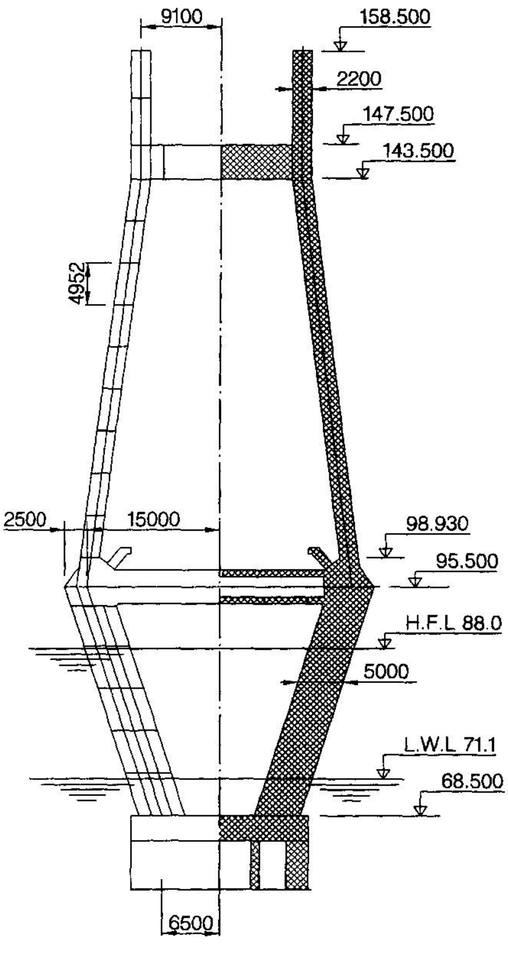

Figure 3. Section Through Pylon

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The design of the bridge has focused on simplicity and consideration to local conditions and technology. At the same time considerable effort to achieve a light and elegant impression of the bridge has been aimed at. It is expected that the developed design may form the basis for several new cable stayed bridge across the numerous rivers in India in the coming years.