

Design and Erection of the Arrah-Chhapra Bridge

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Abstract

The Arrah-Chhapra Bridge represents an evolution of bridge technology and construction processes in the Indian State of Bihar. The bridge will be an important link in the 117m-person state; increasing the road transportation capacity over the Ganges River by 66%. The original plan called for 36 approach spans that were to be erected span-by-span as precast box girder segments, whereas the 16 navigation spans were to be cast-in-place with variable depths of up to 8m. To reduce the construction schedule, while also creating a flexible construction sequence, McElhanney Consulting Services Ltd. engineers proposed an alternative extradosed system that permitted free-cantilevering segments of only 3.4m deep; enabling multiple spans to be erected simultaneously and rapidly. Through detailed construction stage analysis, rigorous geometry control, and exhaustive efforts in the riverbed, the new bridge is entering its final stages of construction.

Keywords: Extradosed; cable; free-cantilevering; erection engineering; construction stage analysis.

1 Introduction

The state of Bihar, in north-eastern India, is not only India's third-most populous state, but also its poorest in terms of GDP per capita. One of the most important difficulties facing the Bihari economy is the lack of reliable transportation of goods and people across the Ganges River. The river's 400km-long course through the state is currently spanned by only 4 road bridges:

- Rajendra Setu (2 lanes)
- Vikramshila Setu (2 lanes)
- Mahatma Gandhi Setu (4 lanes – 2 lanes frequently closed for rehabilitation work)
- The seasonal pontoon bridge at Dalip Chak (1 counter-flow lane)

Thus, there are currently only 6 year-round lanes available for the great number of commercial, industrial, resource, and personal vehicles that must cross these bridges daily. These bottlenecks

create lengthy queue times and stifling congestion in the adjacent cities, including the capital, Patna.



Figure 1. Project location

The sparse distribution of the bridges also makes for long travel times for much of the state's whose region is not located near one of the bridge sites. Furthermore, the enormous daily traffic loading