

Rajiv Gandhi Sealink – Mumbai: Design and construction of the Bandra and Worli Twin Cable-stayed Bridges

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Rajiv Gandhi Sealink Project (Bandra to Worli Sealink) in Mumbai, India, is an eight lane 4.7 km long offshore road viaduct, West of the Mumbai Peninsula, which provides an alternative connection across the Mahim Bay between the districts of Bandra in the North and Worli in the South. Part of this viaduct are two twin cable-stayed bridges, the single pylon Bandra Cable Stayed Bridges (Figure 1) and the double pylon Worli Cable Stayed Bridges (Figure 2).



Figure 1 – The Bandra Cable Stayed Bridges

This project forms first phase of the Western Freeway sealink project in Mumbai, which will be, once completed, an offshore bypass all the way down to Nariman Point at the Southern tip of the Mumbai peninsula. The southbound carriageway was opened to traffic in July 2009, followed by the Northbound carriageway in March 2010.

The project was awarded to main contractor Hindustan Construction Company (HCC) in 2000. Due to the local fisherman community demands, owner Maharashtra State Road Development Corporation (MSRDC) had to add, after award of work and start of construction, a second 150m long navigation span to the original design and the bridge alignment was shifted 150m into the sea near the Worli connector. In addition MSRDC decided to get the Bandra Cable Stayed landmark bridge redesigned, so that it could be built bound by bound enabling to complete the Southbound carriageway ahead of the Northbound carriageway to generate earlier revenue from tolls. MSRDC engaged Dar-Al-Handasah Consultants (DAR) from UK to undertake the design of the second navigation span as a cable stayed bridge, called the Worli cable stayed bridge, and to redesign the Bandra cable stayed bridge. The original twin deck structure of the Bandra Cable Stayed Bridge was replaced by independent stayed bridges for each bound, whose single pylons are made up of four slender legs arranged longitudinally as inverted Y and transversely as diamond.



The link is made up of two independent twin viaducts with four traffic lanes per carriageway. The viaduct deck is composed of precast concrete segments. A typical segment is 18.1m wide and 22.7m wide when suspended from stays. Segments are for typical field segments 3.0m deep and about 3m long. They have three cells and a curved “fish belly” underside. Segment weight varies between 80 ton to 140ton for pier and expansion joint segments.

The viaducts consist of continuous girder modules with decks, which are continuous over 4 to 6 spans having typical spans of 50m, and cable stay bridges. The stay cable bridges are the Bandra twin stay cable bridges with one individual pylon for each bound and two 250m spans and the Worli twin cable-stayed bridges with two pylons for each bound and a main span of 150m.



Figure 2 – The Worli Cable Stayed Bridges

Construction of the Rajiv Gandhi Sealink Project faced great technical and logistical challenges, mainly due to major design changes after award and start of construction and the adverse sea conditions, which prevented HCC from carrying out any work over water for one third of a calendar year. Use of preassembled steel cofferdams for construction of pile caps and pier shafts, resegmentation of viaducts, commissioning of quality short line match cast cells for production of deck segments, use of VSL overhead gantries, which were completely selflaunching and could receive either segments delivered from sea or from behind, good climbform systems for pylon leg construction and use of VSL strand lifting technology for installation of the parallel wire stays and detailed construction stage analysis and geometry control during tower leg and deck cantilever erection of stayed cable bridge's main spans helped greatly to overcome at least some of the technical challenges in the construction of this very visible new landmark structure in Mumbai.