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2. Mississippi River Bridge, Luling (Louisiana, USA)

Owner: Louisiana Department of Transportation and Development
Engineers: Frankland and Leinhard/ Modjeski and Masters
Principal Contractors:
Substructure: Massman Constr. Co.; Al Johnson Constr. Co.
Superstructure: Williams Brothers Constr. Co. Inc.
Approaches, North: T. L. James Constr. Co.
South: Boh Brothers Constr. Co. Inc.
Construction Period: 1974-1982

Background

In 1970, the Louisiana Department of Transportation and Development initiated studies to determine the feasibility of spanning the Mississippi River in the delta area near New Orleans, with complete flexibility in locating the spans at the bends as well as in the reaches. The investigation, undertaken by Modjeski and Masters, required feasibility studies of bridges with main spans ranging in length from 376 m to 640 m. Conventional suspension bridges, cantilever trusses and cable-stayed bridges were compared for applicability under poor foundation conditions in the Mississippi River Delta, and for relative cost. This study concluded that all types appear feasible in this range of span lengths; although further testing was recommended before attempting construction of the large pile foundations required for the suspension bridge anchorages.

General

As a result of these studies, the Department decided to build a steel cable-stayed bridge as part of an interstate route (I-310) near New Orleans, crossing the Mississippi River in the vicinity of Luling. This stretch of the river is navigable by ocean-going vessels requiring a horizontal clearance of 366 m and a vertical clearance of 40.5 m. The main span of the bridge was set at 376 m making it the longest of this type in the United States and among the longest in the world. Side spans of 151 m together with the adjacent approach spans of 79 m were to be continuous forming a main span bridge unit 836 m long. Conventional beam and girder spans were used on the approaches.

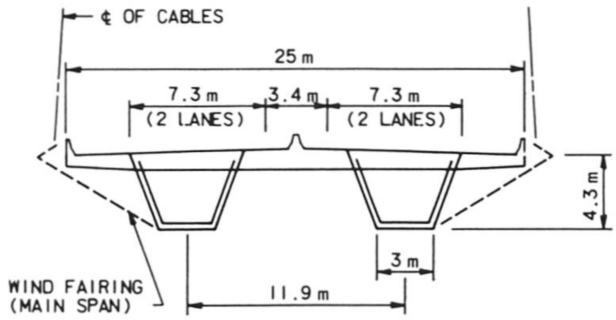

Fig. 2 Cross section of structure

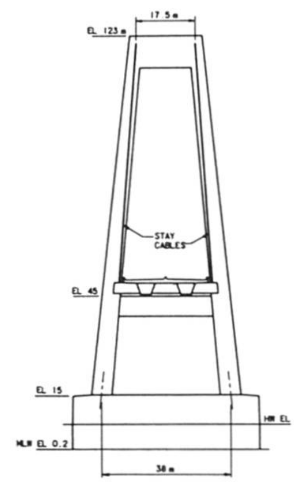

Fig. 3 Tower

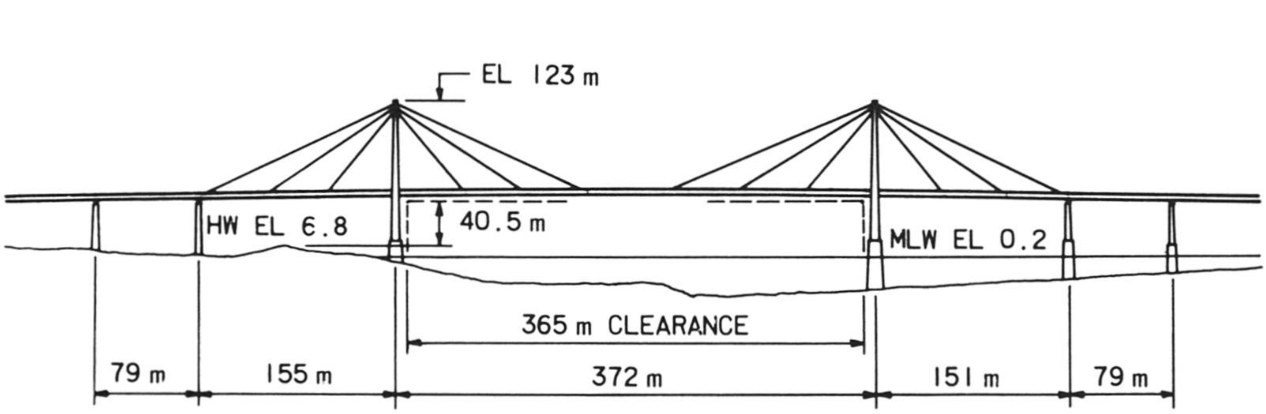

Fig. 1 Elevation

Substructure

The deeper water in the river cross section and the main navigation channel is adjacent to the south bank. The south tower pier was placed at the base of the slope from the south levee. The north tower pier and the north anchor pier are located near the center of the river. In general, water depths in the northern half of the river are shallower.

All three of these piers are founded on tremie sealed open dredge concrete caissons. In general, the surface layers are sandy, silty river deposits unsuitable for foundations of bridges of this magnitude. One encounters a very stiff clay suitable for founding at elevations approximately 48 to 56 m below mean low water. The caissons are founded in this stiff clay material and carried up to about river bottom. Concrete shafts are then extended to elevation +15 so that the likekihood of a collision between a vessel and the steel towers is relatively small.

These piers are protected against scour of the river bottom by the use of willow mattresses and riprap.

The south anchor pier is well behind the levee and is supported on 457 mm cast-in-place concrete piles. The remainder of the piers on both approaches are also pile supported.

During the sinking of the south tower pier the contractor had difficulty in maintaining its longitudinal position. As a result, the pier was finally founded in a location 4 m north of its design location. This required a reduction in the main span to 372 m while increasing the south anchor arm to 155 m.

Towers

The two towers have a modified A-shape and extend approximately 107 m above the top of the concrete pier. Each leg of the tower is a 9-cell steel box tapered in both the longitudinal and transverse directions. Since it had been decided that the metalwork is to be unpainted to minimize maintenance, high strength weathering steel has been used in the fabrication.

Cable Stays

A plane of cable stays is used on either side of the bridge roadway and in line with the tower legs. Three groups of stay cables are attached to the top of each tower in a fan arrangement. Each stay is composed of two or four parallel wire strands each made up of between 103 and 307 wires of 6.35 mm diameter.

The strands have been socketed on each end with a HI-AM socket for connections to the top of the tower and to cross girders supporting the deck structure. All cable adjustments are to be made at the cross girders.

The strands are enclosed in a polyethylene jacket, which is applied by the fabricator, and are then shipped to the site on reels. After erection and final stressing, the space between the jacket and the cables will be filled with a Portland cement grout.

Suspended Structure

A steel orthotropic deck is supported by two longitudinal trapezoidal box girders spaced 11.9 m apart. A 7.9 m wide section of orthotropic deck above each longitudinal box girder is fabricated with the girder and shipped as a unit. After erection, a 4 m section of deck is placed between the longitudinal girders and a 2.6 m section is cantilevered from either side. All field splices are made using high strength bolts. Metalwork is high strength weathering steel Between the two main towers, a sloping fairing plate has been provided to improve the aerodynamic properties of the section.

The final wearing surface is to be 64 mm of epoxy asphalt.

Steel median barriers and steel parapets have been provided for the protection of traffic. Two 3.7 m lanes of traffic are carried in each direction with 1.3 m lefthand shoulders and 3 m righthand shoulders. The total width out-to-out of parapets is 25 m.

(T. Robert Kealey)

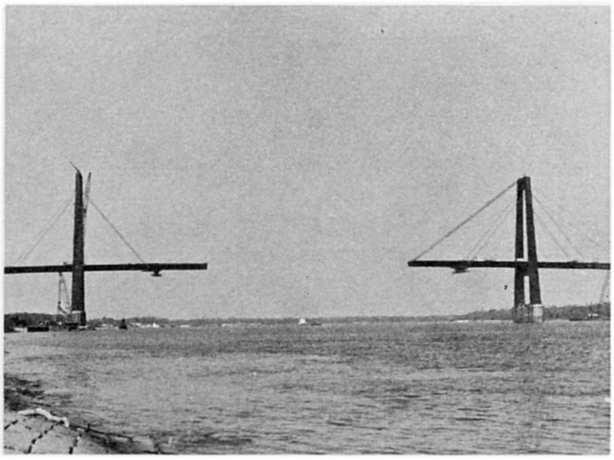

Fig. 4 Construction stage

Fig. 5 Construction stage