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"The Danziger Vertical Lift Bridge",
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THE DANZIGER VERTICAL LIFT BRIDGE

INTRODUCTION

The Sverdrup Corporation was engaged by the Louisiana Department of Transportation and Development to design the widest vertical lift bridge in America. The result is the Danziger Lift Bridge crossing the Industrial Canal in New Orleans, which blends together several unusual features to provide the community with an economical, safe, aesthetically pleasing structure. This bridge was opened to traffic in November 1987.

REQUIREMENTS

The requirements for this structure grew from the Louisiana DOTD's experience with numerous movable bridges, and in particular the existing 48 year old low level double leaf bascule bridge across the Industrial Canal. The old bridge became obsolete for both the heavy nautical utilization of the canal as well as the increased U. S. Route 90 highway traffic in the New Orleans area. The old four lane bridge had to be raised for marine traffic approximately 22 times a day, as well as experiencing numerous extended closings to highway traffic due to ship damage to the structure. The 90 ft. horizontal clearance of the existing bridge provided marginal room for the ocean going ships navigating the narrow canal between Lake Pontchartrain and the Mississippi River.

An alignment for the new structure was selected by the La. DOTD to provide a medium height vertical lift span to be built as close as possible and to the south of the existing bridge. The new structure would provide 50 ft. clearance above water in the closed position to allow 90% of the marine traffic to pass without interrupting highway traffic. The Industrial Canal is alive with barge and light marine boats. The lift span would provide 125 ft. vertical clearance in the open position to allow ocean ships access to Lake Pontchartrain. It was anticipated that the new span would be opened for marine traffic only 5 times per day.

The lift span would be approximately the size of a football field carrying seven 12-ft. traffic lanes, four 4-ft. shoulders, and a 4-ft. sidewalk with an anticipated traffic volume of about 38,000 vehicles a day. Placing the piers on the edges of the canal, to allow the maximum navigation clearance, resulted in the lift span becoming 320 ft. long and 108 ft. wide.

Safety to marine and highway travelers was a prime consideration stemming from the many man hours and dollars spent on ship related accidents to the old bridge. The new bridge would have the capability of being able to float out and float in the lift span for repairs should it be damaged. The piers were designed for barge impact. Maximum line of sight was to be provided to the bridge operator for both marine and highway traffic.

The selections to fulfill all the above requirements were as usual weighted for efficient operations as well as economics.

GROWTH OF A LIFT BRIDGE

With the design phase of the bridge project assigned to the Sverdrup Corporation, selection of structure shape became the first task. A preliminary engineering report analyzed both the type of structure as well as the floor systems. Weight of the lift span was considered a prime economic factor in the selection of the span as it affects the sizing of the structural, electrical, and mechanical components of the bridge. The preliminary report reviewed three basic floor systems as well as four major span types and presented cost estimates for the two most promising span types. The four span types were a two truss system, a three truss system, a multiple composite plate box girder arrangement, and an orthotropic steel deck with several arrangements of plate box girders. The two truss span with a steel open grid floor and the orthotropic steel deck box girder span were submitted for consideration. Both span types could have been erected by either the float-in or construct-in-place methods. The conclusion of the report recommended the selection of the orthotropic deck box girder span for the final design and development. The box girder span, without the overhead clutter of trusses, would provide the bridge operator an unobstructed view of the marine and highway traffic and would also result in a safe quiet roadway riding surface. These were the moving forces behind the recommendation of the orthotropic deck box girder lift span.

The orthotropic deck consists of a 1/2" deck plate which is stiffened longitudinally by 52 trapezoidal closed ribs and is supported by floorbeams spaced at 14 ft. 7 inch centers. A 2 1/2" asphaltic concrete wearing surface covers the deck plate. The floorbeams are supported by three box girders. The box girders bottom flanges are 14 ft. 3 inches below profile grade. A side view of this span shows the top of the roadway barriers and the bottom of the box girders both parallel to profile grade. This forms a solid narrow band of steel from tower to tower.

The towers consist of stiffened plate tee-shaped legs connected with a box top strut. The 20 ft.wide vertical band of steel complements the narrow horizontal band of the lift span. The selection of the tee-shaped leg served many functions. The cables are carried outside the roadway allowing the sheave loads to be directly over the tower legs. The span guides are placed on the face of the legs. The tee-shape conceals the end attachments of both the counterweight and the lift span. It also allows the clutter of the ropes, guide tracks, balance chains and electrical guides to blend into the vertical band of the steel towers. Access to the machinery, counterweights, and control houses is provided by stairways inside the north legs of both towers.

The machinery to operate the span is located on top of the tower struts. Atop each tower are two 75-hp. electrical drive motors. The span drive system only requires one motor per tower but the built-in redundancy of two motors allows uninterrupted service during motor repair or replacement. Under normal operations, use of the two drive motors is alternated.

The span is braked by frictionless eddy-current brakes during normal speeds and by thruster-shoe brakes during slow speeds as well as in the stopped position.

The sheaves are welded steel, 17 ft. in diameter, and are supported by spherical roller bearings. The span is lifted by 80 - 2 1/2" diameter wire ropes.

The lift span guidance system was influenced by the thermal movements of this wide span. One longitudinal track and two transverse tracks, with rollers on each side of the tracks, has been provided to guide the span. This system allows for expansion and contraction of the span and eliminates binding due to tower alignment deviations.

Two control rooms are cantilevered from the faces of the northwest tower leg, one for traffic control and the other for lift span operations. The traffic control room cantilevers over the roadway for clear vision in both directions of all highway traffic and controls the lights, gates, and traffic barriers. The lift span control room is located on the canal side of the tower for clear view of the marine traffic. The electrical panels are located one floor below the span control room. Both control rooms are on the same level of the tower and are interconnected.

The counterweights are concrete with two encased steel trusses to support the concrete dead weight. The shape of the tower hides the counterweight end connections and the concrete finish color blends with the silver blue steel bridge. This creates an illusion that the counterweight is a part of the tower when the counterweight is in the up position.

CONSTRUCTION

The Danziger Bridge was built by a joint venture of Williams Brothers Construction Company and Cianbro Corporation, except for the two lift span piers which were constructed by Landis Construction Company, Inc. The Louisiana DOTD provided all construction and fabrication inspection with consultation provided by the Sverdrup Corporation.

A barge mounted crane erected all of the structural steel and placed the machinery. The steel elements of the towers and the lift span were field bolted with 7/8" high strength A325 bolts, with some 3/4" bolts required in the tower splices.

The lift span was erected in the down position by the construct-in-place method with two temporary bents supporting the span between the towers. The span members are field spliced at approximately the third points. This method required the center portion of the orthotropic deck box girder lift span to be erected with the span down thus blocking navigation on the canal to ships requiring 50 ft. vertical clearance. As soon as the span was bolted together, it was raised to clear the canal. This required temporarily balancing the span prior to placing the final span weights of the wearing surface, roadway barriers, paint and other minor items. At this stage the forms were in place to complete the concrete counterweight when the deck work and painting were complete.

U.S. Fabrication, a Division of U.S. Steel Corporation, fabricated all of the steel at Orange, Texas. They welded 3,300 tons of steel to form the towers, lift span, and counterweight trusses. These elements contain a mixture of A36, A588, and A572 structural steels. Their strict attention to final dimensional control of the heavily welded tower segments as well as the orthotropic deck box girder lift span elements resulted in precise, timely erection. The thirty-seven lift span deck and girder segments were bolted together without any external loading or blocking.

Stewart Machine Co. Inc. provided and installed all of the machinery and Best Electrical Construction, Inc. provided and installed the electrical components to move this structure.

APPROACH SPANS

The overall length of the replacement bridge is 5,500 ft. with many concrete beam approach spans. These spans, designed by David Volkert & Associates, raise the highway traffic from street grade to the medium high level of the lift span.

OPERATIONS

It takes less then 2 minutes to raise or lower the 2200 ton lift span the full 75 ft. of travel including locking and or unlocking the span. The maximum rate of span travel is 0.9 ft. per second.

CONCLUSIONS

I hope your travels will include an opportunity to see the Danziger Vertical Lift Bridge. The clean functional lines of structure have been recognized by many as a outstanding engineering achievement. It received the 1988 engineering excellence honor award by the American Consulting Engineers Council.