

## Project Profile – Composite Deck Lift Bridge

### **Overview**

Terminal Island (originally named Rattlesnake Island) lies off the coast of California in Los Angeles Harbor, combined with the port facilities of the mainland, Terminal Island is one of the world's biggest and busiest ports. The earliest train crossing to Rattlesnake Island was a fixed-in-place trestle bridge, constructed in 1891 by the Los Angeles Terminal Railroad Company. At that time, the Terminal Land Company purchased Rattlesnake Island and renamed it Terminal Island with the idea that it would



be the ultimate destination (or terminal) for a rail route from Utah to Los Angeles. In 1906, the U.S. military ordered the removal of the fixed bridge and plans soon began for the construction of a movable bridge at the same location to allow the passage of ships through the channel between Terminal Island and Long Beach. This facilitated its use as entry and exit point for major shipping to the Pacific and other parts of the world. The Island, along with the mainland port facilities, became a major portal for all types of goods, necessitating the need for construction of additional rail links to the mainland. To increase road vehicle traffic capacity to Terminal Island, in 1941 the U.S. Navy installed a temporary swing bridge at the location of the current Schuyler F. Heim Bridge and next to the Henry Ford Bridge. During World War II, shipbuilding facilities on Terminal Island required an enormous amount of supplies be transported by rail and truck traffic. Five years after the installation of the two-lane road bridge, the Navy contracted for its replacement with the construction of the modern-day vertical-lift bridge, one of the largest of its type in the country and the largest on the west coast. It is shown above, the foreground bridge is the Badger Avenue railroad bridge.

Due to the enormous quantity of traffic across the bridge, mostly heavy shipping container trucks, the existing deck of welded-steel grating has required regular replacement, most recently in 1997. The California Department of Transportation (Caltrans) selected composite materials to demonstrate their feasibility for displacing steel in this type of bridge, to eliminate the corrosion common around a salt-water seaport. Martin Marietta Composites in Raleigh, North Carolina, received the contract to design and fabricate the Fiber-Reinforced Polymer (FRP) deck panels. The bridge has a custom 5-inch (125mm) thick deck and is arranged in 8 panels measuring 6' (1.8m) by 36' (10.9m). Instrumentation was installed in the panels to facilitate long-term monitoring of the deck performance, if successful the entire deck may be replaced with FRP panels.

## **What We Did**

Our task was to design and supply the data acquisition system. This included the following work:

- Design of data acquisition system to read a variety of instrumentation, including linear potentiometer type displacement transducers, thermocouples, bonded-foil resistance strain gages, environmental sensors including solar radiation, wind speed and direction, and traffic count, a total of over 100 instruments. This included using our MultiSensor Interface and (6) daisy-chained MultiMux's. Use of the daisy-chain feature on our MultiMux allowed for a single multiplexer cable to interconnect all of the multiplexers. Views of the data acquisition system cabinet (top right) and multiplexers (bottom right) are shown in the images.
- Design of the communications system to support wireless communications to the bridge tender's office, with a phone line interface. The wireless link was necessary because the data acquisition system was installed on the lift deck, so hard-wire to the bridge tender's office was not possible. The use of phone line to wireless interface provides for remote monitoring of the system during the monthly static load testing which is a part of the FRB deck panel qualification program.
- Supply of traffic counting sub-system to monitor traffic flow in either direction across the bridge. This presented a few challenges because the traditional methods, either using road-tubes or embedded road loops were inappropriate for the application. In the case of road tubes the high volume of heavy truck traffic would have destroyed the tubes fairly quickly, in the case of the embedded road loops the use of the FRB deck panels precluded trenching and installation of the wire loops for traffic sensing. The solution was to use traffic loops installed on the surface of the deck using an epoxy based mounting kit. The data acquisition system also included manual digital readouts of the traffic counts in either direction.

## **Who to Contact**

### Regarding the project:

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