

DESIGN OF A SMART STRUCTURAL HEALTH MONITORING SYSTEM FOR THE NEW I-10 TWIN SPAN BRIDGE OVER LAKE PONTCHARTRAIN

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ABSTRACT

A new Interstate 10 Twin Span Bridge over Lake Pontchartrain is being constructed to replace the existing Twin Span Bridge, which was heavily damaged by Hurricane Katrina in 2005. The new bridge consists of two 3-lane spans with 30 feet elevation above the surface of the Lake, 21 feet higher than the old bridge that makes it less vulnerable to high storm surge, and an 80-foot high rise near Slidell. The bridge will be supported by groups of battered pile foundations. In order to verify the analysis method used in the design and to address some concerns raised during the design phase, LA DOTD decided to install a health monitoring system on a selected M19 eastbound bridge pier of the main span. The pier consists of 24 square PPC battered piles (batter slope 1:6). The piles are 36 in wide and 110 ft long. The system includes both sub-structure and super-structure instrumentations for use in the short-term monitoring during a static lateral load testing, and for long-term monitoring during selected events such as wave, wind and vessel impact. The sub-structure instrumentation includes strain gauges and MEMS In-Place Inclinometers (IPI) cast inside the foundation piles, triaxial accelerometers to measure lateral movements of pile cap, water pressure cells to measure wave forces, tiltmeters, and corrosion meters in the pile cap. The superstructure instrumentation includes strain gauges and corrosion meters inside the columns; strain gauges in the bent cap, three steel girders, three concrete girders, and one diaphragm; and installing a weigh in motion (WIM) system in the concrete bridge deck. A unique lateral load test was designed and conducted at M19 pier to assess the validity of the analysis method used to design the pile foundations. The test was conducted by pulling the M19 east and west bounds toward each other using two high strength steel strands that were run through the pile caps. A total of 1870 kips lateral load was applied in increments using two hydraulic jacks. This paper will present the design and development of the sub-structure instrumentation plan of I-10 Twin Span Bridge and its use during the lateral load test.