

## JUST THE FACTS

**Start Date:**

November 1, 2007

**Duration:**

36 Months

**End Date:**

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Federal

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INTEREST:

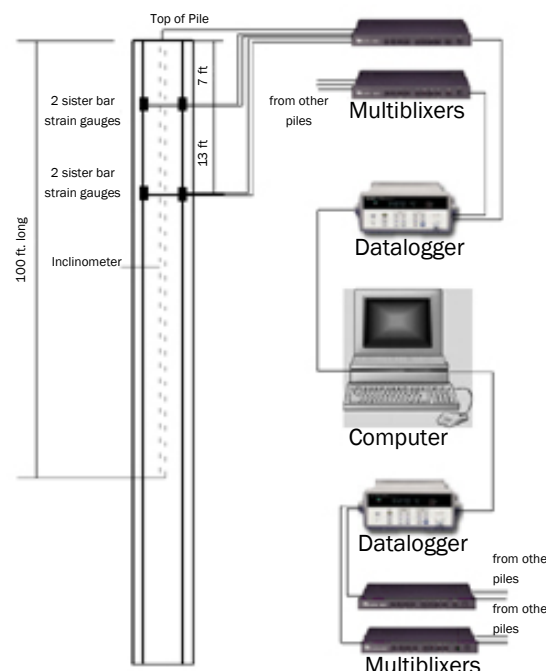
- Problem Addressed
- Objectives of Research
- Methodology Used
- Implementation Potential

## Structure Health Monitoring of I-10 Twin Span Bridge

**PROBLEM**

The FB-MultiPier analysis program, developed at the University of Florida, has been used by Louisiana and other states in the design and analysis of pile group system subjected to lateral loading. This program is a nonlinear finite element analysis program that was developed, verified, and validated based on the results of lateral static load tests conducted on vertical group pile-cap systems. The LADOTD is building the I-10 twin span bridge over Lake Pontchartrain using a special foundation design that consists of 24 battered group piles connected together with a concrete footing. The applicability of the FB-MultiPier design methodology to predict the lateral performance of these unique structures needs to be validated by being compared with the results of lateral load testing.

There are several uncertainties in the prediction of short term and long term dynamic response behavior of the I-10 twin span bridge caused by strong wind, waves, and vessel collision loads that are subject to unknown factors. The present study is aimed at examining these uncertainties by establishing a monitoring system that can collect data such as strains, axial and lateral displacements, and accelerations on the piles. In the monitoring system, the deformation characteristics of the bridge response due to selected events should be elucidated.

**OBJECTIVES**

The main objective of this research project is to establish a bridge substructure health monitoring system for use in short term and long term monitoring purposes.

Short term monitoring will validate the applicability of the FB-MultiPier analysis for predicting the performance of battered pile group systems under lateral loading and to develop (or back-calculate) the p-y multipliers for battered pile groups in similar soil conditions by conducting lateral static load test.

Long term monitoring will describe the behavior of pile group structure under dynamic loads caused by selected events (wind, waves, and vessel collision).

### **OBJECTIVES (CONT'D)**

Another objective is a better approach in the design process of battered pile group.

### **METHODOLOGY**

The field of structural health monitoring (SHM) of civil engineering structures gained great momentum during the 1990s, and research projects have been funded by the National Science Foundation, the FHWA, and State DOTs. Most of the research has been academic or exploratory, and the field applications have not followed suit, mainly because of a lack of funds, inadequate training, and immaturity of proposed technologies.

The proposed research will first focus on the development of an Internet accessible wireless bridge monitoring system for synchronous measurements of loads and responses of bridge substructure components during the short term and long term monitoring. Static lateral load tests will be performed by LADOTD immediately after completing the installation of the monitoring system in the eastbound pier M19.

The research team will work closely with the Twin Span Construction Team, LADOTD design, maintenance, and FHWA to improve field testing using remote sensors, on site of long and short term data processing for load and traffic count. Also, a lateral loads test will be preformed to provide a unique validation for battered piles, and long term monitoring and a tie to superstructure is anticipated.

### **IMPLEMENTATION POTENTIAL**

The results of the proposed research will be implemented in the design and construction of bridge foundations that are built every year in the State of Louisiana and could be extended to other states. This research will provide knowledge that can be used to reduce the construction and maintenance cost of bridges in the State of Louisiana and the Nation.

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*For more information about LTRC's research program, please visit our Web site. [www.ltrc.lsu.edu](http://www.ltrc.lsu.edu)*