



Florida Department of Transportation Research

Long-term Bridge Maintenance Monitoring Demonstration on a Movable Bridge BD548-23

The 98 movable bridges owned and operated by FDOT represent one of the largest populations in the U.S. These complex structures utilize machinery to open a portion of the bridge, which allows for passage of waterborne traffic. Maintenance and rehabilitation repairs on movable bridges cost 100 times more per square foot than fixed bridges. Currently, movable bridges are inspected visually to evaluate their condition and identify maintenance and management needs.

Researchers at the University of Central Florida recently studied an automated sensing system for structural health monitoring (SHM). SHM measures the structure's operating and loading environment through use of sensors to track and evaluate incidents, anomalies, damage, and deterioration. SHM captures the critical inputs and responses of a structural system through technology to understand the cause of problems and to track responses and predict behavior. SHM can improve bridge safety, enhance efficiency, and enable effective and low-cost maintenance through instrumentation, sensing, data collection and processing, use of analytical methods, and specialized algorithms to evaluate condition.

Researchers selected the west-bound span of the Sunrise Boulevard Bridge in Ft. Lauderdale for study. Constructed in 1989, the bridge has double bascule leaves and carries three lanes of traffic. Each leaf is 70 feet long and 40 feet wide. The bridge opens 10 to 15 times per day.

The researchers designed a monitoring system and installed 200 sensors on the bridge to collect data for critical structural, mechanical and electrical components. They also installed cabling, cabinets, and data acquisition systems. They monitored the bridge to establish operating conditions under vehicular traffic, environmental effects, and routine operation of the bridge for vehicular and marine traffic, and collected data during each bridge raising and lowering. They also



The Sunrise Boulevard Bridge, Ft. Lauderdale, Fla.

conducted truck load tests to determine stress levels on various structural components.

The researchers developed a method to assess and identify structural changes and to assess the effectiveness of maintenance to operate gears, gear boxes, and rack and pinion mechanisms. Data collected from continuous monitoring and load tests enabled researchers to calculate the design load rating of the bridge. Researchers also were able to collect data to determine long-term environmental effects, including temperature, humidity, and barometric pressure, on structural and mechanical components.

Researchers concluded that the SHM system on a movable bridge has the potential to improve knowledge about mechanical performance and degradation, to allow for the design of better performance models, and to reduce maintenance and operation costs. Because the three-month study produced only a limited amount of data, researchers recommend extending the study to collect additional performance data and develop more accurate, long-term performance projections.