Florida Department of Transportation Research

Sunshine Skyway Bridge Monitoring Phase II: System Development

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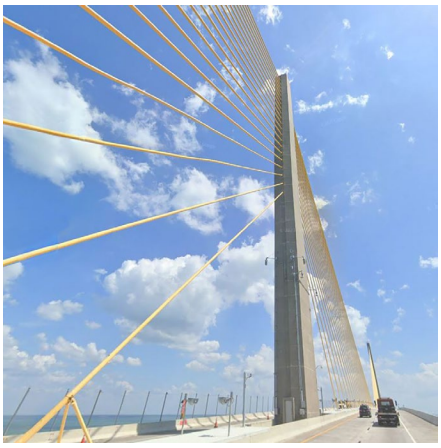
BDV31-977-73

Project Manager
Jim Jacobsen
FDOT Maintenance Office

Principal Investigator
Jennifer Rice
University of Florida

Current Situation

The Sunshine Skyway Bridge is Florida's largest cable-stayed bridge, a major connector on Florida's southwest coast and a symbol of the state on innumerable postcards, in films and television, and on a U.S. stamp. The bridge is constructed from a number of steel and steel-reinforced concrete technologies and requires constant monitoring, not just for corrosion in its warm, coastal environment but also for potential hazards due to high winds, hurricanes, and traffic. Monitoring sensors on the bridge added over time by various authorities are useful but independent. A single, centralized system to collect data from these sensors would allow comprehensive and more effective monitoring of bridge movements.



Cables that help support the Sunshine Skyway Bridge fan out from its north tower.

Research Objectives

University of Florida researchers developed a Web interface which centralizes the systems monitoring the Sunshine Skyway Bridge. They also analyzed long-term bridge data to establish the bounds of typical bridge behavior and made recommendations for an alert response plan when data indicate out-of-bounds behavior.

Project Activities

In Phase I (BDV31-977-43), the researchers assessed and documented all data collection systems installed on the Sunshine Skyway Bridge and developed specifications for a single bridge monitoring Web interface, the Sunshine Skyway Monitoring System (SSMS). In this project, the researchers identified a firm (BDI, Inc.) to develop the interface based on the firm's experience providing monitoring equipment for the bridge and the capability of their existing monitoring interface to meet requirements of the SSMS. The Web portal that was developed provides data archiving, visualization, and alerts, including data from four cable stay accelerometers and a weather station. GPS data to monitor bridge motion have been partially incorporated, and procedures for adding additional sensors or external data have been provided. A system security plan for the SSMS was developed with input from the FDOT Information Security Administration Office to comply with state cybersecurity standards for information technology resources.

Monitoring data for 2020 were assessed for quality and reliability and to determine the bounds of typical bridge response to temperature-, wind-, and traffic-induced loading. Overall, data quality was good with low rates of erroneous data points. Accelerometer data from two cables and the north tower were correlated with wind and temperature measurements to establish daily and seasonal response patterns. Cable force estimates matched well with bridge studies and showed expected variation with temperature. Most out-of-bounds events in 2020 resulted from high wind, though none threatened the bridge's structural integrity.

Statistical analysis of the 2020 data was used to establish four alert levels ranging from low to high severity with corresponding response procedures, including the Skyway Emergency Response Plan (ERP) for the highest severity.

Project Benefits

Centralized monitoring of the Sunshine Skyway Bridge will help ensure that the bridge continues to serve drivers for many years.

For more information, please see www.fdot.gov/research/.