



Florida Department of Transportation Bridge Wind Speed Alerting System

The Florida Department of Transportation (FDOT) has implemented a high-wind alert system on multiple road bridges across the State. The system assists the transportation and public safety of communities by providing real-time wind speed status information during severe weather events from each monitored bridge structure. This information is used to assist transportation managers with bridge closure decisions.

Background

Typically, when a severe weather event occurs in Florida, such as a tropical storm, hurricane, or nor'easter, local law enforcement personnel are deployed to each bridge in advance of the weather event. An officer takes periodic wind speed measurements and reports the information to their local law enforcement agency. The agency is then responsible for making any bridge closure decisions. This protocol may put law enforcement personnel in harm's way and may deploy them during a time when the officers may be needed elsewhere. There is also minimal dissemination of the wind speed data to local and regional public safety and transportation stakeholders with this protocol.

System Overview

By using the FDOT high-wind alert system, these shortcomings are addressed. Data are reliably collected from the system, and automatically and instantly disseminated to FDOT Regional Traffic Management Centers (RTMCs) and local public safety officials. As a result, all parties have more accurate data from which to make informed decisions about bridge closures and evacuation routes.

Since its implementation, the system has been deployed across 18 locations in Florida. This includes instrumentation of all critical waterway bridges, interchange flyovers, barrier island bridges, most river bridges, and the three major highway interchanges in the Jacksonville, FL, area.

Additionally, FDOT has realized cost savings using the system because of low-cost, wind-only detectors and solar-powered satellite transmitters that use a free telemetry service. The service is offered by the National Oceanographic and Atmospheric Administration (NOAA) and called the Data Collection System. Other than maintenance, there is no monthly, reoccurring operational cost. Generally, the installation cost to instrument a bridge is approximately \$10,000, including material and labor. Furthermore, to enhance data dissemination to RTMCs statewide, FDOT also has procured satellite communications ground station equipment.

System Components

Each bridge is outfitted with a Data Collection Platform (DCP) that includes an ultrasonic wind sensor installed at approximately 10 ft above the bridge road deck (see [figure 1](#)). The wind sensor connects to a data logger that performs analytics to discern wind gusts and continuous high winds. Multiple alarm thresholds are used to detect high wind conditions, triggering the data logger to transmit an alert message via a NOAA Geostationary Operational Environmental Satellite (GOES). The satellite transmitters are solar powered. GOES transmits alerts to FDOT, which can disseminate the alerts via the FDOT statewide area network or the internet.

System Operations

Continuous wind condition sampling is designed to maintain a low-power draw for the system. Wind measurements are performed over 1-minute sample periods that are spaced 10 minutes apart. Wind anomalies associated with passing vehicles are filtered out during this process, ensuring that only continuous winds and gusts are reported.

If the wind conditions trigger any of the multiple alarm thresholds, one or more alert messages are relayed via GOES to FDOT. FDOT receives the bridge wind alerts from GOES via two satellite communications ground stations. Once received, those alerts are disseminated to the statewide RTMCs. The main ground station is located away from the coastline and next to a FDOT communications network hub. FDOT operates a redundant statewide area network over microwave and fiber links that provides a highly reliable connection to the RTMCs (these connections are 99.999 percent reliable, experiencing just 5 minutes of down time per year). This feature helps to ensure that data are securely and reliably disseminated to the RTMCs during severe weather events that may compromise commercial telecommunications infrastructures.

RTMC computers, then, monitor the wind speed alerts and display them graphically on a map of the area. Alerts are received at the RTMC once wind speeds at any bridge reach 30 mph. Alerts continue to be received for each additional 5-mph incremental increase. The RTMC personnel can inform local public safety officials of each new alert condition on a bridge, giving law enforcement officers enough time to deploy and secure a bridge for closure. The system will also inform RTMC personnel when wind conditions are receding.

Wind speed data and alerts have also been integrated into FDOT's Data Integration and Video Aggregation System (DIVAS). DIVAS was developed to provide authorized local public safety and emergency management personnel with accurate real-time information (see [figure 2](#)). It allows FDOT and local officials to monitor FDOT wind alert data securely online (see [figure 3](#)). This secondary means of viewing the wind alerts has given hundreds of authorized public safety officials the ability to monitor local bridge wind speed conditions without compromising FDOT internal network performance or security.



Figure 1. Florida Department of Transportation bridge wind speed monitor installation. (Source: Florida Department of Transportation)

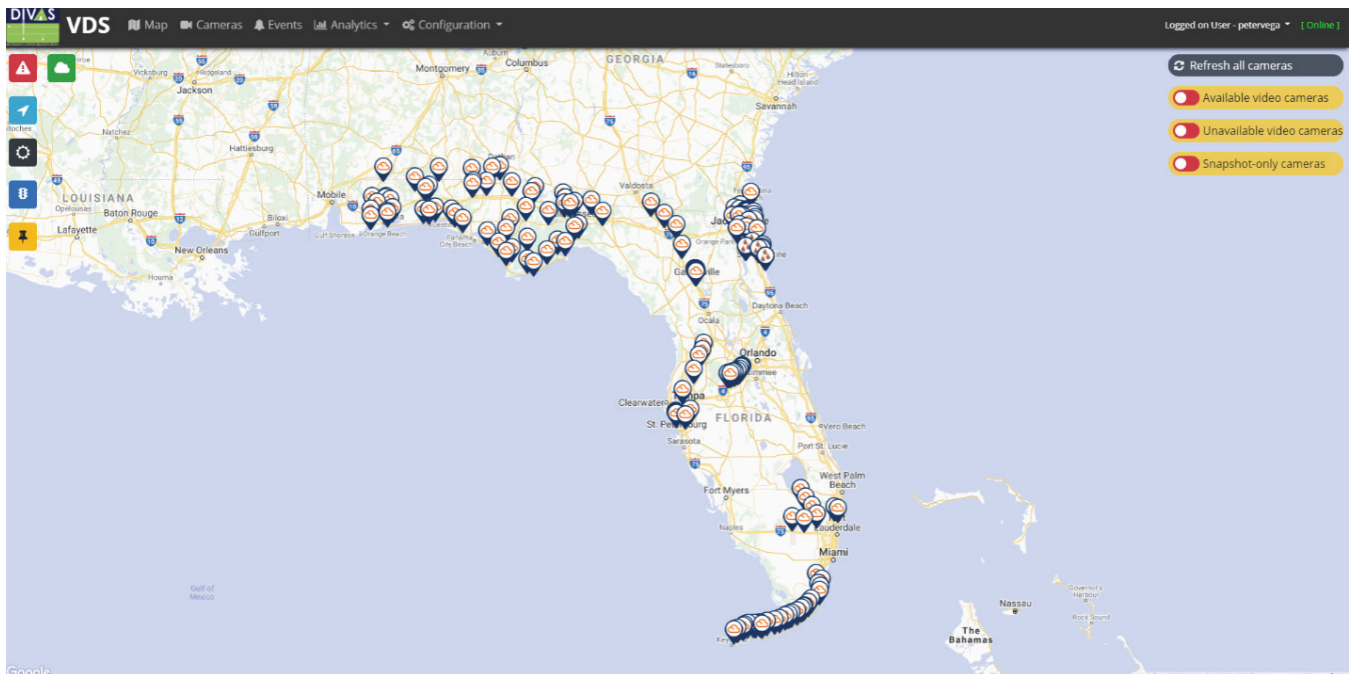


Figure 2. Screenshot of DIVAS. (Source: Florida Department of Transportation)

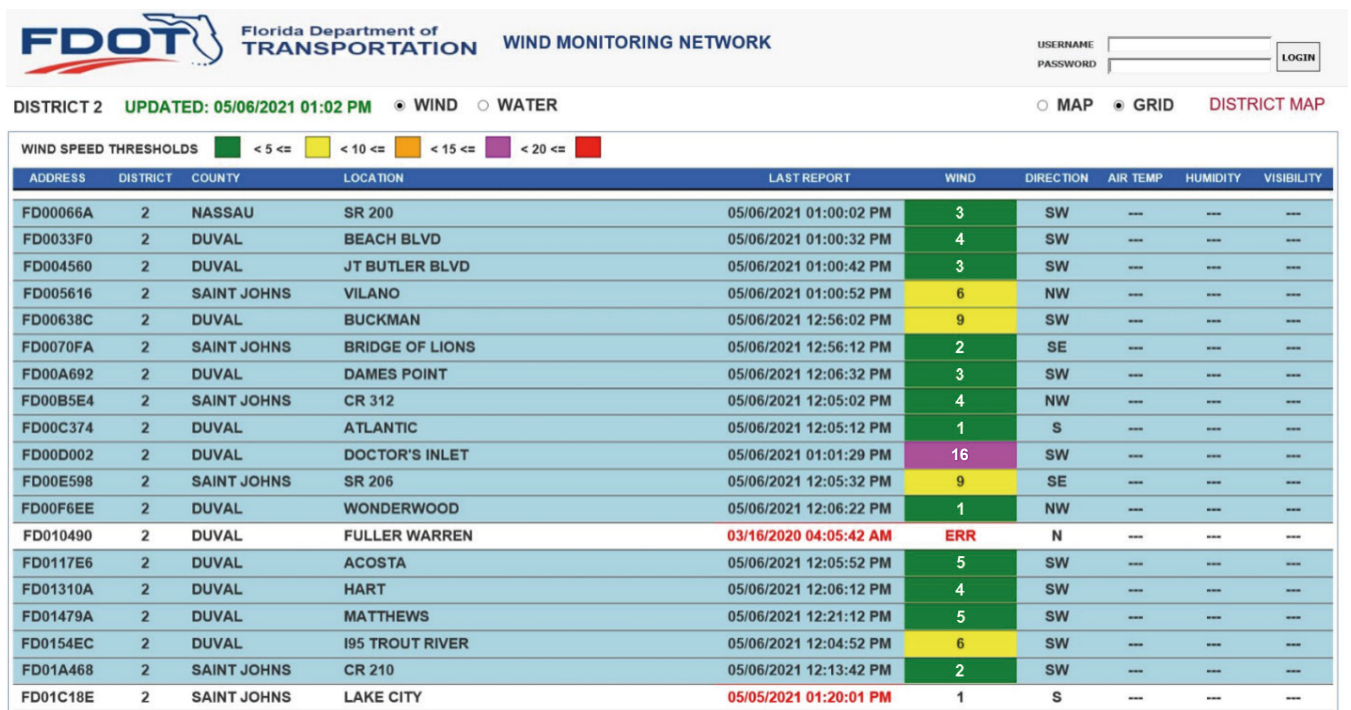


Figure 3. Wind Monitoring Network. (Source: Florida Department of Transportation)

Transportation Outcomes

FDOT's bridge wind speed alerting system provides a more efficient, safe, and accurate method for collecting and disseminating information about potentially dangerous wind conditions on bridges. In addition, the system is able to share severe weather data with the Federal Highway Administration as well as other agencies such as the National Weather Service.

One of the most significant benefits of this project is the low-cost way it was implemented. The use of the NOAA GOES system to collect wind speed alerts from the bridges resulted in substantial operational cost savings. For example, had FDOT used cellular modems to communicate with the bridge DCPs, an eventual statewide deployment may have cost the State \$750,000 over 5 years just for the cell phone bill.

Implementation Issues

The installation of the bridge wind speed monitors required FDOT and its contractors to develop a mounting method that was performed quickly to minimize lane closure time but also robust enough to withstand bridge vibrations and severe wind conditions. The monitor on each bridge was installed at the highest point possible but with a clear view of the southern sky so that the satellite transmitter could communicate with GOES. To avoid return visits to bridges to make installation changes, each bridge DCP was configured and initially tested on a rooftop FDOT test stand before being deployed.

References

1. Florida DOT, *SunGuide Disseminator Newsletter*, October 2011. "A New Public Safety Focus for FDOT and ITS," https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/content/traffic/newsletters/2011/2011-010-oct.pdf?sfvrsn=920d35ba_0
2. NOAA Data Collection System Website <https://dcs1.noaa.gov/>

<https://highways.dot.gov>

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