



Florida Department of Transportation Research

Development of Risk Models for Florida's Bridge Management System

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Many hazards, beyond Florida's famous hurricanes, both natural and manmade, can affect the state's infrastructure. For the Florida Department of Transportation (FDOT) to plan for and manage the results of such events, historical data and hazard models must be combined with good management systems. FDOT has been implementing AASHTO's Bridge Management (BrM) software to support decision making throughout its operations. Several projects have helped identify needs and implement BrM's economic models. In this project, Florida State University researchers laid a foundation for extending BrM tools and processes to cover the risk management of hazards likely to affect Florida bridges.

The researchers developed a comprehensive framework for and components of a bridge management risk model. They determined the likelihood and severity of disaster events, both natural and manmade, and combined these with measures of bridge vulnerability.

To select natural hazards to investigate, the researchers reviewed historical records. Events were selected for direct damage to structures or for rendering bridges inaccessible or impassable. The review confirmed hurricanes as Florida's most significant disaster, followed by wildfires, tornadoes, and floods. The high water flows generated in waterways by hurricanes and floods cause significant scour, also considered in this category. Manmade events which could present serious hazards were also considered: vehicle collisions, especially those resulting in fires, such as tanker trucks; vessel collisions with bridge structures; and the natural aging and deterioration of bridge components that can lead to fatigue, structural instability, or failure.

The likelihood of each event type was determined from historical records and represented both as events per county and events within a given radius of a structure. The researchers listed the top 20 bridges vulnerable to each event type.



This bridge approach was undermined by heavy scour produced by Hurricane Ike in 2009.

The researchers then addressed the model's second part, bridge condition and susceptibility to service disruption. FDOT seeks to maintain bridges with minimal service disruption, but with Florida's large inventory of bridges, maintenance activities must be prioritized against available funds, and maintenance for some structures may be delayed. The longer needed maintenance is delayed, the more likely a service disruption will occur when bridge work begins. So, the time since last maintenance becomes an important measure of a bridge's vulnerability. Also, over time, the natural aging of bridge components may lead to material fatigue, such as cracking in steel members or failure of pretensioning strands in concrete. Fatigue life estimation was based on standard models. Consequences of fatigue were computed in terms of agency costs and impact to road users.

The tools developed in this project will be part of an advanced management program for Florida's bridges. Better prioritization and scheduling of inspection and maintenance will make Florida's bridges more dependable for the day-to-day needs of the many citizens and businesses that depend on them. The deeper understanding of disaster vulnerability produced by this study will help assure that Florida's bridges are open and safe when they are most urgently needed.

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For more information, visit <http://www.dot.state.fl.us/research-center>