Florida Department of Transportation Research

Application of Dynamic Crash Prediction Methodologies to FDOT Safety and Transportation System Management and Operational (TSM&O) Programs

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Current Situation

As more electronics and sensors are added to roadway systems as part of the intelligent transportation system (ITS), vast amounts of data are being delivered minute-by-minute to traffic control centers. This is called "big data," and its analysis has great potential for both retrospective and real-time insight into traffic conditions. Dynamic crash prediction analyzes big data coming from roadway monitoring systems and predicts crash risk based on traffic conditions. Knowing that conditions are ripe for collisions on a particular road segment makes proactive responses possible, such as safety messages on the many dynamic message signs being added to highways across Florida, deployment of stationary police cars with flashing lights to calm traffic, or advance warning to Road Rangers for more rapid response if a collision occurs.

Rush hour is prime time for crashes on crowded freeways.

Research Objectives

University of South Florida researchers documented and evaluated existing dynamic crash prediction methods and practices related to accuracy and timeliness. Based on the information gathered, they developed recommendations for implementing a proactive safety strategy in Florida.

Project Activities

The researchers developed extensive information about dynamic crash prediction through examinations of previous studies, existing technologies, and current user and implementation experiences through literature review, online search, document review, and interviews. Based on what they learned, they selected a product suitable for traffic data collection and analysis for pilot studies of dynamic crash prediction.

For the pilot study, the researchers collected historic traffic and crash data for a recent four-year period at two sites, one on an Interstate highway and the other on a large arterial roadway. Based on historical data, the researchers built a model that can predict crash risk during a three-hour period (the "window") based on traffic and crash conditions for the nine hours leading up to the window. In a simulation test, the researchers used the model with data from three different months in 2020 to evaluate the performance of dynamic crash prediction on Florida roadways. Results showed that the model performed better for the Interstate site than the arterial corridor because of higher number of crashes, which provided more data to analyze, and simpler traffic patterns on the interstate. The model correctly predicted 60% of crashes during the three-hour evening rush period on the Interstate.

The researchers recommended that the dynamic crash prediction model be applied to freeways like the Interstate for the time being. They also recommended that work should be continued with the vendor of the data collection and analysis system to improve the model's performance for periods other than evening rush hour as a first step to extending the model's capabilities.

Project Benefits

Dynamic crash prediction has the potential to reduce roadway crashes as well as the injuries, deaths, and costs – of response, slowdowns, repairs, health care, etc. – that result from crashes.

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