Florida Department of Transportation Research

Characterizing Curve Crashes in Florida

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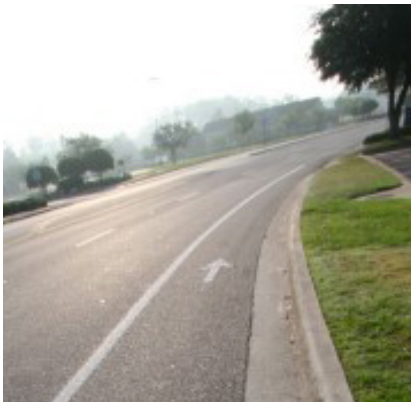
Current Situation

Horizontal curves are a basic element of roadway design. Unfortunately, they are also one of the most hazardous locations on roads. In the U.S., the crash rate at horizontal curves is three times higher than at other parts of the roadway. In 2019, close to 20 percent of highway crashes occurred on curves. Roadway departure crashes—mainly run-off-the-road and head-on traffic crashes—account for most fatal crashes on these types of curves.

Florida has over 200,000 curves on public roads. Currently, there is limited statewide curve safety data, which would be valuable to statewide safety improvement efforts. While horizontal curves are being studied on small and rural county roads, curve risk factors have not been studied statewide. In 2019, FDOT and the University of Florida developed an automated procedure to detect curves and calculate their characteristics, providing an opportunity to evaluate curve safety on public roads across the state.



Road departure crashes account for most fatal crashes on horizontal curves like the one seen here. FDOT and University of Florida researchers have developed a database to track high-risk curve locations, resulting in opportunities to enhance curve safety.

Research Objectives

University of Florida researchers sought to characterize curve crashes and give a statewide overview of curve safety performance in Florida. They also conducted a systemic safety analysis characterizing curve crashes for all roads, identifying contributing factors for curve crashes, developing safety performance functions (SPFs) – mathematical representations that relate the number of crashes with different site characteristics – for curves, and developing preliminary guidance on how to prioritize the highest-risk locations for curve improvements.

Project Activities

After a curve safety literature review, the team applied a curve improvement algorithm to the previous curve dataset and performed an additional quality check to validate the method. The team segmented all 40,000 horizontal curves on Florida roads and assigned crashes to curves using historical crash data from 2015 to 2020 and GIS, including more than 200,000 crashes.

The research team then developed descriptive statistics to address curve crash profiles by type and severity. This preliminary dataset served as the foundation for SPF development and included more than 40 risk factors in its analysis while developing curve SPFs.

The team categorized curves into groups based on area type, the travel directions, and the relation with intersections then analyzed total crashes, fatal and injury crashes, and fatal and severe injury crashes. The team developed models to determine customized risk factors for curves statewide. The research team adopted the customized curve SPFs and used them to predict future crash frequencies on curves. That analysis let the team identify the top 10 percent high-risk curve locations.

Project Conclusions and Benefits

This research developed an updated, statewide curve database and methods to prioritize high-risk curve locations to make them safer. Ultimately, the project allows transportation professionals to better understand curve safety issues in Florida and enable transportation engineers and planners to select proper countermeasures and effectively target resources to the highest-risk locations.

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