



Florida Department of Transportation Research

The Safety and Operational Performance Evaluation of Four Types of Exit Ramps on Florida's Freeways

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In Florida, four types of ramps are typically found for traffic exiting freeways. How these exits affect the integrated performance of interchanges depends on differences in their design elements and factors. Some of these differences raise concerns about safety, operational performance, and correlations among design factors affecting the selection of exit ramp type, such as lane utilization, geometrics, land use, and others. Before this project, these issues had not been explicitly studied, and no clear guidelines, either federal or state, were available.

Researchers from the University of South Florida were contracted to develop a method to evaluate the safety and operation performance of four common exit ramp types and to develop tailored technical guidelines for selection of optimum ramp type based on design factors. Also, a study on placement distance of advance guide signs was conducted. Ramp types considered were diamond, out-connection, free-flow loop, and parclo loop.

For safety analysis, the researchers evaluated impacts of different exit ramp types on safety performance for freeway diverge areas. They identified factors contributing to crashes on exit ramps, based on crash histories of 424 sites in Florida. Crashes on both the freeway diverge area and the exit ramp itself were examined. Freeway diverge areas were defined by number

of lanes used to exit. Crash frequency, crash rate, crash severity, and crash type were compared between exit ramp types. Crash predictive models quantified the impact of contributing factors.

The operational analysis was model-based. An integrated model was developed to select optimum exit ramp type based on a number of design factors. The contribution of factors such as number of lane changes, speed standard deviation, and control delay were estimated with measures of effectiveness. Data for traffic simulations were collected for 24 Florida sites; simulations were conducted with the Traffic Software Integrated System (TSIS). In addition, some design issues of ramp section and cross-road section were demonstrated, such as minimum ramp length and minimum distance between ramp terminal and downstream/upstream intersections.

The researchers' detailed models comprehended safety and operational performance of exit ramps, a method for optimum exit ramp type selection, and supplemental guidelines for placing advance guide signs. Crash rates and crash frequencies at exit ramps are much higher than on highways, so methods of this type offer the opportunity of making design choices that will reduce crashes, fatalities, and interruptions of traffic flow.

Above: The type and design of exit ramps affect their safety and operational performance.

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