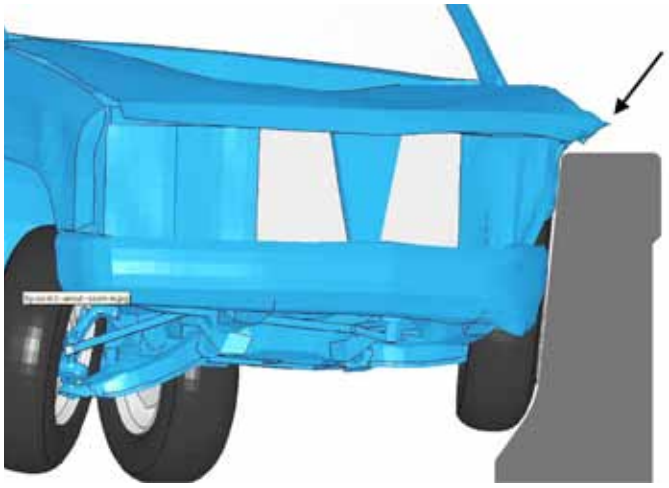
Florida Department of Transportation Research

Zone of Intrusion Study
PR4893118

Concrete traffic railings are a common safety feature along our state highways. As new types of traffic railings are developed and new types of vehicles appear, the effectiveness of these traffic railings must be evaluated. Standards for evaluating traffic railings using crash testing were established by the National Cooperative Highway Research Program (NCHRP) in its Report 350. Test standardization is the basis for comparison of testing across the many agencies concerned with this information.

A common traffic railing along bridges in Florida is the F-shape railing, often 32 or 42 inches high. The intended function of this traffic railing is to contain and redirect an errant vehicle and safely bring it to rest. When a vehicle impacts a traffic railing at high speed, parts of the vehicle may lean over the traffic railing, or deform to project some distance into the space above the traffic railing. The overhanging part of the vehicle may then impact objects mounted on or closely behind the traffic railing. The area into which the vehicle overhangs is called the Zone of Intrusion (ZOI). Engineers must understand the likely extent of ZOI when determining the minimum offset of other structures from the top or back of an adjacent traffic railing.

Researchers at the University of Nebraska-Lincoln's Midwest Roadside Safety Facility (MwRSF) were contracted to simulate the ZOI for a particular class of impact: a 2000P vehicle (light pickup) impacting a 40-inch-high F-shape barrier. Simulations were conducted using LS-DYNA® (Livermore Software Technology Corp.), a dynamic finite element program. Finite-element models of the test vehicle and the barrier were constructed based on previous crash tests performed by MwRSF, and impact tests were simulated at 45 mph and 62 mph (100 km/hr). The impact angle in both cases was 25 degrees. Simulations were conducted for three basic scenarios: impact only, impact with tire blowout, and impact with tire blowout and suspension failure. Scenarios were simulated at three friction values: 0.05, 0.3, and 0.6.



This image from the simulation shows the model truck during impact with the traffic railing. The arrow shows the Zone of Intrusion, the region beyond the plane of the traffic railing into which the impact-deformed vehicle intrudes. The profile of the traffic railing is characteristic of the F-shape barrier.

The ZOI was determined to be relatively small. The results were intended only to give an envelope of ZOI, because it varies in a complex way with the variables studied.

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