South Carolina
Department of Transportation

CLEMSON UNIVERSITY

UNIVERSITY OF SOUTH CAROLINA

THE CITADEL
The Military College of South Carolina

U.S. Department of Transportation
Federal Highway Administration

PROJECT SUMMARY

Report No. FHWA–SC–15–02
November 2015

South Carolina
Department of Transportation
P. O. Box 191
Columbia, SC 29202-0191

SUPPORT FOR THE DEVELOPMENT AND IMPLEMENTATION OF AN ACCESS MANAGEMENT PROGRAM THROUGH RESEARCH AND ANALYSIS OF COLLISION DATA

Overview

The South Carolina Access and Roadside Management Standards (ARMS) provides standards and guidelines for permitting access encroachments onto SCDOT right-of-way. In April, 2013, SCDOT initiated research that would be used to update this manual with the intent that recommended changes could result in a reduction in crashes, injuries, and fatalities on South Carolina roadways. The research examined current and historical practices used by other transportation agencies with regard to access management. Using empirical data collected along several corridors that ranked highest in driveway related crashes, the researchers statistically analyzed and identified the correlation of access issues with crash data. Crash data were associated with driveways using complex Geographic Information System (GIS) modeling tools.

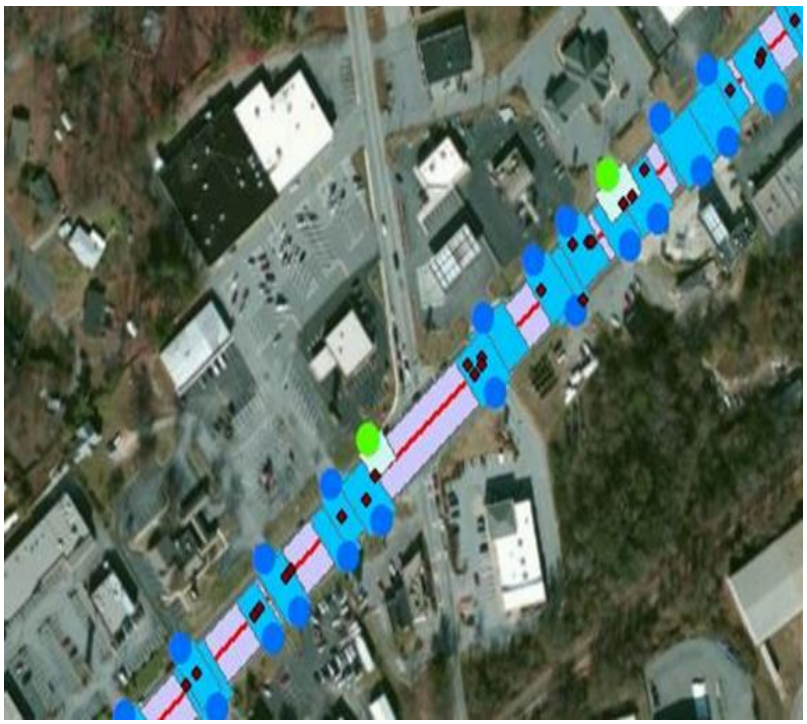

Figure 1: Crashes were associated with driveways using specialized buffers. Full access driveways are shown with blue dots and right-in right-out driveways are shown with green dots.

Key Findings

A negative binomial regression model was employed to identify driveway geometrics and roadway characteristics that affect driveway related crashes. The negative binomial model is shown below.

$$\ln \lambda_i = \beta X_i + \varepsilon_i$$

where:

λ_i is the expected number of crashes for driveway *i*,

X_i is a vector of explanatory variables,

β is vector of estimable coefficients, and

$\exp(\varepsilon_i)$ is a gamma-distributed error term

The statistical analysis identified several significant independent variables that influence crash rates. The results shown in the table indicate that increasing the distance between driveways, increasing the number of entry lanes, and having a raised median will decrease driveway related crashes. Conversely, increasing driveway width, corridor volume and corridor speed limit will increase crashes. Similarly, a driveway with high turnover land use, a driveway with full access (as opposed to right-in right-out), and the presence of nearby signalized intersections will increase crashes.

Negative Binomial Estimation Results for Crashes per Driveway

Variables	Estimate	p-value
Intercept	-19.56	< 2e-16
Driveway Spacing	-0.0004154	0.1392
Driveway Width	0.02656	< 2e-16
Number of Entry Lanes	-0.3245	0.0696
Raised Median	-0.7094	0.0284
D_Class4 High Turnover	0.759	<2e-16
D_Class5 High Turnover	0.8610	1.11e-08
Driveway Control	1.381	2.51e-14
Ln(AADT)	1.668	< 2e-16
Speed Limit	0.01300	0.1818
FA or RIRO	0.8114	0.000494

This study estimates the crash modification factors (CMFs) directly from the coefficients of the developed negative binomial model. The graph shows how CMF changes with a corresponding change in driveway spacing.

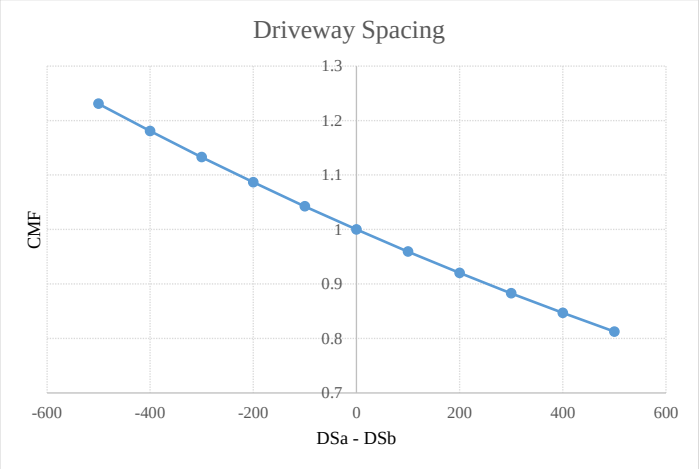

Figure 2: CMF for change in driveway spacing

Other Results

A micro-simulation analysis was used to investigate the operational performance of different driveway spacing policies adopted by various DOTs in the US. Experimental results indicate that driveway spacing has direct influence on the average travel speed of a corridor. Since reduced driveway spacing negatively impacts corridor travel speed, selection of a minimum spacing should consider its effect on the operational performance of the corridor. Benefit-cost analyses of two different access modification strategies suggest that it is beneficial to convert a TWLTL to a raised median. Similarly, it is beneficial to reduce the driveway density on a corridor. The research also reviewed SCDOT access waiver procedures. While the current process suffices based on our literature review it is evident that this process could be significantly streamlined and enhanced with a paperless system.

Conclusion

Based on findings from the research a series of proposed changes and modifications are identified for the SCDOT Access and Roadside Management Standards (ARMS). Most of the standards identified in the current ARMS are still valid. Safety problems are most prevalent at driveways that deviate from adopted design standards. It is anticipated that implementation of the findings of this research will result in long-term economic benefits, and improved traffic flow and safety.

Wayne Sarasua, Jennifer Ogle, Mashur Chowdhury (Clemson Univ), Nathan Huynh (USC), and William J. Davis (The Citadel) were Principal Investigators on this research.
For further information contact Terry Swygert at SCDOT 803-737-6691, swygerttl@scdot.org