South Carolina
Department of Transportation

CLEMSON
UNIVERSITY

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PROJECT SUMMARY

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Fatal Crashes on Rural Secondary Highways

Overview

Traffic crash statistics indicate that eight southeastern states (AL, MS, GA, FL, SC, NC, TN, and KY) consistently have higher numbers and rates of fatal motor vehicle crashes than the national averages. Under the auspices of the Federal Highway Administration (FHWA), these southeastern states are conducting a pooled fund study to investigate the overrepresentation of crashes in the region. This study, entitled "Investigation and Identification of Principal Factors Contributing to Fatal Crashes in the Southeastern United States" (SPR-3[057]), is being coordinated by the Georgia Institute of Technology (Georgia Tech), with universities in each of the other states serving in a supporting role.

This report outlines Clemson University's research project entitled "Fatal Crashes on Rural Secondary Highways" for the South Carolina Department of Transportation (SCDOT). The principal objectives of the proposed research effort were to obtain for SCDOT a set of data records for randomly selected fatal crashes on rural South Carolina two-lane roads, evaluate these data, and ascertain how the safety of these roads might be improved by specific crash countermeasures.

Methodology

In order to study the phenomenon of high fatal crash rates on South Carolina's rural two-lane roads, a comprehensive data set was collected for 157 randomly selected fatal crashes. These crashes occurred throughout the state during calendar year 1998. Georgia Tech provided data dictionaries and report forms covering five categories of data–site, environment, crash details, vehicle details, and involved persons. Based upon the requirements, the Clemson research team identified potential sources of crash related data within SC state and federal agencies. Crash data from these sources were collected and converted to the required formats. In addition, the research team visited each crash site to verify the crash circumstances and to collect a wide variety of additional data on roadway and roadside conditions. The data included measurements of roadway geometry, location of relevant traffic control devices, photographs, and observations about the roadside environment. All information obtained was organized and recorded in computer databases for later analysis. The collected crash data were provided to Georgia Tech, which will use the data contributed by all of the southeastern states to evaluate accident causes and possible mitigation measures.

The 157 crashes evaluated resulted in 176 deaths, with an average number of fatalities per crash of 1.12. Ninety five additional persons received injuries. Of the crashes, 61 percent involved a single vehicle. Sixty-five (65) percent of theinvolved vehicles had a single occupant. Intersection locations accounted for 51 percent of the total crashes.

After completing the data collection process, Clemson performed an analysis of the SC sample crash data to predict the reduction in fatalities for selected countermeasures. The research team employed a process called the Bayesian Statistical Analysis Framework (B-SAF). This approach, developed by Georgia Tech, involves the use of Bayesian statistics to develop crash reduction factors (CRF) for a specific countermeasure. B-SAF uses the results of an expert assessment to develop subjective distributions of the countermeasure effectiveness. These are combined with distributions developed from empirically derived data, resulting in "posterior" distributions and estimates that more accurately reflect the effects of countermeasures on the crash population of interest.

Working in conjunction with SCDOT staff, the researchers selected a set of 30 countermeasures for which to develop CRFs. Though B-SAF is applicable to all types of countermeasures, the countermeasures selected in this study were almost exclusively engineering treatments. A team of five safety experts was selected by SCDOT to perform a subjective assessment of the potential impact of each countermeasure on the sample crashes. Each expert examined the sample crash data and, for each crash and countermeasure, determined the likely effect of the countermeasure on the crash outcome. These assessments were recorded and subsequently used to develop a subjective, or "prior" distribution for the effectiveness of each countermeasure.

A literature survey was conducted to identify CRF values for each of the selected countermeasures. The results of this survey provided, in most cases, a range of CRF values for each countermeasure. Several countermeasures had no literature coverage, and so were dropped from further consideration. The CRF values for the others were used to develop objective, or "likelihood" distributions.

The posterior CRF, θ, is derived by combining the distributions of the prior and likelihood values. It represents the probability that a countermeasure will prevent a crash given the characteristics of the entire crash population. This approach is substantially different from the normal use of a CRF, where it is necessary to isolate crashes susceptible to the countermeasure. The report outlines the developments of CRF values applicable to SC's rural two-lane rural roads.

Results

Using the derived CRF values, the research team then assessed the potential impact of each treatment on fatal crashes within the state. The estimated number of reduced crashes was calculated for each countermeasure. Using a societal cost of $3 million for a fatal injury, the potential benefit of each treatment was then calculated.

The study results appear to provide a reasonable indication of the effectiveness and potential value of the selected set of countermeasures. Estimated societal benefits of the countermeasures, based upon the study methodology and assumptions, ranged from $0 to $846.5 million, assuming complete prevention of each crash. It is apparent that some countermeasures have a high payoff potential within the state. Others appear to have little overall impact. The analysis should help policy makers to direct safety funds towards countermeasures having a high payoff potential.

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