UPDATE OF FLORIDA CRASH REDUCTION FACTORS AND COUNTERMEASURES TO IMPROVE THE DEVELOPMENT OF DISTRICT SAFETY IMPROVEMENT PROJECTS

PROBLEM STATEMENT

Crash Reduction Factors (CRFs) are used to estimate the expected reduction in crashes that will occur during a given period as a result of implementing a proposed countermeasure. This estimate is needed to perform benefit-cost analysis to help safety engineers select safety projects for implementation. In 1987, the Florida Department of Transportation (FDOT) contracted with the University of Florida (UF) to develop a set of Florida-specific CRFs. The study identified 103 countermeasures, and CRFs were developed for 58 of them based on 237 improvement projects submitted by various FDOT district offices. Since the completion of the UF study, many safety improvement projects have been implemented throughout the State. In addition, shortcomings associated with the method used to develop CRFs have become better recognized, notably, the validity of CRFs developed using the method.

OBJECTIVES

The objectives of this project include the following:

1. Perform a comprehensive review of the literature on the state-of-the-art research in CRFs and countermeasures.
2. Conduct a survey of all U.S. State Departments of Transportation (DOTs) to identify the state-of-the-practice in CRFs and countermeasures.
3. Update existing Florida CRFs with data from additional safety improvements projects to improve their accuracy.
4. Develop CRFs for countermeasures that were not developed in the UF study, due to insufficient data, to provide a more complete set of CRFs for use by District Offices.
5. Create a database of safety improvement projects and a user-friendly application software to interface with the database to facilitate continued update of CRFs.

FINDINGS AND CONCLUSIONS

Before-and-after study is the most commonly used method for developing CRFs. Researchers reviewed three types of before-and-after methods: (1) the simple before-and-after study method, (2) the before-and-after study with comparison group method, and (3) the before-and-after study with Empirical Bayes (EB) method. The method used to calculate CRFs in Florida has been based on the commonly used simple before-and-after approach. This approach is easy to implement and has been used widely by state DOTs. However, this approach is known to suffer a widely recognized problem known as the regression-to-the-mean (RTM)—a statistical phenomenon that occurs when a non-random sample is selected from a population. This selection bias tends to overestimate the crash reduction for a treatment site.

The Empirical Bayes (EB) method has been introduced by researchers as a way to address the RTM problem. Implementation of the EB method to account for the RTM bias will be an important, though challenging, effort. In 2001, the Federal Highway Administration (FHWA) started to develop an EB-based system known as *SafetyAnalyst*. This system is aimed at providing the state and local highway agencies with a comprehensive set of tools to improve their programming of site-specific highway safety improvements. States will have the option to use localized values to better represent the local crash experience.

The Crash Reduction Analysis System Hub (CRASH) system that was developed in this study provides a good start to FDOT's long-term effort to improve Florida's safety improvement programs. It also provides a platform for FDOT to support applications of *SafetyAnalyst*. Developed as a web-based application that runs on FDOT's Intranet system, CRASH is able to perform the following tasks in a highly automated manner:

1. Record and maintain safety improvement projects
2. Update CRFs using the latest available safety improvement projects and crashes
3. Apply the latest CRFs in the benefit-cost analyses of specific projects
4. Perform before-and-after analyses to evaluate the effectiveness of safety programs

In addition, the system provides various functions for data retrieval and exportation for different analysis and reporting purposes.

CRASH, however, does not collect all of the data needed to use *SafetyAnalyst*. Many of the necessary factors are contained in the FDOT's Roadway Characteristics Inventory (RCI), but there is a need for much more detailed information if FDOT is to have a Safety Analyst system customized for Florida's crash experience and roadway conditions. Therefore, it is recommended that FDOT develop a system that can help to provide Florida-specific data in the format needed for use with *SafetyAnalyst*.

BENEFITS

The CRASH program developed in this project provides an effective means to systematically maintain Florida's safety improvement projects and allow CRFs to be updated easily and regularly. This allows the most up-to-date CRFs to be used in benefit-cost analysis of safety improvement projects. CRASH's ability to perform such analysis in a highly automated manner allows safety engineers to greatly reduce the time needed to perform project analysis. In addition, its ability to quickly perform before-after analysis of selected projects provides a powerful tool to evaluate the effectiveness of safety programs. Thus, analysis that took hours to perform takes minutes to do with CRASH, the consequence of which should be several hundreds of labor hours annually saved statewide. CRASH also facilitates the systematic storage and usability of data, which will improve the ability to perform final evaluations years after projects have been completed. Finally, the ability of the program to generate before-and-after reports greatly reduces the time needed for FDOT to prepare its annual reports for submission to Federal Highway Administration (FHWA).