Joint Transportation Research Program

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Updating RoadHAT: Collision Diagram Builder and HSM Elements

Introduction

This study includes two separate but related components:

1. Comparison of the HSM-based and Indiana methods of safety management; and
2. Development of a Collision Diagram Builder (CDB) to improve current Indiana safety management tools.

Indiana developed and started implementing its road safety management methods before the Highway Safety Manual (HSM) and SafetyAnalyst became available. The considerable cost of replacing the Indiana current practice with safety management practices based on the Highway Capacity Manual prompted the Indiana Department of Transportation (INDOT) to continue using its own safety management tools. This study compared the HSM-based and Indiana safety management methods in order to identify similarities and differences. The primary motivation of this study was to point out possible improvements of the Indiana and HSM-based approaches to safety management. This study had three objectives:

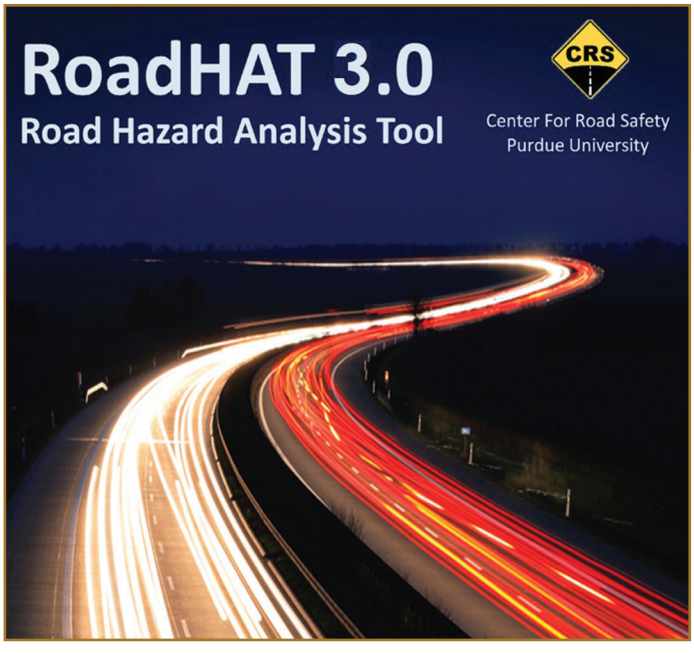
1. Evaluate the HSM safety performance functions (SPFs) with Indiana data;
2. Determine the best network screening strategy available in the HSM and compare it to the Indiana strategy; and
3. Compare the HSM and Indiana procedures for economic evaluation of safety improvement projects.

To address the three research objectives, the HSM was studied with a particular focus on the chapters describing the criteria for identification of high-crash locations, SPFs, and life-cycle estimation of the benefits and costs of safety measures. The HSM and Indiana SPFs were compared and their performance evaluated using Indiana data. The HSM models also were checked as to whether they would perform better in Indiana by calibrating them with Indiana data.

A second major component of the study was to improve the current Indiana safety management tool, RoadHAT2, by developing a computer application facilitating preparation of a so-called collision diagram. These diagrams are an important component of safety audits. However, they are not used frequently due to the considerable time required to build collision diagrams.

Findings

This study concluded that the HSM SPFs would need to be calibrated to the Indiana conditions before they could be used. Calibrating the SPFs for so-called base



conditions would lead to an insufficient number of roads and, consequently, to estimates that could not be trusted. This problem is amplified by the large number of road categories and crash types in HSM (110 categories and 468 crash severity proportions). Furthermore, the re-calibration process is not a one-time effort. It must be repeated over time to keep the SPFs updated to the changes in safety.

An advanced statistical simulation of a safety management system aimed to maximize the total safety benefit was performed. The results indicate that the two best-performing criteria—the HSM EPDO-based criterion and the Indiana total cost of crashes criterion—are equivalent and they produce the same results. Some of the criteria proposed by HSM are inadequate for maximizing the overall safety benefit. It is important that the HSM provides guidance as to which screening criteria support which screening objectives.

Although the total number of crashes was shown to be an effective criterion of identifying locations with high potential for safety savings, its usefulness strongly depends on a stable correlation between severe and less severe crashes. It was also concluded that although the cost of crashes and the Index of Crash Cost and Frequency used separately proved to be good screening criteria in Indiana, the combined use of these two measures did not deliver any considerable improvement.

Two major differences were found between the HSM and Indiana procedures for evaluating the benefits and costs of safety projects: the infinite period of analysis and the road capacity constraint on traffic growth. The Indiana results depend on the capacity constraints, while the HSM results depend on the length of the analysis period. The differences between the two methods are typically limited. The results from both methods can be fully reconciled by relaxing the road capacity constraint in the Indiana method and by using a long analysis period in the HSM method.

The developed Collison Diagram Builder reduces the time needed to prepare a collision diagram from one to two days to an hour or less. The application provides additional tools for analyzing and visualizing crash patterns.

Implementation

The findings of this study help improve the Indiana network screening method. The screening tool, SNIP2, has already been modified to implement the EB estimation of the crash cost. There is no need to modify another Indiana tool, RoadHAT2. Both tools already use Safety Performance Functions and crash unit costs developed and updated to the Indiana conditions on a regular basis. These tools are flexible, incorporating the recommended changes through modifying the application settings and without modifying the computer code.

A beta version of the Collision Diagram Builder was developed and delivered to INDOT for testing and evaluation. A CDB User Manual was developed to help implement and use the tool. A workshop was delivered by the research team to introduce the CDB tool to INDOT users.

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