HIGHWAY SAFETY MANUAL, SAFETY PERFORMANCE FUNCTIONS (SPF) & ROADWAY CALIBRATION FACTORS

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PURPOSE OF THE PROJECT

The purpose of the project is to enhance transportation safety through Tennessee Department of Transportation (TDOT) adoption of the Highway Safety Manual (HSM). HSM is a resource that will facilitate decision making based on safety performance of roadways. The use of HSM will provide TDOT with quantitative information for decision making and tools for consideration of safety across the range of highway activities including planning, programming, project development, construction, operations, and maintenance. One of the key features included in the 2010 HSM is the crash predictive models for three facility types: 1) Rural Two-Lane and Two-Way Roads, 2) Rural Multilane Highways and 3) Urban and Suburban Arterials, which will be covered in this project.

Given the availability of data in E-TRIMS, TDOT is adopting HSM and can benefit from software applications that can make it easier to use HSM procedures. The research team will install and demonstrate Safety Analyst for TDOT and develop application software for generating calibration factors from E-TRIMS, using crash, inventory, and traffic data. Training of TDOT staff on using the software will be provided. The team will coordinate their efforts with TDOT and obtain input from various TDOT entities that include Information Technology, Long Range Planning, and Strategic Transportation Investments Divisions. The project is benefiting greatly from a related Highway Safety Manual project undertaken by members of the research team through the USDOT sponsored Southeastern Transportation Center at University of Tennessee, with Dr. Steve Richards as the PI. This federal project has improvements in Highway Safety Manual procedures as one of the four major research initiatives. The goal of this research is to assist the TDOT in adopting the Highway Safety Manual's predicted modeling process. To perform this work, the research team will obtain relevant data, develop calibration factors, and help TDOT staff use the procedure (by providing detailed methodology) to predict future crashes and countermeasures that can reduce crashes. This study is a collaboration between Dr. Asad Khattak of UTK (as the PI) and Dr. Deo Chimba of TSU (as the Co-PI) to calibrate the HSM predictive models for TDOT use.

SCOPE AND SIGNIFICANCE OF PROJECT

Safety Performance Functions (SPFs) are statistical models used to estimate the expected crash frequency for these facility types with specified “base” conditions. The 2010 HSM recommends local agencies such as TDOT either to develop their own SPFs using local data or calibrate the HSM developed SPFs to reflect local conditions. Opting for Calibration method and because the HSM predictive models were developed using data from a subset of states, they need to be calibrated to match Tennessee conditions. Geographical conditions of the state of Tennessee may differ substantially from the factors used to develop predictive models presented in HSM such as terrain, climate, animal population, driver populations, crash reporting threshold, and crash reporting practices, hence requiring calibration before use in Tennessee. Calibration is the process of multiplying the HSM predictive models (SPFs) by a factor to account for Tennessee HSM users. Specifically, the calibration factors to be estimated in this study are the sum of observed crashes divided by the SPF predicted crashes for the sites of a particular facility type. The HSM calibration process for use in Tennessee will involve identifying facility types for which the predictive model is to be calibrated, selecting sites for calibration of the predictive models for each facility type and obtaining crash, roadway and traffic data for each facility type applicable for calibration. The study will then apply the SPFs to predict crash frequency for each site during the calibration period as a whole. The study will compute calibration factors for selected facilities in Tennessee.

EXPECTED OUTCOMES

The overall outcome is the support of more informed decision-making about appropriate safety countermeasures in transportation safety. The project will help operate and manage Tennessee's

transportation system to provide a high level of safety and service to the public. The project will improve safety by using available safety-related data i.e., evidence-based approach to understand safety needs at the statewide level and consider cost-effective countermeasures. Specifically, the calibrated models will predict the expected number and severity of crashes based on crash histories and experiences at similar sites, for different road type, road class. The framework will evaluate the impacts of proposed safety countermeasures, based on their cost-effectiveness. The selection of proposed safety projects will be improved through the calibration of 2010 HSM Predictive Models to reflect Tennessee conditions. The calibrated predictive models will accurately predict crashes and assist TDOT improve reliability of common activities such as screening a network for sites where realistic reductions of crashes or their severity can be achieved.

TIME PERIODS AND STATUS OF THE PROJECT

The project is broken out into several tasks with Phase 1 covering tasks 1 to 7, and Phase 2 covering tasks 8 to 14. To perform this work, the research team is obtaining relevant data, developing calibration factors, and will be helping TDOT staff use the procedure to predict future crashes and apply appropriate safety countermeasures.

Table 1 Task Descriptions and Progress (as of September 16, 2016)

Task	**Task Descriptions**	**% done**
1	Literature Review & Current Practices for Generating Calibration Factors/SPFs	100%
2	Identify Facility Types for Which the Predictive Models are to be Calibrated	100%
3	Select Sites for Calibration of the Predictive Models for Each Facility Type	80%
4	Gather/Collect Traffic & Road Inventory & Crash Data for Study Sites using E-TRIMS	75%
5	Gather additional data as needed, integrate data & prepare for analysis	85%
6	Apply Predictive Models for Rural Two-Lane & Two-Way Roads	25%
7	Compute Calibration Factors for Rural Two-Lane & Two-Way Roads Models	35%
7.1	Interim report	
8	Apply Predictive Models for Rural Multilane Highways	
9	Compute Calibration Factors for Rural Multilane Highways Predictive Models	
10	Apply Predictive Models for Urban & Suburban Arterials	
11	Compute Calibration Factors for Urban & Suburban Arterials Models	
12	Review & Begin Install/update & Demonstration of Software for Use	
13	Begin Work to Develop Customized Software for TDOT to Generate Calibration Factors from E-TRIMS & Train TDOT Personnel	
14	Final Report & Tech Transfer	

NOTE: * INDICATES PROGRESS DONE FOR RURAL TWO-LANE & TWO-WAY ROADS (PHASE 1)

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