NCHRP 17-50 TECHNICAL BRIEFINGS

This series of technical briefings provide a reference for highway agencies that are interested in initiating the implementation of the American Association of State Highway and Transportation Officials (AASHTO) Highway Safety Manual (HSM) principles and philosophy within their organization. The series summarizes lessons learned, best practices, challenges, and other aspects of implementation of the 13 lead states and 8 support states that participated in the research project.

Highway Safety Manual Implementation

The HSM, published in 2010, provides a complete collection of currently available information and scientific-based methods for estimating and evaluating the quantitative safety effects of decisions throughout the project development process. The HSM is intended for use by any professionals responsible for planning, design, construction, operations, and maintenance of a highway system.

There are many benefits associated with HSM implementation, including the introduction of a second dimension of safety, or substantive safety. Understanding of substantive safety provides State Departments of Transportation (DOTs) with a basis for decision-making during the project development process.

The sections below include examples of HSM implementation activities undertaken by various transportation agencies.

Implementation Plans

An implementation plan lays out the steps required to communicate what needs to be done, set a timeline, and identify the issues that will be addressed. Most lead states have developed HSM implementation plans that contain common core elements, such as policy, training, organizational issues, and data assessment. Lead states implementation plans can be made available by contacting the Transportation Research Board (TRB) project manager listed at the end of this briefing.

New Hampshire DOT developed a roadmap and an implementation plan of the state's current HSM integration status and implementation strategy for a regionwide implementation. The documents highlight the activities initiated before the release of the HSM, current efforts, and upcoming activities.

FIGURE 1: Elements of HSM Implementation

Organizational Support

One of the key elements of implementing the HSM is the designation of one or more champions within the organization. A key characteristic of such a leader would be considerable influence within the agency. Executive support is important to ensure the agency's commitment to the implementation task.

Florida DOT has successfully engaged upper management and has a safety champion in each district. Senior leadership in Utah DOT is well versed in HSM and support its application. In general, most lead states have expressed that support from the top down has helped with increasing awareness of the HSM within their agencies.

Policy

Widespread implementation of the HSM is the ultimate goal. This translates to incorporating the HSM principles into the agencies decision-making processes and the overall project development process. Some areas where states have applied the HSM include:

Planning and programming: Illinois DOT developed a network screening process for identifying locations for potential improvement using HSM-based prediction methods for segments and intersections. Sites are ranked based on a safety performance measure called Potential for Safety Improvement (PSI), and results are used to develop IDOT's annual Five Percent Report. Michigan DOT is using the HSM and SafetyAnalyst for network screening and alternative evaluation on MDOT safety projects.

Project scoping: Michigan DOT included HSM language into the MDOT Scoping Manual.

Design exceptions: Ohio DOT developed a design exceptions policy document that uses HSM predictive methods.

FIGURE 2: Missouri DOT Design Exception Policy

Design process: Utah DOT has implemented the Operational Safety Report (OSR) requirements into the design process.

Road safety audits: Alabama DOT is developing a Road Safety Audit guidance manual that incorporates HSM language and quantitative safety analysis approaches for various types of projects.

Pavement preservation: Louisiana DOT has included requirements to conduct some level of safety assessment from a simple review to a full blown RSA into their pavement preservation projects (3R).

Training

HSM training is one of the first implementation elements to be discussed and implemented. Based on lead states experiences, training is more effective when conducted using a multi-tier approach. First, select a group of key people that can transfer the knowledge to others. This may include technical experts, project managers, and senior managers. A second group includes executives and upper management, so they have a good understanding of the HSM philosophy and are engaged with the implementation process. Lastly, tailored training has proven to be the most effective. Divisions of planning and programming may benefit the most with Part B training, while professionals involved in design decision-making and project development may benefit the most with Parts C and D training.

Maine DOT worked with the Federal Highway Administration (FHWA) resource center to provide an HSM overview to upper management, and the FHWA Practitioner's Workshop for the HSM, providing 1- and 2-day tailored training sessions for planners and safety practitioners, respectively.

Data

Application of the HSM methods and other quantitative safety analysis tools requires various data elements. State DOTs have been investing time and effort developing robust data systems. Utah DOT is performing a systematic data collection of several roadway elements in the state system using light detection and ranging (LIDAR) technology. New Hampshire DOT participated in the FHWA Model Inventory of Roadway Elements (MIRE) pilot data collection effort. MIRE contains a recommended catalogue of roadway inventory and traffic elements critical to safety management. NHDOT had intersection data collected for use with SafetyAnalyst.

Tools

Network screening and project level application tools are typically needed for an effective HSM evaluation. SafetyAnalyst is a tool designed to implement the HSM Part B Roadway Safety Management Process. Ohio DOT and Michigan DOT have successfully integrated SafetyAnalyst into their network screening and project prioritization practices.

FIGURE 3: SafetyAnalyst

The Interactive Highway Safety Design Model (IHSDM) is a suite of software analysis tools developed by FHWA to evaluate the safety and operational effects of project-level geometric design decisions on highways. IHSDM contains all HSM Part C predictive models. Louisiana DOTD used IHSDM for the safety performance evaluation of various alternatives of a 20-mile high speed, four lane rural arterial connecting the city of Bush and I-12.

FIGURE 4: Interactive Highway Safety Design Module

Many states have developed their own version of the National Cooperative Highway Research Program (NCHRP) Project 17-38 spreadsheets, which were designed as a Part C training tool. Such a tool is typically used for application of Part C predictive methods in small projects or site-specific analyses.

Safety Performance Function Development and Calibration

A successful application of HSM Part C predictive methods requires that states either calibrate HSM safety performance functions (SPFs) or develop state-specific SPFs. HSM calibration is essential to allow states and local agencies to take full advantage of HSM Part C methods, which account for regression to the mean. Development of state- or region-specific SPFs requires more data; however, agency-developed SPFs should be even more accurate than calibrated SPFs from the HSM. During the SPF development period, analysts can still use the HSM Part C models to assess relative differences among alternatives. However, without calibration factors, output from the HSM Part C models cannot be used as absolute numbers or described as an actual prediction.

Most lead states have calibrated and/or developed agency-specific SPFs. Alabama, Washington, and Oregon have compared the performance of their own SPFs against the default HSM SPFs and found the results to be different. Typically, a robust and complete data system is required for SPF development. SPF development is more expensive than calibration. Alabama DOT recommends beginning with the most common facility type to assess data availability and accuracy. Virginia DOT recommends starting with sites with the most data available.

Highway Safety Manual Applications (Highway Safety Manual Parts B, C, and D)

Washington DOT performed a corridor study using SafetyAnalyst for the confederated Tribes of the Chehalis reservation on US Highway 12. The analysis included an estimation of expected average crashes for different locations, and the calculation of benefit-cost ratios to show return investments.

Missouri DOT used the HSM to establish speed limits on expressways. Their proposed approach took into account a specific criteria based on predicted crash frequency limits, specific geometric considerations, presence of safety enhancements, and the number of median openings.

Alabama DOT has been using the HSM for a variety of projects, including establishing bridge and shoulder widths, vertical alignment, horizontal alignment, and interchanges using Part C and Part D methods and information.

Results Post Implementation

The HSM has been a game changer for many agencies and maximum potential is yet to be achieved. As stated by Timothy Barnett, Alabama DOT State Safety Operations Engineer, "The use of the HSM in Alabama is improving our ability to identify and prioritize safety improvements, and is allowing for a scientific basis for the consideration of safety in design alternatives analysis."

Overview of the National Cooperative Highway Research Program Project 17-50

The NCHRP project 17-50, Lead State Initiative for Implementing the Highway Safety Manual, kicked off in 2011, bringing together representatives of 13 lead states and 8 support states. Exhibit 1 shows the states participating in the project.

As part of the effort, two peer exchanges were held that provided a venue for participating states for sharing lessons learned and best practices and a forum for discussion among states' representatives. Additionally, a HSM User Guide was developed to help safety analysts begin to use the HSM. The HSM User Guide is a companion document to the HSM and is used as a reference document for analysts with basic knowledge of the HSM.

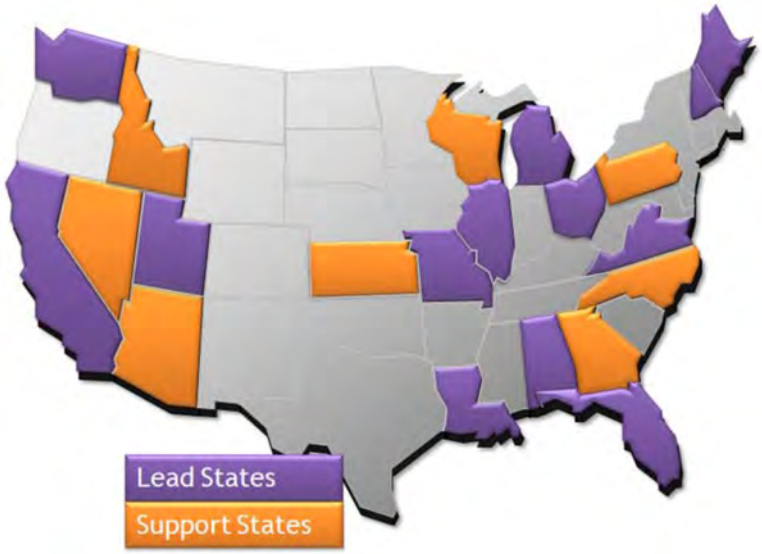

EXHIBIT 1: States Participating in NCHRP 17-50

The next phase of the project includes the development of two peer exchanges in 2015 and 2016, and the development of this technical briefing series and corresponding webinars.

References

HSM Users Guide http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP17-50_UserGuide.pdf
NCHRP 17-50 Peer Exchange 1 Report http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP17-50_PeerExchange1_Report.pdf
NCHRP 17-50 Peer Exchange 2 Report http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP17-50_PeerExchange2_Report.pdf
HSM Implementation Guide for Managers http://safety.fhwa.dot.gov/hsm/hsm_mgrsguide/
Integrating the HSM into the Highway Project Development Process http://safety.fhwa.dot.gov/hsm/hsm_integration/
Other Highway Safety Manual Resources http://safety.fhwa.dot.gov/hsm/
MIRE MIS http://www.mireinfo.org/mire_mis.html
AASHTO Highway Safety Manual http://www.highwaysafetymanual.org/Pages/default.aspx
SafetyAnalyst http://www.safetyanalyst.org/
Interactive Highway Safety Design Module http://www.ihsdm.org
HSM Crash Prediction Spreadsheets http://www.highwaysafetymanual.org/Pages/tools_sub.aspx#1
Missouri Department of Transportation Design Exception Policy
http://epg.modot.org/index.php?title=131.1_Design_Exception_Process

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