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2010 HIGHWAY SAFETY MANUAL LEAD STATE PEER-TO-PEER WORKSHOP

November 17–18, 2010
District 1 Office
Illinois Department of Transportation
Schaumburg, Illinois

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16. Abstract

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EXECUTIVE SUMMARY

The Illinois Department of Transportation (IDOT) and the Illinois Center for Transportation (ICT) sponsored and hosted the 2010 *Highway Safety Manual* (HSM) Lead State Peer-to-Peer Workshop November 17–18, 2010, at the IDOT District 1 Office in Schaumburg, Illinois. The peer-exchange workshop involved representatives from 13 selected states and experts familiar with HSM development and implementation in order to facilitate the exchange of experiences and examples related to HSM implementation among the lead states.

The workshop covered a wide range of topics regarding the institutionalization of new quantitative safety methods (policies, design, planning, leadership, etc.), challenges and barriers (data collection and integration, statistical methods, analysis tools, training needs), case studies, and successful applications of the HSM. This report summarizes attendee statistics, the conference program, main activities (including 24 presentation and discussion sessions), and attendee feedback. Prospects for future workshops and training opportunities are also discussed.

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CHAPTER 1 INTRODUCTION

The substantial development effort by the National Cooperative Highway Research Program (NCHRP), the Transportation Research Board (TRB), and the American Association of State and Highway Transportation Officials (AASHTO) has led to publication of the first edition of AASHTO's *Highway Safety Manual* (HSM). The HSM is the first comprehensive document providing a scientific, data-supported decision-making tool for practitioners when considering safety explicitly during their daily work. It provides new concepts for application by state highway agencies throughout the safety management process and particularly in the estimation of safety benefits of proposed highway improvement projects. The manual also includes network screening methods to identify potential safety improvement project locations, diagnostic guidance based on historical crash patterns, selection process of appropriate countermeasures, economic analyses, and establishment of project priorities, along with methods for evaluating the effectiveness of completed projects. The HSM also provides predictive methods for estimating the safety benefits of proposed highway improvement projects. Estimating the effect of proposed projects or of several project design alternatives on crash frequencies and severities can now become a routine part of the project development process. It will allow safety to be considered on a quantitative basis in project development the same way as other factors such as traffic operations, air quality, noise, and cost are considered.

The Illinois Department of Transportation (IDOT) in partnership with the Illinois Center for Transportation (ICT) developed analytical tools to identify and manage a systemwide program of site-specific and systematic improvements to develop strategies to prevent and reduce fatalities and severe injuries from motor vehicle crashes. These tools, such as Illinois' own safety performance functions (SPFs), were developed using advanced statistical techniques for Illinois state highways. IDOT has fully incorporated SPFs into its safety program and has used SPFs to identify locations to be included in the federally required 5% report. IDOT further expects to implement the *SafetyAnalyst* tool and adopt the AASHTO HSM. Illinois' participation in the review of the HSM through development has allowed IDOT to begin implementation immediately. Illinois, along with a key group of other states, is aggressively working to implement the HSM. IDOT has worked with those states, FHWA, AASHTO, and NCHRP in a phased approach to implementation, which included hosting a national SPF Summit, providing training to IDOT staff, and the proposed lead state peer exchange.

IDOT sponsored in partnership with FHWA the first-ever Safety Performance Function (SPF) Summit with state DOT representatives across the country. This event created significant benefits to Illinois and IDOT. It allowed IDOT to validate its SPFs and take steps to update them to be in line with the HSM, led to development of a one-day SPF workshop by ICT for IDOT engineers, and ultimately brought IDOT more resources and support from FHWA and AASHTO. Upon the success of the SPF Summit, IDOT was granted the opportunity to host the HSM pilot training in Schaumburg in May 2010, which allowed many Illinois engineers to become familiar with the HSM document and its applications. IDOT has used the training materials from NCHRP Project 17-38, "Highway Safety Manual Implementation and Training Materials," and expanded this training to all five regions in the state to maximize implementation.

The HSM has the potential to bring about major changes in the accuracy and completeness of safety analyses conducted by highway agencies. However, like any new analysis tool, the HSM will be effective only if it is implemented by highway agencies.

Recent experience has shown that one of the best ways to encourage highway agencies to implement new approaches is to show examples of other agencies that are taking a lead role in the implementation. IDOT and ICT, therefore, sponsored and hosted the HSM Lead State Peer-to-Peer Workshop to facilitate the systematic and effective implementation of the HSM in Illinois and peer states. The purpose of this two-day workshop, held November 17–18, 2010, at the IDOT District 1 Office in Schaumburg, Illinois, was to disseminate information and facilitate discussions on various ongoing and emerging activities and issues regarding the development and implementation of the HSM. Twenty-four presentations followed by question-and-answer time and facilitated open discussions gave the representatives of 13 lead states and other organizations the opportunity to learn about recent developments by the leading states and federal initiatives. The workshop facilitated the exchange of experiences and examples related to HSM implementation among the lead states by covering a range of topics such as

- Achievements in the institutionalization of new quantitative safety methods
    - Network screening
    - Policies
    - Construction, design, planning, and operations
    - Leadership and champions
- Challenges faced and overcoming barriers
    - Data, data needs, methods for completing the dataset
    - Methods for using tools with limited data
    - SPF calibration an SPF development
    - Leadership support and resources
    - Training DOT staff and local agencies
- Training
    - Needs and available training
    - Outcome of local training sessions
    - Future plans for training
- Data, data needs, and tools
    - Sharing data
    - Data collection methods
    - Data integration
- SPF development and calibration
    - SafetyAnalyst and Interactive Highway Safety Design Model (IHSDM)
- Case studies and applications of the HSM
    - Projects using HSM methods

There was open communication and sharing of experiences, challenges, and successes throughout the workshop, which helped ensure that leading highway agencies benefit from the experiences of other highway agencies. The survey at the end of the workshop showed that all participants found the experience very positive and would like to return to another workshop next year. It was clear that the momentum created at last year's SPF summit has continued to grow, and we aim to continue these advancements in the

explicit quantification of safety. Among the 104 participants, about 50 came from IDOT district and central offices; hence, the workshop also helped IDOT agencies benefit from the experience of leading states in the nation.

The organization of this report is as follows. Section 2 briefly describes attendee statistics. Section 3 presents the conference program, including preparation and management of the event, and then briefly summarizes the main activities at the workshop. Section 4 summarizes the next steps for implementation in various states and at FHWA. Section 5 summarizes attendee feedback. Section 6 then discusses prospects for future training opportunities and recommends future steps to build on the current momentum and address the needs of the safety community.

CHAPTER 2 ATTENDEE STATISTICS

2.1 STATE SELECTION SURVEY

IDOT and ICT created an HSM Lead State Peer-to-Peer Workshop Planning Committee to identify participating states, develop the workshop program, and organize the workshop. There was overwhelming interest from states to participate in the HSM Lead State Peer-to-Peer Workshop; however, budget and space constraints limited the number of states attending to 13. The HSM Workshop Planning Committee distributed a short survey to states to gain insight into their HSM implementation experiences and determine their commitment to advancing HSM. The following questions were included in the survey:

1. Has your agency expressed interest in implementing the HSM?
2. Has your agency assigned a lead staff member or team to assist in the implementation of the HSM?
3. Has your agency supported staff to assist with the development or implementation of the HSM on the national level?
4. Has your agency purchased copies of the HSM for staff?
5. Has your agency provided or have funds dedicated to implement a plan to provide staff with HSM training (at least 1 day training, beyond webinars)?
6. Has your agency calibrated or have funds dedicated to calibrate the HSM safety performance functions (SPFs) for use in your state or has your agency developed or have funds to develop state specific SPFs in the near future?
7. Has your agency begun or plan on implementing SafetyAnalyst?
8. Has your agency supported local and MPOs in safety analysis techniques?
9. Does your agency have a plan for supporting local agencies in the implementation of the HSM?
10. Will your agency support other non-lead state DOTs in the implementation of the HSM?

The HSM Workshop Planning Committee reviewed each of the questionnaire responses and based on HSM implementation experience, commitment to implementation at the state and local level, and geographic representation assigned states in two groups: (1) HSM lead states or (2) HSM support states. The following states, including Illinois, were invited to participate as lead states: Alabama, California, Florida, Louisiana, Maine, Michigan, Missouri, New Hampshire, Ohio, Utah, Virginia, and Washington. IDOT and ICT extended invitations to the HSM development and implementation lead state experts to participate in the workshop and share information. These HSM lead states are expected to partner with HSM support states (and others still in the infancy of implementing the HSM) to further HSM implementation within their agencies. HSM support states will be asked to participate in future initiatives.

The travel expenses of up to three people from the invited state DOTs were covered by the project. Representatives from IDOT’s central office and each of the IDOT districts were also invited. A total of 102 participants attended the workshop, representing safety engineers, data managers, head analysts, agency statisticians, local university researchers (affiliated with state DOT's and FHWA division offices, AASHTO, and TRB), key researchers

involved in the development of HSM, and researchers and developers from the private sector. A list of attendees and their affiliations is presented in Appendix A.

On the workshop registration page, each attendee was asked to provide personal information and respond to the following request: “Please briefly explain your perspective on implementing HSM in your organization.”

Among the 102 attendees, 49 provided a response to this question, which can be classified into four major categories:

- Implementation of HSM has been initiated.
- Preparations are going on for future implementation.
- Considering implementation/interested to know more about HSM implementation.
- No answer (implying no immediate intention to implement HSM).

Figure 1 shows that the majority of the attendees will be involved with HSM implementation in the near future.

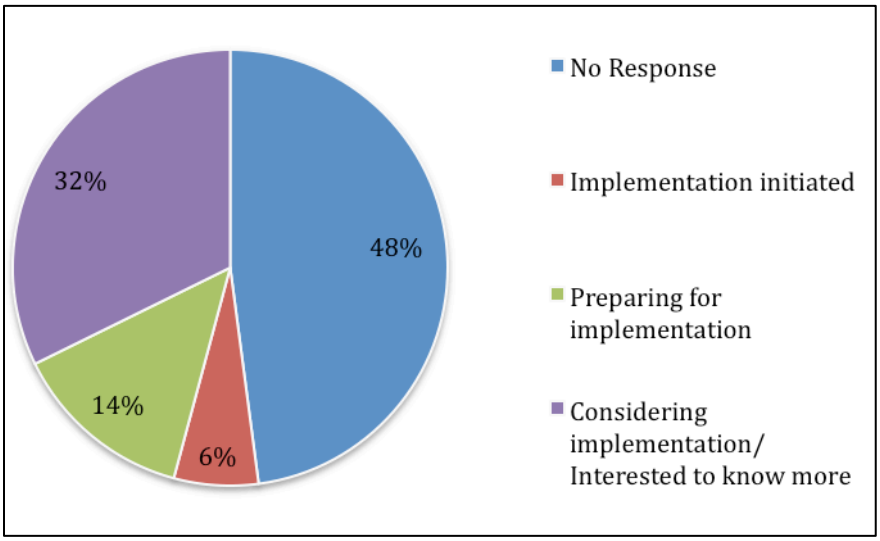

Figure 1. State of HSM implementation among participants.

Among the 102 attendees, their affiliations can be classified into four categories (Figure 2):

- Federal agency
- State/local agency
- Academic organization
- Private organization

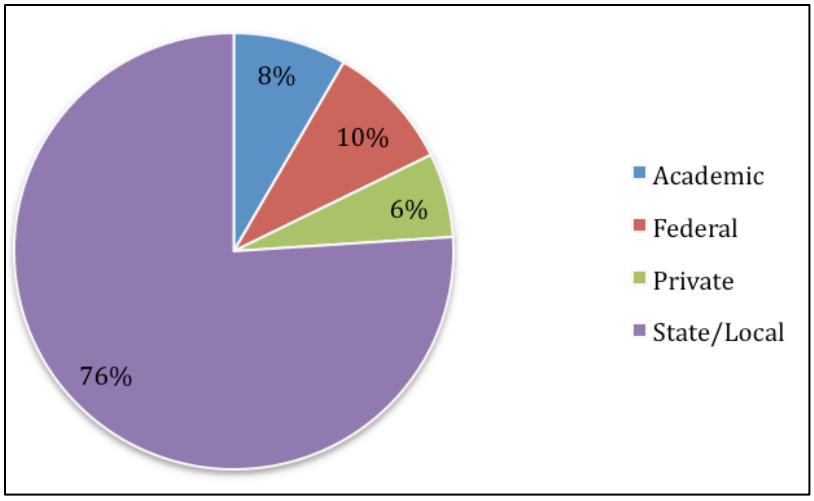

Figure 2. Breakdown of participants by affiliation.

The following organizations were represented (number of attendees in parentheses):

AASHTO (1)

Alabama Department of Transportation (1)

AWPA Chicago Metro Chapter (1)

California Department of Transportation (1)

CH2M HILL (4)

CUATTS (1)

Federal Highway Administration (7)

Florida Department of Transportation (3)

Illinois Department of Transportation (44)

Ionia County Road Commission (1)

LA LTAP/LA Transportation Research Center (1)

Louisiana Department of Transportation and Development (3)

Maine Department of Transportation (2)

Michigan Department of Transportation (2)

Michigan Tech University (1)

Missouri Department of Transportation (3)

NAVIGATS Inc. (1)

New Hampshire Department of Transportation (3)

Ohio Department of Transportation (2)

Southern Illinois University–Edwardsville (1)

Transportation Research Board (1)

University of Alabama (2)

University of Illinois at Urbana-Champaign (8)

Utah Department of Transportation (2)

Virginia Department of Transportation (3)

Washington State Department of Transportation (3)

CHAPTER 3 THE WORKSHOP

During the course of planning for the HSM Lead State Peer-to-Peer Workshop, the HSM Workshop Planning Committee held individual conference calls with each of the selected lead states to gather input. The first set of calls was intended to gather basic information from the states to determine their vision for a successful workshop and gain insight into information the states would like to contribute to the workshop. Specific call discussion topics included

- Confirming primary point of contact
- Obtaining the state's vision for a successful workshop
- Asking whether there is a topic the state would be interested in presenting on (from an initial set of topics identified by the planning committee)
- Asking whether there is any topic that the state would be interested in presenting on (that was not on the initial topic list)
- Obtaining name of proposed speaker(s)
- Asking whether the state would be sending reference materials
- Soliciting other comments

The information gathered on the calls was used to refine the workshop agenda and prepare for the HSM Lead State Peer-to-Peer Workshop planning meeting that was held on September 29, 2010. The invitation of speakers, attendees, and online registration of the workshop started in September. Onsite registration was open from 4:30 to 5:30 p.m. on Tuesday, November 16, and continued from 8:00 to 8:30 a.m. on Wednesday, November 17. The conference sessions (no breakout sessions) started at 8:30 a.m. on November 17 and concluded at 5:00 p.m. on November 18. In most sessions, the presentations were followed by question-and-answer time or facilitated discussions.

3.1. PREPARATION PRIOR TO THE WORKSHOP

One of the major comments obtained from the phone calls pertained to the workshop format. Participants did not want to hear several reports or a series of structured presentations; rather they wanted an opportunity to share and discuss best practices with their peers. This was accomplished by focusing on key aspects of HSM implementation for approximately one hour per topic. Typically two presenters would start the discussions with a short 5- to 10-minute presentation to set the stage for more detailed discussion and exchange among peers on the particular focus topic. After brief opening presentations, there was approximately 45 minutes of facilitated dialog.

Presenters were told that the presentations should include the purpose of the work, how they went about the work, data needs and how they were addressed, identification of barriers and how they were overcome, and next steps. Presenters were also given a list of items that participants wanted to hear about during discussions on the topic, as well as a presentation template. The template used the AASHTO HSM background for consistency and helped to ensure that presenters addressed key items for setting the stage for further discussion on the focus topic.

On September 29, 2010, representatives from HSM lead states met from 8:00 to 9:30 a.m. to coordinate workshop planning. During the planning meeting, these representatives discussed their vision for a successful workshop; confirmed their topics, speakers, and

attendees; and reviewed registration, travel plan logistics, and important dates (see Sections D.1, D.2, and D.3 in Appendix D).

Results of the planning meeting were used to refine the workshop agenda and provide additional guidance to states for developing their presentations for the workshop. Just prior to submitting the final presentations by the November 8 deadline, the HSM Workshop Planning Committee conducted a second set of calls with lead states. Each of the lead states was contacted to confirm participation and logistics and discuss their presentation, including content, to ensure consistency and make sure the presentation addressed information sought by lead states (see Sections D.4 and D.5 in Appendix D).

By November 8, HSM lead states had submitted several items including their final presentations, resources to share with other states, and a discussion form. The shared resources were items states had worked on and were willing to share with other states as examples that could be used to help other states in their efforts to advance HSM implementation. For example, IDOT shared a draft policy titled "Safety in the Project Development Process," and Louisiana shared its "Guidance for Safety Improvements for Pavement Preservation/Rehabilitation/Replacement (PRR) Projects."

Finally, to better facilitate discussions during the workshop, the HSM Workshop Planning Committee distributed a discussion form to gather additional input from participants prior to the workshop. The discussion form included questions by topic area asking participants what they wanted to contribute and what they would like to hear discussed for each topic area. The results of the discussion form were used to ensure that questions were addressed and that states contributed items that added value to the workshop and helped achieve the goal of advancing HSM implementation (see Appendix D, Section D.6).

3.2 PROGRAM OVERVIEW

Table 1 is a list of sessions and speakers/moderators at the HSM workshop. Electronic versions of these files, as well as video footage of all sessions, are available at the conference website (http://ict.illinois.edu/conferences/hsmworkshop2010/ schedule.htm). The biographies of all speakers and moderators can be found in Appendix B, a list of acronyms is provided in Appendix C, and the presentation slides are provided in Appendix E.

Table 1. 2010 HSM Workshop Program

Welcome and Opening Session	Priscilla Tobias and Kelly Hardy
Session 1: Global Perspective on HSM Implementation	Washington, John Milton
Session 2: Approach to Institutionalization	Utah, Robert Hull Ohio, Don Fisher
Session 3: State Implementation Plans, Step by Step	Missouri, Jon Nelson Alabama, Dan Turner
Session 4: Policy	Illinois, Dave Piper Louisiana, Dan Magri
Session 5: Resources and Funding	Illinois, Priscilla Tobias

(table continues, next page)

Session 6: Training	Michigan, Tim Colling New Hampshire, Stuart Thompson Alabama, Tim Barnett
Session 7: National Roadmap for Implementation	FHWA, Esther Strawder
Session 8: Data and Data Needs	Washington, John Milton Louisiana, Terri Monaghan Florida, Joe Santos FHWA, Jeff Miller
Session 9: HSM Applications–Part B	Washington, John Milton Ohio, Jonathan Hughes
Session 10: SPF Development and Calibration	Michigan, Dale Lighthizer Virginia, Stephen Read
Session 11: HSM Applications–Part C	Maine, Darryl Belz Florida, David O'Hagan
Session 12: State Implementation Next Steps	Each state identifies and presents an overview of its own implementation plans or next steps.
Session 13: FHWA Implementation Next Steps	Esther Strawder

3.3 SUMMARY OF KEY SESSIONS

In this section, we briefly summarize the presentation and discussions in several key sessions.

Session 1: Global Perspective on HSM Implementation

Washington State Department of Transportation

In his presentation, John Milton from WSDOT provided an overview of the implementation of HSM. He started with the definition of safety and explained its dilemma. Then he described the four components of HSM.

- Part A introduces HSM and briefly mentions human factors and fundamentals.
- Part B discusses road safety management process, which includes network screening, diagnosis and countermeasure selection, economic appraisal and prioritization, and safety effectiveness evaluation.
- Part C specifies predictive methods, including safety performance functions, crash modification factors, and calibration. Part C also provides applications, example problems and references. Relevant facilities in this part include rural two-lane, two-way roads, rural multilane highways, and urban and suburban arterials.
- Part D is about crash modification factors, which describe the safety effectiveness of countermeasures or treatments.

Milton then explained why and how to use the methodology specified in Part C. He said that crash fluctuations can be viewed in reliable way (i.e., reliable drive decisions are based on the expected average crash frequency). He stated that the ability to implement HSM lies in a state's capability for integrating data and tools, its project development process, its system management, and its policy to support top management. The HSM can be used to address several cross-cutting issues, such as policy development, legal and risk management, structure and business processes, and resources. Milton concluded his presentation by discussing several related issues such as training, funding, and marketing. In summary, he stated, the purpose of HSM is to reduce crash frequency and severity.

Session 2: Approach to Institutionalization

Utah Department of Transportation

In his talk, Robert Hull from UDOT shared his department's experience in institutionalizing HSM. The milestones included review of its Highway Safety Improvement Program (HSIP) and design exception process, as well as develop training materials. One major challenge UDOT is facing in the course of HSM institutionalization is the decentralized work environment and shortage of design staff. To overcome those barriers, UDOT is looking to implement an extensive training process, enhance the existing processes, and help users understand the advantages of HSM. Finally, he emphasized that the best approach is to start from the strength of the organization (i.e., what they do best) and keep things simple without adding extra work.

Ohio Department of Transportation

Don Fisher from ODOT shared its plan and experience in implementing HSM. The department's short-term goal is to establish training for internal and external stakeholders, provide network screening for safety analysis, revise safety study guidelines, and modify safety application scoring. In the long-term, they intend to look into implementing HSM in a strategic highway safety plan, state long-range plan, and project development process. Some of the major challenges they encountered in the process included changes in safety policy, getting "buy-in" from key stakeholders, and implementing the HSM at district and local levels. In his opinion, support from the executive management toward safety program policy change is indispensable to overcome these barriers. Furthermore, stakeholders require training on the project development process, and training must be implemented at district and local levels.

Session 3: State Implementation Plans, Step by Step

Missouri Department of Transportation

Jon Nelson from MoDOT discussed that department's initial HSM implementation plan. The plan included obtaining support material, increasing internal understanding, establishing an implementation team, providing training, developing policy and guidelines, and providing technical support. Among the support materials MoDOT procured were an HSM PowerPoint presentation, copies of the HSM, and SafetyAnalyst. However, it is still being determined whether the IHSDM will be a useful tool or whether spreadsheets will be adequate. Although funding is the biggest challenge for most states in this area MoDOT fortunately has been able to buy an adequate number of manuals and a license for SafetyAnalyst. However, its greatest challenge lies in successfully integrating SafetyAnalyst.

Nelson stressed the importance of support of safety program policy change from senior management and pointed out that MoDOT has the privilege of an influential champion in

Leanna Depue (highway safety manager for MoDOT) to help stress to senior management the value of the manual in achieving MoDOT's goals for highway safety.

From their experience, putting together the implementation team was rather simple. However, optimizing the role of the team was more complicated. Full participation had not always been achieved in previous meetings/trainings. Also, the timing of events such as the release of the manual or employee training session limited the seamless function of the team. There is a current need for the team to reconvene and be updated on the next steps for proper implementation.

Overall, training had been successful and economically viable for MoDOT. FHWA provided two, 2-day workshops. Approximately 35 employees (mostly Traffic and Design) attended each class. The workshops have served as a cost-effective way to educate and expose employees from every district to the HSM. The workshops have focused primarily on Part C and have been very participatory—which are a benefit as well as an efficient use of attendee time. A couple of challenges experienced in the training included an insufficient "hands-on" use of the manual itself. Likewise, the Microsoft Excel spreadsheets, though distributed, were not reviewed during the class due to time restraints. The question that remains is how much training must be done going forward and how in-depth the training should be.

One of the lingering items yet to be addressed by MoDOT is the need for state-specific SPFs and calibration factors. The consensus is that such parameters will eventually be required to optimize the reliability of the manual in Missouri. Questions remain about who will develop such parameters and how much resources it will require to do so (how much will it cost? how long will it take to complete?). In the meantime, the question is to what extent should the manual be used with only national data available.

The greatest hurdle faced by MoDOT in terms of full implementation is getting local agencies and consultants to use the manual. Missouri has 114 counties as well as a major metropolis, St. Louis. The challenges are how to begin the training for so many agencies with extreme variation in engineering expertise, how local agencies will fund such resource, and where consultants enter the picture.

Alabama Department of Transportation and University of Alabama

Daniel Turner from the University of Alabama shared the experience in implementing HSM at ALDOT. The implementation program started with significant training and scoping projects to fit HSM procedures to Alabama and vice versa, in collaboration with the Strategic Highway Safety Program (SHSP), University of Alabama (UA), the Traffic Road Coordinating Committee (TRCC), and other stakeholders. The steps in project scoping include defining and understanding user needs, training in software such as SafetyAnalyst, IHSDM, data needs assessment, potential integration with the CARE software developed by University of Alabama, SPFs for Alabama, and other software support for HSM. Some of the questions they faced during the process included how to blend SafetyAnalyst with CARE and whether to calibrate HSM SPFs for three terrain types in Alabama or to prepare Alabama-specific SPFs. They are in the process of analyzing the software migration issue using gap analysis. For the SPF, ALDOT decided to test both approaches before making any decision. Turner also emphasized the importance of support by senior management, internal marketing, and extensive training for successful implementation of HSM.

Session 4: Policy

Illinois Department of Transportation

Dave Piper from IDOT discussed policy development for HSM. He mentioned that throughout this process the HSM has been under development as a backdrop to IDOT's efforts. SAFETY-LU and the HSIP program led to development of an SHSP to guide IDOT's efforts, a data-driven 5% report, and a benefit/cost tool to help document the decisions on project selection. IDOT and FHWA also jointly identified a need to do a better job at the project level in identifying when safety is a driving force for a project and to better document how such conclusions and recommended improvements are supported. One of the recommendations of this process review is an improved policy for safety analysis. Development of the policy has considered not only technical guidance from many national resources and developments, but also the feedback from users (the IDOT districts) who will be applying the policy.

The steps provided by IDOT in safety analysis policy under HSM include the safety management process cycle, network screening, diagnosis, countermeasures, economic appraisal, and project priorities. Since 2002, the Bureau of Engineering and Design manual has referenced an old FHWA document that provides foundations similar to those in the HSM. What the HSM really accomplishes is to bring many sources together and link them in a comprehensive fashion. Although the safety management process cycle is the safety cycle for a network, it brings diagnosis and countermeasure selection to the project level. Prioritization also has an element of project-level application.

IDOT used SPFs and an empirical Bayesian method to estimate potential for safety improvement (PSI). PSI is a weighted average of SPFs (what have been predicted for the site) and the observed crashes (what is observed at the site), which is more reliable than either one individually. To produce a 5% report, it is necessary to look at all locations. Plotting PSI in decreasing order shows how the worst performers are on the leg of the curve that differs remarkably from their peers. These are the locations of interest. IDOT also suggests using a threshold value, such that there is a tangible value to the PSI number that is worth investigation.

The network screening triggers more detailed safety analysis. HSM Chapter 3 provides the basic guidelines. It is provided by the Bureau of Safety Engineering (BSE), and users can find all the segments and intersections on their particular (state) project. IDOT recommends investigating sites that are in the 5% report, above a threshold PSI (10 rural; 25 urban), and above a "knee of curve" point determined graphically by BSE. IDOT also provided a simple critical PSI value for each peer group, considering those three criteria.

In summary, improved data, data tools, organized analysis procedures, and organizational backing have allowed development of an improved method for safety analysis.

Louisiana Department of Transportation and Development

Dan Magri from LA DOTD shared that department's experience of incorporating HSM methodologies into policy and their HSM implementation plan. The implementation plan includes the following:

- a scope and feasibility study
- an environmental study
- a safety assessment for pavement preservation projects
- an assessment of impact on new developments, permits, traffic signals, and median openings
- documentation of design exceptions, variances, and waivers

The challenges encountered in this process were lack of knowledge and training for metropolitan planning organizations (MPOs), local agencies and consultants. To overcome these barriers, LDOT is working in collaboration with the local technical assistance program (LTAP). They conducted FHWA resource center workshops and organized an NCHRP 17-38 workshop.

Session 5: Resources and Funding

Illinois Department of Transportation

PriscillaTobias from IDOT discussed resource and funding issues in implementing HSM. Implementation of HSM requires coordinating many factors, including training, data and analytical tools, and policy. Necessary resources come from internal and external parties, including resources such as staffing and expertise. These resources can be from in-house (central and district) and/or provided by consultants, universities, and FHWA. Funding is available from the Highway Safety Improvement Program (HSIP), State Planning and Research (SP&R), the Safety Belt Bonus, the Traffic Records Coordinating Committee, and LTAP. Tobias shared IDOT's experience in collecting funding from different resources. She also presented an overview of the training classes and data and analytical tools used. Tobias also discussed the possibility of an HSM implementation pooled fund.

Session 6: Training

Michigan Tech Transportation Institute

Tim Colling from Michigan Tech Transportation Institute discussed training state and local agencies, MDOT engineers, and local agency engineers on HSM principles. Their initial plan included review of business and organizational needs and then providing internal training followed by training for multiple units. The groundwork of the process was laid out in 2008, which involved training more than 500 elected officials, building trust among practitioners and the technical group, raising awareness about the benefits and advantages of HSM, introducing safety workflow, and training on HSM tools and data. The subsequent plan for 2011 to 2012 is to conduct 9 or 10 elected training sessions and 12 to 14 8-hour HSM training sessions. The major challenges include identifying the policy changes needed for full implementation, convincing management that change is necessary, and providing user access to the HSM manual. In Colling's opinion, the barriers can be overcome by internal and external marketing, and with extensive training.

New Hampshire Department of Transportation

Stuart Thompson talked about the safety training experience at NHDOT. He stated that safety training using HSM was conducted at state and local levels, including regional planning commissions, towns, and cities. Training sessions for consultants were also organized. Training topics were New Approaches to Highway Safety Analysis, Application of Crash Reduction Factor, Road Safety Audits, and HSM Practitioners' Guide for Geometric Design.

Alabama Department of Transportation

Timothy Barnett from ALDOT shared their experience on conducting HSM training and workforce development. He emphasized the importance of HSM training for the state, counties, cities, planning agencies, consultants, and others involved in planning, designing, constructing, and managing highways and streets. To that end, ALDOT developed a robust training program to address not only the training about the HSM, but also the fundamental knowledge and skills

to properly apply various aspects of the HSM. To date, 243 individuals have received some level of HSM training from ALDOT, including personnel from ALDOT, counties and cities, FHWA, the military, and various other organizations, as well as consultants.

Training sessions involved an HSM overview and two-day workshops with national experts, which brought credibility and provided a real understanding of HSM concepts to the attendees. The goal of these workshops is to allow decision makers to see the value of the HSM and how it could possibly change their approaches to enable them to quantify safety values for decision making using advanced and more rigorous methodologies, to understand the importance of data requirements for successful implementation, and above all, to understand the benefits and advantages the HSM has to offer.

In addition to the HSM training, ALDOT developed a program on workforce development to increase and improve the knowledge and skills of personnel from ALDOT, counties and cities, consultants, and other stakeholders. The program includes workshops on four topics related to highway safety, which are in direct support of the HSM: Safety and Operational Effects of Geometric Design Features, Low-Cost Safety Improvements, Improving Safety of Horizontal Curves, and Road Safety Audits.

One of the barriers encountered was the need to develop the basic knowledge and skills of HSM workshop attendees. Some attendees did not have a broad-enough understanding of the engineering and operational aspects of highway design, maintenance, and operation to fully understand how best to apply the HSM concepts. Another challenge, especially when there is a broad range of specialties and experience in the audience is keeping everyone engaged. The one-day HSM overview course is insufficient to cover the material in enough detail to fully convey the benefits of the HSM. Participants can be easily overwhelmed with the complexity of the concepts and lose focus during the workshop. The two-day HSM is much more thorough, but it is still complex. The cost of the training is also an issue. In particular, ALDOT provides a copy of the HSM to individuals who attend the two-day workshop. The manuals cost almost $300 each, which stresses the training budget.

To overcome these challenges, ALDOT is working with academia to develop more-specific subject-area training opportunities. Specifically, ALDOT prefers to provide a one- to two-day course for transportation planners, maintenance personnel, highway designers, traffic engineers, construction engineers, and similar personnel. Along with the possibility of providing more-specific training on the individual chapters of the HSM (such as human factors, network screening, diagnosis, economic appraisal, predictive methods for each road type, and CMFs) ALDOT is also continuing the Workforce Development Plan and is refining and amending the plan as needed. As part of the Workforce Development Plan, ALDOT is teaming up with FHWA and the Alabama LTAP at Auburn University to offer a program that addresses some the basic knowledge and skills necessary to apply the HSM concepts. They are working to identify methods to provide HSMs to county and city engineers and traffic engineers at no cost. Funding for past and future efforts have been through various mechanisms, including HSIP funds, outreach funds, and other state and federal funds.

Session 7: National Roadmap for Implementation

For an overview of this session, please see Appendix E (presentation by Esther Strawder, FHWA).

Session 8: Data and Data Needs

Washington State Department of Transportation

John Milton from WSDOT discussed HSM data and data needs. When implementing HSM, data are needed to determine needs, assess priorities, estimate crashes, and improve project selection. Data for HSM–Part B and C include site characteristics, traffic volume, and crash statistics. In WSDOT, all crash data and most geometric data are available. Ramp and intersection data are the biggest challenge, and driveways are not specifically identified by milepost. Among all types of data, volume is a key variable in all models.

When implementing SafetyAnalyst many types of data are needed, such as roadway segment data/traffic, ramp data/traffic, intersection data, etc. Substantial effort is required to prepare data for importing into SafetyAnalyst. Not all agencies have all data types required for full implementation of SafetyAnalyst. Therefore, implementing SafetyAnalyst requires user training and agency commitment. From the experience of WSDOT, data experts, IT support, and team communication are important in implementing SafetyAnalyst. Small datasets are preferable to start with, and data updates can be slow. The biggest data challenges were to determine minor road average daily traffic and to create unique IDs for ramp intersections. Scientific methods were used in network screening, systemic improvements, countermeasure evaluations, and economic analysis. State-specific SPFs were developed for predictive methods in HSM–Part C.

Louisiana Department of Transportation and Development

Terri Monaghan from LA DOTD shared that department's experience with HSM data. She said the data should be accurate, timely, and of good quality. At LA DOTD, basic roadway elements are in-place in the state system, although some additional roadway elements are still needed. However, there are very limited data available for local road systems, and even basic roadway elements are needed. Roadware is under contract to fill the data gaps, and the funding is from HSIP and TRCC. Regarding the crash data, a contract has been made with LSU using an FHWA CDIP grant. In the next steps, LA DOTD will proceed with HSM implementation. They will expand data access to MPOs, locals, and law enforcement. Link-predicted methodology in Part C will be applied, including SPFs and CMFs to Crash1 program analysis. They will also continue to improve crash data quality, accuracy, and timeliness, and develop Louisiana-specific SPFs.

Federal Highway Administration

Jeff Miller from FHWA discussed comprehensive approaches for enhancing road safety in terms of data collection and processing. He started with the current conditions of roadway data status and emphasized the importance of creating a consistent state of practice in transportation safety planning by developing MIRE. There are several alternatives to address GAO recommendations in Report GAO-09-35, including defining a minimum set of data for roadway elements and types. Better and more complete crash and roadway data collection can improve roadway safety. In this regard, many states joined the pilot Crash Data Improvement Program (CDIP) in 2009–2010 and are interested in the Roadway Data Improvement Program (RDIP), which is under development and will be piloted in 2011. He also talked about an

assessment of state roadway data collection and analysis processes that will be conducted during 2011–2012 to determine state and national capacity and gaps. Finally, cost-benefit analysis for data systems and processes investment and crash updates would help decision makers weigh the benefits of data investments against other investments.

Florida Department of Transportation

Santos shared FDOT's experience in updating site characteristics, traffic volume, and crash data. Most characteristics (i.e., area type, segment length) and traffic volume data are available or can be collected from Florida's Roadway Characteristics Inventory (RCI) database, while crash and location data are processed by DHSMV or stored in FDOT's Safety Office. The RCI database contains the most characteristic data and traffic volume data for the state highway system, which counts for 10% of all public roads. Santos also talked about the accomplishments of FDOT, including development of an all-roads base map (funded by a 408 grant), calibration of HSM equations, and development of SPFs. However, there are also some challenges in quality and availability of local road data, model minimum uniform crash criteria (MMUCC) compliance, and resources to process long-form (fatal and serious injury crashes) and short-form (property damage only) crash reports. To overcome the barriers, several approaches have been introduced, such as improving GIS line work, AADT, and roadway characteristic data for local roads; developing new MMUCC compliant crash report forms; and investigating technology enhancements and resource sharing between FDOT and DHSMV to improve processing efficiency. Santos also discussed future plans, such as use of Traffic Safety Web Portal, for data exchange.

Session 9: HSM Applications–Part B

Washington State Department of Transportation

John Milton from WSDOT shared information about HSM applications. He discussed introducing a road safety management process in Part B, which includes network screening, diagnosis and countermeasure selection, economic appraisal and prioritization, and safety effectiveness evaluation. He also discussed Part C methodology, which includes safety SPFs, crash modification factors, and calibration. He explained crash modification factors (CMFs), which describe the safety-effectiveness of countermeasures or treatments (Part D).

To maximize the potential returns on investment for each safety project, WSDOT needs to estimate future crash occurrence more precisely, using scientifically based estimates such as SPFs. Although WSDOT first developed SPFs in the mid 1990s, there was redevelopment for interstates and SPFs for severity on multilane divided roadways. He concluded with brief a discussion about priority programming, countermeasure selection, project schedules, and work plans.

Ohio Department of Transportation

Jonathan Hughes discussed ODOT's implementation of the SafetyAnalyst tool. SafetyAnalyst uses several data elements, including segment/intersection data, crash data since 2001, and road inventory data elements such as intersection control information, roadway location attributes, and cross-section elements. In addition, SafetyAnalyst has roadway/ intersection traffic volume data and external sources for obtaining them. It also has additional crash data screening elements, which are customizable.

Hughes presented a comparison between existing ODOT high crash locations and SafetyAnalyst locations using maps of Ohio. The methodology was used to search for statewide peak segments that had 20 or more of the expected crashes, and those results were compared

to statewide segments generated from the sliding window that also had 20 or more of expected crashes and hot spots. However, it turned out that complementary safety study tools are still needed.

His presentation ended with a discussion of the benefits of SafetyAnalyst. He stated that SafetyAnalyst improved ODOT's data collection processes and helped with needs assessment. It also helped ODOT prioritize elements for asset management and road inventory and identify site subtypes and flag locations where errors existed or data were missing. Finally, SafetyAnalyst gave districts the ability to run specialized and localized network screenings and site priority lists on an ad hoc basis.

Session 10: SPF Development and Calibration

Michigan Department of Transportation

Dale R. Lighthizer discussed MDOT's efforts with SafetyAnalyst/HSM calibration. MDOT implemented SafetyAnalyst for the Michigan trunk line system and extracted calibration data from the SafetyAnalyst data management tool. Also, comparisons by site subtype calibration factors were made. In developing local SPFs, there were several challenges, such as lack of accurate cross volume and ramp volume data.

Lighthizer emphasized the necessity of calibration in HSM crash distributions. He provided several example tables such as default crash distributions used in Part C predictive models. To accomplish this goal, crash data were extracted from the SafetyAnalyst database for homogeneous segments/intersection site subtypes, and Michigan distributions were compiled to match HSM tables using SPSS. Preliminary results showed that Michigan has very high percentage of animal crashes compared to default states and that additional data integrity checks are needed.

In this analysis, several challenges could be found. First, file size and data formatting led to some issues. Also, IT resources as well as critical data for SafetyAnalyst/HSM were not sufficient. Hence, MDOT concluded that they need to develop Michigan-based SPFs and calibrate crash distributions. Also, these new distributions will be used in SafetyAnalyst and the deployment of the HSM spreadsheets. Finally, they might need to remove animal crashes from SafetyAnalyst data. For the next steps, they plan to complete crash distribution analysis for all subtypes and monitor their traffic volume collection program to obtain necessary ADT information to support SPF development.

Virginia Department of Transportation

Stephen Read talked about VDOT's experience with highway safety improvement programs and SPF modeling. He mentioned their past initiatives included SafetyAnalyst preparation. Currently they are working on additional SafetyAnalyst roadway types. In future efforts they will focus on HSM and SafetyAnalyst deployment. He also discussed SHSP and action planning by the percentages of deaths, injury crashes by system, and lane mileage.

As their planning-level SPFs, a key focus of the VDOT strategic highway safety plan is the treatment of corridors with high numbers of crashes. Virginia is developing a new approach that applies planning-level SPFs on long sections of road. Their project goals include developing SPFs to identify 2+ mile-long sections of road for more detailed analysis and helping to identify longer sections where a safety assessment or coordinated set of improvements might be beneficial. In their approach, they use data from 2003 to 2007 on Virginia's primary system, and SPFs aggregate intersections and segments together. They focus on 7339 miles of road and almost 160,000 total crashes. Different models for distinct regions of the state (i.e., DC suburbs, western mountains, and central/eastern urbanized area) are studied. Considering geometric

categories, they study rural two-lane planning SPFs, intersection SPF development, and two-lane highway SPF models. Then they evaluate the quality of planning-level SPFs in SafetyAnalyst and use statewide planning model safety measures. Finally, they evaluate freeway models. For present SPF modeling, they are currently developing models for multilane arterials and freeway segments. Their preliminary findings led to the realization that one regional multilane model does not follow the normal form. Furthermore, methods to define freeway segments range from simple to HCM definition.

For SPF application, they are currently reloading VDOT district data into SafetyAnalyst to investigate using Virginia SPFs. They are going to use SafetyAnalyst for FY13 HSIP project planning. VDOT is changing road network GIS models to consider safety models as well. For HSM applications, they plan to use HSM–Part C for project analysis to be able to compare national to Virginia values and to show value added to management. On the other hand, they use rural multilane SPF data sets to develop crash distribution values, calibration factors, and methods. Finally, they apply their findings to study a pilot corridor project.

Session 11: HSM Applications–Part C

Maine Department of Transportation

Darryl Belz shared MaineDOT's experience with HSM applications in safety design. He emphasized the significance of HSM in providing information and tools to facilitate explicit safety considerations for planning, design, operations, and maintenance. He mentioned that MaineDOT assists in review and documentation of design exceptions, variances, and waivers. He claimed that the common reasons for considering exceptions are their impacts to the natural environment, social or right-of-way impacts, preservation of historic or cultural resources, sensitivity to context or accommodating community values, and the construction or right-of-way costs. He introduced Maine's design exception process and mentioned that the review team is made up of representatives from core members from highway, traffic engineering, bridge, multimodal, and safety , as well as additional members from maintenance, planning, FHWA, and environmental sectors.

Basic analysis steps for applying the predictive method process include determining data needs, dividing locations into homogeneous segments or intersections, identifying the appropriate SPF, applying CMFs to calculated SPF values, and applying a local calibration factor. The background knowledge and data requirements include SPF for specific facility type, AADT, length, site characteristics to adjust with CMFs (roadway and intersection), local calibration factors, and historical crash data. As their data methodology, MaineDOT considers as-builts, crash analysis system, route log mile filter, MaineDOT's digital video log (VisiWeb), Automatic Road Analyzer (ARAN), Google Earth, and Bing maps. They use HSM spreadsheets containing a roadway segment safety prediction worksheet, which includes predicted total crashes per year compared with actual crashes for tangent sections applying accident modification factors (AMFs). They predict safety for an entire rural roadway section, combining predicted roadway segment and intersection-related crashes to obtain the total predicted crashes for the entire segment.

Challenges that MaineDOT has encountered include lack of resources and knowledge, SPF state-specific development, SPF calibration to local conditions, and institution of a paradigm shift. MaineDOT's next steps in safety applications are executive acceptance, HSM training, examining Maine's strategic highway safety plan to evaluate program initiatives in light of HSM, transitioning from descriptive analyses to quantitative predictive analyses, and working collaboratively with New Hampshire and Vermont to develop SPFs, as they have similar highway characteristics.

Florida Department of Transportation

David O'Hagan shared FDOT's experience with the application of HSM. They use AASHTO Green Book and Florida Plans Preparation Manual (PPM) criteria in safety applications. For FLDOT's cost analysis, they consider pre-construction, right-of-way, construction, and maintenance. Maintenance and user cost analyses are performed by considering insignificant differential and safety, respectively. Their main objective is to reduce the cost of FDOT projects without sacrificing safety and operational/functional characteristics. They can optionally use the variations process to justify reduced criteria (maintain status quo), eliminate the need for some variation submittals (revise PPM criteria), and include a safety analysis to quantify impacts of reduced criteria (revise variation requirements). On the other hand, there is a requirement for a safety analysis with design variations for all new and reconstruction projects when reductions in critical design elements are being considered. To justify that the variation process is working well, they need to quantify safety impacts of cross-section decisions, consistent with including non-DOT costs (user costs in pavement-type selection) in their decisions.

O'Hagan then introduced some projects performed under the supervision of FDOT, considering safety applications. A 2007 study by the roadway design office considered the construction cost differences, which ranged from 1% to about 20% in interstate widening to new overpass projects, respectively. A 2008 study by the roadway design office included right-of-way and maintenance costs with construction costs. They have also performed studies on segments of SR 43, SR 50, and SR 574. On SR 43, construction, right-of-way, and DOT costs were greater for PPM design rather than as-designed. However, crashes in 20 years were less, and the DOT and user costs in 20 years were greater. The same trends were found for SR 50. In the SR 574 study, they used the accident modification factors worksheet to consider on-street parking, roadside fixed objects, median width, lighting, auto speed enforcement, and also combined AMF.

3.4 RESOURCES

Many participating lead states have stated the need to share information. All current resources from this HSM workshop are publicly available on the P2P website, hosted by the Illinois Center for Transportation at the University of Illinois at Urbana-Champaign (http://ict.illinois.edu/conferences/HSMWorkshop2010).

In the future, this information might also be placed on another site of the HSM implementation (such as the NCHRP 17-50, in a protected location on the AASHTO Safety Portal, or in a protected location at the highwaysafetymanual.org site. The information to be shared includes the following:

- Training
- Policy
- SPF Clearinghouse (new SPFs)
- Tools—best practices and lessons learned
- Best practice guide, case studies

CHAPTER 4 STATES' NEXT-STEP IMPLEMENTATION PLANS

In Session 12, all participating lead states were requested to report on their next-step plans for HSM implementation. Most of the reported action items can be categorized as follows:

- Planning and Policy
- Training
- Data and SPF Calibration.

Table 2 summarizes the planned action items by each state.

Table 2. States' Next Step Implementation Plans

State	Planning and Policy	Training	Data and SPF Calibration
Utah	▪ Need a formal team ▪ Implement HSM program in the state level ▪ Look at vendors and products	▪ Focus on network training process ▪ Provide training for engineers, consultants and community	▪ Build a complete electronic crash data submittal ▪ Geospatially locate all crashes ▪ Implement HSM without jumping into the whole data collecting issue
California	▪ Examine existing system of crash and compare it with available safety tools	▪ Look at alternatives for training ▪ Provide training for districts, designers, maintenance people about safety manual and tools	▪ Initiate a research effort to look at safety analysis relative to existing method of evaluating collision concentrations
Ohio	▪ Formalize one-page outline of the implementation plan ▪ Learn from other states ▪ Design exception process and alternative analysis ▪ Use value engineering ▪ Setup an implementation team ▪ Expand SA to local systems		
Missouri	▪ Formalize an information team ▪ Review the current HSIP policy ▪ Design exceptions ▪ Work on the existing safety program guidelines ▪ Develop a trial policy and have it be reviewed by engineers		▪ Do calibration at county level ▪ Develop SPF ▪ Calibrate the SPF to finalize SA ▪ Look at fatal and severe injury crashes in local system

(table continues next page)

State	Planning and Policy	Training	Data and SPF Calibration
Alabama	▪ Have one plan for DOT, one for cities, and the others for counties and towns ▪ Look for RFRP program to better understand our sections ▪ Simulate state goals ▪ Disseminate information and material via webpage ▪ Keep stakeholders engaged and informed	▪ Continue training program at county level ▪ Two-day courses; the primary course is on design ▪ Offer courses within the DOT and in the counties ▪ Offer other large two-day courses	▪ Cooperate with FHWA to investigate data availabilities ▪ Collect the data information
Louisiana	▪ Have implementation steps and plan by the middle of next January ▪ Have implementation committee review and incorporate the IHDSM policies, safety procedures, projects delivery manual and EBS standard ▪ Incorporate safety into the value engineering process ▪ Have all people work together ▪ Develop communications and outreaching marketing plan, internal and external for partners ▪ Work on spot replacement guideline	▪ Two training courses and one more left for DOT employees ▪ Train the NPOs, the locals (districts) and consultants, and internally for junior staff	▪ Continue data construction and collection ▪ Collect data in the next one to eight years ▪ Address technical issues ▪ Use both short-term and long-term approaches
Michigan	▪ Start doing marketing ▪ Let people know HSM is not something to be afraid of ▪ Let people know HSM does relate to the local agencies ▪ Look for areas where we can integrate with other processes ▪ Solve local agency funding issues ▪ Give local agency some benefit or encouragement for implementing HSM	▪ 2011 is going to be the training phase	
LTAP Louisiana	▪ Work on marketing, awareness, and outreach ▪ Communicate with local people, municipal, county, associations ▪ Have people participate in each other's activities such as SPF summit ▪ Work with FHWA for road and local safety	▪ Develop own staff for training ▪ Work with FHWA Safety Resource Team to develop a course on HSM ▪ Work with FHWA to enhance staff training	▪ Have data source available for getting access to ▪ Integrate data into the local system *(table continues next page)*

State	Planning and Policy	Training	Data and SPF Calibration
	▪ Get local participation		
New Hampshire	▪ Develop a policy guide regarding safety and implementing HCM ▪ Purchase more HSM and IHSDM ▪ Improve internal under-standing ▪ Establish an implementation team to present plans ▪ Get safety process into studies ▪ Work with other states such as Maine and Vermont	▪ Provide training via resource center to learn HSM and IHSDM	▪ Have recent capital investment in data collection and processing
Washington	▪ Use HSM and SafetyAnalyst to address safety concerns ▪ Use these safety resources to widen the scope of HSM/SA and integrate them into the design process ▪ Use this information to quantify the policy, planning, and design elements ▪ Set up workforce to address several needs ▪ Share information among various states		▪ Work efficiently on safety project in light of limited data source
Florida	▪ Work with locals and ELTAB ▪ Develop lots of sample projects with districts	▪ Have a regional workshop ▪ The HSM training is coming up in December	▪ Have some research and a lot of discussion about SPFs and calibration ▪ Have two ongoing research projects
Virginia	▪ Start with small implementation plan ▪ Focus first on Part C ▪ Use consultants to help develop the implementation plan ▪ Prepare materials and information to share with different division and partners ▪ Develop a plan that is not only internal but external ▪ Work with universities ▪ Work on marketing and materials ▪ Put information on website to brand and market HSM for	▪ Provide training activities for different user groups	▪ Have own calibration *(table continues next page)*

State	Planning and Policy	Training	Data and SPF Calibration
	agencies		
Maine	▪ Find high-level people for highway safety office ▪ Have an implementation team to develop implementation plan and policy ▪ Use the existing marketing team ▪ Have the idea of MPOs and have transportation conference every year ▪ Bring up the universities ▪ Work with New Hampshire ▪ Work on design exception	▪ Like the idea of LTAP ▪ Need both internal and external training ▪ Need more guideline from FHWA	▪ Develop SPF
Illinois	▪ Develop a formal plan and go through an agenda ▪ Identify key points, resources needed, and next steps ▪ Develop a comprehensive action plan for the next months and years ▪ Update safety plan within the next year ▪ Design exception ▪ Look at all multiple year projects and see if PSI and SPF values can be used to evaluate the impacts of these projects and put them into the IRIS system ▪ Start institutionalizing ▪ Continue to seek resource and funding	▪ Continue training on HSM (e.g., one-day SPF workshop, hands-on network screening training) ▪ Look forward to course development help from FHWA for us to engage Illinois planners and programmers ▪ Have a few classes about the newly purchased safety analysis for the SPF development ▪ Give districts some training on exceptions	▪ Communicate better within and outside of organization to find out what the available data are and how data quality can be improved ▪ Work with FHWA and other peer states to advance analytical tools and address research needs ▪ Make sure every one knows what SPFs are

CHAPTER 5 SURVEY FEEDBACK

At the end of the workshop, the attendees were requested to fill out a one-page, double-sided survey, which provided valuable feedback to the organizing committee. A copy of the survey is available in Appendix F. A total of 62 responses were collected.

The attendees were asked about their satisfaction with a few key aspects of the workshop. As shown in Table 3, most attendees (85%) said that they were very satisfied or satisfied with all aspects of the workshop, including the registration process, materials/handouts, speakers/presenters, and venue/ facility.

Table 3. Attendees' Overall Satisfaction

Overall Satisfaction	Very Satisfied	Somewhat Satisfied	Neutral	Somewhat Dissatisfied	Very Dissatisfied	Total
Registration Process	41	15	5	1		62
Materials/Handouts	36	18	8			62
Speakers/Presenters	42	18	2			62
Venue/Facility	24	15	19	2	1	61

There was a question about how the attendees would like the workshop to improve. Only a total of 25 meaningful responses were provided. About 10 attendees suggested improving the venue facility (e.g., providing more room for networking, improve the video and audio quality). A few attendees suggested more efficient reimbursement or including more case studies in the workshop, etc. Some attendees suggested making handout materials more reader-friendly (e.g., enlarging the font size of printed slides). These comments will be carefully considered when we plan for future workshops.

A total of 59 attendees responded to Question 2: "What did you like most about the workshop and what is your most important gain?" Many attendees responded that they considered more than one aspect of the workshop beneficial. The answers are summarized in Table 4. More than half of the attendees stated that they benefited from learning about peer states' experiences with HSM. In addition, many attendees felt that the networking opportunity, as well as the information about IHDSM, SafetyAnalyst, and their integration with design and planning process was important. Some attendees also stated that they benefited from basic information and resources for HSM implementations.

Table 4. Attendees' Most Important Gain (out of 59 responses)

Well-organized presentations and discussions	7	(12%)
Networking opportunity with peers	14	(24%)
Information (basic introduction, resources) on HSM	11	(18%)
Peer states' experience and plan	36	(61%)
Examples and applications	16	(27%)

The attendees were asked, "Do you plan to attend the workshop again in the near future (e.g., next year)?" An absolute majority of the attendees stated that they would be planning to come next year, as shown in Table 5. During the course of the conference, we also heard from many attendees that they were interested in bringing more participants from their states to benefit from the (next) workshop.

Table 5 Attendees' Plan to Attend Next Year

Yes	56
No	4
Undecided (or no response)	2

Table 6 is a summary of 52 responses to Question 3 on the kinds of sessions to be included in future workshops. Training and hands-on exercises and positive evaluation of safety treatments are the two subjects most frequently recommended by attendees. Other major suggestions focus on in-person training on implementation and use of HSM.

Table 6. Attendees' Preference for Sessions to Be Included Next Year

Examples of technical application/implementation	34
Update on statistical tools and data	13
Training and tutorial	12
SPF development	10
Others (e.g., update on marketing to management)	4

The last question in the survey asked attendees what types of help they would anticipate being needed for HSM implementation in the coming year. A total of 35 attendees responded to this question. There are a variety of suggestions and ideas about resources and support needs. It seems that there is a need to work in greater depth on all topics covered in the workshop. In particular, many attendees requested for more information on evaluation of treatments and projects. Regarding training, the attendees are very interested in learning more on how to market the HSM to decision-makers and politicians. It seems that for next P2P lead state or support events, in order to highest ranked ideas, the following are desirable:

1. Data and Data Needs with tools demonstrations for supporting applications in Part C and B; this part should include SPF development and calibration since they are intrinsically connected, and demos of good/effective ways to collect field data;
2. State Implementation Plans (e.g., in-depth and detailed best practices, or lessons learned); these should include Policy and Institutionalization since they are intrinsically connected.

Many attendees mentioned the need for training, which should be pursued as a national effort in terms of creating a pool of resources such as tutorials, applications, guidance for marketing market HSM to decision makers, executive training, and train the trainer. The hope is that various state agencies can access the materials and adapt them as needed.

Overall, the survey feedback demonstrates that the 2010 HSM workshop very successfully achieved its objectives. The attendees benefited significantly from this event, and they look forward to attending future workshops so that they can benefit from the momentum and engage in activities to continue the advancement in the explicit quantification of safety.

In addition, the planning committee and others met the day after the workshop to discuss workshop feedback and next steps for ongoing and upcoming HSM implementation support efforts.

CHAPTER 6 NEXT STEPS

The participants requested that efforts be made to keep the momentum going by means of several initiatives:

1. Assistance with the implementation processes: a quick reference guide on what to do, by whom, why.
2. Assistance in setting avenues of communication such as
   - Regional meetings
   - Conference calls
   - Monthly web-meetings: Have speakers for the calls, coordinate discussion in advance, lead states talk among themselves
3. Development of performance indicators for tracking progress and assessing impacts
4. Platform to post information:
   - User discussion forum
   - AASHTO web site
   - Implementation plans and other resources

6.1 COORDINATION WITH NCHRP 17-50 AND FHWA ROADMAP

The NCHRP 17-50 will commence soon and will form the continuation of the work started by this P2P workshop. It will also liaise closely with the FHWA Roadmap, as they will complement the global effort. The following points summarize the activities that we may consider for future:

- FHWA will include AASHTO on all initiatives related to the HSM so that the integration with the other efforts is facilitated via this link.
- FHWA will develop a clear guidance (easy user guide) to the states for implementation of the HSM and its institutionalization, with particular focus on anticipated performance measures and other future expectations from the states; these are key to assisting the states in their ranking of tasks and in their data collection for measuring their progress.
- FHWA will disseminate the Roadmap to states to review and provide feedback on challenges and solutions prior to conclusion.
- Implementation is at its very early stage in the lead states.
- Use of www.highwaysafetymanual.org as the point of contact and link with other sites.
- FHWA, AASHTO, NCHRP 17-50, and others will involve LTAP representation at all levels:
  - To provide feedback on where this needs to go in the future
  - To figure out how to sell to the locals
  - To identify how it integrates in the local process (large cities are similar to states; the smaller ones need a different approach)

APPENDIX A ATTENDEE ROSTER

2010 Highway Safety Manual (HSM) Lead State Workshop
Attendee Roster

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APPENDIX B SPEAKER BIOGRAPHIES

2010 Highway Safety Manual Lead State Peer to Peer Workshop

Speaker Bios

Geni Bahar, P.Eng. P.E.

Geni Bahar, President of NAVIGATS Inc., is a professional civil engineer practicing as a road engineer in consulting and research organizations for more than 31 years. Geni has led over 200 projects encompassing several areas such as safety management, traffic and road safety analysis of existing and new road facilities, speed and traffic area management, network screening methodologies, countermeasure selection and evaluation, multi-disciplinary strategic safety program and policy development, project team management and facilitation, contract management, community joint-participation projects, and training development and delivery. Geni has worked closely with federal, provincial, state and municipal public agencies, and private firms. She has conducted research in conjunction with the National Academy of Sciences, the Transportation Research Board, Transportation Association of Canada, Transport Canada, the Institute of Transportation Engineers, Israel Technion Road Safety Centre, and the South African Council for Scientific and Industrial Research.

Geni is an active member of key professional associations and committees: ITE and the Transportation Safety Executive Council (Member Emeritus); TRB Committee for Transportation Safety Management, TRB Committee on Safety Data, Analysis and Research, TRB Highway Safety Performance Committee, TAC Road Safety Standing Committee (serving as its Vice-Chair presently) and TAC Geometric Design Standing Committee.

Timothy E. Barnett, P.E., PTOE

Tim Barnett's active career has revolved around traffic operations and traffic safety at the state and local levels. He currently serves as State Safety Operations Engineer for the Alabama Department of Transportation, where he has been employed in various positions since 2004; including time as a Division Right-of-Way Engineer and as a Division Design Engineer. He holds a B.S. and M.S. in Civil Engineering from the University of Alabama in Huntsville. Tim maintains a professional engineer's license in both Alabama and Mississippi, and is a certified Professional Traffic Operations Engineer. Prior to his career with ALDOT, he served twenty years with the City of Huntsville, Alabama in various engineering positions, and held the title of City Traffic Engineer prior to accepting a position with the State of Alabama. In addition to his duties for the rapid response and resolution of pressing highway safety concerns on the public roadway system, he is responsible for managing the implementation of the *Highway Safety Manual* for ALDOT. Tim is a Fellow of ITE, and a member of ASCE, ASEM, and IMSA.

Darryl Belz, P.E.

Darryl is the Safety and Scoping Manager in the Maine Department of Transportation Bureau of Transportation Systems Planning. Throughout his 19 year tenure at MaineDOT,

he has developed experience in multi-modal transportation planning, traffic analysis, safety assessments, and bridge construction. He is responsible for administering the capital safety improvement programs and managing multi-modal corridor studies including environmental, planning, operational, and safety. He is a member of MaineDOT's Design Exception and Highway Policy Committees and serves on Maine's four MPO Technical Committees. Darryl graduated from the University of Maine with a B.S. in Civil Engineering, and is a Registered Professional Engineer in the state of Maine.

Tim Colling, PhD., P.E.

Dr. Colling is the Director of the Center for Technology and Training and is a Senior Research Engineer at the Michigan Tech Transportation Institute (MTTI) at Michigan Tech University. Dr. Colling is primarily involved in outreach and technical support to transportation agencies within the State of Michigan, as well as performing research activities in the field of pavement management and traffic safety engineering.

Dr. Colling has been involved in a number of research and education programs relating to traffic safety. Dr. Colling was instrumental in completing a state wide traffic safety study evaluating the relative risk of Michigan log trucks. This study was part of a larger multi phase study commissioned by the Michigan State Legislature to determine safety factors related to Michigan log truck safety and measures to mitigate risks identified with these vehicles.

Dr. Colling developed and presented training materials for an 8 hour professional development class focusing on traffic safety at intersections for non-engineers. The development of this project was funded by the FHWA Office of Safety and the Michigan Office of Highway Safety Programs. The completed workshop materials were distributed to all 51 of the Local Technical Assistance Programs and the 7 Tribal Technical Assistance Programs throughout the United States. To date his program has been presented 30 times in Michigan and has had an over attendance of over 500 people.

Don Fisher, P.E.

Don manages the safety section of the Office of Systems Planning & Program Management for the Ohio Department of Transportation. As Safety Program Engineer, he oversees a budget of over $70 million in annual program commitments and leads systematic safety improvements like cable median barriers and edge line rumble stripes. He has 19 years of experience at ODOT, including work in roadside maintenance, estimating, planning and

safety. He is a graduate of the University of Toledo with a Bachelor of Science degree in Civil Engineering and a registered professional engineer in the state of Ohio

Jonathan Hughes, P.E.

Jonathan Hughes is the Systems Planning section manager for the Ohio Department of Transportation. Systems planning is responsible for statewide safety location analysis, systems conditions analysis for pavements and bridges, and forecasting fiscal levels needed to meet system condition goals. Previous duties with ODOT include highway project design and construction project engineering. Jonathan has a bachelor and masters degree from The Ohio State University and is a registered professional engineer in the state of Ohio.

Robert E. Hull, P.E.

Mr. Hull has served with the Utah DOT for 21 years. He has a Civil Engineering Degree from the University of Utah and a Marketing Degree from Utah State University. He is a licensed professional engineer in Utah. Mr. Hull has held several positions within UDOT. His experience includes statewide and region service in Maintenance, Urban Planning, Materials, Traffic Operations, and Safety. Currently, he is responsible for developing and issuing statewide direction, policies, and procedures for all traffic and safety management related programs. He manages all planning and programming of Federal and State funding used in transportation safety programs and projects. In addition, he is responsible for all engineering standards and specifications related to traffic and safety. Mr. Hull developed and directs the Zero Fatalities program for Utah. This program represents the umbrella program to all other traffic safety programs in Utah and provides the goal and direction for improving safety through the Utah Comprehensive Safety Plan. Robert is the co-chair of the TRB Transportation Safety Committee ANB10, and serves on several AASHTO Standing Committees and Subcommittees, the National Committee on Uniform Traffic Control Devices, several NCHRP panels, and the World Road Congress (PIARC).

Kim Kolody Silverman, P.E.

Ms. Kimberly Kolody Silverman, P.E. has worked for CH2M HILL since 1998 serving as a program manager and engineer focusing mainly on preliminary engineering and Phase I work. Since 2006 Kim has worked closely with the Illinois Department of Transportation Bureau of Safety Engineering on a variety of safety support services to help to reduce roadway fatalities to the lowest numbers since 1921. Tasks have included updates to and the implementation of their Strategic Highway Safety Plan, leading implementation teams, reviewing and preparing policies and providing technical guidance and support. She has authored research papers on the subjects of transportation planning and safety, and has

participated in technical training programs. She had previously worked for the Michigan Department of Transportation and the City of Lansing (MI). Kim obtained a masters degree from Michigan State University. Kim has been a member of the International and local ITE sections since 1994 and currently serves the Illinois section's Vice President.

Dale Reed Lighthizer, PhD., P.E

Dr. Lighthizer has worked in the areas of transportation, traffic, and traffic safety engineering for over 30 years. For over the past 20 years he has worked for the Michigan Department of Transportation in a variety of engineering positions, coming to the Department after working for local government and as a consultant. Currently, he is the manager of the Safety Programs Section. A key part of the mission is advocating for highway traffic safety at local agencies. Dale holds a B.S.C.E. in Civil Engineering from Michigan Technological University, a Master's Degree in Engineering, and Ph.D. in Civil Engineering from Michigan State University.

Daniel J. Magri. P.E.

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The Highway Safety Office is responsible for development, administration and evaluation of the Department's Highway Safety Improvement Program (HSIP). Activities related to this program include:

- Identification and Evaluation of Abnormal Crash Locations
- Development and administration of a $30 million HSIP
- Highway Safety Studies
- Traffic Records
- Tort Reduction
- Strategic Highway Safety Plan

Experience:

He is the Highway Safety Office administrator for the Louisiana Department of Transportation and Development and is responsible for all statewide highway safety activities. He also chairs the Louisiana Traffic Records Coordinating Committee. He has twenty-seven years experience in the transportation field. He has spent the last twenty-three years in highway safety both with the Governor's Office of Highway Safety (Louisiana Highway Safety Commission) and the Louisiana Department of Transportation and Development.

Organizations:

- Louisiana Traffic Records Coordinating Committee
- Association of Transportation Safety Information Professionals (past president)
- Institute of Transportation Engineers
- American Society of Civil Engineers
- National Committee on Uniform Traffic Control Devices
- Louisiana Engineering Society

Jeffrey (Jeff) Miller

Jeffrey Miller works in the Office of Safety at the Federal Highway Administration (FHWA) where he serves as the team Leader for the Analysis and Evaluation Team. In that capacity he leads efforts such as the promotion of analytical processes and tools for safety decision-making and the coordination of the Cross-Functional FHWA Safety Roadmap to promote the Comprehensive Approach to Safety Planning. Jeff also leads efforts to promote highway data standardization, safety data analysis, the Focused Approach to Safety, liaison to the National Transportation Safety Board and Government Accountability Office; and Program Evaluation of the activities, processes and programs conducted by the Office of Safety. Jeff joined FHWA in October 2009. Before coming to FHWA he was the Division Chief of Strategic Planning and Program Evaluation for the Federal Motor Carrier Safety Administration (FMCSA) where he led Agency activities for strategic planning, the performance budget, performance management, performance measurement, liaison to oversight organizations and management of the Motor Carrier Safety Advisory Committee. Prior to his service at FMCSA, he worked at the United States Capitol Police, the police force for the Legislative Branch. In that capacity he served as the Acting Chief Financial Officer and Management Analyst, where he led acquisitions, financial management, budget, accounting, strategic planning, audit liaison and overall administrative functions for the Department. Jeff served seven years at the Federal Emergency Management Agency (FEMA) in the capacity of strategic planning and budgeting for their Response Program; congressional liaison, intergovernmental affairs liaison, and national manager of the FEMA Congressional Affairs Cadre. He also served as a member of leadership teams for several large national disasters including response to Hurricane Floyd in North Carolina and two deployments as the lead for Intergovernmental Affairs in New York City after the 9/11 attacks. Jeff is a graduate of the Federal Executive Institute in Charlottesville Virginia. He holds a bachelors degree in Political Science from Bridgewater College in Virginia and is currently pursuing a Masters Degree in Government Studies (with a concentration in government communications) from Johns Hopkins University.

2010 Highway Safety Manual Lead State Peer to Peer Workshop

Speaker Bios

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John currently serves as the Director of Enterprise Risk Management for the Washington Department of Transportation. He is a licensed engineer with over 20 years of experience in transportation and traffic engineering. He has held a number of engineering positions in WSDOT's design, traffic and planning sections. John holds a B.S. in Civil Engineering and a Masters in Engineering Management from St. Martin's College; he also holds a M.S. and Ph.D. in Civil Engineering from the University of Washington. His research has focused on econometric and statistical modeling of the frequency and severity of collisions. John has served on numerous National Academy of Engineering research panels with an emphasis on highway safety and data analysis and serves on the Task Force for the Development of the Highway Safety Manual (ANB25T), Safety Data, Analysis and Evaluation (ANB20) and Statistical Methods Committee (ABJ80). He is the Chair of the Transportation Research Board Task Force for the Development of a Highway Safety Manual.

Terri Monaghan, P.E.

Terri Monaghan, P.E. has been with the LA DOTD since 1992 and has 18 years experience in the transportation field. She has worked in the DOTD Highway Safety Office for the past seven years. Her current areas of oversight/responsibility include the Strategic Highway Safety Plan, Safe Routes to School Program, Local Road Safety Program, Fatality Analysis Reporting System (FARS), statewide highway safety studies, and traffic records. Prior to working in the DOTD Highway Safety Office, she worked in various offices across the Department including Environmental, Hydraulics, Construction, and District Design. Terri earned her Civil Engineering degree from Mississippi State University in 1992.

Organizations:

- AASHTO Subcommittee on Safety Management
- Louisiana Traffic Records Coordinating Committee

Jon Nelson, P.E.

Jon is a Senior Traffic Studies Specialist for the Missouri Department of Transportation. He has been employed with MoDOT since 2003 when he started his career as a Materials Inspector. Jon currently works in the Central Office Traffic Division where his responsibilities include researching and implementing effective engineering solutions to help reduce fatalities and severe injuries on Missouri roadways. In addition, he serves as a liaison to district staff on traffic safety and has been tasked with implementing the Highway Safety

Manual within MoDOT. Jon received his bachelor's degree in civil engineering from the University of Missouri and is licensed as a professional engineer.

David C. O'Hagan, P.E.

David O'Hagan, serves as the State Roadway Design Engineer for the Florida Department of Transportation (FDOT). The FDOT selected him for this position in 2004 after he served as an Assistant State Structures Engineer for 2 years. Prior to that appointment, David worked as a consulting bridge engineer for 25 years where he worked on many notable bridges including the Sunshine Skyway Bridge in Tampa.

In his current role, David oversees creation, implementation and maintenance of all the policies, standards and rules related to road, drainage and pavement designs. Included in these duties is the approval of all Design Exceptions to AASHTO's highway design policies. He also serves as the FDOT's Roadway Departures Emphasis Area Champion on its Strategic Highway Safety Plan. Short-term safety policy goals that David wants to achieve include the following:

- Increased consideration of roundabouts in intersection design and reconstruction.
- Implementation of the pavement safety edge on local roads.
- Implementation of the Highway Safety Manual in our design processes.

Dave Piper, P.E.

Dave Piper is the Safety Design Engineer in the IDOT Bureau of Safety Engineering. He works with IDOT Districts and others to assist in developing Highway Safety Engineering Program (HSIP) from screening to coordination of projects, and other responses to safety concerns. Dave has responsibilities for RSAs and roadside safety hardware, such as guardrail, cable median barrier, and crash cushions approved for use by the Department. In 1980 Dave graduated the University of Illinois with a BS degree in Civil Engineering. As a result of coming in through the cooperative program between the University of Illinois and Illinois College, he also received a concurrent BA degree in Mathematics from Illinois College. Dave has worked continuously with IDOT since his graduation, first in District 5, Paris for almost 22 years in Construction, Land Acquisition and Design in various responsibilities. In 2002 he accepted a position in the IDOT Headquarters working in the Highway Policy section in Design and Environment. He worked there with pavement design and roadside safety issues. When the Bureau of Safety Engineering was founded in 2005 he

came along to work in his current position. Much is happening in the developing field of safety engineering and Dave hopes to be involved in bringing better tools and processes to improve safety for those using our roadways, and to make the work easier and more productive for planners and designers.

Stephen W. Read, P.E. (VA), P. Eng. (ON, CANADA)
Highway Safety Improvement Programs Manager
VDOT – Traffic Engineering Division
Degrees:
B. Sc. Civil Eng. (Univ. of New Brunswick, CAN)
M.A. Sc. Civil Eng. (Univ. of Waterloo, CAN)
Experience:
23 years of traffic engineering and multi-modal transportation planning projects, research and management. Project consulting and research work in London, UK; Toronto and Ottawa, ON; and Alexandria, VA. VDOT experience conducting and managing multi-modal corridor environmental, planning, operational, safety studies and research; design project travel forecasting and traffic operations and safety assessments; regional long-range plan development and documentation. Presently leads VDOT's highway, bicycle and pedestrian, and rail-grade crossing crash data analysis and safety improvement programs.
Other info/activities:
Travel, reading, hiking, biking, hockey, lacrosse, tennis

Joseph (Joe) Santos, PE
Joe currently is the Transportation Safety Engineer for the Florida Department of Transportation (FDOT). He has been with FDOT for 18 years and has served as the Transportation Safety Engineer for 3 years. His background in FDOT has included 5 years in Construction, 8 years in Planning, and 2 years in Project Management. He has also served 27 years in the United States Navy Civil Engineering Corp, Reserve, as a Civil Engineer. He has a B.S. in civil engineering from Florida State University and is a registered Professional Engineer in Florida.

Esther Strawder
I have been with FHWA, for 19 years and am currently a safety specialist in the HQ Office of Safety for the past 3 years on the Analyst and Evaluation team working primarily on the

focused approach to safety and safety analysis tools. Before joining the Office of Safety, I was a Highway Safety Engineer in the Maryland Division as well as Quality Coordinator. My career with FHWA has taken me to North Carolina, Alaska, Texas, various Headquarters positions in Policy, Construction Management, and Finance. I received a Bachelor's degree in Civil Engineering from Morgan State University in 1990.

Stuart Thompson, P.E.

Stuart currently serves as the Highway Safety Engineer for the New Hampshire Department of Transportation. He is a licensed engineer with over 30 years of experience in the transportation industry. He has work for various transportation related organizations including Union Pacific Railroad, Utah Local Technical Assistance Program and the Central Massachusetts Regional Planning Commission. Stuart holds a B.S. in Civil Engineering, a Masters in Civil Engineering and a Masters in Business Administration from Utah State University. Stuart is a committee member of the Committee on Roadside Safety Design (AFB20), the Committee on Maintenance and Operations Personnel (AHD15), and serves as the Chair of the Committee of Signing and Marking Materials (AHD55). He also serves on the Task Force for the AASHTOWare product, SafetyAnalyst.

Priscilla A. Tobias, P.E.

Priscilla Tobias is a graduate of Virginia Tech, a licensed Professional Engineer for the State of Illinois and the State Safety Engineer for the Illinois Department of Transportation (IDOT). She has been with IDOT for 19 year and has a broad range of experience in the areas of planning, design, policy development and implementation, and safety which has allowed her to implement safety initiatives that are practical yet effective at saving lives within Illinois and nationally. Based on her experience and initiative, she was appointed in 2004 to lead IDOT's newly created Bureau of Safety Engineering. Since that time she has been instrumental in partnering with safety stakeholders to develop and implement several new safety initiatives thus allowing Illinois to reduce traffic related fatalities to the lowest numbers since 1921. These initiatives include coordinating efforts to develop and implement the Illinois Strategic Highway Safety Plan, incorporating safety into the overall planning and programming process, integrating the 4E (Engineering, Enforcement, Education, and EMS) approach into the crash analysis and safety strategy implementation, and improving safety programs for all Illinois roadways, including the local roadways. She

has been responsible for developing and implementing a safety research program with the Illinois Center for Transportation which addresses both behavioral and infrastructure safety needs and has had key projects that have an impact at the state and national level in influencing safety investment decision making. Ms. Tobias represents Illinois and the AASHTO Region III on the AASHTO Standing Committee for Highway Traffic Safety and the AASHTO Subcommittee on Safety Management, serving as the Chair for Task Group on Technical Safety Publication Oversight and Coordination which oversees the AASHTO HSM. Ms. Tobias also serves as the Chair for the NCHRP Project 17-48 - Highway Research Infrastructure and Operations Research Needs.

Her efforts to implement statewide safety programs helped Illinois receive the 2007 and 2010 AASHTO Safety Leadership Award. Ms. Tobias received the 2009 American Traffic Safety Services Association National Safety Award and the 2010 WTS Greater Chicago Woman of the Year Award for outstanding service and dedication to traffic safety.

Daniel S. Turner, PhD, PE,

Dan's specialty areas are teaching, research and service in the fields of traffic operations and safety; highway design; and transportation management, finance and policy. He has conducted or managed 125 research projects for over $30 million; has over 300 publications; has delivered over 500 presentations at technical and professional meetings, and has written/taught 75 short courses.

Dr. Turner is well known for vision and leadership. He is a past President of the American Society of Civil Engineer sand the Council of University Transportation Centers. He has held leadership positions in five national organizations, including service on the board of direction or member of the Executive Committee of the Accreditation Board for Engineering and Technology and the American Association of Engineering Societies. Within TRB he has chaired committees and NCHRP panels, the Operations Section and Operations & Preservations Group, and is a member of the Technical Activities Council. Among his honors are citations in Who's Who in Engineering, Who's Who in Education, and 20 similar publications. He is a national Honor Member of Chi Epsilon Civil Engineering Honor Society. At the University of Alabama, he has been selected as the outstanding teacher in the College of Engineering and the Outstanding Faculty Member on the University campus.

APPENDIX C LIST OF ACRONYMS

AADT—Annual Average Daily Traffic

CHSIM —Comprehensive Highway Safety Improvement Model

CRF—Crash Reduction Factor

DHV—Design Hourly Volume (traffic)

EA—Environmental Assessment

EB—Empirical Bayes(ian)

EIS—Environmental Impact Study/Statement

HSM —Highway Safety Manual

IHSDM—Interactive Highway Safety Design Model

LOSS—Levels of Service for Safety

NEPA—1969 National Environmental Policy Act

PHF—Peak Hour Factor

RTM—Regression to the Mean

SPF—Safety Performance Function

APPENDIX D COMMUNICATIONS

D.1. INITIAL STATE CONTACT

Your state has expressed interest in participating as a lead state for the NCHRP HSM Lead State Project.

Illinois will be hosting a HSM Lead State Peer-to-Peer Workshop November 17-18, 2010 in Schaumburg, Illinois (west suburb of Chicago). The intent is to share and discuss state's efforts, experiences, challenges and possible solutions, and best practices with implementing the HSM.

We would like your state to respond to the questionnaire below (reply to sender and fill in the blanks, please) so that we can get a better idea of where states are at in regards to implementation of the HSM. Let me know if you have any questions.

Thank you,

Priscilla Tobias

1. Has your agency expressed interest in implementing the HSM?
2. Has your agency assigned a lead staff member or team to assist in the implementation of the HSM?
3. Has your agency supported staff to assist with the development or implementation of the HSM on the national level?
4. Has your agency purchased copies of the HSM for staff?
5. Has your agency provided or have funds dedicated to implement a plan to provide staff with HSM training (at least 1 day training, beyond webinars)?
6. Has your agency calibrated or have funds dedicated to calibrate the HSM Safety Performance Functions (SPFs) for use in your state or has your agency developed or have funds to develop state specific SPFs in the near future?
7. Has your agency begun or plan on implementing SafetyAnalyst?
8. Has your agency supported local and MPOs in safety analysis techniques?
9. Does your agency have a plan for supporting local agencies in the implementation of the HSM?
10. Will your agency support other non-lead state DOTs in the implementation of the HSM?

D.2. NOTIFICATION (1)

Dear Lead State,

Thank you for your interest in participating in Illinois' hosted Highway Safety Manual Lead State Peer to Peer Workshop (HSM-LSP2P) on November 17-18, 2010 in Schaumburg, Illinois. The intent of the HSM-LSP2P is to bring states together that have experience in implementing the AASHTO HSM (2010) in their agencies to discuss their successes, challenges and solutions, lessons learned, relevant tools, etc. in order to support the continued shift to and application of the science of safety. States that participate in the HSM-LSP2P will clearly demonstrate their commitment to leadership in the implementation of the HSM, and their willingness to support other agencies such as local ones and other states.

Illinois had not anticipated the numerous responses we received and were faced with the reality that the budget available for this initiative would not enable us to invite all states. Thus, we worked diligently to establish two working groups. For this purpose, the HSM-LSP2P committee has reviewed each of the questionnaire responses and based on HSM implementation experience, commitment to implementation at the state and local level, and geographic representation assigned states in two groups: 1. HSM Lead States or 2. HSM Support States. The HSM Lead States will be invited to the HSM-LSP2P workshop to share information and will be expected to partner with HSM Support States (and others still in the infancy of the implementation of the HSM) to further the HSM implementation within their agencies. HSM Support States will be asked to participate in future initiatives. This workshop will help support FHWA's efforts with their HSM Implementation Plan project and the NCHRP HSM Lead State Project.

We are pleased to invite XXXX to be an HSM Lead State in the implementation process of the HSM. Additional information regarding meeting details, agenda, and logistics will follow. We look forward to working with you on November 17th and 18th in Schaumburg, Illinois.

Sincerely,

Priscilla Tobias

D.3. NOTIFICATION (2)

Dear Support State

Thank you for your interest in participating in Illinois' hosted Highway Safety Manual Lead State Peer to Peer Workshop (HSM-LSP2P) on November 17-18, 2010 in Schaumburg, Illinois. The intent of the HSM-LSP2P is to bring states together that have experience in implementing the AASHTO HSM (2010) in their agencies to discuss their successes, challenges and solutions, lessons learned, relevant tools, etc. in order to support the continued shift to and application of the science of safety. States that participate in the HSM-LSP2P will clearly demonstrate their commitment to leadership in the implementation of the HSM, and their willingness to support for other agencies such as local ones and other states.

Illinois had not anticipated the numerous responses we received and were faced with the reality that the budget available for this initiative would not enable us to invite all states. Thus, we worked diligently to establish two working groups. For this purpose, the HSM-LSP2P committee has reviewed each of the questionnaire responses and based on HSM implementation experience, commitment to implementation at the state and local level, and geographic representation assigned states in two groups: 1. HSM Lead States or 2. HSM Support States. The HSM Lead States will be invited to the HSM-LSP2P workshop to share information and will be expected to partner with HSM Support States (and others still in the infancy of the implementation of the HSM) to further the HSM implementation within their agencies. HSM Support States will be asked to participate in future initiatives. One initiative we are pursuing is creating an HSM Implementation Pool Fund to further assist interested states with implementation efforts.

We are pleased to invite Idaho to be an HSM Support State in the implementation process of the HSM. As an HSM Support State, we will endeavor to keep you informed of all materials developed for the LSP2P event and other related efforts. We will also encourage that your state coordinate with a Lead State for mutual assistance. Furthermore, we suggest that your State consider active participation in the TRB Highway Safety Performance Committee and AASHTO Safety Management and Planning Committees' activities and meetings; those are excellent venues for gathering additional knowledge and updates on related initiatives.

If you have questions or would like additional information please contact me. We look forward to working with you in the future.

Sincerely,

Priscilla Tobias

D.4 FOLLOW-UP COMMUNICATION

Thank you for participating in the HSM LSP2P planning meeting on September 29th, 2010 in Kansas City. Your input is very valuable and will help to make the LSP2P workshop beneficial to all participants and to others interested in implementing the HSM. Attached for your reference is the presentation that was prepared for the planning meeting (HSMLSP2P_PlanningMtg_20100929.pdf).

Based on the information you have provided a successful workshop will:

- Learn and exchange best practices
    - How to collect and maintain a sustainable data system
    - Data integration
    - Policy including legal aspect and all types of policies that may be addressed (design, planning, etc.)
    - HSM integration into processes
    - Use of the HSM and other related software tools
    - Marketing within the agency and motivating staff, How to build confidence in the HSM and buy-in to modify practices
    - Overcoming funding shortages including buying SA, SPF development outside of DOT, buying the manual, paying for training
    - Local perspective
    - How to develop training for the different roles and levels in the DOT and Locals
    - What is the value added relative to the cost of HSM implementation
    - Design of implementation plans (examples of sample from various states)

Each state will prepare at least one 5-10 minute presentation to share case studies with peers. We discussed that ***XXXXX*** would present on ***Funding and Resources*.**

Please confirm that you will present on these topics and provide speaker contact information by ***October 15th*.**

The presentation should include the purpose of the work, how you went about the work, data needs and how they were addressed, identification of barriers and how they were overcome and next steps. Please use the attached template for developing your presentation and include the following specific information in your presentation as requested by peers during the planning meeting.

- **Obtaining funding for training, support, HSM implementation**
- **Overcoming funding shortages should include purchasing SafetyAnalyst, SPF development (inside or outside of DOT), buying the manual, paying for training**
- **Cover different funding sources to create data sets**
- **Multiple sources for funding**

I will send a meeting request for a conference call to discuss your presentation. Please let me know what dates and times will not work for you over the next couple of weeks.

Please make sure you register at the conference website and make flight and hotel reservations before October 29th.

http://ict.illinois.edu/conferences/HSMworkshop2010/index.htm

Date	Action
October 15	Send Speaker Contact Information and Presentation Title
October 25	Registration Closes
October 25 – 29	Conference Calls with Speakers
October 29	Hotel Room Block Closes
November 8	Submit Short Presentations Submit Shared Resources
January 1	Submit Preliminary Action/Implementation Plans for the LSP2P Website

[NOTE: Text in bold/underscored type was customized (e.g., Funding and Resources)]

D.5 PHONE CALL WITH STATES

1. Confirm participation

- Who is the state sending?
- Have they registered for the workshop?
- Have they made their hotel reservations (released this week)?

2. Topics for presentation

- Is the presentation topic acceptable?
- Describe your presentation content.
- How much time do you need to present the material?
- What should the title be for State Approach to Implementation session?

3. Materials to send to us:

- Speaker bios by November 8th
- Receiving draft presentation by November 8th
- Materials i.e. policies, implementation plans by November 8th
- Complete survey
- Submit Preliminary Action/Implementation Plans for the LSP2P Website by January 1st
- Case Studies for FHWA project

4. Do you need any support from us?

5. Questions?

D.6 COMMUNICATION DISCUSSION FORM

Highway Safety Manual Lead State Peer to Peer Workshop Discussion Form

Completed by: _____
Agency:

Instructions

We heard from you that one of the visions for a successful HSM LSP2P workshop includes hearing lots of discussion from other states on various aspects of HSM implementation. As such the agenda for the HSM LSP2P workshop includes about a half hour of open discussion on each of the topics. In order to better facilitate discussions please use the form below to indicate:

- What you would like to **contribute** during discussions for each agenda topic
- What you would like to hear **discussed** during discussions for each agenda topic

These notes will not be distributed to meeting attendees but will serve as prompts for meeting facilitators. Please email this form to Kim Kolody at kim.kolody@ch2m.com by **November 8th, 2010.** We look forward to meeting with you soon and thank you for your help in making this a successful HSM LSP2P workshop.

Sincerely,

The HSM LSP2P Planning Committee

Approach to Institutionalization

What you would like to **contribute** during discussions on Approach to Institutionalization?

What you would like to hear **discussed** during discussions on Approach to Institutionalization?

State Implementation Plans

What you would like to **contribute** during discussions on State Implementation Plans?

What you would like to hear **discussed** during discussions on State Implementation Plans?

Policy

What you would like to **contribute** during discussions on Policy?

What you would like to hear **discussed** during discussions on Policy?

Resources and Funding

What you would like to **contribute** during discussions on Resources and Funding?

What you would like to hear **discussed** during discussions on Resources and Funding?

Training

What you would like to **contribute** during discussions on Training?

What you would like to hear **discussed** during discussions on Training?

Data and Data Needs

What you would like to **contribute** during discussions on Data and Data Needs?

What you would like to hear **discussed** during discussions on Data and Data Needs?

HSM Applications–Part B

What you would like to **contribute** during discussions on HSM Applications–Part B?

What you would like to hear **discussed** during discussions on HSM Applications–Part B?

SPF Development and Calibration

What you would like to **contribute** during discussions on SPF Development and Calibration?

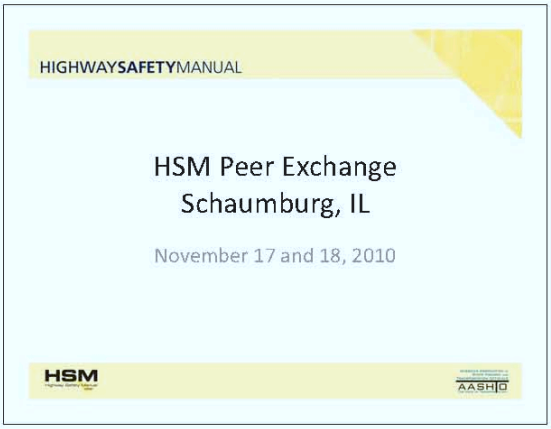
What you would like to hear **discussed** during discussions on SPF Development and Calibration?

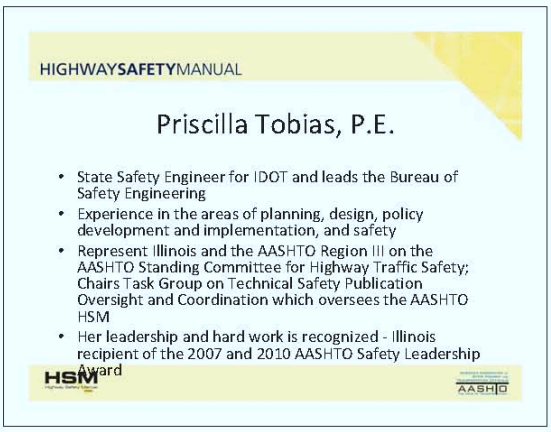
HSM Applications–Part C

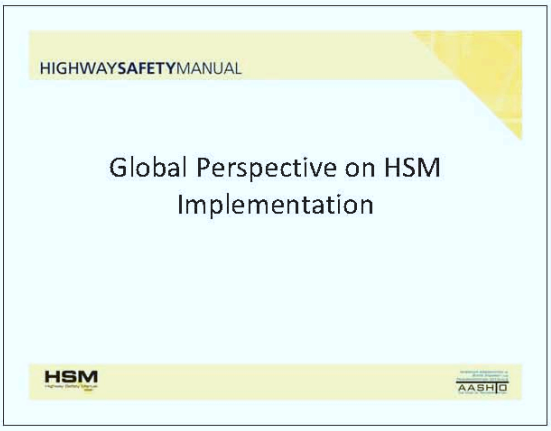
What you would like to **contribute** during discussions on HSM Applications–Part C?

What you would like to hear **discussed** during discussions on HSM Applications–Part C?

APPENDIX E PRESENTATION HANDOUTS







HIGHWAYSAFETYMANUAL

Approach to Institutionalization

HSM

HIGHWAYSAFETYMANUAL

What you would like to hear

- What do we mean by "institutionalization"?
- Comprehensive approaches to HSM Institutionalization
- How far reaching will changes be made
- How to reach out to other professionals in the agency
- It will take time – how long?

HSM

HIGHWAYSAFETYMANUAL

Robert Hull, P.E.

- Engineer for Traffic and Safety in UDOT
- Responsible for statewide policies and procedures for traffic and safety management programs; planning and programming of funding for safety programs and projects; and for engineering standards and specifications related to traffic and safety
- Co-chair of the TRB Transportation Safety Committee, serves on several AASHTO Standing Committees and other organizations

HSM

HIGHWAYSAFETYMANUAL

Don Fisher, P.E.

- Safety Program Engineer in ODOT
- Experience in roadside maintenance, estimating, planning and safety
- Manages the safety section of the Office of Systems Planning & Program Management for ODOT

HSM

HIGHWAYSAFETYMANUAL

More information

- Louisiana – Communications Plan
- Washington – Small task groups and individual focus
- California – Policy changes with high level support
- Michigan – Targeted training

HSM

HIGHWAYSAFETYMANUAL

BREAK

HSM

HIGHWAYSAFETYMANUAL

State Implementation Plans

HSM

HIGHWAYSAFETYMANUAL

What you would like to hear

- How to gain buy-in from upper management and secure the new way of doing business; where is the champion?
- How to strengthen link between HSM, HSIP and SHSP
- Common obstacles and how to overcome
- Timelines for implementation (state and local)
- Components of and an example of successful plan

HSM

HIGHWAYSAFETYMANUAL

Jon Nelson, P.E.

- Senior Traffic Studies Specialist in MoDOT
- Research and implement effective engineering solutions to help reduce fatalities and severe injuries on Missouri roadways
- Serve as a liaison to district staff on traffic safety and tasked with implementing the Highway Safety Manual within MoDOT

HSM

HIGHWAYSAFETYMANUAL

Dan Turner, PhD, PE,

- Professor in University of Alabama
- Experience in traffic operations and safety; highway design; and transportation management, finance and policy
- Past President of ASCE and the Council of University Transportation Centers, leadership positions in five national organizations, chaired committees and NCHRP panels within TRB

HSM

HIGHWAYSAFETYMANUAL

More information

- Utah – Links between HSM, HSIP and SHSP
- Louisiana – HSM Implementation team
- New Hampshire – The role of *SafetyAnalyst*
- Florida – The role of a Champion
- Washington – Evaluating HSM, *SafetyAnalyst*, and CMF Clearinghouse within budgetary conditions
- California – Role of training
- WA – Implementation Plan Assistance

HSM

HIGHWAYSAFETYMANUAL

LUNCH

HSM

HIGHWAYSAFETYMANUAL

Policy

HSM

HIGHWAYSAFETYMANUAL

What you would like to hear

- HSM – as policy or guidance?
- HSM – integrated in certain areas or certain projects (HSIP)? Who is setting the policies?
- What the challenges and solutions have been
- How to evaluate the implications and other direct impacts such as department documents or standard procedures

HSM

HIGHWAYSAFETYMANUAL

Dave Piper, P.E.

- Safety Implementation Engineer in the IDOT Bureau of Safety Engineering
- Develops HSIP from screening to coordination of projects
- Responsible for RSAs and road safety hardware

HSM

HIGHWAYSAFETYMANUAL

Dan Magri. P.E.

- Highway Safety Administrator in LA DOTD
- Responsible for all statewide highway safety activities
- Chair of the Louisiana Traffic Records Coordinating Committee, past president of Association of Transportation Safety Information Professionals, member of ITE, ASCE, etc.

HSM

HIGHWAYSAFETYMANUAL

More information

- Florida – importance of policy in the implementation and guidance on who takes responsibility
- Washington – Identification of policy changes at technical and executive levels, and related liabilities
- Utah – Integration into design process
- FHWA – Available guidance and guidebooks

HSM

HIGHWAYSAFETYMANUAL

Resources and Funding

HSM

HIGHWAYSAFETYMANUAL

What you would like to hear

- Experiences and lessons learned using different resources and funding sources
  - State
  - Local agencies
- How to fully implement HSM with existing resources
- How much needed for full implementation
- How to measure the impact of the better decisions based on HSM methods

HSM

HIGHWAYSAFETYMANUAL

Priscilla Tobias, P.E.

- State Safety Engineer for IDOT and leads the Bureau of Safety Engineering
- Experience in the areas of planning, design, policy development and implementation, and safety
- Represent Illinois and the AASHTO Region III on the AASHTO Standing Committee for Highway Traffic Safety; Chairs Task Group on Technical Safety Publication Oversight and Coordination which oversees the AASHTO HSM
- Her leadership and hard work is recognized - Illinois recipient of the 2007 and 2010 AASHTO Safety Leadership Award

HSM

HIGHWAYSAFETYMANUAL

More information

- New Hampshire– Use of HSIP funds
- Florida – Use of HSIP, 408 Grants, and in house staff
- Utah – Dedicated funds
- Lousiana – Hiring contract personnel
- Washington – Use of limited, non-dedicated funds
- New Hampshire - Pool fund for CMF verification
- FHWA – Eligible federal funding

HSM

HIGHWAYSAFETYMANUAL

BREAK

HSM

HIGHWAYSAFETYMANUAL

Training

HSM

HIGHWAYSAFETYMANUAL

What you would like to hear (1 of 2)

- What areas of focus have been most valuable
- How different training for different divisions, locals, consultants, and others
- Upcoming training programs
  - could be available on an on-demand
  - locals and state agencies as time and resources
  - Upper managers

HSM

HIGHWAYSAFETYMANUAL

What you would like to hear (2 of 2)

- Detailed case studies for traffic safety engineers using HSM
- Successful and challenges of training efforts
- Is there a Train-the-trainer program?
- What training should look like going forward (after initial implementation)

HSM

HIGHWAYSAFETYMANUAL

Tim Colling, PhD., P.E.

- Director of the Center for Technology and Training and Senior Research Engineer in MTTI
- Involved in outreach and technical support to transportation agencies within the State of Michigan
- Involved in a number of research and education programs relating to traffic safety

HSM

HIGHWAYSAFETYMANUAL

Stuart Thompson, P.E.

- Highway Safety Engineer for NHDOT
- Over 30 years of experience in various transportation related organizations
- Member of the TRB Committee on Roadside Safety Design, the Committee on Maintenance and Operations Personnel, and the Chair of the Committee of Signing and Marking Materials

HSM

HIGHWAYSAFETYMANUAL

Tim Barnett, P.E., PTOE

- State Safety Operations Engineer in ALDOT
- Experience in traffic operations and traffic safety at the state and local levels
- Fellow of ITE, and member of ASCE, ASEM, and IMSA.

HSM

HIGHWAYSAFETYMANUAL

More information

- FHWA – Available training
- Missouri – Recent training experience
- Illinois – Training approach
- Utah – How to direct training
- Ohio and New Hampshire – Experience with NHI and *SafetyAnalyst* course
- Washington – Future module development for state specific applications

HSM

HIGHWAYSAFETYMANUAL

National Roadmap for Implementation

HSM

HIGHWAYSAFETYMANUAL

Esther Strawder

- Safety Specialist in the HQ Office of Safety (FHWA)
- Work on focused approach to safety and safety analysis tools
- Prior - Highway Safety Engineer in the Maryland Division, positions in North Carolina, Alaska, and Texas

HSM

AASHTO

HIGHWAYSAFETYMANUAL

Close-out

Priscilla Tobias, P.E.

HSM

AASHTO

HIGHWAYSAFETYMANUAL

Thank you for your participation!

HSM

AASHTO

HIGHWAYSAFETYMANUAL

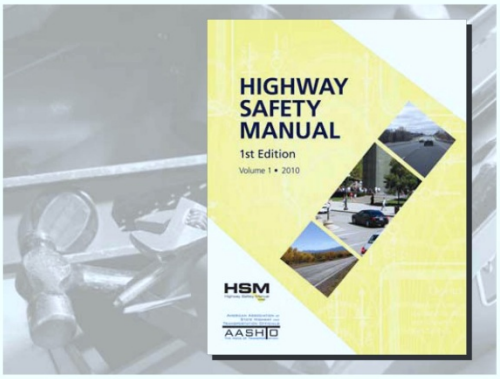
Global Perspective on HSM Implementation

John Milton, Ph.D., P.E.
Washington State DOT
miltonj@wsdot.wa.gov
Washington State Department of Transportation

HSM

What is safety?

HSM



Part A
Introduction
Human Factors
Fundamentals

Part D
Crash Modification Factors (CMFs)

HSM
Highway Safety Manual

Part B
Roadway Safety Management Process

Part C
Predictive Method

HSM

Part A
Part B
Part C
Part D

1. Introduction & Overview
2. Human Factors
3. Fundamentals

HSM

Part A
Part B
Part C
Part D

Road Safety Management Process

- Network Screening
- Diagnosis & Countermeasure Selection
- Economic Appraisal & Prioritization
- Safety Effectiveness Evaluation

HSM 7

Part A
Part B
Part C
Part D

Predictive Methods

- Part C Methodology
  - 'Safety Performance Functions'
  - 'Crash Modification Factors'
  - 'Calibration'
- Applications
- Example problems
- References

HSM 8

Part A
Part B
Part C
Part D

Facilities Included in Part C

10. Rural Two-Lane, Two-Way Roads 
11. Rural Multilane Highways 
12. Urban & Suburban Arterials 

HSM 9

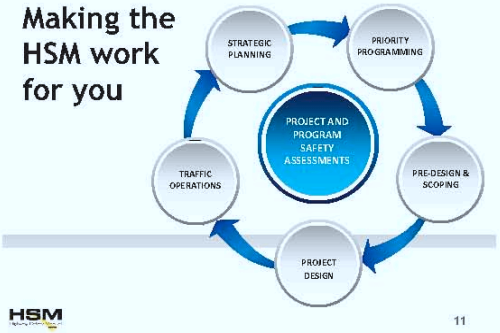
Part A
Part B
Part C
Part D

Crash Modification Factors (CMFs)

- Describe the safety-effectiveness of countermeasures or treatments
  - Roadway Segments
  - Intersections
  - Interchanges
  - Special Facilities and Geometric Situations

HSM 10

Making the HSM work for you



HSM 11

Don't use Part C

Incorporate Part C into

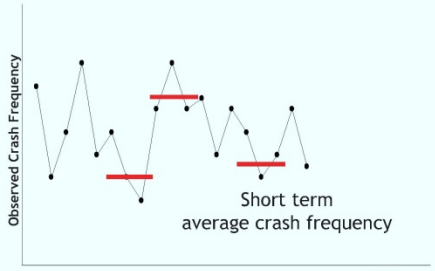
- Programming
- Project Development
- Performance Measurement
- Evaluation

HSM 12

Why use Part C?

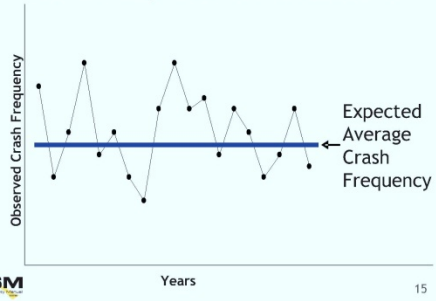
HSM 13

Crashes fluctuate



HSM 14

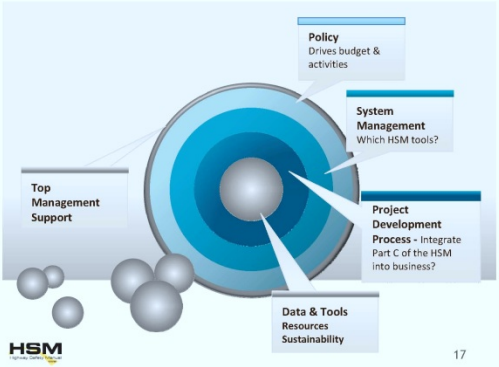
Reliability drives decisions



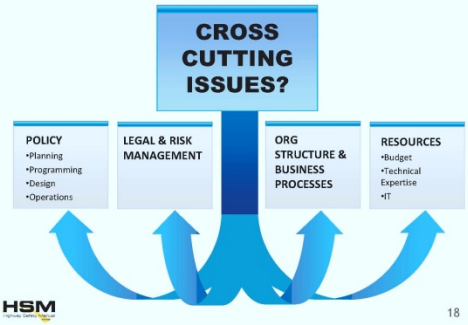
HSM 15

What does implementation mean to your state?

HSM 16



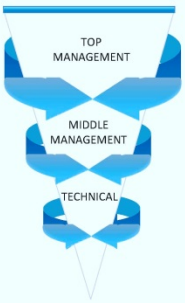
HSM 17



HSM 18

How?

- AWARENESS
- INSTITUTIONAL SUPPORT
- TECHNICAL EXPERTISE



HSM 19

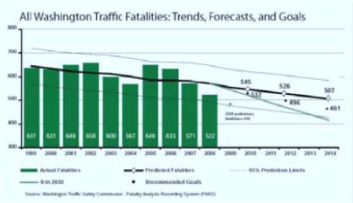
How will you identify priorities for HSM implementation?

HSM 20

How do you write great policy?

HSM 21

How will you measure success?



HSM 22

Do you have in-house technical expertise?

How will you approach training?

How will you fund implementation?

24

How will you market the HSM in your state?

25

The purpose of the HSM is to reduce crash frequency and severity!

26

HIGHWAYSAFETYMANUAL

Ohio's HSM Implementation Approach

Don Fisher
Ohio DOT

HSM

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Ohio's Implementation Approach

- Short Term
  - Training
  - Safety Program Procedures
- Long Term
  - Project Development Process
  - Strategic Highway Safety Plan
  - State Long Range Plan

HSM

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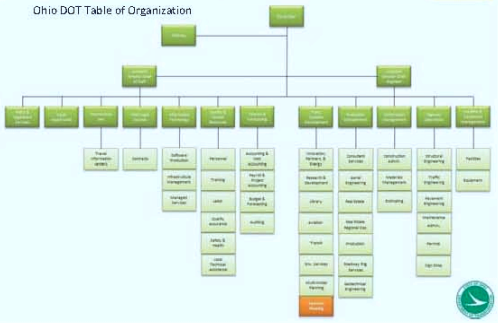
Ohio DOT Table of Organization



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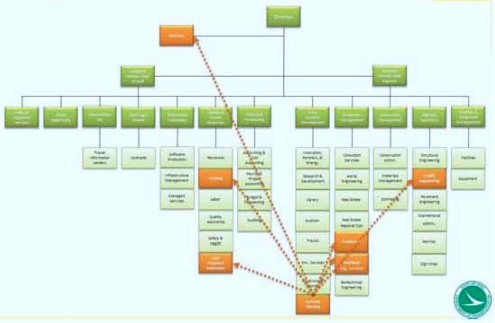
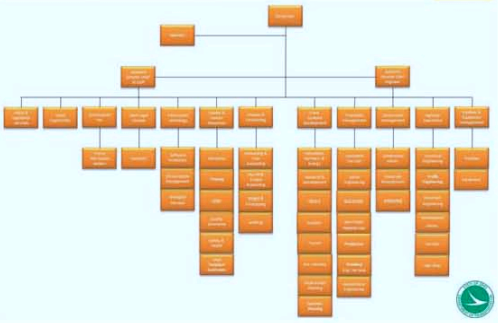


HIGHWAYSAFETYMANUAL



HIGHWAYSAFETYMANUAL

Short Term

- Training
  - Internal / External Stakeholders
- Safety Program
  - Network screening
  - Revise Safety Study Guidelines
  - Modify Safety Application Scoring

HSM

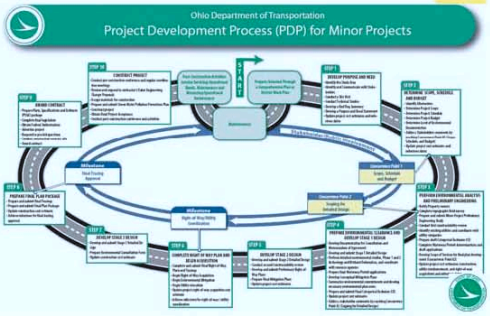
HIGHWAYSAFETYMANUAL

Long Term

- Strategic Highway Safety Plan
- State Long Range Plan
- Project Development Process (PDP)

HSM

HIGHWAYSAFETYMANUAL



HSM

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Barriers/Challenges Encountered

- Change of Safety Policy
- Getting "Buy-in" from Key stakeholders
- District / Local use

HSM

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Overcoming Barriers/Challenges

- Safety Program Policy changes will require support from executive management
- Key stakeholders – PDP Process
- Districts / Local use – Training

HSM

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Next Steps

- Develop training materials and schedule training sessions and workshops.
- Review Scoring of Safety Program Projects
- Review Safety Study Guidelines
- Work with Production / Design to modify PDP

HSM

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Questions?

HSM

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Missouri's Plan for HSM Implementation

Jon Nelson, P.E.

MoDOT

HSM

AASHTO

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MoDOT's Plan

- Obtain support materials
- Increase internal understanding
- Establish an implementation team
- Provide training
- Develop policy/guidance
- Provide technical support
- Other issues

HSM

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Support Materials

- HSM PowerPoint
- Obtain the HSM
  - 25-30 copies
- SafetyAnalyst
- Interactive Highway Safety Design Model (IHSDM)
  - Microsoft Excel spreadsheets
- CMF Clearinghouse
  - www.cmfclearinghouse.org

SafetyAnalyst

IHSDM

$$$!

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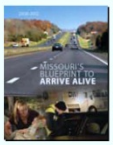
Internal Understanding

- Meet with Executive Team
- Meet with Chief Counsel's Office
- Meet with division heads
- Meet with district engineers
- Present at division meetings
  - Planning/Design
  - Traffic



Find a champion!

HSM

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Implementation Team

- Representatives
  - Planning
  - Design
  - Traffic
  - Highway Safety
  - District
- Familiarity with the manual
- Serve as liaisons
- Challenges
  - Full participation
  - Timing
  - Disconnect
    - Update
    - Re-convene

HSM

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Training

- Implementation Team
  - HSM Webinars
- 2-Day Workshops
  - Focused on Part C
  - Calculations, example problems
  - Participatory
- Challenges
  - Involving the manual
  - Using the spreadsheets
  - What's next?

U.S. Department of Transportation Federal Highway Administration

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Policy/Guidance

- Network screening – SafetyAnalyst
- HSIP/Safety projects
- Design exceptions
- Value engineering studies
- Identify other needs
  - Project prioritization
  - Environmental Impact Studies

Should?
Shall?
If possible?

HSM AASHTO

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Technical Support

- Adapt to Missouri conditions/data
  - Safety Performance Functions
  - Calibration factors
  - Distribution tables
- Internal training/support
  - Example problems
  - Pilot projects

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Other Issues

- HSM Lead State Initiative
  - NCHRP 17-50
- Expand awareness to outside partners
  - Local agencies
  - Consultants
- Challenges
  - Where do we start?
    - 114 counties
    - St. Louis City
  - Resources/Funding

MISSOURI-LTAP

HSM AASHTO

HIGHWAYSAFETYMANUAL

IMPLEMENTATION
Alabama DOT

Dan Turner
(University of Alabama)

HSM

HIGHWAYSAFETYMANUAL

Outline

- Current ALDOT/Alabama situation
- Relationship to SHSP, TRCC, and other acronyms
- Actions underway
  - Introductory training
  - Scoping project

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Current ALDOT/Alabama situation

- CARE Software
- SHSP partnership of ALDOT, GHSP, University of Alabama and others
  - Data (TRCC), HSP (GHSR), Infrastructure, Legislative and Stakeholder Community
- Actions underway
  - Significant training
  - Scoping project – to fit HSM procedures to Alabama and vice versa

HSM

HIGHWAYSAFETYMANUAL

Scoping Project

1) Users/user needs
2) AASHTOWare (SafetyAnalyst)
3) FHWA Software (IHSDM)
4) Data Needs Assessment
5) Potential Integration with CARE/CORRECT
6) SPFs for Alabama
7) Additional Software to Support HSM
8) Develop full plan

HSM

HIGHWAYSAFETYMANUAL

1) Users/User Needs

- Interviews/discussions
  - Training needs, time table

2) AASHTOWare

- Install SafetyAnalyst
- Overlaps with CARE functions
  - Blend it with Care?
  - Expand CARE capabilities?

HSM

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3) Data

- 3 ALDOT Bureaus need data
- Needs, assessment, gap analysis

4) Integrate CARE/CORRECT

- Mutually supportive use
- Gap analysis to migrate one software to the other

HSM

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5) Integrate CARE/CORRECT

- Mutually supportive use
- Gap analysis to migrate one software to the other

6) SPFs

- 3 terrain types in state
- Calibrate HSM SPFs, or prepare Alabama specific?
  - Test both ways to make decision

HSM

HIGHWAYSAFETYMANUAL

7) Develop Support Software

- Test EB methodologies vs. extensive data
- Evaluate needed data and data cost

8) Completed Implementation Plan

- Maximum effectiveness
  - Uses best components of HSM
  - Uses current Alabama safety tools
  - Cost effective, time effective

HSM

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Overcoming Barriers/Challenges

- Internal marketing
- Managers got overview training
  - Established expectations
- Funding – prior approval
- Scoping study underway

HSM

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Conclusions

- Good safety cooperation among agencies
- ALDOT managers see advantages of HSM
- Safety Operations Engineer has established a path and is moving forward
- Technical and training help is in place

HSM

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Highway Safety Manual and Policy Development

Dave Piper, P.E.
Illinois

HSM

HIGHWAYSAFETYMANUAL

HIGHWAY SAFETY MANUAL NCHRP 17-38 SAFETY MANAGEMENT PROCESS CYCLE

	NATIONAL			ILLINOIS		
	INITIATIVE	SAFETY-LU & HSIP	NHI – NEW APPROACH CLASS	PROCESS REVIEW – SAFETY IN PHASE I	NEED TO RECOGNIZE AND PRIORTIZE SAFETY NEEDS	CHANGE TO CRASH DATA SYSTEM
	TARGET	SHSP 5 % REPORT	SPF/PSI MEASURE	IMPROVE AND DOCUMENT SAFETY ANALYSIS	RSAs	NEW METHOD TO PROVIDE NETWORK SAFETY SCREENING
	INTERIM WORK		DEVELOP SPFs	DRAFT POLICY REVIEW	RSA TRAINING AND PRACTICE	LEARNING CURVE
		5% REPORT	PSI SCREENING PRODUCT	REDRAFT REVIEW	ENCOURAGED AS BEST PRACTICE	BEST PRACTICES
	NEW POLICY	B/C TOOL PSI NETWORK SCREENING SAFETY MANAGEMENT PROCESS & TOOLS		REDRAFT BUREAU OF DESIGN AND ENVIRONMENT NEW POLICY FOR SAFETY ANALYSIS IN PHASE I OF PROJECT DEVELOPMENT.		

HSM

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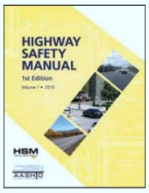
Highway Safety Manual and Safety Analysis

- Safety Management Process Cycle
- Safety Analysis Portion
  - Network Screening (HSM Ch 4)
  - Diagnosis (HSM Ch 5)
    - Data/Resources Analysis (Office Review)
    - Crash Report Review
    - Safety Concerns
    - Site Review
    - Problem ID
  - Countermeasures (HSM Ch 6)
  - Recommended Countermeasures (HSM Ch 7 & 8 and Part D)



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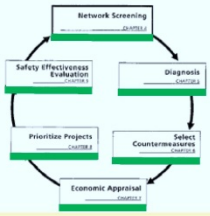
Safety Management Process Cycle

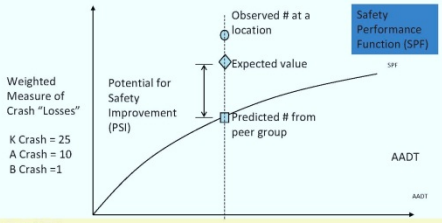


HSM Chapters 5 through 8 reflect project level safety analysis.

HSM

HIGHWAYSAFETYMANUAL

Using SPFs and Empirical Bayesian Methods to Estimate Potential for Safety Improvement (PSI)



HSM

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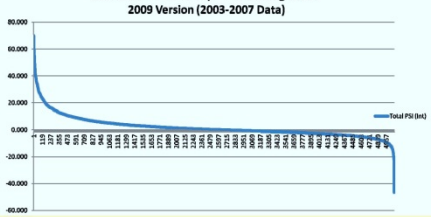
PSI Thresholds



HSM

HIGHWAY**SAFETY**MANUAL

Safety Analysis

- **Network Screening** (HSM Chapter 3)
  - Provided by BSE
  - PSI Values for all segments/intersections
  - Detailed investigation for
    - 5% Report locations
    - Other Locations
      - Knee of Curve
      - Threshold

HSM

HIGHWAY**SAFETY**MANUAL

Critical PSI Values for Peer Groups
Based on 2009 IDOT "Five Percent Report"

Peer Group Number	Peer Group Name	Critical PSI
SEGMENTS		
1	Rural 2-Lane Hwy	10.0
2	Rural Multilane Undivided Hwy	5.0
3	Rural Multilane Divided Hwy	7.0
4	Rural Freeway 4-Lanes	10.0
5	Rural Freeway - 6+ Lanes	7.0
6	Urban 2-Lane Hwy	10.0
7	Urban One-Way Arterial	13.5
8	Urban Multilane Undivided	25.0
9	Urban Multilane Divided Hwy	25.0
10	Urban Freeway, 4 Lanes	25.0
11	Urban Freeway, 6-Lanes	25.0
12	Urban Freeway, 8+ Lanes	25.0
INTERSECTIONS		
1	Rural Minor Leg Stop	3.0
2	Rural All-Way Stop Control	1.7
3	Rural Signalized	5.5
4	Rural Undetermined	1.3
5	Urban Minor Leg Stop	4.7
6	Urban All-Way Stop	3.5
7	Urban Signalized	15.0
8	Urban Undetermined	9.3

HSM

HIGHWAY**SAFETY**MANUAL

Highway Safety Manual and Safety Analysis

- Safety Management Process Cycle
- Safety Analysis Portion
  - Network Screening (HSM Ch 4)
  - Diagnosis (HSM Ch 5)
    - Data/Resources Analysis (Office Review)
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    - Safety Concerns
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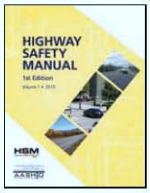

HSM

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HSM Policy

Dan Magri, P.E.
Highway Safety Administrator
Louisiana Department of
Transportation and Development

HSM

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Introduction

- Incorporating HSM methodologies in policy
- Leadership approval and commitment
- HSM Implementation Plan
- Phased-in approach
  - Short Term 0-3 years
  - Long Term 3-7 years

HSM

HIGHWAYSAFETYMANUAL

Actions Accomplished

- Stage 0 – scope and feasibility
- Stage 1 – environmental studies
- Safety assessment for pavement preservation projects
- Centerline/edgeline rumble strips
- ⃠ Five-Lane sections

HSM

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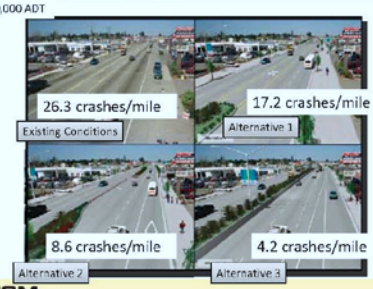
At 20,000 ADT



HSM

4

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Actions Accomplished (cont.)

- Evaluating the safety impacts of new developments, permits, traffic signals, median openings
- Evaluating safety of alternative design approaches
- Documenting design exceptions, variances and waivers

HSM

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Barriers/Challenges Encountered

- Personnel – lack of knowledge and experience
- MPOs/Local agencies/Consultants
- Lack of training
- Organizational structure of DOTD Districts
- Tort liability

HSM

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Tort Liability

- Does not establish a standard of care for users
- Provides information to assist agencies in the decision making process
- Information compiled or collected for safety purposes are privileged under 23USC 409

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23 USC 409

- **§ 409. Discovery and admission as evidence of certain reports and surveys**

Notwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential accident sites, hazardous roadway conditions, or railway-highway crossings, pursuant to sections 130, 144, and 148 of this title or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.

HSM

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Overcoming Barriers/Challenges

- Conducted FHWA Resource Center workshops
- Scheduled the NCHRP 17-38 workshop
- Working with LTAP
  - LRSP
- Obtained leadership approval and commitment
- Include HSM implementation as a strategy in the SHSP

HSM

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HSM

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Next Steps

- Review Department policies
- Incorporate written HSM policies in:
  - Project Delivery Manual (Stage 0, Stage 1, etc.)
  - Engineering Directives Standards Manual (EDSM)
  - Louisiana Safety Assessment Process (PRR)
- Conduct training for MPOs/Locals/consultants
- Develop a communications plan

HSM

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Driving Zero Fatalities to a Reality

Resources and Funding

Priscilla A. Tobias, PE
State Safety Engineer
Illinois Department of Transportation

HSM

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Driving Zero Fatalities to a Reality

Implementation of HSM

- Highway Safety Manual (Manual and/or CD)
- Training
- Data
- Analytical Tools (Safety Analyst)
- Policy

HSM

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Driving Zero Fatalities to a Reality

Resources

- Internal
- External
- Manpower
  - Staffing
  - Expertise
- Funding

HSM

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Driving Zero Fatalities to a Reality

Manpower

- In-house
  - Central
  - District
- Consultant
- University
- FHWA

HSM

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Driving Zero Fatalities to a Reality

Funding

- Highway Safety Improvement Program (HSIP)
- State Planning and Research (SP&R)
- Safety Belt Bonus (Section 406)
- Traffic Records Coordinating Committee (Section 408)
- LTAP

HSM

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Driving Zero Fatalities to a Reality

Resources and Funding

- Statewide Consultant Various-Various Work Order Contract --(HSIP)
- Illinois Center for Transportation (ICT)--(SP&R)
- HSM Manuals and CDs--(Section 406)
- Safety Analyst (Section 408)
- Locals—LTAP and various

HSM

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Driving Zero Fatalities to a Reality

HSM Manuals

- Training Discount
- Safety Belt Bonus $$ (Sec 406)
- 50 hard copies
- 10 CDs

HSM

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Driving Zero Fatalities to a Reality

Training

- NCHRP Pilot HSM Class (Free +FHWA $)
- 6 Two-Day Regional HSM Classes (CH2MHill)
- 1 Day HSM Class –Local Agencies (IDOT/CH2MHill)
- SPF Summit (ICT)
- SPF 1-day workshop (ICT)
- HSM Lead State Peer to Peer (ICT)

HSM

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Driving Zero Fatalities to a Reality

Data and Analytical Tools

- Locating Local Crashes (HSIP)
- SPF Development (ICT)
- SPF Update (CH2MHill)
- B/C Tool (CH2MHill)
- Safety Analyst (IDOT, CH2MHill)
  - Section 406 and 408
  - HSIP

HSM

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Driving Zero Fatalities to a Reality

Next Steps

- HSM Implementation Pool Fund?

HSM

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Training State and Local Agencies on HSM Principles

Tim Colling, PhD., P.E.
Michigan

HSM

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Target Audience

MDOT
Local Agencies

HSM

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Plan Going Forward – MDOT

- Review of business /organization needs
- Internal Training
  - Targeted Training
- Multiple Units

HSM

Village intersection poses risks

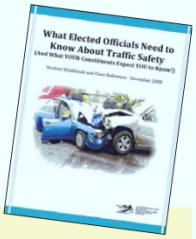
"There is no reason why Michigan Street doesn't have any stop signs."

-Willy Maki, downtown business owner

HIGHWAYSAFETYMANUAL

Laying the Groundwork in 2008

- Elected official training?
- Build trust in technical
- Raise awareness



HSM

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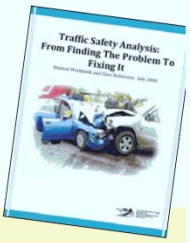
Laying the Groundwork in 2008

- Local agency technical staff
- Raise awareness of HSM (not yet released)
- Introduce safety workflow
- Train on tools and data



HSM

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Plan Going Forward – Local Agency

- 2011-2012 – 9-10 elected training sessions
- 2011-2012 – 12-14 HSM trainings 8hr sessions

HSM

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Barriers/Challenges Expected

- Getting elected / appointed to attend
- Policy changes needed for full Implementation
- Convincing people a change is needed
- Access to the HSM Manual

HSM

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Data Needs and Other Background Knowledge

HSM

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Overcoming Barriers/Challenges

- Marketing – Its not a "dirty" word
  - Internal & External
- Peer Advocates
- Data Access

HSM

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Next Steps

1. LTAP Newsletter Article - HSM
2. Awareness "Marketing"
3. Peer Advocates
4. Train...Train....Train!
5. Implement

HSM

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Questions ?

HSM

HIGHWAYSAFETYMANUAL

Safety Training

Stuart Thompson
New Hampshire

HSM

HIGHWAYSAFETYMANUAL

Introduction

- Safety Training - HSM
  - State
  - Local – RPC\Towns\Cities
  - Consultants - ITE

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Actions Accomplished

- New Approaches to Highway Safety Analysis 9/25/2007
- Application of Crash Reduction Factors 2/24/2009
  - In conjunction with RSA training
- Highway Safety Manual Practitioners Guide for Geometric Design 10/21/2009
- Safety Workshop - ITE 6/23/2010

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Other Opportunities for Promotion

- PE Review
- Technical Advisory Committee
- RSA Process
- Project reviews

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Next Steps

- Highway Safety Manual Training
  - Executive Overview
  - HSM - NHI
  - SafetyAnalyst

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HSM Training & Workforce Development

Timothy E. Barnett, P.E., PTOE
State Safety Operations Engineer
Office of Safety Operations
Alabama Department of Transportation

HSM

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Introduction

- HSM Training and Workforce Development are Essential to Implementing the Highway Safety Manual
- Need to Educate
  - Agency leaders so they understand HSM concepts and can facilitate implementation
  - DOT Personnel, County, City, Consultants, and Others involved in Planning, Designing, Constructing, and Managing our Highways and Streets

HSM

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HSM Training Accomplished

- HSM Overview Seminar (September 2010)
  - 37 attendees
- HSM Two-Day Workshop (September 2010)
  - 80 attendees
- Alabama T^2 LTAP at Auburn University One-Day Course (October 2010)
  - 4 offerings throughout the state
  - 126 attendees

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HSM Training Accomplished

- HSM Overview and Two-Day Workshops
  - Facilitated by Tim Newman, Ida van Schalkwyk, and Dan Turner
  - National Experts brought Credibility and Real Understanding of HSM Concepts
  - Administrators and Managers in the 2-Hour HSM Overview were Very Impressed

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Actions Accomplished

- Workforce Development Courses Prior to HSM:
  - Safety and Operational Effects of Geometric Design Features
    - 36 attendees (1 session)
  - Low-Cost Safety Improvements
    - 39 attendees (1 session)
  - Improving Safety of Horizontal Curves
    - 70 attendees (2 sessions)
  - Road Safety Audits
    - 35 attendees (1 session)

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Barriers/Challenges Encountered

- Basic Knowledge and Skills of Attendees
- Hard to keep everyone engaged when there are so many job specialties in audience
- HSM One-Day Course is Insufficient to Cover Material & Overwhelming to Participants
- HSM Two-Day Workshop is Thorough, but Still to Complex for a the Time Expended
- Cost of Training, Specifically Manual Cost

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Overcoming Barriers/Challenges

Additional Course Offerings:

- Divide the HSM Training into Manageable Parts, i.e., more specific subject areas
  - HSM for Planners, for Maintenance, for Designers, etc.
  - Individual Courses for Each HSM Chapter
- Workforce Development Opportunities to develop Knowledge and Skills of Stakeholders
  - State-Wide Training Program through LTAP
- Providing Manuals through Special Funding

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Next Steps

- Additional HSM Two-Day Workshop Planned for Spring 2011
- Develop More Focused and Specific HSM Training
- Continue Implementing Workforce Development Plan
- State-Wide Training Opportunities in Coming Year

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Conclusions

- ALDOT is Committed to Training of Staff and Stakeholders
  - Training to Develop a Safety Culture
  - Training on the Use of the HSM
  - Training to Develop and Reinforce the Basic Knowledge and Skills Needed to Implement the HSM

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HSM Implementation Roadmap

Esther Strawder, FHWA
Office of Safety

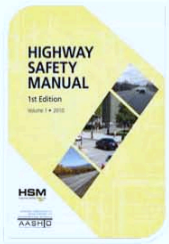
HSM

November 17, 2010
HSM Peer Exchange
Schaumburg, IL

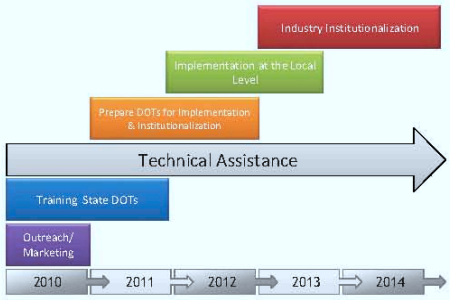
FHWA Implementation Roadmap for the HSM

Roadmap Elements

- Outreach and Marketing
- Training – Building Core Capacity
- Technical Assistance
- State and local implementation
- Institutionalization



HSM IMPLEMENTATION ROADMAP



HSM Marketing and Outreach

Ongoing Activities:

- Executive briefings and introductory overviews by AASHTO, FHWA, TRB
- Updated HSM Website- AASHTO
  - www.highwaysafetymanual.org
  - http://safety.fhwa.dot.gov/hsm
- Distribution of HSM & marketing products
- AASHTO video (available online)

Planned Activities:

- State Implementation strategies report
- Release of Electronic Suite DVD
- HSM Case Studies

HSM
Highway Safety Manual

HSM Training Activities

Completed Training

- HSM Workshops at TRB Jan. 2010
- NCHRP HSM Training Pilots in DC, WA, and IL
- FHWA Resource Center (RC) recorded HSM Webinars -12 available at www.highwaysafetymanual.org
- FHWA RC delivered HSM Practitioners Guide course in 10 states in FY 10

Planned Training

- 50 HSM courses requested in 13 states for FY11
- Additional NCHRP HSM Training Pilots LA, FL, AZ
- Web-based HSM and IHSDM training

HSM
Highway Safety Manual

HSM Available Training

Course	Description
Interactive Highway Safety Design Model (NHI 380071)	2-day IHSDM overview course
New Approaches to Safety Analysis (NHI 380075)	2 ½ day workshop introducing SafetyAnalyst methodology
Highway Safety Manual (NHI 380106)	***NCHRP 17-38 pilot course*** 2 day HSM overview
HSM Practitioner's Guide for Two-Lane Rural Roads (NHI 38070A)	2 day Safety Effects of Geometric Design Features for two lane rural roads
HSM Practitioner's Guide for Multilane Highways and Urban/Suburban Roads (NHI 38070B)	2 day Safety Effects of Geometric Design Features for multi lane highways and urban/suburban roads
HSM Practitioner's Guide for Intersections (NHI 380105)	1 day Safety Effects of Geometric Design Features for Intersections
HSM Practitioners Guide for Horizontal Curves (NHI 380088)	1 day Safety Effects of Geometric Design Features for Horizontal Curves
Using SafetyAnalyst	2 day Introductory SafetyAnalyst course Available for licensed states

FHWA Priorities

FHWA will give priority consideration to the lead states as we assist with HSM outreach, training, technical assistance, and implementation planning

HSM Technical Assistance

Available Technical Assistance:

- General HSM: AASHTO www.highwaysafetymanual.org
- SafetyAnalyst : service units through AASHTO
- IHSDM:
  - IHSDM.support@fhwa.dot.gov & help line at (202)493-3407

Planned Technical Assistance:

- www.highwaysafetymanual.org - user discussion forum
  - Access to experts to answer questions
- Ongoing assistance through AASHTO Task Group, TRB Highway Safety Performance Committee, & FHWA
- FAQs on all HSM related websites

HSM Highway Safety Manual

FHWA Technical Assistance

Additional Technical Assistance:

- SafetyAnalyst (Part B Supporting tool):
  - For those states considering licensing FHWA can offer:
    - Informational/overview webinars
    - Data preparation support
    - Software demonstration
- IHSDM (Part C Supporting tool):
  - Limited calibration factor assistance
  - FAQs
- CMF clearinghouse (Part D Supporting tool)
  - CMF Guidebook
  - FAQs

HSM Highway Safety Manual

Potential HSM Implementation Activities

Activities a State may want to consider:

- Identify HSM Champion within DOT & build implementation team
- Use state strategies, lead state peer workshop as resource to develop implementation plans

Activities local agencies may need assistance with:

- Awareness and training of County Engineers, MPOs, Cities
  Engage LTAP Centers, NACE, ITE, AMPO, NARC
- Addressing data shortcomings at local level

HSM Highway Safety Manual

Proposed HSM Institutionalization Activities

Activities that support HSM Institutionalization:

- Incorporate state-specific Calibration and SPF development as appropriate
- Consider developing state policies on HSM in project development processes such as design exceptions and alternative selection
- Routinely evaluate projects with HSM methodology
- Incorporate HSM methodology into higher education curriculum
- Establish performance measures

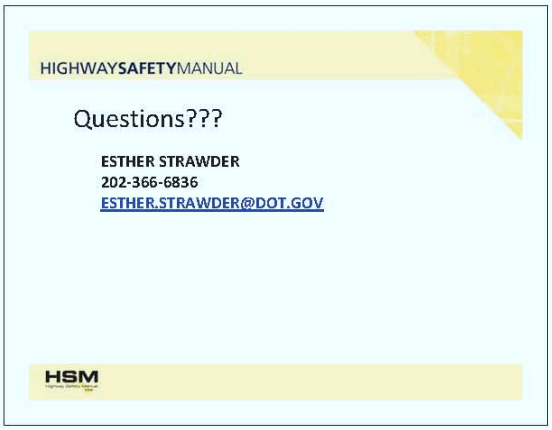
HSM Highway Safety Manual

Potential Implementation Activities

- Develop guidebooks for HSM applications in project development
- Assist states with development of HSM implementation plans
- Establish SPF Clearinghouse
- Offer technical assistance to states to facilitate their efforts in developing calibration factors
- Offer technical assistance to states to facilitate their efforts in developing a SPF

HSM Highway Safety Manual


HIGHWAYSAFETYMANUAL Helpful Resources
Resource
Contact Info
www.highwaysafetymanual.org
Kelly Hardy, AASHTO
khardy@aashto.org
202 624 5868
http://safety.fhwa.dot.gov/hsm
Esther Strawder, FHWA HQ
esther.strawder@dot.gov
202 366 6836
http://safetyperformance.org
Rick Pain, TRB
rpain@nas.edu
202 334 2964
http://www.safetyanalyst.org
Vicki Schofield, AASHTO
vschofield@aashto.org
202 366 3640
http://www.ihsdm.org
Clayton Chen, FHWA R&D
clayton.chen@dot.gov
202 493 3054
http://www.cmfclearinghouse.org
Karen Yunk, FHWA
Karen.yunk@dot.gov
609 637 4207
HSM


HIGHWAYSAFETYMANUAL
Questions???
ESTHER STRAWDER
202-366-6836
ESTHER.STRAWDER@DOT.GOV
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Day 2

HSM

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Highlights of Day 1 and Overview of Day Ahead

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Data and Data Needs

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What you would like to hear

- Ohio: How many states have a statewide inventory of all intersections, sections, and ramps as well as associated road inventory attributes, lanes, widths, volumes, etc?
- Missouri/Michigan/Florida: How are you collecting data that is currently unknown
  - curve lengths and radii
  - volume data on "all" local roads
  - Other cost effective techniques to collect the data?

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What you would like to hear

- Approaches to developing data specific to the HSM based on available data.
- Missouri: Can analysis be done if certain data is missing?
- Louisiana: Where states stand on data collection and compliance with MIRE, especially on the local road system?
- New Hampshire: Who is doing the states data collection and maintenance and update of data set.
- Michigan: Are others looking at crash distribution issues? What methods are being used?

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John Milton, P.E., Ph.D.

- Director of Enterprise Risk Management in WSDOT
- His research focused on econometric and statistical modeling of the frequency and severity of collisions
- Served on numerous National Academy of Engineering research panels
- Chair of the Transportation Research Board Task Force for the Development of a Highway Safety Manual

HSM

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Terri Monaghan, P.E.

- Highway Safety Manager in LA DOTD
- Work in Strategic Highway Safety Plan, Safe Routes to School Program, Local Road Safety Program, etc.
- Member of AASHTO Subcommittee on Safety Management and Louisiana Traffic Records Coordinating Committee

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Joe Santos, PE

- Transportation Safety Engineer in FDOT
- Experience in construction, planning and project management
- Also served 27 years in the United States Navy Civil Engineering Corp, Reserve

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More information

- New Hampshire: Road layer in GIS, working on intersections
- Michigan:
  - Data issues related to *SafetyAnalyst*
  - SPF and crash data distribution calibration
  - Techniques to overcome some data limitations/incomplete data

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Jeff Miller

- Leader for the Analysis and Evaluation Team of the FHWA Office of Safety
- Coordinates the Cross-Functional FHWA Safety Roadmap to promote the Comprehensive Approach to Safety Planning
- Prior - Division Chief of Strategic Planning and Program Evaluation for the FMCSA

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BREAK

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HSM Applications Part B

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What you would like to hear

- Michigan: What are the states actually using it for today?
- Ohio: How many states plan to use Safety Analyst?
- Missouri: Are there any best practices they've learned pertaining to implementation and/or its use?
- Florida: What are the implementation steps for HSM Applications in Part B?

HSM AASHTO

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What you would like to hear

- Ohio/Louisiana: How are states handling Network Screening?
- Kim: If you are not using *SafetyAnalyst* currently, do you plan to continue with existing procedures or change to *SafetyAnalyst* or another program in the future?
- New Hampshire: Who is doing the work.

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- Chair of the Transportation Research Board Task Force for the Development of a Highway Safety Manual

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Jonathan Hughes, P.E.

- Systems Planning Section Manager in ODOT
- Work on statewide safety location analysis, systems conditions analysis for pavements and bridges, and forecasting fiscal levels
- Previous duties with ODOT include highway project design and construction project engineering

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More Information

- Illinois: Using SPFs into procedures
- New Hampshire: We are using SafetyAnalyst, but have not fully implement the steps in Part B.

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Lunch

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SPF Development and Calibration

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What you would like to hear

- Utah: What are the data needs for the program to be successful?
- Florida: Realistic impact from not calibrating the formulas for a particular state conditions.

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What you would like to hear

- Missouri/Maine/Ohio:
  - How much does it cost to calibrate SPFs?
  - How much does it cost to develop SPFs?
  - Are SPF's and calibration factors being developed internally or externally?
  - How long does it take?
  - How different are the results vs. using calibrated SA data? What is the net benefit? What is realized in terms of better analysis? Is it worth it?

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Dale Lighthizer, PhD., P.E

- Manager of the Safety Programs Section in MDOT
- Work in the areas of transportation, traffic, and traffic safety engineering
- Advocating for highway traffic safety at local agencies

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Stephen Read, P.E., P. Eng.

- Highway Safety Improvement Programs Manager in VDOT
- Experience in conducting and managing multi-modal corridor environmental, planning, operational, safety studies and research, etc.
- Lead VDOT's highway, bicycle and pedestrian, and rail-grade crossing crash data analysis and safety improvement programs

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More Information

- Louisiana: Pending research proposal to develop SPFs for the local road system.
- Maine: Working with other states to develop regional SPFs.
- Michigan: Describe what we are doing to examine issues related to SPF and crash distribution calibrations

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HSM Applications Part C

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What you would like to hear

- Maine / Louisiana / Michigan / New Hampshire: How are other states using or planning on using Part C? who, when, to what degree will it be implemented at the local level?
- Utah: How has the use of the HSM improved their decision making process.
- Ohio: Additional roadway types such as: Urban Interstates, roundabouts, ramps…

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What you would like to hear

- Missouri: Is anyone using IHSDM?
- Missouri: Who's spreadsheet is being used (there are multiple versions)?
- Louisiana: A discussion of available tools and systems (e.g., SafetyAnalyst, IHSDM, DiExys, safety module developed by Agile Assets, dTIMS safety module developed by Deighton, etc.) that are currently available.

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Darryl Belz, PhD., P.E.

- Safety and Scoping Manager in MaineDOT
- Experience in multi-modal transportation planning, traffic analysis, safety assessments, and bridge construction
- Member of MaineDOT's Design Exception and Highway Policy Committees and Maine's four MPO Technical Committees

HSM AASHTO

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David O'Hagan, P.E.

- State Roadway Design Engineer for the Florida Department of Transportation
- Oversees creation, implementation and maintenance of all the policies and standards
- Serves as the FDOT's Roadway Departures Emphasis Area Champion on its Strategic Highway Safety Plan.

HSM AASHTO

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More Information

- Louisiana: The use of these methods in project development.
- Utah: The approach taken to institutionalize the HSM.

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BREAK

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State Representatives

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FHWA Implementation Next Steps

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Esther Strawder

- Safety Specialist of FHWA HQ
- Work on the focused approach to safety and safety analysis tools
- Was a Highway Safety Engineer in the Maryland Division as well as Quality Coordinator before joining the Office of Safety

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Close-up

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Priscilla A. Tobias, P.E.

- State Safety Engineer in IDOT
- Experience in the areas of planning, design, policy development and implementation, and safety
- Represent Illinois and the AASHTO Region III on the AASHTO Standing Committee for Highway Traffic Safety; serve as chair in multiple groups

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The End!
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AASHTO

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HSM Data and Data Needs

John Milton, Ph.D., P.E.
Washington State DOT miltonj@wsdot.wa.gov
Washington State Department of Transportation

HSM

IDOT HSM Lead State Peer-to-Peer Workshop
Schaumburg, IL – November 17 & 18, 2010

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Why is data needed?

- For use in determining needs
- Assessing Priorities
- Estimating Crashes
- Improving project selection

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Data for Part B andC

- Site Characteristics
- Traffic volume
- Crash Data

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Part B

- Network Screening
- Diagnosis
- Select Countermeasures
- Economic Appraisal
- Prioritizing Projects
- Safety Effectivness Evaluation

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Part C

- Breaking out Segments and Intersection
- Calibrating Models
- Selecting appropriate SPFs
- Estimating Crashes using EB

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Part C

- Each Chapter has different data needs as outlined by NCHRP 329 and the HSM
- Data requirements differ because different of the different functional class characteristics
- Data is used to assess difference from base conditions
- Volume is a key variable in all models

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Washington State

- All crash data available
- Most geometric data available
- Ramps and intersections biggest challenge
- Driveways not specifically identified by milepost.
- Volume is a key variable in all models

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Safety Analyst Implementation

- Data
- Key Risks
- Lesson Learned
- Challanges

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Data Element	Records
Roadway Segments	705,962
Intersections	11,847
Collisions (2004-2008)	238,810
Segment AADT	3,309,626
Minor Road Traffic AADT	12,777
Major Road Traffic AADT	708,160

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Data Elements

- Roadway Segment Data
- Segment Traffic
- Ramp Data
- Ramp Traffic
- Intersection Data
- Major Road Traffic
- Minor Road Traffic
- Intersection Leg Data
- Intersection Leg Traffic
- Collision Data
- Construction Project
- Implemented Countermeasure

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Process	Time
Data Import	13 Hours
Post-Processing	4½ Days
Calibration	9 Hours

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Consideration for Implementing SafetyAnalyst

- Requires substantial effort to prepare data for importing into SafetyAnalyst
- Full implementation uses data types that not all agencies have available
- Requires training for users
- Requires agency commitment

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Timeline Risks

- Server Space
- Roles and Responsibilities (Charter)
- Required SafetyAnalyst Data Elements
- Data Mapping
- Crosswalk SA Data to DataMart Data
- Determining Minor Road ADT
- Processing Data
- Identifying Additional Data Sources

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Successes/Lessons Learned

- Data experts
- IT Support
- Team Communication
- Start with small data set
- Trivial decisions…aren't
- Data updates can be slow

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Crosswalk SafetyAnalyst Data Needs to Agency Data

- Need to know data format
- Data Accuracy
- Unknown (99) is not always valid

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Safety Analyst Implementation

- Biggest Data Challenges
  - Determining Minor Road ADT
    - Using 1 as an ADT placeholder created problems
  - Unique ID for Ramp Intersections

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Identifying Additional Data Sources

- Access permit database
- SRView3 (log of highways, 360 degree view)
- Arial photos (TTI Method)
- Region databases
- Local Agencies
- GIS
- MPO/RTPO

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Required SafetyAnalyst Data Elements

- Data Mapping
- Crosswalk SA Data to DataMart Data
  - Need to know data format
  - Data Accuracy
- Determining Minor Road ADT
- Processing Data
- Identifying Additional Data Sources

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Required SafetyAnalyst Data Elements

- Accuracy has varying impact on output (e.g. minor road ADT)
- Data Mapping (know what you have, identify what you need to collect)
- Planned vs. Actual (Access Control)

HSM

Part A
Part B
Part C
Part D

Road Safety Management Process

Network Screening

Diagnosis & Countermeasure Selection

Economic Appraisal & Prioritization

Safety Effectiveness Evaluation

HSM

20

Part A
Part B
Part C
Part D

Predictive Methods

- Part C Methodology
  - 'Safety Performance Functions'
  - 'Crash Modification Factors'
  - 'Calibration'

HSM

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Part A
Part B
Part C
Part D

Facilities Included in Part C

10. Rural Two-Lane, Two-Way Roads

11. Rural Multilane Highways

12. Urban & Suburban Arterials

HSM

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Part A
Part B
Part C
Part D

Crash Modification Factors (CMFs)

- Describe the safety-effectiveness of countermeasures or treatments
  - Roadway Segments
  - Intersections
  - Interchanges
  - Special Facilities and Geometric Situations

HSM

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WSDOT choice

Use Scientific methods

- Network screening
- Systemic improvements
- Evaluate countermeasures
- Economic Analysis

Use Predictive Methods (Part C)

State-specific SPFs

Incorporate Part C into:

- Programming
- Project Development
- Performance Measurement
- Evaluation

Priority Programming

WSDOT Strategies include?
Crash frequency, crash type, crash severity

Performance Measures
Fatal and Serious Crashes

HSM

24

EB allows for future estimates of crashes

PART C is all about higher RELIABILITY

Quantification is Key!

- WSDOTs goal is to maximize return on investment for each project dollar spent
  - To achieve this goal we must estimate future crash occurrence well
  - Scientifically based estimates that control for statistical issues increase potential returns
  - Use of SPFs (calibrated or developed)

HSM

WSDOT Developed SPF early

- WSDOT first developed SPFs in the mid 1990s
  - Redeveloped for Interstates
  - Research for Rural two lane and Suburban/Urban Arterials Identified
  - SPFs for Severity on multilane divided developed
  - Future SPFs will be developed.

HSM

Priority Programming

- Supplemental Tools?
  - GIS Maps, Crash Records, Diagrams
- Contributing factors analysis
  - Colorado's Diagnostics Assessment
  - Greater than expected occurrence

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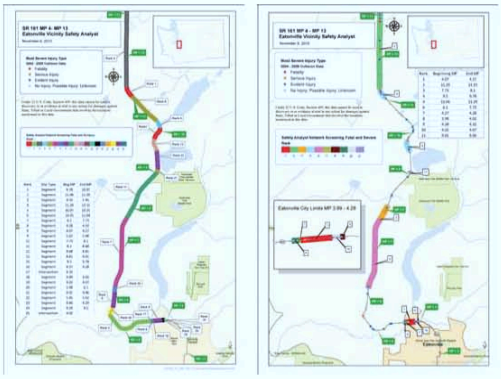

Countermeasure Selection

- Countermeasure Selection
  - Developing Policy on use of CMFs
    - Not all CMFs are created Equal (Star Rating)
- Develop Policy on B/C ratio
  - What Benefits and Costs
  - Service Life
  - Crash Costs

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Countermeasure Selection

- Prioritization of Projects
  - Programmatic structure and policy issues

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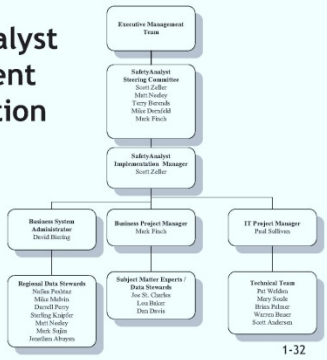
SafetyAnalyst Deployment Organization Chart



HSM

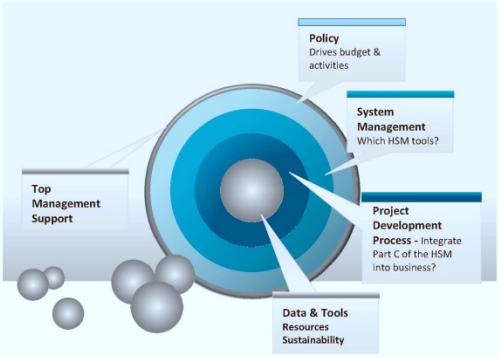
1-32

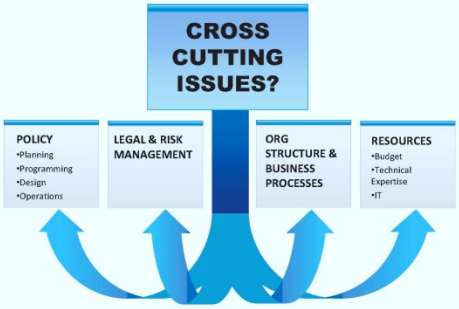
Project Schedule & Work Plan

Date	Description
October 2009	SafetyAnalyst Project Evaluation Team Formed Data Crosswalk investigation begins Identified Evaluation Phase Tasks SafetyAnalyst v4.0.0
December 2009	SafetyAnalyst Charter identifies stake holder responsible for carrying out the SafetyAnalyst evaluation
October 2009-June 2010	Data crosswalk and computer system requirements. Computer memory issues identified compiling WSDOT data
September 2010	Successful data load, calibrate and post process without memory error issue. SafetyAnalyst v4.0.8
October 2010	SafetyAnalyst training (2 days)
November 2010	Evaluation Complete Verbal approval to implement
December 2010	Form Project Implementation Team & Charter Update 2008 data collision codes.
January 2011	Develop Region Intersection Database
February 2011	Region Training
March 2011	Begin Region data collection
April 2011	Address Ramp data
May 2011	Region update TRIPS data
June 2011	End of Year 2010 Data lock
July 2011	Load and Process 2010 data
August 2011	CALICADSAL and 5% report data generated

HSM

1-33





Highway Safety Manual

Data & Data Needs

Terri Monaghan, P.E.
Highway Safety Manager
Louisiana DOTD
November 17 – 18, 2010

Highway Safety Manual

The HSM & Data / Data Needs

- THE core element
- Accurate, Quality, & Timely
- Data gaps
  - State highways
  - Local roads

1

Highway Safety Manual

Accomplishments & Strengths

- DPS / DOTD crash data MOU
  - Crash data is responsibility of DOTD
- TRCC – 2 tier
- LSU contract
  - Crash data collection & analysis
  - LA Crash – state electronic reporting system
- FARS resides at DOTD
- 2010 Base Map
- Law Enforcement Expert

2

Highway Safety Manual

Data Needs

- State System
  - Basic roadway elements in-place
  - Additional roadway elements - MIRE
    - Turn lanes
    - Complete / Accurate signal inventory
    - Intersection traffic control & geometric data
    - Curve data – location & geometry
    - Etc.

3

Highway Safety Manual

Data Needs

- Local Road System – 65% of mileage
  - Very limited data available
  - Basic roadway elements needed
    - Location referencing system (crash analysis)
    - ADT – currently have 10 year blanket counts
    - Intersection data
    - Roadway data (width, length, curves, etc.)
    - Posted speed limit

4

Highway Safety Manual

Action Items & Accomplishments

- Data gaps - *Roadware* contract
  - Funding sources HSIP and TRCC
  - State system - additional elements (1-3 yrs)
  - Local system - basic elements (5-8 yrs)
    - Linear referencing system (LRSID) & GPS
    - Video log
  - Curve inventory for state highways complete

5

Highway Safety Manual

Action Items & Accomplishments (cont.)

- 2010 Base Map
  - ALL public roads in Louisiana geo-located
- Data quality, accuracy, GPS reporting
  - Law Enforcement Expert contractor - "staff"
  - FHWA CDIP grant award
  - 60% crash reports GPS coordinates
  - 95% crash reports with location data
- Data timeliness
  - 78% electronic reporting (less than 30 days)

6

Highway Safety Manual

Overcoming Barriers & Challenges

- Referencing system – ALL public roads
  - 2010 Base Map
  - *Roadware* Contract (HSIP & TRCC funding)
- Roadway Elements - MIRE
  - *Roadware* Contract

7

Highway Safety Manual

Overcoming Barriers & Challenges

- Crash data – accuracy, quality, timeliness
  - LSU contract
  - FHWA CDIP grant
  - Electronic reporting
  - Law Enforcement Expert contractor
  - 2010 Base Map

8

Highway Safety Manual

Overcoming Barriers & Challenges

- RESOURCES!!!
  - Staffing Needs
    - Personnel – bodies
      - Experienced personnel
      - Qualified personnel
      - Span of control – depending on others, IT Section

9

Highway Safety Manual

Next Steps

- Proceed with HSM Implementation
  - Long term versus short term - as data available
  - Expand data access to MPO's, locals & law enforcement (Crash1 - internal analysis /query program)
  - Link predicted methodology (Part C) - including SPF's and CMF's to Crash1 program analysis

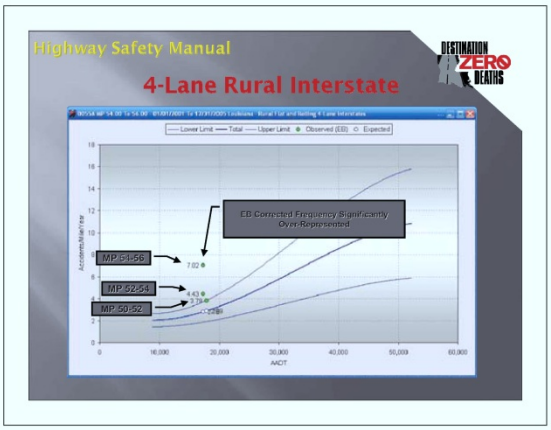
10

Highway Safety Manual

Next Steps

- Continue to improve crash data quality, accuracy, and timeliness
  - LSU contract
  - Utilization of Law Enforcement Expert
- Develop Louisiana specific SPF's
  - Currently have 2-lane rural & 4-lane rural interstate
    - DiExSys Roadway Safety Systems – (LOSS)

11


Highway Safety Manual
4-Lane Rural Interstate
DESTINATION ZERO DEATHS
Lower Limit
Total
Upper Limit
Observed (EB)
Expected
EB Corrected Frequency Significantly Over-Represented
MP 61-56
MP 52-53
MP 50-52
7.02
4.43
3.29
AADT


Highway Safety Manual
DESTINATION ZERO DEATHS
Questions / Discussion
13

HIGHWAYSAFETYMANUAL

Florida Data Update

Site Characteristics, Traffic Volume, and Crash Data

Joe Santos
Florida Department of Transportation

HIGHWAYSAFETYMANUAL

Data Needs and Other Background Knowledge

- Site Characteristics Data
  - Most characteristic data are available from Florida's **Roadway Characteristics Inventory** (RCI) database
- Traffic Volumes
  - Traffic volume data are collected in the RCI
- Crash Data
  - Crashes are processed and location data are stored in a database managed by the FDOT Safety Office

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Site Characteristics Data

- Most characteristic data for the State Highway System (SHS) (10% of all public roads) are available from Florida's **Roadway Characteristics Inventory** (RCI) database

HSM Variables for Site Characteristics	Florida RCI Data
Area Type	Yes
Segment Length	Yes
Lane, median, and shoulder information	Yes
Number and type of driveways	No
Curve data	Yes
Grade/Terrain	Yes
Roadside Hazard Rating and other roadside data	Partial
Length and type of on-street parking	Yes
Lighting	Yes
Intersection number of legs	Yes
Intersection traffic control	Yes
Intersection turn signal phasing and signage	No
Intersection skew angle	Yes
Intersection sight distance	No

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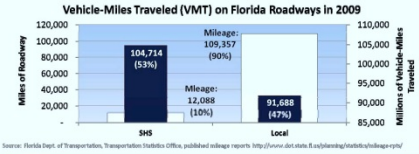
Site Characteristics Data

- SHS roads make up 10% of all public roads by centerline mileage, but carry over 50% of the total traffic each year and right at 50% of long-form-reported crashes



Source: Florida Dept. of Transportation, Transportation Statistics Office, published mileage reports http://www.dot.state.fl.us/planning/statistics/mileage-rpts/

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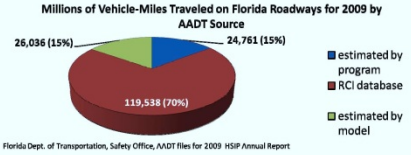
Traffic Volume Data

- Traffic volume data are collected and estimated in the RCI for roadways on the SHS
- Gaps and Local Road volumes are resolved using a combination of modeling processes and programmatic estimation



Source: Florida Dept. of Transportation, Safety Office, AADT files for 2009 HSIP Annual Report

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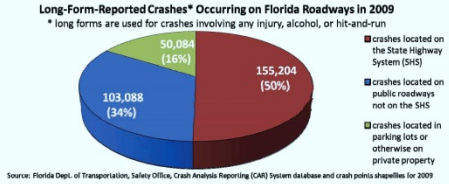
Crash Data

- Crashes are collected by Dept. of Highway Safety and Motor Vehicles (DHSMV) and locations are processed by the FDOT Safety Office



Source: Florida Dept. of Transportation, Safety Office, Crash Analysis Reporting (CAR) System database and crash points shapefiles for 2009

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Actions Accomplished

- 408 Grant Funded (and using in-house staff)
  - All Roads Base Map (GIS, Linear Referencing System (LRS), Crash Shapefiles, AADT)
  - Working with partners and developing tools to promulgate use of common map
- Research
  - Safety Analyst (Safety Analyst Data Converter)
  - Calibration of HSM Equations and Development of SPF

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Barriers/Challenges Encountered

- Quality and Availability of Local Road Data including:
  - Map line work
  - Traffic volumes (AADT)
  - Roadway characteristics
- Model Minimum Uniform Crash Criteria (MMUCC) compliance of Florida Traffic Crash Report forms
- Resources to process both Long Form (Fatal and Serious Injury Crashes) and Short Form (Property Damage Only) crash reports

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Overcoming Barriers/Challenges

- GIS line work (local roads):
  - Resolved using technology and staff to merge state base map with third party local road map
- AADT for local roads:
  - Resolved using a combination of modeling processes using adjacent land uses and parcel data paired with existing traffic counts in state inventory
  - Investigating processes for acquiring more accurate local information
- Roadway Characteristic data for local roads:
  - Investigating processes for acquiring more accurate local information
- New, more MMUCC-compliant crash report form coming on-line in 2011
- Investigating technology enhancements and resource-sharing between FDOT and DHSMV to improve processing efficiency

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Next Steps

- Initiate use of Traffic Safety Web Portal for data exchange
- Partner with local agencies to share available data on local roads by using the Traffic Safety Web Portal
- Work internally for data refinement for state roads
- Request FHWA data system evaluation

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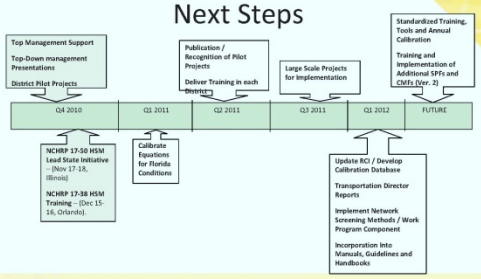
Next Steps



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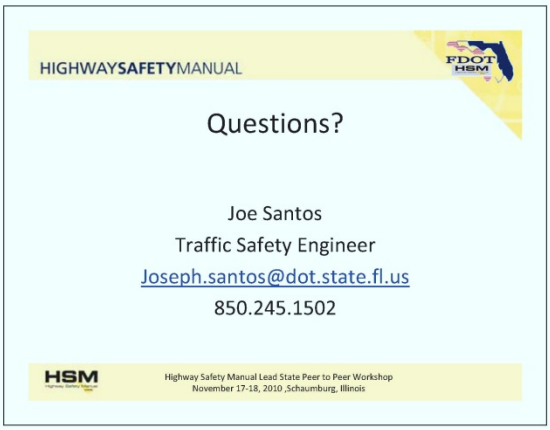
Conclusions

- Time and familiarity with the data and the data requirements will help facilitate implementation of the HSM. The more users we have that will use the methodology in the HSM, the better the availability and use of the data will be.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FDOT HSM
Questions?
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Traffic Safety Engineer
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HSM
Highway Safety Manual Lead State Peer to Peer Workshop
November 17-18, 2010 ,Schaumburg, Illinois

CAtS
Comprehensive Approach to Safety Roadmap

Better Data + Better Processes + Better Planning = Better Safety

CAtS: Current Conditions: Roadway Data Status

The Development of MIRE is an Important Stage in Creating a Consistent State of Practice in Transportation Safety Planning.

- Establishes core elements for collection
- Will lead to a minimum to maximum collection list
- Will set standards for data format

CAtS: GAO Recommendations

(Report GAO-09-35)

Working Group is Considering Alternatives for Addressing GAO Recommendations:

- Minimum Set of Required Roadway Elements for State Collection.
- Definition of Roadway Types for Which this Collection is Required
- Timeline for States to Meet the Requirement.
- Economic Assessment of Roadway Data Collection

CAtS: Crash Data Quality & Completeness

Crash Data Improvement Program (CDIP):

- Crash Data Technical Assistance
- Piloted in 2009-2010 (NM, LA, TN, MD, WA, MT, MN).
- New Contract and More States in 2010 - 2011
- Assesses State Crash Data Processes and Systems.
- Gives State a Report and Recommendations for Improvement
- Offers Seed Funding to Address Recommendations
- Currently Enrolling States for FY 2011

CAtS: Roadway Data Collection, Quality & Completeness

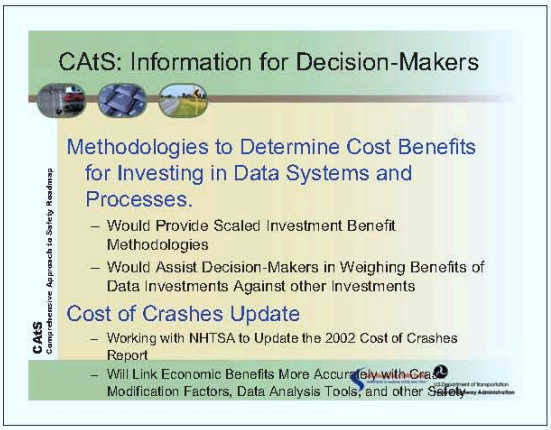
Roadway Data Improvement Program (RDIP):

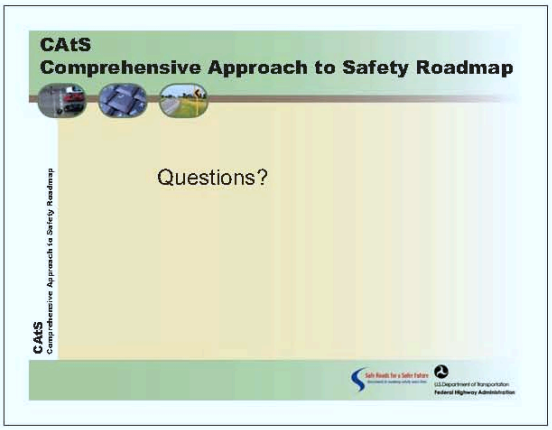
- Roadway Data Technical Assistance
- Will be Developed in 2011
- Will Assesses State Roadway Data Processes and Systems.
- Will Provide State Recommendations for Improvement
- Will Tie Directly to any Requirements Established in Response to the GAO Recommendations.
- Will be Piloted in 2011-2012.
- States are Already Expressing Interest

CAtS: State & National Capabilities and Gaps

Assessment of State Roadway Data Collection and Analysis Processes

- 20-Month Effort (2011-2012)
- Will Determine Capabilities and Gaps for each State
- Will Include State Action Plans / Assistance (CDIP & RDIP)
- Will Determine National Capabilities and Gaps
- Will Allow FHWA to Focus Data Initiatives on the Largest Gaps and Highest Priorities.


CAtS: Information for Decision-Makers
Methodologies to Determine Cost Benefits for Investing in Data Systems and Processes.
– Would Provide Scaled Investment Benefit Methodologies
– Would Assist Decision-Makers in Weighing Benefits of Data Investments Against other Investments
Cost of Crashes Update
– Working with NHTSA to Update the 2002 Cost of Crashes Report
– Will Link Economic Benefits More Accurately with Crash Modification Factors, Data Analysis Tools, and other Safety
CAtS
Comprehensive Approach to Safety Roadmap


CAtS
Comprehensive Approach to Safety Roadmap
Questions?
CAtS
Comprehensive Approach to Safety Roadmap

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HSM Applications Part B

John Milton, Ph.D., P.E.
Washington State DOT miltonj@wsdot.wa.gov
Washington State Department of Transportation

HSM

Part A
Part B
Part C
Part D

Road Safety Management Process

Network Screening
↓
Diagnosis & Countermeasure Selection
↓
Economic Appraisal & Prioritization
↓
Safety Effectiveness Evaluation

HSM

Part A
Part B
Part C
Part D

Predictive Methods

- Part C Methodology
  - 'Safety Performance Functions'
  - 'Crash Modification Factors'
  - 'Calibration'

HSM

Part A
Part B
Part C
Part D

Facilities Included in Part C

10. Rural Two-Lane, Two-Way Roads

11. Rural Multilane Highways

12. Urban & Suburban Arterials

HSM

Part A
Part B
Part C
Part D

Crash Modification Factors (CMFs)

- Describe the safety-effectiveness of countermeasures or treatments
  - Roadway Segments
  - Intersections
  - Interchanges
  - Special Facilities and Geometric Situations

HSM

WSDOT choice

Use Scientific methods

- Network screening
- Systemic improvements
- Evaluate countermeasures
- Economic Analysis

Use Predictive Methods (Part C)

State-specific SPFs

Incorporate Part C into:

- Programming
- Project Development
- Performance Measurement
- Evaluation

Priority Programming

WSDOT Strategies include?
Crash frequency, crash type, crash severity

Performance Measures
Fatal and Serious Crashes

HSM

EB allows for future estimates of crashes

PART C is all about higher RELIABILITY

7

Quantification is Key!

- WSDOTs goal is to maximize return on investment for each project dollar spent
  - To achieve this goal we must estimate future crash occurrence well
  - Scientifically based estimates that control for statistical issues increase potential returns
  - Use of SPFs (calibrated or developed)

HSM

8

WSDOT Developed SPF early

- WSDOT first developed SPFs in the mid 1990s
  - Redeveloped for Interstates
  - Research for Rural two lane and Suburban/Urban Arterials Identified
  - SPFs for Severity on multilane divided developed
  - Future SPFs will be developed.

HSM

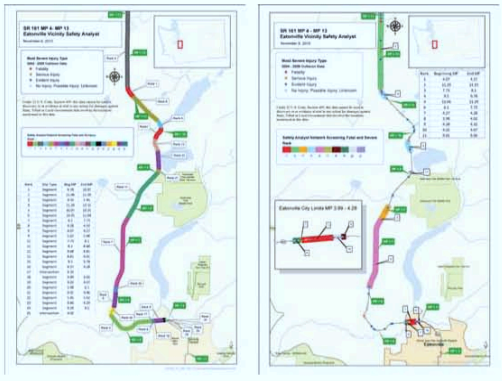
9

Priority Programming

- Supplemental Tools?
  - GIS Maps, Crash Records, Diagrams
- Contributing factors analysis
  - Colorado's Diagnostics Assessment
  - Greater than expected occurrence

HSM

10



Countermeasure Selection

- Countermeasure Selection
  - Developing Policy on use of CMFs
    - Not all CMFs are created Equal (Star Rating)
- Develop Policy on B/C ratio
  - What Benefits and Costs
  - Service Life
  - Crash Costs

HSM

12

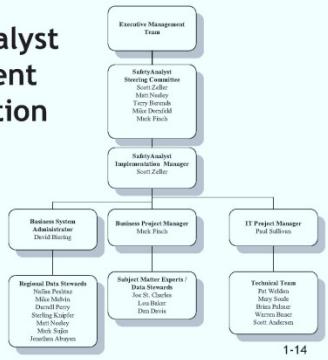
Countermeasure Selection

- Prioritization of Projects
  - Programmatic structure and policy issues

HSM

13

SafetyAnalyst Deployment Organization Chart



HSM

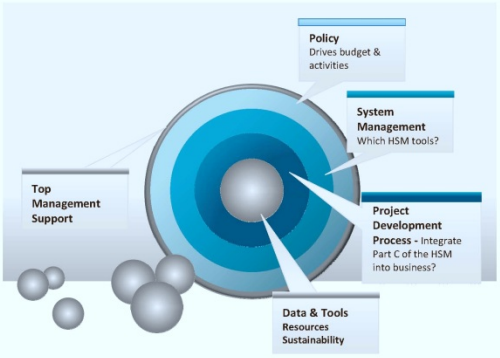
1-14

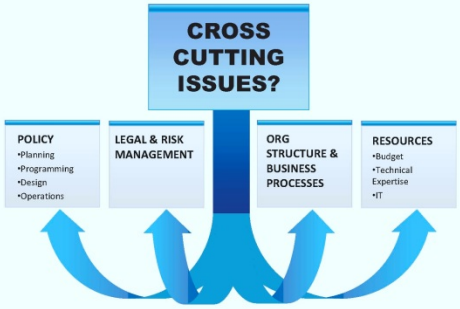
Project Schedule & Work Plan

Date	Description
October 2009	SafetyAnalyst Project Evaluation Team Formed Data Crosswalk investigation begins Identified Evaluation Phase Tasks SafetyAnalyst v4.0.0
December 2009	SafetyAnalyst Charter identifies stake holder responsible for carrying out the SafetyAnalyst evaluation
October 2009-June 2010	Data crosswalk and computer system requirements. Computer memory issues identified compiling WSDOT data
September 2010	Successful data load, calibrate and post process without memory error issue. SafetyAnalyst v4.0.8
October 2010	SafetyAnalyst training (2 days)
November 2010	Evaluation Complete Verbal approval to implement
December 2010	Form Project Implementation Team & Charter Update 2008 data collision codes.
January 2011	Develop Region Intersection Database
February 2011	Region Training
March 2011	Begin Region data collection
April 2011	Address Ramp data
May 2011	Region update TRIPS data
June 2011	End of Year 2010 Data lock
July 2011	Load and Process 2010 data
August 2011	CALICADSAL and 5% report data generated

HSM

1-15





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SafetyAnalyst Implementation

OHIO DEPARTMENT OF TRANSPORTATION

Jonathan Hughes, P.E.
Office of Systems Planning & Program Management

HSM

SafetyAnalyst Development

- SafetyAnalyst Segment Data
  - Roadway Segments – 34,275
  - Traffic Segments – 170,997
- SafetyAnalyst Intersection Data
  - Intersections – 45,915
  - Major Road ADT – 231,084
  - Minor Road ADT – 58,538
- SafetyAnalyst Crash Da
  - 2001 – 166,549
  - 2002 – 170,732
  - 2003 – 175,177
  - 2004 – 173,485
  - 2005 – 162,939
  - 2006 – 148,849
  - 2007 – 147,179
  - 2008 – 139,091
  - 2009 – 131,392

HSM

SafetyAnalyst Development

- Road Inventory Data Elements
  - Intersection Control Information
  - Roadway Location Attributes
  - Cross Section Elements
- Roadway/Intersection Traffic Volume Data
  - 14,000 State System Counts (3-Year Cycle)
  - 3,000 Counts on Rural Major & Minor Collectors (6-Year Cycle)
  - 6,000 Safety Program Counts (6-Year Cycle)
    - Roadway Segments Analyzed and Counted Based on Crashes
  - 3,500 Ramp Data Counts (3-Year Cycle)
- External Sources for Traffic Volume Data
  - MPOs and County Engineers
    - Quality is Inherent Concern
    - DOT Develop Standards
  - Fill in Count Data Gaps by Working with Modeling & Forecasting Section to Estimate and Model Missing Data

HSM

SafetyAnalyst Required Elements

SafetyAnalyst Element	Requirements
Segment ID	Required during data import
Start location	Required during data import
End location	Required during data import
Segment length	Required for post-processing
Roadway Class level 1	Required for post-processing site subtype assignment
Median Type level 1	Required for post-processing site subtype assignment
Access Control	Required for post-processing site subtype assignment
Two Ways, One Way Operation	Required for post-processing site subtype assignment
Interchange Influence Area on Mainline Freeway	Required for post-processing site subtype assignment
Route Type	Required during data import
Route Name	Required during data import
Area Type	Required for post-processing site subtype assignment
Route Name	Required during data import
Direction	Required during data import
Number of Through lanes	Required for post-processing site subtype assignment
Year	Required during data import
AADT	Required during data import
Intersection ID	Required during data import
Location	Required during data import
Intersection Type level 1	Required for post-processing site subtype assignment
Traffic Control Type at Intersection	Required for post-processing site subtype assignment
Year	Required during data import
AADT	Required during data import
Year	Required during data import
AADT	Required during data import
Leg ID	Required during data import
Type	Required for post-processing traffic data and in crash assignment
Year	Required during data import
AADT	Required during data import
Year	Required during data import
Ramp ID	Required during data import
Start Location	Required during data import
Ramp Type	Required for post-processing site subtype assignment
Ramp Configuration	Required for post-processing site subtype assignment
Year	Required during data import
AADT	Required during data import
Accident ID	Required during data import
Location	Required during data import
Accident Date	Required during data import
Accident Severity level 1	Required during data import
Number of Fatalities	Required during data import
Number of Non-Fatal Injuries	Required during data import
Relationship to Junction	Required during data import
Accident Type and Manner of Collision	Required during data import
Number of Vehicles Involved	Required during data import
Initial Direction of Travel	Required during data import
Vehicle Maneuver/Action	Required during data import

HSM

SafetyAnalyst Development

- Additional Crash Data Screening Elements (Customizable)
  - The Following Items Added to the Data to Perform Network Screening:
    - School Bus Related
    - Work Zone Related
    - Alcohol Related
    - Drug Related
    - Animal Related
    - Motorcycle Related
    - Speed Related
    - Commercial Motor Vehicle Related
    - Youth Related (16-25)
    - Senior Related (>64)
    - Pedestrian Related
    - Bicycle Related
    - Road Contour (Curve, Grade)
    - School Zone Related
    - No Restraint Used
    - Red Light Running
- Additional Site Subtype Development
  - Interchanges (Including Ramps)
  - Parking Sections
  - Interchange Influence Areas

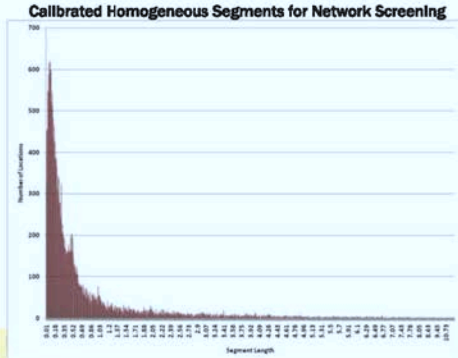
HSM

SafetyAnalyst Deployment

- Derby Client Install
  - Import CSV Files – 1 Hr
  - Post Process Data – 7 Hrs
  - Data Calibration – 45 Min
  - Create Derby Installer – 15 Min
- Client-Server Install
  - Perform a Database-to-Database Copy from Derby to Oracle – 5 Hrs
    - Currently Using Oracle 10g Upgrading to 11g
  - Create Oracle Installer – 15 Min
    - All Users Connect to the Same Dataset
- District Deployment
  - SafetyAnalyst has been installed and tested at the district level for 5 months
  - SA is being testing along side our existing high crash analysis tools this year and will go live next year and our historical tools decommissioned (main-frame).
  - Updates are pushed out to the Oracle server on a quarterly basis updating software builds and the data

HSM

Calibrated Homogeneous Segments for Network Screening



HSM

Site Subtype Analysis

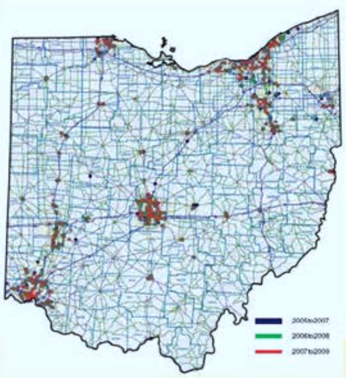
- Listing of SA Site Subtypes
- Count of the Locations in each Site Subtype
- Sum of the Length of the Roadway Network if a Segment
- Count of the Crashes by Site Subtype

SA Site Subtype	Number of Locations	Sum of Length	Number of Crashes
Int/Rur; 3-leg minor-rd STOP	2,969		8,580
Int/Rur; 3-leg signalized	43		657
Int/Rur; 4-leg all-way STOP	14		92
Int/Rur; 4-leg minor-rd STOP	20,410		41,272
Int/Rur; 4-leg signalized	571		11,453
Int/Urb; 3-leg all-way STOP	4		86
Int/Urb; 3-leg minor-rd STOP	4,695		46,355
Int/Urb; 3-leg signalized	934		29,294
Int/Urb; 4-leg all-way STOP	15		173
Int/Urb; 4-leg minor-rd STOP	10,398		63,597
Int/Urb; 4-leg signalized	4,849		220,148
Rural Interchange No Traffic Control	0		47
Rural Interchange Signalized	29		1,398
Rural Interchange Stop Controlled	195		2,795
Seg/Rur; 2-lane	10,295	12,986	309,570
Seg/Rur; Fwy (4 ln)	356	696	28,352
Seg/Rur; Fwy (6+ ln)	55	165	13,517
Seg/Rur; Fwy in intchng area (4 ln)	407	184	10,216
Seg/Rur; Fwy in intchng area (6+ ln)	51	26	3,799
Seg/Rur; Multilane divided	623	846	17,069
Seg/Rur; Multilane undivided	413	139	6,499
Seg/Urb; 2-lane arterial	5,580	2,225	123,790
Seg/Urb; Fwy (4 ln)	607	413	28,296
Seg/Urb; Fwy (6 ln)	232	192	27,814
Seg/Urb; Fwy (8+ ln)	72	50	7,655
Seg/Urb; Fwy in intchng area (4 ln)	1,799	445	59,548
Seg/Urb; Fwy in intchng area (6 ln)	589	250	81,571
Seg/Urb; Fwy in intchng area (8+ ln)	186	88	35,070
Seg/Urb; Multilane divided	1,249	379	32,695
Seg/Urb; Multilane undivided	2,955	590	164,811
Seg/Urb; One-way arterial	361	66	7,043
Segment rural 1 lane	8	1	5
Segment rural traffic circle	29	1	37
Urban 3 Leg Intersection; No Traffic Control	40		1,139
Urban 4 Leg Intersection; No Traffic Control	31		1,404
Urban Interchange No Traffic Control	15		497
Urban Interchange Signalized	959		85,605
Urban Interchange Stop Controlled	400		17,228
Urban Intersection_ Greater Than 4 Legs	75		3,117
Urban Traffic Circle/Roundabout	30		471
Grand Total	71,172	19,499	1,370,843

HSM

PEAK SEARCHING W/ EXPECTED CRASHES >= 20

COMPARISON 2005-2007 VS. 2006-2008 VS. 2007-2009

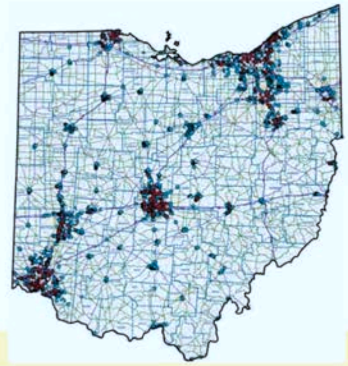


HSM

PEAK SEARCHING W/ EXPECTED CRASHES >= 20 (8,420 - 0.1 MILE WINDOWS)

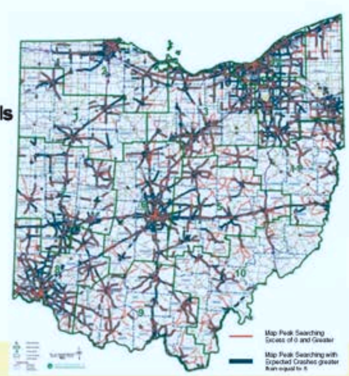
VS.

TOP 500 PEAK SEARCHING WINDOWS (0.1 MILE SECTIONS)



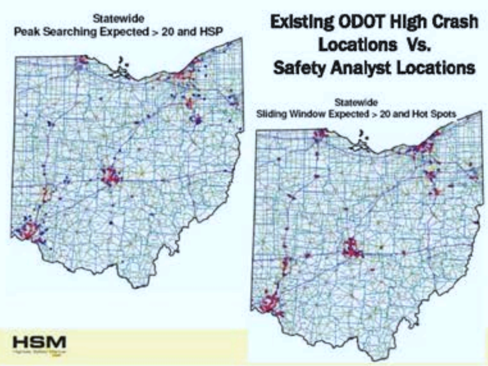
HSM

Excess vs. Expected Crash Analysis



HSM

Existing ODOT High Crash Locations Vs. Safety Analyst Locations

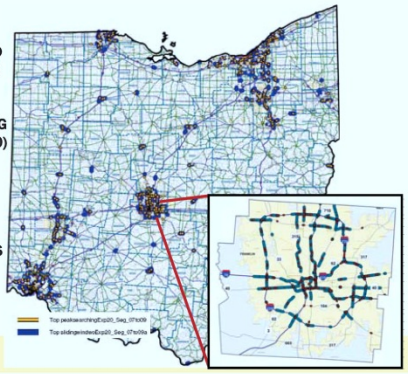


HSM

EXPECTED CRASHES >= 20 PEAK SEARCHING (TOP 1,000)

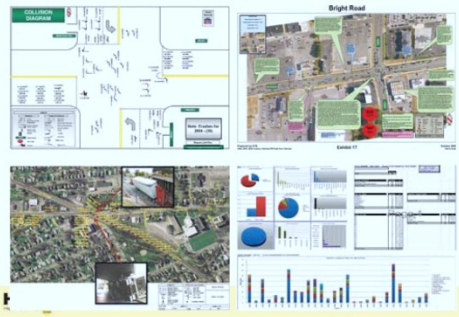
VS.

1 - MILE SLIDING WINDOWS



HSM

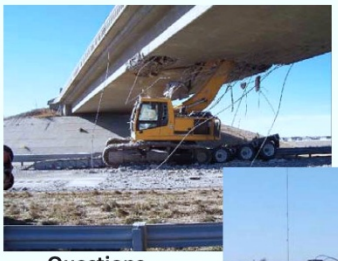
Complimentary Safety Study Tools Still Needed



SafetyAnalyst Benefits

- Improved our data collection processes and helped with needs assessment
- Help prioritize elements for asset management and road inventory
- Help identify site subtypes and flag locations where errors or data is missing and needs cleaned up
- Gives the districts the ability to run specialized and localized network screenings and site priority lists on an ad hoc basis
- Input implemented countermeasures (systematic/project) and evaluate the effects on highway safety – develop CMFs

HSM



Questions.... About SafetyAnalyst?

HSM

HIGHWAYSAFETYMANUAL

Michigan's Efforts in SafetyAnalyst/HSM Calibration

Dale R. Lighthizer
Michigan

HSM

HIGHWAYSAFETYMANUAL

Introduction

- Development of Local SPF's
- Calibration of SPF's
- Calibration of crash distributions in HSM tools

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SPF Actions Accomplished

- Implemented SafetyAnalyst for Michigan trunkline network
- Extracted calibration data from SA data management tool
- Compared by site sub-type Cal factors

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Michigan SafetyAnalyst SPF Calibration Data

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SPF SITE SUBTYPE	SITE SUBTYPE	ACCIDENT SEVERITY LEVEL	SPF CAL FACTOR YEAR	SPF CAL FACTOR VALUE	SPF CAL FACTOR VALUE Wo Anml Crshs
101	*Seg/Rur; 2-lane*	*Total Accidents*	*2004*	1.481549	0.546300
101	*Seg/Rur; 2-lane*	*Total Accidents*	*2005*	1.388434	0.491013
101	*Seg/Rur; 2-lane*	*Total Accidents*	*2006*	1.361050	0.432300
101	*Seg/Rur; 2-lane*	*Total Accidents*	*2007*	1.443805	0.469985
101	*Seg/Rur; 2-lane*	*Total Accidents*	*2008*	1.496305	0.495788
101	*Seg/Rur; 2-lane*	*Total Accidents*	2009	1.485792	0.420627
101	*Seg/Rur; 2-lane*	*Fatal and All Injury Accidents*	2009	0.501338	0.415579
102	*Seg/Rur; Multilane undivided*	*Total Accidents*	2009	1.241091	0.629335
102	*Seg/Rur; Multilane undivided*	*Fatal and All Injury Accidents*	2009	0.447126	0.402856
103	*Seg/Rur; Multilane divided*	*Total Accidents*	2009	1.679579	0.620630
103	*Seg/Rur; Multilane divided*	*Fatal and All Injury Accidents*	2009	0.781024	0.707803
104	*Seg/Rur; Fwy (4 ln)*	*Total Accidents*	2009	2.203001	1.279805
104	*Seg/Rur; Fwy (4 ln)*	*Fatal and All Injury Accidents*	2009	1.192295	1.108289

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HIGHWAYSAFETYMANUAL

SPF SITE SUBTYPE	SITE SUBTYPE	ACCIDENT SEVERITY LEVEL	SPF CAL FACTOR YEAR	SPF CAL FACTOR VALUE	SPF CAL FACTOR VALUE Wo Anml Crshs
201	*Int/Rur; 3-leg minor-rd STOP*	*Total Accidents*	2009	1.820089	1.114184
201	*Int/Rur; 3-leg minor-rd STOP*	*Fatal and All Injury Accidents*	2009	0.675477	0.645716
203	*Int/Rur; 3-leg signalized*	*Total Accidents*	2009	1.235844	1.114129
203	*Int/Rur; 3-leg signalized*	*Fatal and All Injury Accidents*	2009	0.385392	0.385392
204	*Int/Rur; 4-leg minor-rd STOP*	*Total Accidents*	2009	1.566285	1.000576
204	*Int/Rur; 4-leg minor-rd STOP*	*Fatal and All Injury Accidents*	2009	0.673991	0.662568
206	*Int/Rur; 4-leg signalized*	*Total Accidents*	2009	2.031717	1.328336
206	*Int/Rur; 4-leg signalized*	*Fatal and All Injury Accidents*	2009	1.225909	1.220736
251	*Int/Urb; 3-leg minor-rd STOP*	*Total Accidents*	2009	1.119258	1.056448
251	*Int/Urb; 3-leg minor-rd STOP*	*Fatal and All Injury Accidents*	2009	0.502106	0.499295
253	*Int/Urb; 3-leg signalized*	*Total Accidents*	2009	1.435288	1.411705
253	*Int/Urb; 3-leg signalized*	*Fatal and All Injury Accidents*	2009	0.617168	0.617168
254	*Int/Urb; 4-leg minor-rd STOP*	*Total Accidents*	2009	1.416196	1.363455
254	*Int/Urb; 4-leg minor-rd STOP*	*Fatal and All Injury Accidents*	2009	0.688521	0.686737
256	*Int/Urb; 4-leg signalized*	*Total Accidents*	2009	1.740743	1.720939
256	*Int/Urb; 4-leg signalized*	*Fatal and All Injury Accidents*	2009	0.832621	0.831435

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Local SPF Development Issues

- Lack of accurate cross volume data
- Lack of ramp volume data
- Unique MI operations
- When available MDOT will either develop SPFs in house or contract with a University

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HSM Crash Distribution Calibration

HSM

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HSM Crash Distributions

Needing Calibration

HSM

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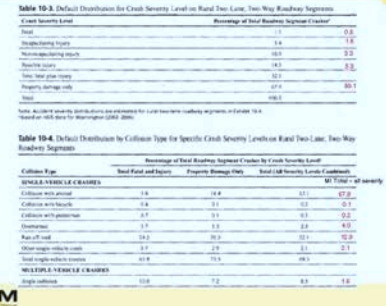

HSM

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Methodology

- Extract crash data from SafetyAnalyst database for homogenous segments/ intersection site subtypes
- Compile MI distributions to match HSM tables using SPSS

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Preliminary Findings

- MI has very high reported percentage of animal crashes compared to default states
- Investigation of crash distributions has lead to need to do additional data integrity checks
- Iterative process

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Challenges

- File size has led to some issues
- Logistics
- Data formatting
- Extracting some of the key data

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Conclusions

- MI will likely need to develop MI based SPFs
- MI will need to calibrate crash distributions
- These new distributions will be used in safetyAnalyst and the deployment of the HSM spread sheets
- May remove animal crashes from SafetyAnalyst data

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Barriers/Challenges Encountered

- Lack of IT resources
- Lack of critical data for SafetyAnalyst and HSM

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Next Steps

- Complete crash distribution analysis for all sub-types
- Monitor traffic volume collection program to obtain necessary ADT information to support SPF development

HSM

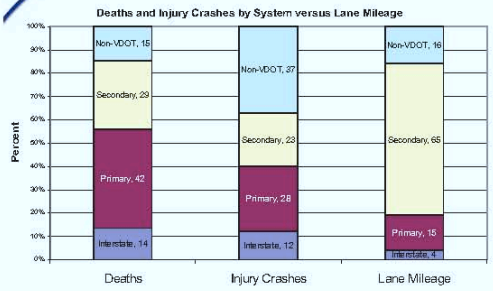
SPF Modeling in Virginia

Stephen W. Read P.E., P.Eng.
Highway Safety Improvement Programs

Virginia's SPF Modeling Story

1. Past Initiatives
   - SafetyAnalyst preparation
2. Present Initiatives
   - Additional SafetyAnalyst roadway types
3. Future Efforts
   - HSM and SafetyAnalyst deployment

SHSP and Action Planning



Planning Level SPFs

- A key focus of the VA Strategic Highway Safety Plan is the treatment of corridors with high numbers of crashes
- Virginia is developing a new approach that applies planning-level SPFs long sections of road

Planning Level SPFs

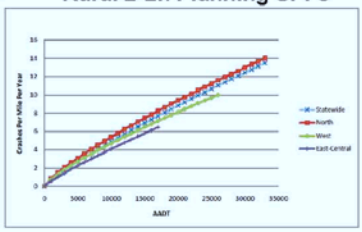
- Project Goals:
  - Develop SPFs to identify 2+ mile long sections of road for more detailed analysis
  - Help to identify longer sections where a safety assessment or coordinated set of improvements may be beneficial
- Summary of Approach:
  - SPFs aggregate intersections and segments together
  - Using data from 2003 to 2007 on Virginia's primary system
  - 7339 miles of road and almost 160,000 total crashes
  - Different models for distinct regions of the state – DC suburbs, western mountains, and central/eastern urbanized area

Planning Level SPFs

$$Crashes = e^{\alpha}(ADT)^{\beta}(Length)$$

- SPF breakdown:
  - Use same model form as SafetyAnalyst
  - SPFs for all crashes and fatal/injury
  - SPFs for rural/urban
  - Geometric categories:
    - 2 lane roads
    - Multilane undivided
    - Multilane divided – not access controlled
    - Multilane divided – access controlled

Rural 2-Ln Planning SPFs



- Performed better than Critical Rate approach to find "sites with Promise"
- Next steps:
  - Evaluate quality of planning level SPFs in SafetyAnalyst if possible
  - Use for statewide planning model safety measure.
  - Evaluate freeway models

Intersection SPF Development

Intersection Related Crash Subtypes -

- Urban 4-Leg Signalized
  - 568 Sites
- Urban 4-Leg with Minor Stop Control
  - 1239 Sites
- Urban 3-Leg Signalized
  - 836 Sites
- Urban 3-Leg with Minor Stop Control
  - 5367 Sites
- Rural 4-Leg Signalized
  - 182 Sites
- Rural 4-Leg with Minor Stop Control
  - 1570 Sites
- Rural 3-Leg Signalized
  - 183 Sites
- Rural 3-Leg Signalized with Minor Stop control
  - 8411 Sites

Functional Form for Intersection SPFs:

$Acc = e^{a} \times AADT^{B}_{maj} \times AADT^{C}_{min}$

Acc = predicted accident frequency per intersection per year
$AADT_{maj}$ = average annual daily traffic on the major road (veh/day)
$AADT_{min}$ = average annual daily traffic on the minor road (veh/day)

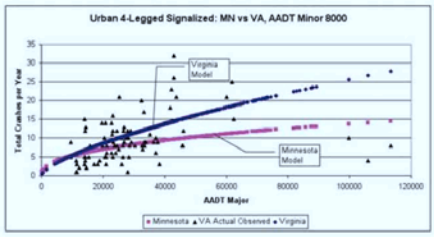
Intersection SPF Models

- Models for urban (8010 sites) and rural (10,346 sites) intersection related (within 250 ft) for:
  - Total Crashes
  - F+I Crashes
    - Compared to MN models in SafetyAnalyst
- Difficulties
  - Defining TCD
    - Poor inventory – impute from crash report for signals, 2 and 4 way stops
    - Insufficient 4-way stop sites for model
  - Determining "Urban" or "Rural"
    - Based on Functional Classification
    - Mixed approach leg classes were excluded
  - Defining Major versus Minor Approach Volumes
    - important since the model parameters are matched to the natural log of the major and minor AADT
    - Used sum of the two highest approach volumes for 3 and 4 leg configurations

Intersection Model Comparison

	R^2 Freeman Tukey (%)			
	TOTAL CRASH		FATAL&INJURY CRASH	
	VA	MN	VA	MN
Urban 4-Legged Signalzied	56.04	33.58	40.58	32.42
Rural 4-Legged Signalized	81.69	80.84	64.53	19.49
Urban 4-Legged Minor Stop Control	31.29	21.55	19.28	7.57
Rural 4-Legged Minor Stop Control	16.90	13.43	10.00	9.98
Urban 3-Legged Signalized	37.01	30.86	26.01	26.20
Urban 3-Legged Minor Stop Control	22.97	10.38	13.38	9.77

Intersection Model Comparison



Findings:
• Urban VA SPFs have better fit than SA models
•Rural VA SPFs are slightly better or same

Two-Lane Highway SPF Models

Purpose and Data

- AADT based for SA categories
- Rural and Urban based on Functional Class
- Approx 50,000 miles with Traffic Volumes and Roadway Inventory for years 2003-07
  - Secondary (local) system counts every five years
- Sites segmented at all:
  - Intersections (none internal to site)
  - geometric changes
  - speed zones
- Excluded if Functional Class or Number of lanes changed in study period

Two-Lane Highway Data

AREA	# OF SEGMENT	LENGTH (Miles)	REGION	# OF SEGMENT	LENGTH (Miles)
Urban	57605	6949.8	Northern	30685	3398.0
			Northwest and Southwest	9142	1431.5
			Central and Eastern	17778	2120.3
Rural	82030	42837.5	Northern	8186	3932.8
			Northwest and Southwest	49737	27169.6
			Central and Eastern	24107	11735.1

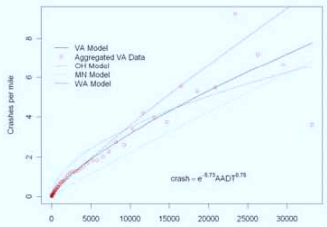
Approach :
- to remove regional models not performing better than statewide
- to determine if models for primary and secondary "system" perform better

Two-Lane Highway SPF Models

$$crashes = e^{a} \cdot AADT^{b} \cdot segmentlength$$

		a	b	k	R^2_{ft}	$R^2_{ft(OH)}$
Total	Urban	-6.158	0.811	1.140	35.6%	32.5%
	Rural	-5.721	0.746	0.397	34.5%	10.0%
Fatal + Injury	Urban	-6.191	0.814	1.128	35.5%	32.1%
	Rural	-5.694	0.742	0.401	34.0%	9.2%

SPF Comparisons



Findings:
- Many regional SPF models selected
- System specific SPFs typically performed better
- To be determined if SafetyAnalyst will accept the multiple models

Present SPF Modeling

- Currently developing models for:
  - Multilane arterials
  - Freeway segments
- Preliminary findings:
  - One regional multilane model is not following normal form
  - Method to defining freeway "segments" range from simple to HCM definition

SPF Application
"Down the Road Efforts"

- Presently reloading VDOT District data into SafetyAnalyst to investigate using VA SPFs
- Hope to use SA for FY13 HSIP project planning
- VDOT is changing road network GIS model, so change to safety models is continual

HSM Application
"Down the Road Efforts"

- Determine use of HSM Part C for project analysis
  - Compare national to VA values
  - Show value added to management
- Using Rural Multilane SPF data sets to develop:
  - Crash distribution values
  - Calibration factors and methods
- Apply findings to study a *pilot* corridor project

HIGHWAY SAFETY MANUAL
Applications in Design

Darryl Belz, P.E.
Maine Department of Transportation

November 17-18, 2010

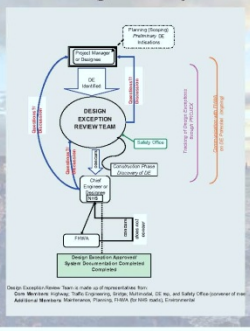
WHAT IS THE HSM?

- Provide
  - **Information**
  - **Tools**
- To facilitate explicit safety considerations for:
  - **Planning, Design, Operations, and Maintenance**
- MaineDOT use to date:
  - **Assist in review and documentation of design exceptions, variance and waivers**

Common Reasons for Considering Exceptions

- Impacts to the natural environment
- Social or right-of-way impacts
- Preservation of historic or cultural resources
- Sensitivity to context or accommodating community values
- Construction or right-of-way costs

Maine's Design Exception Process



Basic Analysis Steps for Applying the Predictive Method Process

1. Determine data needs
2. Divide locations into homogeneous segments or intersections
3. Identify and apply the appropriate SPF
4. Apply CMFs to calculated SPF values
5. Apply local calibration factor

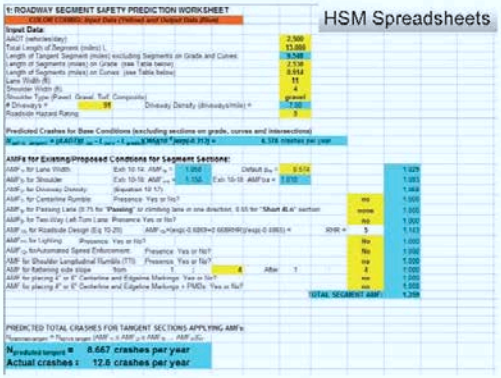
Data Needs and Other Background Knowledge

- SPF for specific facility type
- AADT
- Length
- Site characteristics to adjust with CMFs
  - Roadway
  - Intersection
- Local calibration factors
- Historical crash data

Data Methodology

- As-Builts
- Crash Analysis System
- Route Log Mile Filter
  - milepoints, mainline AADT, number of lanes, roadway type, and shoulder data
- VisiWeb (MaineDOT's Digital Video Log)
  - Milepoints, driveways, and roadside objects
- Automatic Road Analyzer (ARAN)
  - Grade, curve radius, x-section, pavement markings, turning lanes, passing zones, and roadway survey data
- Google Earth
- Bing Maps

HSM Spreadsheets

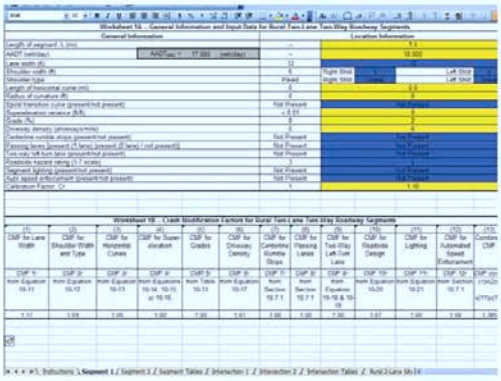


Safety Prediction for an Entire Rural Roadway Section

$$N_{total\ predicted} = \Sigma N_{predicted\text{-}rs} + \Sigma\ N_{predicted\text{-}int}$$

Roadway Segments — Intersections

- Combine predicted roadway segment and intersection related crashes to obtain the total predicted crashes for the entire segment



Barriers/Challenges Encountered

- Lack of resources
- Lack of knowledge
- SPF state-specific development
- SPF calibration to local conditions
- Institution of a paradigm shift

Next Steps

- Executive acceptance
- HSM training
- Examine Maine's Strategic Highway Safety Plan to evaluate program initiatives in light of HSM
- Transition from descriptive analyses to quantitative predictive analyses
- Work collaboratively with New Hampshire and Vermont to develop SPFs, as we have similar highway characteristics


Thank You

HIGHWAYSAFETYMANUAL

HSM APPLICATIONS – PART C
FLORIDA DOT

- AASHTO vs Plans Preparation Manual Criteria
- SR 43 (US 301): Balm Rd to Gibsonton Dr.
- SR 50: US 19 TO CR 587
- SR 574 Study

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AASHTO vs. PPM

- SITUATION
  - AASHTO "Greenbook"
  - Florida DOT PPM
- ANALYSIS
  - DOT's Costs: Pre-construction, right of way, construction, maintenance.
  - Maintenance: Insignificant differential.
  - User Costs: Safety
- GOAL
  - To reduce the cost of DOT projects without sacrificing safety and operational/functional characteristics.

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AASHTO vs. PPM

OPTIONS:

1. Maintain Status Quo: Use Variations Process to justify reduced criteria
2. Revise PPM Criteria: Eliminates need for some Variation submittals
3. Revise Variation Requirements: Include a safety analysis to quantify impacts of reduced criteria.

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AASHTO vs. PPM

- RECOMMENDATION
  - Option 3: Require a safety analysis with Design Variations for all new and reconstruction projects when reductions in critical design elements are being considered.
- JUSTIFICATION
  - Variations Process already working well.
  - Means to quantify safety impacts of cross-section decisions.
  - Consistent with including non-DOT costs in our decisions (user costs in pavement-type selection).

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AASHTO vs. PPM

- 2007 Study by Roadway Design Office
  - Construction Cost Differences Only
    - Interstate Widening (1.2%)
    - New Rural Freeway (8%)
    - New Rural Arterial (7%)
    - New Urban Arterial (10%)
    - New Overpass (21%)

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AASHTO vs. PPM

- 2008 Study by Roadway Design Office
- Include right of way and maintenance costs with construction costs.
  - Rural Arterial Widening
  - Urban Arterial Widening
  - Interstate Widening
  - New Overpass Construction

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SR 43 (US 301): Balm Rd to Gibsonton Dr.

- ✓ Hillsborough County, 6.16 miles
- ✓ Currently: Two-lane rural
- ✓ New Design: Six-lane rural with sidewalk and shared-use path.
- ✓ Design at 90% Complete when studied
- ✓ Several Variations to eliminate ROW acquisition for typical section

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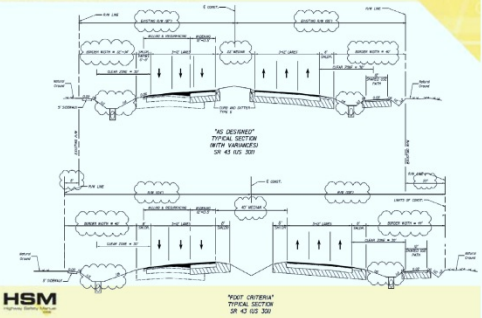

HSM

"DOT CRITERIA"
TYPICAL SECTION
SR 43 (US 301

HIGHWAYSAFETYMANUAL

SR 43 (US 301): Balm Rd to Gibsonton Dr.

As designed	PPM Design
➢ Construction: $82,200,000	➢ Construction: $82,800,000 (+0.7%)
➢ Right of Way: $10,200,000 (Ponds)	➢ Right of Way: $26,300,000 (+158%)
➢ **DOT Costs**: $92,400,000	➢ **DOT Costs**: $109,100,000 (+18%)
➢ Crash (20 yr): $95,600,000	➢ Crash (20 yr): $88,000,000 (-8%)
➢ **DOT+User Costs (20 yr):** $188,200,000	➢ **DOT+User Costs (20 yr):** $197,300,000 (+5%)

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SR 50: US 19 TO CR 587

- ✓ Hernando County, 3.73 miles
- ✓ Currently: Four-lane rural
- ✓ New Design: Six-lane rural with sidewalk and shared-use path.
- ✓ Design at 30% Complete when studied
- ✓ Several Variations to eliminate ROW acquisition for typical section
- ✓ Closed conveyance drainage system

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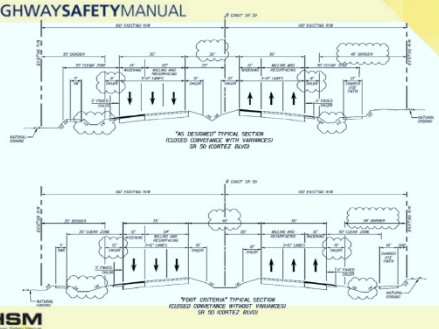

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SR 50: US 19 TO CR 587

AS DESIGNED	PPM DESIGN
➢ Construction: $49,200,000	➢ Construction Cost: $58,100,000 (+18%) (Walls were +17%)
➢ Right of Way: $0	➢ Right of Way: $0*
➢ **DOT Costs**: $49,200,000	➢ **DOT Costs**: $58,100,000
➢ Crash(20 yr): $85,600,000	➢ Crash(20 yr): $79,100,000 (-8%)
➢ **DOT+User Costs** (20yr): $134,800,000	➢ **DOT+User Costs** (20yr): $137,200,000 (+2%)

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** $32,800,000 if open conveyance & excluding business damages.*

HIGHWAYSAFETYMANUAL

SAFETY IMPACT DIFFERENCES

SR 43 (Hillsborough)	SR 50 (Hernando)
Side Slope:	Side Slope:
– HSM: +$6.6M	– HSM: +$6.0M
– RSAP: +$9.4M	– RSAP: +$9.7M
Median Width:	Median Width:
– HSM: +$1.0M	– HSM: +$0.5M
– DOT Research: +$3.0M	– DOT Research: +$0.5M
Combined:	Combined:
– HSM: +$7.6M	– HSM: +$6.5M

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HIGHWAYSAFETYMANUAL

SR 574 Study

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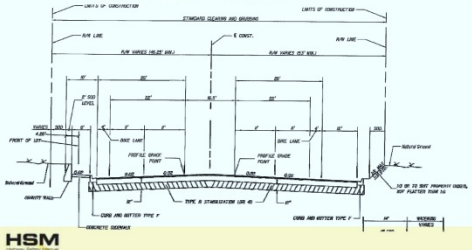
HIGHWAYSAFETYMANUAL

SR 574, Option 1



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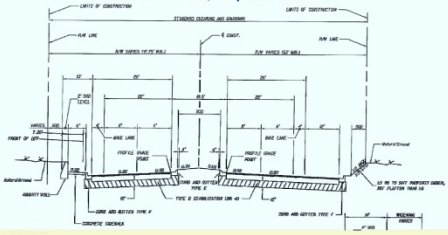
HIGHWAYSAFETYMANUAL

SR 574, Option 2



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HIGHWAYSAFETYMANUAL

SR 574 Study

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HIGHWAYSAFETYMANUAL

SR 574 Study

Worksheet 1B - Accident Modification Factors - 4D

(1.0)	(2.0)	(3.0)	(4.0)	(5.0)	(6.0)
AMF for On-Street Parking	AMF for Roadside Fixed Objects	AMF for Median Width	AMF for Lighting	AMF for Auto Speed Enforcement	Combined AMF
AMF_{1r}	AMF_{2r}	AMF_{3r}	AMF_{4r}	AMF_{5r}	AMF_{COMB}
From Equation 12-32	From Equation 12-33	From Exhibit 12-39	From Equation 12-34	From Section 12.7.1	(1)*(2)*(3)*(4)*(5)
N/A	N/A	0.99	N/A	N/A	0.99

Worksheet 1B - Accident Modification Factors - 5T

(1.0)	(2.0)	(3.0)	(4.0)	(5.0)	(6.0)
AMF for On-Street Parking	AMF for Roadside Fixed Objects	AMF for Median Width	AMF for Lighting	AMF for Auto Speed Enforcement	Combined AMF
AMF_{1r}	AMF_{2r}	AMF_{3r}	AMF_{4r}	AMF_{5r}	AMF_{COMB}
From Equation 12-32	From Equation 12-33	From Exhibit 12-39	From Equation 12-34	From Section 12.7.1	(1)*(2)*(3)*(4)*(5)
N/A	N/A	1	N/A	N/A	1

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HIGHWAYSAFETYMANUAL

SR 574, 4-Lane Divided

4-Lane Divided
Multi-Vehicle Non-driveway Crashes

	AADT	Total MVND Crashes*	FI(MVND)	PDO(MVND)	FI(adj)	PDO(adj)	FIcost	PDOcost	Present Value
1	26800	1.795	0.522	1.376	0.484	1.302	$78,092	$9,632	$84,350
2	27342	1.845	0.535	1.414	0.507	1.338	$80,131	$9,904	$83,242
3	27895	1.896	0.549	1.454	0.520	1.376	$82,224	$10,183	$82,149
4	28459	1.948	0.563	1.495	0.533	1.415	$84,371	$10,470	$81,070
5	29035	2.002	0.578	1.537	0.547	1.455	$86,574	$10,764	$80,005
6	29622	2.057	0.593	1.580	0.562	1.496	$88,835	$11,068	$78,954
7	30221	2.114	0.609	1.624	0.576	1.538	$91,154	$11,379	$77,917
8	30832	2.172	0.624	1.669	0.591	1.581	$93,534	$11,700	$76,894
9	31456	2.232	0.641	1.716	0.607	1.626	$95,977	$12,029	$75,884
10	32092	2.294	0.657	1.764	0.623	1.671	$98,482	$12,368	$74,887
11	32741	2.357	0.674	1.814	0.639	1.718	$101,054	$12,717	$73,903
12	33404	2.422	0.692	1.865	0.655	1.767	$103,692	$13,075	$72,932
13	34079	2.489	0.710	1.917	0.673	1.817	$106,399	$13,443	$71,974
14	34769	2.558	0.728	1.971	0.690	1.868	$109,177	$13,822	$71,028
15	35472	2.629	0.747	2.026	0.708	1.920	$112,027	$14,211	$70,095
16	36189	2.701	0.766	2.083	0.727	1.974	$114,951	$14,611	$69,174
17	36921	2.776	0.786	2.141	0.746	2.030	$117,952	$15,022	$68,265
18	37668	2.852	0.807	2.201	0.765	2.087	$121,030	$15,445	$67,368
19	38430	2.931	0.828	2.263	0.785	2.146	$124,189	$15,880	$66,483
20	39207	3.012	0.849	2.326	0.806	2.206	$127,431	$16,328	$65,609
	40000								$1,492,186

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HIGHWAYSAFETYMANUAL

SR 574, 4-Lane Divided

Single-Vehicle Crashes

	AADT	Total SV Crashes*	FI(SV)	PDO(SV)	FI(adj)	PDO(adj)	FIcost	PDOcost	Present Value
1	26800	0.301	0.054	0.248	0.054	0.248	$8,494	$1,833	$9,930
2	27342	0.304	0.055	0.250	0.054	0.250	$8,604	$1,849	$9,665
3	27895	0.307	0.055	0.253	0.055	0.252	$8,716	$1,865	$9,406
4	28459	0.310	0.056	0.255	0.056	0.254	$8,829	$1,881	$9,155
5	29035	0.313	0.057	0.257	0.057	0.256	$8,943	$1,897	$8,910
6	29622	0.316	0.057	0.260	0.057	0.259	$9,059	$1,914	$8,672
7	30221	0.319	0.058	0.262	0.058	0.261	$9,176	$1,930	$8,440
8	30832	0.322	0.059	0.264	0.059	0.263	$9,295	$1,947	$8,214
9	31456	0.325	0.060	0.267	0.060	0.265	$9,415	$1,964	$7,995
10	32092	0.328	0.061	0.269	0.060	0.268	$9,536	$1,981	$7,781
11	32741	0.331	0.061	0.272	0.061	0.270	$9,660	$1,998	$7,573
12	33404	0.334	0.062	0.274	0.062	0.272	$9,784	$2,016	$7,370
13	34079	0.337	0.063	0.277	0.063	0.275	$9,911	$2,033	$7,173
14	34769	0.341	0.064	0.279	0.063	0.277	$10,039	$2,051	$6,982
15	35472	0.344	0.065	0.282	0.064	0.280	$10,169	$2,069	$6,795
16	36189	0.347	0.066	0.284	0.065	0.282	$10,300	$2,086	$6,613
17	36921	0.350	0.066	0.287	0.066	0.284	$10,433	$2,105	$6,436
18	37668	0.354	0.067	0.289	0.067	0.287	$10,567	$2,123	$6,264
19	38430	0.357	0.068	0.292	0.068	0.289	$10,704	$2,141	$6,097
20	39207	0.360	0.069	0.295	0.069	0.292	$10,842	$2,160	$5,934
	40000								$155,404

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HIGHWAYSAFETYMANUAL

SR 574, 4-Lane Divided

Multi-Vehicle Driveway Crashes

	AADT	N(majority)	N(minority)	N(other)	N(total)	FI(SV)	PDO(SV)	FIcost	PDOcost	Present Value
1	26800	0.063	0.105	0.485	0.652	0.185	0.467	$29,305	$4,827	$32,819
2	27342	0.064	0.107	0.496	0.667	0.189	0.477	$29,961	$4,935	$32,263
3	27895	0.066	0.109	0.507	0.682	0.194	0.488	$30,632	$5,045	$31,717
4	28459	0.067	0.112	0.518	0.697	0.198	0.499	$31,318	$5,158	$31,180
5	29035	0.069	0.114	0.530	0.713	0.202	0.510	$32,020	$5,274	$30,652
6	29622	0.070	0.117	0.542	0.729	0.207	0.522	$32,737	$5,392	$30,133
7	30221	0.072	0.119	0.554	0.745	0.212	0.533	$33,470	$5,513	$29,623
8	30832	0.073	0.122	0.566	0.762	0.216	0.545	$34,219	$5,636	$29,122
9	31456	0.075	0.125	0.579	0.779	0.221	0.558	$34,985	$5,762	$28,629
10	32092	0.077	0.128	0.592	0.796	0.226	0.570	$35,769	$5,891	$28,144
11	32741	0.078	0.130	0.605	0.814	0.231	0.583	$36,570	$6,023	$27,668
12	33404	0.080	0.133	0.619	0.832	0.236	0.596	$37,389	$6,158	$27,199
13	34079	0.082	0.136	0.633	0.851	0.242	0.609	$38,226	$6,296	$26,739
14	34769	0.084	0.139	0.647	0.870	0.247	0.623	$39,082	$6,437	$26,286
15	35472	0.085	0.142	0.661	0.889	0.253	0.637	$39,957	$6,581	$25,841
16	36189	0.087	0.146	0.676	0.909	0.258	0.651	$40,852	$6,729	$25,404
17	36921	0.089	0.149	0.691	0.930	0.264	0.666	$41,767	$6,879	$24,974
18	37668	0.091	0.152	0.707	0.950	0.270	0.681	$42,702	$7,033	$24,551
19	38430	0.093	0.156	0.723	0.972	0.276	0.696	$43,658	$7,191	$24,135
20	39207	0.096	0.159	0.739	0.993	0.282	0.711	$44,636	$7,352	$23,727
	40000									$660,807

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HIGHWAYSAFETYMANUAL

SR 574, 5-Lane with TWLTL

Multi-Vehicle Non-driveway Crashes

	AADT	Total MVND Crashes	FI(MVND)	PDO(MVND)	FI(adj)	PDO(adj)	FIcost	PDOcost	Present Value
1	26800	3.625	1.008	2.767	0.968	2.657	$153,134	$19,663	$196,151
2	27342	3.711	1.031	2.833	0.990	2.721	$156,849	$20,135	$193,688
3	27895	3.799	1.054	2.900	1.013	2.786	$160,245	$20,617	$190,786
4	28459	3.889	1.078	2.969	1.036	2.853	$163,923	$21,112	$188,168
5	29035	3.981	1.103	3.039	1.060	2.921	$167,685	$21,618	$185,593
6	29622	4.076	1.128	3.111	1.084	2.991	$171,534	$22,136	$183,060
7	30221	4.172	1.153	3.185	1.109	3.063	$175,471	$22,667	$180,569
8	30832	4.271	1.179	3.261	1.135	3.137	$179,499	$23,210	$178,118
9	31456	4.372	1.206	3.338	1.161	3.212	$183,619	$23,767	$175,708
10	32092	4.476	1.234	3.417	1.187	3.289	$187,833	$24,337	$173,334
11	32741	4.582	1.262	3.498	1.215	3.366	$192,144	$24,920	$171,001
12	33404	4.691	1.290	3.581	1.242	3.448	$196,554	$25,518	$168,705
13	34079	4.802	1.319	3.666	1.271	3.531	$201,065	$26,130	$166,447
14	34769	4.916	1.349	3.753	1.300	3.616	$205,680	$26,756	$164,226
15	35472	5.032	1.380	3.842	1.330	3.702	$210,400	$27,398	$162,041
16	36189	5.152	1.411	3.933	1.360	3.791	$215,229	$28,054	$159,891
17	36921	5.274	1.443	4.026	1.392	3.882	$220,169	$28,727	$157,776
18	37668	5.399	1.476	4.121	1.424	3.975	$225,222	$29,416	$155,696
19	38430	5.527	1.509	4.219	1.456	4.070	$230,391	$30,121	$153,650
20	39207	5.658	1.544	4.319	1.490	4.168	$235,678	$30,843	$151,637
	40000								$2,836,003

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HIGHWAYSAFETYMANUAL

SR 574, 5-Lane with TWLTL

Single-Vehicle Crashes

	AADT	Total SV Crashes	FI(SV)	PDO(SV)	FI(SV)	PDO(SV)	FIcost	PDOcost	esent Valu
1	26800	0.774	0.054	0.576	0.066	0.708	$10,471	$5,241	$15,108
2	27342.05	0.783	0.055	0.583	0.067	0.716	$10,595	$5,297	$14,893
3	27895.06	0.791	0.055	0.590	0.068	0.724	$10,720	$5,354	$14,290
4	28459.26	0.800	0.056	0.597	0.069	0.731	$10,846	$5,412	$13,898
5	29034.87	0.809	0.057	0.605	0.069	0.739	$10,974	$5,470	$13,516
6	29622.12	0.817	0.057	0.612	0.070	0.747	$11,104	$5,529	$13,145
7	30221.24	0.826	0.058	0.620	0.071	0.755	$11,235	$5,589	$12,785
8	30832.49	0.835	0.059	0.627	0.072	0.763	$11,367	$5,649	$12,434
9	31456.1	0.844	0.060	0.635	0.073	0.772	$11,501	$5,710	$12,093
10	32092.32	0.854	0.061	0.643	0.074	0.780	$11,637	$5,772	$11,761
11	32741.41	0.863	0.061	0.651	0.074	0.788	$11,774	$5,834	$11,438
12	33403.63	0.872	0.062	0.659	0.075	0.797	$11,913	$5,897	$11,124
13	34079.24	0.882	0.063	0.667	0.076	0.805	$12,054	$5,961	$10,819
14	34768.52	0.891	0.064	0.675	0.077	0.814	$12,196	$6,025	$10,522
15	35471.73	0.901	0.065	0.683	0.078	0.823	$12,340	$6,090	$10,233
16	36189.18	0.911	0.066	0.692	0.079	0.832	$12,485	$6,156	$9,952
17	36921.13	0.921	0.066	0.700	0.080	0.841	$12,633	$6,222	$9,679
18	37667.88	0.931	0.067	0.709	0.081	0.850	$12,782	$6,289	$9,414
19	38429.74	0.941	0.068	0.717	0.082	0.859	$12,932	$6,357	$9,155
20	39207.01	0.951	0.069	0.726	0.083	0.866	$13,085	$6,425	$8,904
									$234,963

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HIGHWAYSAFETYMANUAL

SR 574, 5-Lane with TWLTL

Multi-Vehicle Driveway Crashes

	AADT	N(majority)	N(minority)	N(other)	N(total)	FI(SV)	PDO(SV)	FIcost	PDOcost	Present Value
1	26800	0.326	0.523	3.168	4.017	1.081	2.937	$170,953	$29,727	$192,962
2	27342.05	0.333	0.536	3.243	4.113	1.106	3.006	$175,013	$30,433	$189,946
3	27895.06	0.341	0.548	3.320	4.210	1.133	3.078	$179,169	$31,156	$186,977
4	28459.26	0.350	0.561	3.399	4.310	1.159	3.151	$183,423	$31,895	$184,055
5	29034.87	0.358	0.575	3.480	4.413	1.187	3.226	$187,778	$32,653	$181,178
6	29622.12	0.366	0.588	3.563	4.517	1.215	3.302	$192,237	$33,428	$178,347
7	30221.24	0.375	0.602	3.647	4.625	1.244	3.381	$196,802	$34,222	$175,559
8	30832.49	0.384	0.617	3.734	4.734	1.274	3.461	$201,475	$35,034	$172,815
9	31456.1	0.393	0.631	3.823	4.847	1.304	3.543	$206,259	$35,866	$170,114
10	32092.32	0.402	0.646	3.913	4.962	1.335	3.627	$211,157	$36,718	$167,456
11	32741.41	0.412	0.662	4.006	5.080	1.366	3.713	$216,171	$37,590	$164,838
12	33403.63	0.422	0.677	4.101	5.200	1.399	3.801	$221,304	$38,482	$162,262
13	34079.24	0.432	0.693	4.199	5.324	1.432	3.892	$226,559	$39,396	$159,726
14	34768.52	0.442	0.710	4.298	5.450	1.466	3.984	$231,939	$40,332	$157,230
15	35471.73	0.452	0.727	4.401	5.580	1.501	4.079	$237,447	$41,289	$154,772
16	36189.18	0.463	0.744	4.505	5.712	1.537	4.176	$243,085	$42,270	$152,353
17	36921.13	0.474	0.762	4.612	5.848	1.573	4.275	$248,857	$43,274	$149,972
18	37667.88	0.485	0.780	4.722	5.987	1.610	4.376	$254,766	$44,301	$147,628
19	38429.74	0.497	0.798	4.834	6.129	1.649	4.480	$260,816	$45,353	$145,321
20	39207.01	0.509	0.817	4.948	6.274	1.688	4.587	$267,009	$46,430	$143,050
	40000									$3,336,562

HSM

HIGHWAYSAFETYMANUAL

SR 574 Study

CRASH TYPE	4 LANE, DIVIDED	5 LANE WITH TWLTL
Multi-Vehicle	$1,492,000	$2,856,000
Single Vehicle	$155,000	$235,000
Driveways	$561,000	$3,337,000
Total	**$2,208,000**	**$6,428,000**

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HIGHWAYSAFETYMANUAL

SR 574 Study

BENEFIT-COST RATIO: 4-LANE DIVIDED TO 5-LANE

4-LANE CRASH COST =	$2,208,397
5-LANE CRASH COSTS =	$6,427,529
4-LANE RIGHT OF WAY COSTS =	$2,200,000
5-LANE RIGHT OF WAY COSTS =	$600,000
B/C =	2.64

HSM

APPENDIX F POST-WORKSHOP SURVEY

Highway Safety Manual Lead State Peer to Peer Workshop

Attendee Survey

Thank you for participating in the 2010 HSM Lead State Peer to Peer Workshop. We would appreciate your opinions on the following items. Your comments will enable us to better plan and execute future workshops to meet your needs.

Name (Optional):_____

1. Please indicate your overall satisfaction with this workshop

	Very Satisfied	Somewhat Satisfied	Neutral	Somewhat Dissatisfied	Very Dissatisfied
Registration Process	☐	☐	☐	☐	☐
Materials/Handouts	☐	☐	☐	☐	☐
Speakers/Presenters	☐	☐	☐	☐	☐
Venue/Facility	☐	☐	☐	☐	☐

If you are not satisfied with any of the above, please let us know in what ways the workshop could be improved:

2. What did you like most about the workshop and what is your most important gain from it?

1/2

3. Would you be interested in attending similar workshops again in the near future (e.g., next year)?

☐ Yes ☐ Not

4. If you answered yes to Question 3, what kinds of sessions would you like to see included at the next workshop?

5. While developing and implementing HSM in your organization, what kinds of resources and support would you like to have between now and future workshops (e.g., training, conference calls, tutorial and meetings) within your state, regionally, and nationally?

6. Any additional comments or feedback on this workshop?

Thank you!

The HSM LSP2P Planning Committee


Illinois Department
of Transportation


ILLINOIS
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN