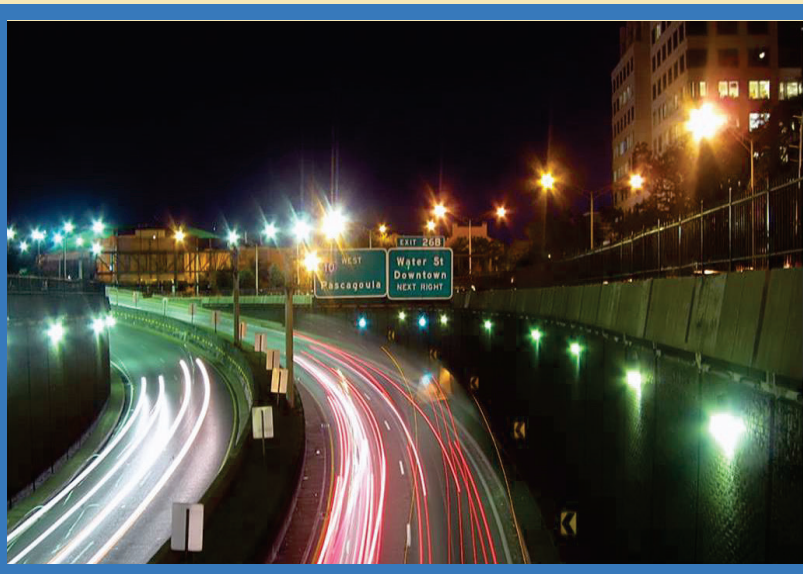
October 2011

Asset Management and Safety Peer Exchange

Beyond Pavement and Bridges: Transportation Asset Management with a Focus on Safety

Publication No. FHWA-HIF-12-005



U.S. Department of Transportation
Federal Highway Administration

Notice

This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The U.S. Government assumes no liability for the use of the information contained in this document. This report does not constitute a standard, specification, or regulation.

The U.S. Government does not endorse products of manufacturers. Trademarks or manufacturers' names appear in this report only because they are considered essential to the objective of the document.

Quality Assurance Statement

The Federal Highway Administration (FHWA) provides high-quality information to serve Government, industry, and the public in a manner that promotes public understanding. Standards and policies are used to ensure and maximize the quality, objectivity, utility, and integrity of its information. FHWA periodically reviews quality issues and adjusts its programs and processes to ensure continuous quality improvement.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Asset Management and Safety Peer Exchange - Beyond Pavement and Bridges: Transportation Asset Management with a Focus on Safety		5. Report Date September 2011 6. Performing Organization Code
7. Authors Hyun-A Park, William Robert		8. Performing Organization Report No.
9. Performing Organization Name and Address Spy Pond Partners, LLC 1165R Massachusetts Avenue, Suite 101 Arlington, MA 02476		10. Work Unit No. 11. Contract or Grant No. DTFH61-07-D-00031
12. Sponsoring Agency Name and Address Federal Highway Administration Office of Acquisition Management 400 Seventh Street S.W., Room 4410 Washington, DC 20590		13. Type of Report and Period Covered Final Report June 2011 – September 2011 14. Sponsoring Agency Code
15. Supplementary Notes FHWA COTR: Stephan Gaj, Office of Asset Management		

16. Abstract

This report summarizes the proceedings of the Asset Management and Safety Peer Exchange hosted by the Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials (AASHTO). The peer exchange was held in Cheyenne, WY on August 2, 2011.

The peer exchange addressed various aspects of asset management and safety – How can one improve safety performance through better asset management? What are effective ways to manage safety assets? How do agencies plan, prioritize, and budget safety asset needs? Managers from state DOTs and FHWA gathered to dialogue on best practices, challenges, and sharing of experiences.

17. Key Words	18. Distribution Statement
Transportation asset management, safety	No restrictions.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	53	

Form DOT F 1700.7 (8-72) **Reproduction of completed pages authorized**

Table of Contents

List of Figures

October 2011

Asset Management and Safety Peer Exchange

Beyond Pavement and Bridges: Transportation Asset Management with a Focus on Safety

Publication No. FHWA-HIF-12-005

U.S. Department of Transportation
Federal Highway Administration

1 Overview

This report summarizes the proceedings of the Asset Management and Safety Peer Exchange hosted by the Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials (AASHTO). The peer exchange was held in Cheyenne, WY on August 2, 2011.

1.1 Peer Exchange Purpose

The purpose of the peer exchange was to:

- Discuss how to structure policies and incentives to reflect best practices in asset management and safety.
- Identify approaches to better incorporate asset management objectives into safety programs.
- Share lessons learned and best practices in managing safety assets.

1.2 Peer Exchange Format

A list of peer exchange participants is presented in Figure 1.1. The peer exchange consisted of a full day of presentations and group discussion on August 2, 2011. Butch Wlaschin, FHWA's Director, Office Asset Management and Ananth Prasad, Secretary of Florida DOT (FDOT) and incoming Chair of the AASHTO Subcommittee on Asset Management, began the peer exchange by delivering the opening remarks. Matt Hardy, AASHTO's liaison for the Subcommittee on Asset Management, and Hyun-A Park of the consultant team then reviewed the workshop agenda and objectives. Following a context-setting presentation by Neil Pedersen, State Highway Administrator of Maryland DOT and Vice Chair of the AASHTO Subcommittee on Asset Management, and a summary of survey results by Hyun-A Park, the peer exchange agenda consisted of facilitated discussions covering four topics:

- Peer Session 1 – Total Asset Management;
- Peer Session 2 – Prioritizing Programming and Budgeting;
- Peer Session 3 – Inventory Management; and
- Peer Session 4 – Safety Asset Management in Context.

For each peer session, two-to-three practitioners from state departments of transportation (DOT) each shared a 10-15 minute discussion of best-practices within his or her agency. The presentations were followed by group discussion periods. Hyun-A Park of the consultant team helped lead the discussion and the question-answer session. The states represented by these summary presentations were: Oregon, Colorado, Washington, Wyoming, Michigan, Kentucky, North Dakota, Virginia, Louisiana, Alaska, and Iowa. The peer exchange agenda appears in the following section.

1.3 Peer Exchange Agenda

Tuesday, August 2, 2011

Introductions

8:00 - 8:15 ***Welcome, Opening Remarks***
Butch Wlaschin (FHWA), Ananth Prasad (Florida DOT)
Workshop Overview and Objectives
Matt Hardy (AASHTO), Hyun-A Park (Spy Pond Partners, LLC)

Setting the Context

8:15 - 8:45 ***Perspectives on Asset Management and Safety***
Neil Pedersen (Maryland State Highway Administration)

8:45 – 9:00 ***Safety Asset Management Survey Summary***
Hyun-A Park (Spy Pond Partners, LLC)

Total Asset Management

9:00 – 9:15 ***ODOT Asset Management Efforts – Building Capacity and Opportunities, Steps Toward a Vision***
Steve Lindland (Oregon DOT)

9:15 – 9:30 ***Multi-Asset Management at Colorado DOT***
Scott Richrath (Colorado DOT)

9:30 – 10:15 ***Group Discussion***

10:15 - 10:30 ***Break***

Prioritizing, Programming, and Budgeting

10:30 - 10:45 ***Prioritizing Safety Related Assets and Asset Improvements***
John Milton (Washington State DOT)

10:45 – 11:00 ***Tying Crash Types to Asset Priorities***
Martin Kidner (Wyoming DOT)

11:00 – 11:15 ***Programming and Budgeting Safety-Related Assets***
Dave Wresinski (Michigan DOT)

11:15 - Noon ***Group Discussion***

Noon - 1:00 ***Lunch***

Inventory Management

1:00 – 1:15 ***Inventory Management Migrating to Asset Management - How Sign Inventory/ Retroreflectivity Requirements are Leading KYTC into Asset Management***
Nancy Albright (Kentucky Transportation Cabinet)

1:15 – 1:30 ***Sign Inventory & Retroreflectivity Program***
Ken Kadrmas (North Dakota DOT)

1:30 - 1:45 ***Traffic and Safety Assets Inventory Communities of Interest***
Vanloan Nguyen (Virginia DOT)

1:45 - 2:30 ***Group Discussion***

2:30 - 2:45 ***Break***

Safety Asset Management in Context

2:45 - 3:00 ***ERP Implementation in Louisiana DOTD***
Michael Bridges (Louisiana DOTD)

3:00 – 3:15 ***Roadway Safety Data Partnership – Developing Robust Data-Driven Safety Capabilities Through Effective Transportation Asset Management Practices***
Jack Stickel (Alaska DOT)

3:15 - 3:30 ***Asset Management in Iowa: From Promising Start to the "Dark Ages" to New Light at the End of the Tunnel***
John Selmer (Iowa DOT)

3:30 - 4:15 ***Group Discussion***

Peer Exchange Wrap-up

4:15 – 5:00 ***Summary of Day's Discussion, Ideas to Consider for Subcommittee Meeting***
Ananth Prasad (Florida DOT)), Steve Gaj (FHWA)

1.4 Peer Exchange Participants

Name	Agency
Jack Stickel	Alaska DOT
Matt Hardy	AASHTO
Katie Zimmerman	Applied Pavement Technology
Scott Richrath	Colorado DOT
Nat Coley	FHWA
Steve Gaj	FHWA
Ken Petty	FHWA
Butch Wlaschin	FHWA
Mark Boushele	FHWA - Wyoming
David Cough	FHWA - Wyoming
Ananth Prasad	Florida DOT
Gordon Proctor	Gordon Proctor Associates
John Selmer	Iowa DOT
Nancy Albright	Kentucky Transportation Cabinet
Michael Bridges	Louisiana DOTD
Neil Pedersen	Maryland SHA
David Wresinski	Michigan DOT
Ken Kadrmas	North Dakota DOT
Steph Weigel	North Dakota DOT
Scott Zainhofsky	North Dakota DOT
Steven Lindland	Oregon DOT
Hyun-A Park	Spy Pond Partners, LLC
William Robert	Spy Pond Partners, LLC
Vanloan Nguyen	Virginia DOT
John Milton	Washington State DOT
Gregg Fredrick	Wyoming DOT
Martin Kidner	Wyoming DOT
Tim McDowell	Wyoming DOT
Delbert McOmie	Wyoming DOT
Shobna Varma	Star Isis
Mark Wingate	Wyoming DOT

1.5 Survey Summary

To further identify topics of interest for the peer exchange, an on-line survey was distributed prior to the peer exchange, in cooperation with AASHTO. Survey questions related to issues such as current practices linking asset management and safety, challenges faced in integrating asset management and safety, and key stakeholders with respect to asset management and safety. Additional areas of focus included the use of safety asset data, and data collection and management. The results of this survey provided insight into issues of high importance for states and were used to help generate discussion at the peer exchange.

As an introduction to the peer exchange, Hyun-A Park of the consultant team summarized the results of the Asset Management and Safety survey. The survey is summarized in section 3.2 of this report with summary charts presented in Appendix A.

Slides summarizing the results of the survey are posted on AASHTO's Asset Management Subcommittee homepage (www.tam/transportation.org).

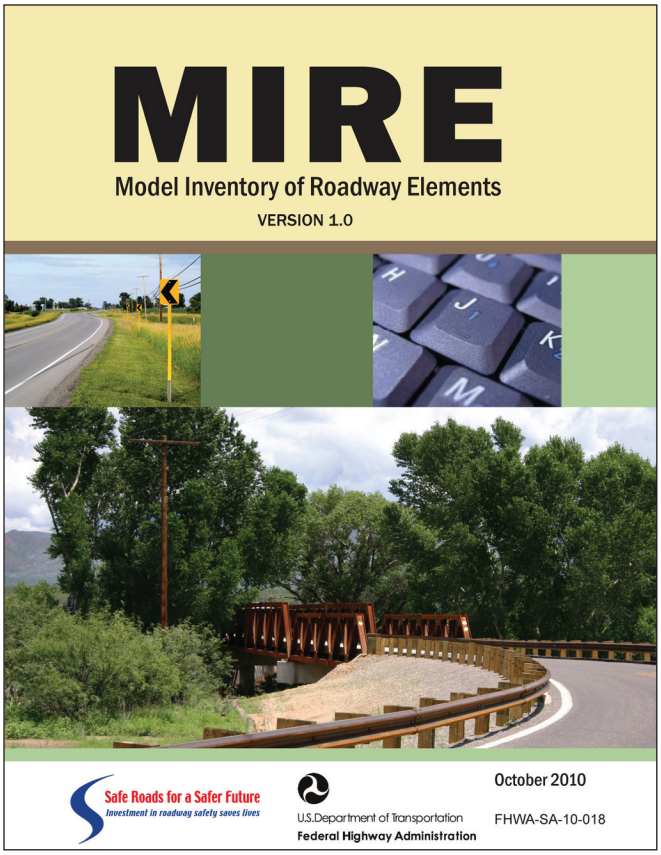
2 Introductions

2.1 Opening Remarks

Butch Wlaschin welcomed participants on behalf of his office and the Office of Planning. Butch noted that FHWA has been sponsoring asset management peer exchanges for several years. The emphasis of this peer exchange is to look beyond pavement and bridge assets, which have been the focus of much of the attention in the past, and focus on safety. State Departments of Transportation (DOT) maintain an extensive amount of safety hardware and numerous roadside appurtenances necessary for safety. Particularly with the advent of increased interest in performance management, there is increased interest in evaluating safety performance of these assets. In addition, DOTs need inventory and condition data on these assets, as they do on other highway assets.

Butch described the work performed by FHWA's Office of Safety related to traffic and safety assets. One important effort has been the development of the Model Inventory of Roadway Elements (MIRE). MIRE provides transportation agencies with a model of safety-related traffic and roadway inventory elements. The index of elements is comprehensive, with over 200 data elements included in the revised listing. MIRE can be used as a guide to improve data inventories and to support the adoption of performance measures. Additional information on MIRE is available at www.mireinfo.org.

Figure 2.1 MIRE Model Inventory of Roadway Elements



Ananth Prasad welcomed participants on behalf of the Subcommittee. He described his initial involvement in the asset management community and noted that FDOT has a robust system for collecting asset inventory data. FDOT has good information on the extent of its assets and has established performance measures for reporting, a key component for an asset management system. However, FDOT does not necessarily have complete condition data for its assets. A general issue for FDOT and other DOTs is to more effectively communicate what DOTs are doing to preserve their assets. Often, it seems to take a crisis to draw attention to infrastructure conditions, but ideally DOTs would use performance measures and asset management to call attention to what has been accomplished, as well as to make the case for increased investment.

Del McOmie, Chief Engineer of Wyoming DOT (WYDOT), welcomed participants to Wyoming and provided an overview of Wyoming's transportation system. Of U.S. states, Wyoming has the lowest population and is the second most sparsely-populated. Wyoming residents drive the most per capita in the U.S. at over 19,000 miles per person per year, hence the reference to the state as "a small town with long streets." Approximately 52% of the vehicle miles traveled (VMT) on Wyoming roads are from out-of-state drivers. Key industries in the state include minerals extraction, tourism and agriculture.

WYDOT's budget has declined approximately 5% in recent years, and there has been a shift from improving to preserving the existing system. However,

overall the state is in good fiscal condition. Asset management and safety are particularly important for WYDOT. The DOT uses asset management concepts to communicate conditions and investment needs to the state legislature. Having better systems for supporting asset management has allowed the DOT to be more responsive to requests for information. Safety is also important. Every traffic fatality is noted in the state. WYDOT has used information on its traffic and safety assets to help identify potential safety improvements. For instance, WYDOT recently used its inventory data to identify locations with a median width of 40 feet or less for potential installation of cable barriers. The fact that they have experienced a large number of hits on recently-installed cable barriers (e.g., over 800 in the Rock Springs area) is an indication that the new barriers are serving their purpose. At a national level, asset management and performance management can be used to help identify what investments are needed for the transportation system, particularly regarding safety.

2.2 Workshop Overview and Objectives

Matt Hardy noted the work by the Subcommittee. The topic of the peer exchange stems from the Subcommittee's strategic plan, which calls for the Subcommittee to promote the expansion of asset management principles to assets related to safety. Part of Matt's work involves coordinating with the FHWA/Federal Transit Administration (FTA) Transportation Capacity Building Program (TPCB) to organize activities such as the peer exchange. Matt thanked Ken Petty of the TPCB, Butch Wlaschin, and Steve Gaj of FHWA for their assistance in helping plan and secure funding for the peer exchange. Matt recommended that one or more presentations be prepared summarizing the results of the peer exchange for the upcoming Transportation Research Board (TRB) Asset Management Conference, scheduled for April 2012.

Hyun-A Park led introductions of the peer exchange participants, reviewed the agenda, and summarized the purpose of the meeting.

3 Setting the Context

3.1 Perspectives on Asset Management and Safety

Neil Pedersen thanked Ananth for agreeing to chair the Subcommittee, noting that the peer exchange represents both an opportunity to share information on traffic and safety assets, and a transition in leadership for the AASHTO Subcommittee on Asset Management.

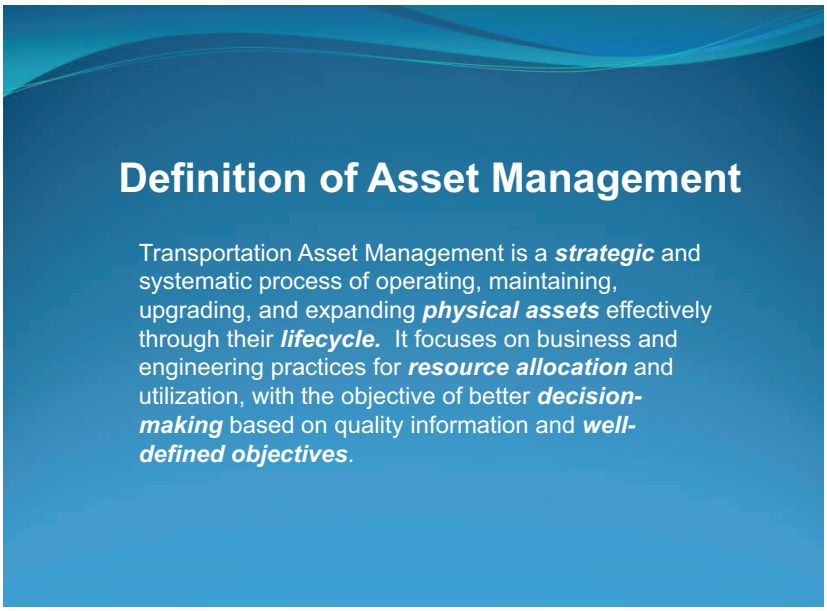
Neil started by placing asset management in a broader context. He described the importance of using asset management to convey investment needs and help support DOT budget requests through providing a transparent, credible and objective process. He recalled his experience in Maryland of working with the state legislature to secure a revenue increase by communicating clearly what funds were needed. Neil then reviewed the definitions of performance management and asset management, which were the focus of the 2010 peer exchange. Performance management involves setting goals and objectives

in terms of quantitative measures, and monitoring these over time. Asset management uses a performance management approach to help make decisions regarding physical assets of the transportation system. Although it is focused on the physical assets of the system, asset management must support and be done in the context of the broader goals of the agency.

Concerning the relationship of these areas to safety, Neil noted that improving safety is a goal of every state DOT, and this goal is usually expressed in terms of reductions in fatalities and personal injuries. Every state DOT is required to have an FHWA-approved Strategic Highway Safety Plan (SHSP) that prioritizes safety improvements considering engineering, education, enforcement, and EMS (the "four E's" of traffic safety). Managing traffic and safety assets is an engineering exercise, but it is important to consider education and enforcement as well when considering how to apply performance and asset management concepts to improving safety. For example, managing dynamic message signs (DMS) is an engineering concern, but using them to reinforce a safety campaign is more closely related to education and enforcement. Ideally there should be a strong linkage between a state's SHSP and its approach to managing traffic and safety assets. A goal of the peer exchange is to address how to make this linkage stronger.

Neil next presented AASHTO's definition of asset management, shown in Figure 3.1.

Figure 3.1 Definition of Asset Management



AASHTO's Transportation Asset Management Guide details this definition and discusses basic concepts of asset management. Neil noted that Volume 2 of the guide was recently published. This volume was developed through National Cooperative Research Program (NCHRP) Project 8-69, chaired by Michael Bridges of the Louisiana Department of Transportation and Development (DOTD).

With respect to managing traffic and safety assets, Neil posed five core questions that an asset management approach can help answer:

- What is the current state of physical assets?
- What are the required levels of service and performance delivery?
- Which assets are critical to sustained performance?
- What are the best investment strategies for operations, maintenance, replacements and improvements?
- What is the best long-term funding strategy?

It is important to answer these questions for the full set of traffic and safety assets, including:

- Signs
- Pavement markings
- Line striping
- Raised pavement markers
- Guardrails and traffic barriers
- Traffic signals
- Intelligent Transportation Systems (ITS) equipment
- Lighting
- Curbing
- Truck weigh and inspection stations
- Pedestrian/bicycle-related assets

In addition to these assets, there are safety-related characteristics of other physical assets that are also important to consider, such as pavement friction, shoulder widths, clear zones, and bridge clearances. Neil provided examples of specific issues for each of the five core questions related to these assets. As an example of these issues, he described Maryland's recent experience with freeway lighting. Maryland recently developed an inventory of its freeway lighting, assessed conditions, and developed a performance goal percent of lights functioning. The agency found that in many cases electrical conduits were highly deteriorated, and that it would be more cost effective to replace the asset rather than rehabilitate. Federal stimulus funds were used for this effort, and the end result is that fewer lights were found to be needed than were originally installed, yielding savings in future energy costs.

3.2 Safety Asset Management Survey Summary

As an introduction to the peer exchange, Hyun-A Park of the consultant team summarized the results of the Asset Management and Safety survey. Survey questions addressed issues such as current practices linking asset management and safety, challenges faced in integrating asset management and safety, and key stakeholders with respect to asset management and safety. Additional areas of focus included the use of safety asset data, and data collection and management.

Hyun-A Park described the purpose of the survey: to identify topics of interest for the peer exchange and to help facilitate discussion. The good response rate was noted. 81 responses from 39 states were received on-line. States represented were: Alabama, Alaska, Arkansas, Arizona, California, Colorado, Delaware, Georgia, Hawaii, Idaho, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Montana, New Jersey, New Mexico, New York Nevada, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Utah, Virginia, Vermont, Washington, Wisconsin, and Wyoming.

Although survey respondents reported that a safety asset inventory would be of value, lack of resources is a significant obstacle for respondents. Most comments regarding agency views on safety asset data indicated that efforts are underway to create or expand data inventories. A minority of comments indicated that costs are too high to justify the investment in a safety asset data inventory.

Respondents reported the most robust inventories for traffic signals, signs, and lighting. Guardrail was also well represented among the states reporting full asset inventories. In contrast, road edge delineators were not robustly inventoried; many respondents reported that they are not inventoried at all.

For most assets, respondents indicated that asset inventories are updated at no set interval. Those respondents who did report that asset inventories are updated at a set interval overwhelmingly reported that this is done on an annual basis. This was the case for nearly all assets, with guardrail a notable exception showing almost the same number of inspections at annual and three-year intervals.

Location data was reported to be the most common data type maintained for all assets. It is notable that for each asset, each data type was reported by at least one respondent. Most comments identified additional asset types that fell into the category “Other.” These included: pipe culverts, ITS devices, turnouts, ADA curb ramps, and impact attenuators. Some responses provided additional detail, elaborating upon the inventory information maintained for a given asset.

An approximately equal number of respondents reported that a maintenance management program is used for safety assets as reported that a maintenance management program is not used for safety assets. Of the respondents that did report the use of a maintenance management program for safety assets, there was no clear consensus as to the specific system or type of system used. Responses ranged from custom-built systems, to well-known dedicated programs, to spreadsheets.

Respondents primarily reported the use of manual field inspections and video for data collection purposes. Most responses indicated that manual field inspections are used in combination with one or more additional data collection method. One respondent reported that video is the sole data collection method used while another respondent reported the use of all data collection methods listed.

Respondents reported that issues with location referencing accuracy/ consistency, temporal referencing accuracy/consistency, availability of trained personnel, and availability of tools/systems had all been faced in integrating safety-related asset data with other data. For these four issues, the response totals were quite closely clustered. However, accuracy of location referencing and availability of trained personnel were the top issues identified by respondents.

In response to the question, “How have you used your safety asset-related data?” response totals were again quite closely clustered for most of the uses listed. However, project scoping emerged as the top use identified by respondents. Maintenance work planning and scheduling was the next-most frequently cited use. While at least one respondent indicated that safety asset information was currently not being utilized, many respondents identified several current uses of safety asset information.

Nearly two-thirds of respondents indicated that their agency had developed performance measures/targets for safety related assets. The comments provided by respondents addressed this question at different scales (enterprise, asset-type, etc.) and with varying degrees of specificity.

Most respondents indicated that safety asset information was made available through a database not directly associated with mapping or geospatial tools. While the second-most frequently given response was “Other,” a number of respondents indicated that mapping tools and performance measure reporting were used for this purpose. Additional responses indicated that this information was generally made available on an ad hoc basis.

Responses indicate that the most common location for the management of activities for safety assets is an Agency’s Operations and Maintenance division. This was the case for all activities, most notably for Condition Data Collection. In contrast, Programming was least concentrated with Operations and Maintenance merely cited with the same frequently as Distributed (multiple locations) and Other. Planning was another frequently-cited location for management of activities for safety assets. Few comments were provided for this survey item. Those comments that were recorded primarily elaborated on agency-specific nomenclature used to refer to a given activity or business unit.

In response to a question seeking average annual expenditure over the last five years on safety-related asset inventory and condition assessment, a wide range of expenditures was reported for these activities. The total reported range ran from $20K–$250M. It is necessary to more carefully define what these figures mean in order to draw meaningful conclusions as to levels of spending.

Respondents provided a number of common responses to a final open-ended question seeking questions for peers. These focused on:

- Experiences and best practices related to data collection, data management, database integration, and geo-referencing
- Experiences implementing transportation asset management and
- Cross-asset prioritization/optimization analyses that include safety assets
- MIRE guidelines
- Funding

Respondents expressed interest in learning more about specific data collection technologies and the advantages and disadvantages of each. Respondents were clear that they not only sought information on best practices but also wanted to hear from their peers about critical obstacles and how these were addressed.

Ken Petty asked whether there were plans to follow up with the states that did not respond. Hyun-A responded that the survey would be left open following the peer exchange to allow additional states to respond. Neil Pedersen and Steve Gaj discussed the fact that in some cases multiple offices within a given DOT responded to the survey. In these cases it may be of interest to compare different responses for the same DOT.

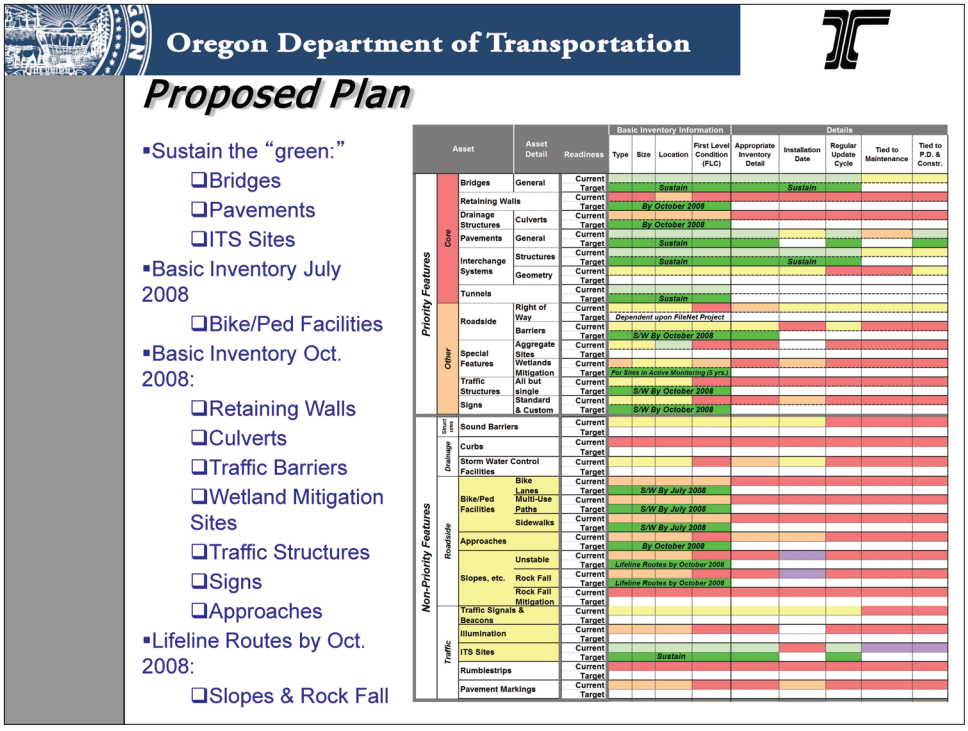
4 Total Asset Management

4.1 ODOT Asset Management Efforts – Building Capacity and Opportunities, Steps Towards a Vision

Steve Lindland of Oregon DOT (ODOT) presented on ODOT's efforts to develop inventory and condition data for traffic and safety assets, and utilize this data for supporting investment decisions. Steve began by describing ODOT's 2006 asset management pilot project. Through the pilot ODOT realized that improving data quality for its inventory of traffic and safety assets was extremely important. For instance, for one section evaluated through the pilot ODOT expected to find three miles of sidewalk, but the road survey performed as part of the pilot showed ODOT actually had nine miles of sidewalk.

Based on the experience gained from the pilot, in 2008 ODOT began to collect additional inventory data for its traffic and safety assets. Also, ODOT developed data collection guides for specific assets, including signs, roadside barriers, bicycle/pedestrian facilities, parking, Americans with Disability Act (ADA) ramps, curbs, and culverts.

Figure 4.1 ODOT's Proposed Plan



To share data on its assets within the organization, ODOT developed two tools: the Features, Attributes & Conditions Survey - Statewide Transportation Improvement Program (FACS-STIP) Map Tool and the FACS Data2Go Tool. The map tool is a web-based system that integrates roadway inventory data, bridge and culvert locations, crash data, traffic data, and information on current and planned projects in a mapping environment. The Data2Go tool stores detailed asset data for the following asset types (as well as additional traffic and crash data):

- ADA Ramps
- Approaches
- Automated Traffic Recorder Sites
- Bike Facilities
- Bridges
- Culverts
- Fish Passages
- ITS Sites
- Pavements
- Retaining Walls
- Sidewalks
- Traffic Barriers
- Traffic Signals
- Traffic Sign Supports
- Tunnels
- Unstable Slopes
- Weigh in Motion Sites

ODOT can use the tool to query over 20 databases, and can export data from the system to Microsoft Excel to facilitate data collection.

Steve described how ODOT is now using its improved asset data to structure its 1R pavement preservation program. To develop the program, ODOT used its inventory data to determine that its needs for replacement of existing traffic and safety assets are approximately $76 million. With the program, ODOT is planning pavement preservation actions and safety improvement independently, targeting each type of action where it is most needed, rather than planning projects that address traffic and safety features only at locations where pavement work is planned. Pavement preservation projects focus strictly on paving, with the qualification that they cannot “make safety features worse.” In addition, $6 million is allocated per year to upgrade traffic and safety features, with prioritization of funds based on analysis of what upgrades are likely to yield the most benefit.

Other activities ODOT is performing include:

- Developing an asset management strategic plan;
- Using its asset list to update ODOT's financial statements;
- Piloting the earthmine system to street level imagery and 3-D data;
- Piloting use of the Juno handheld GPS unit;
- Performing quality assurance/quality control (QA/QC) on its asset data; and
- Developing an approach for prioritizing what asset data to collect.
- QA/QC – going back to 2006 pilot, determining change in inventory since 2006

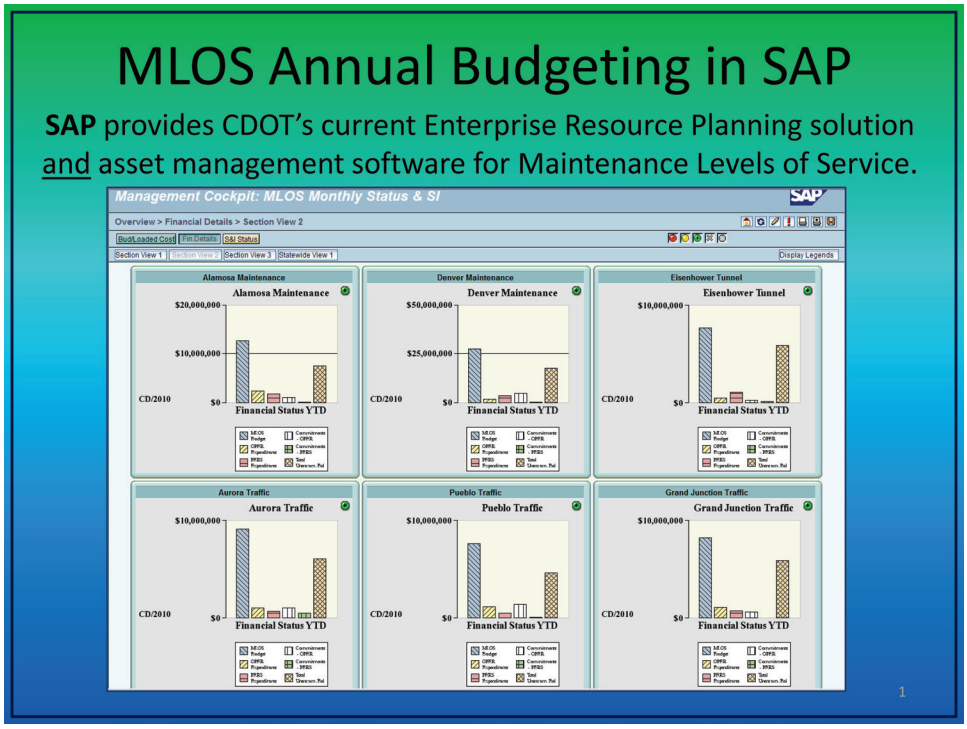
4.2 Multi-Asset Management at Colorado DOT

Scott Richrath of Colorado DOT (CDOT) presented on CDOT's approach to managing traffic and safety assets. Scott noted that different groups within a DOT have different perspectives and require different data on the DOT's assets. For instance, for supporting high-level financial decisions a DOT may not require detailed data on all of its traffic and safety assets, but this information is helpful for day-to-day maintenance.

At CDOT, Microsoft Excel spreadsheets had historically been used to evaluate investment impacts and support resource allocation. Recently the City of Denver used Deighton's dTIMS system to analyze its asset conditions. This analysis helped the City obtain additional transportation funding through a sales tax increase. Given the City of Denver's experience with the software, CDOT is now configuring dTIMS to show investment impacts for five asset types. CDOT will use the system to ingrate analysis of pavement data stored in dTIMS, bridge data stored in the AASHTO Pontis Bridge Management System, and other asset data stored in SAP.

CDOT uses Maintenance Levels of Service (MLOS) for supporting analysis of maintenance needs and budgeting. Through MLOS, CDOT has defined levels of service on an A-F scale for ten categories of maintenance. A sampling approach is used to estimate the level of service currently achieved, an analytical approach has been developed to predicted the level of service that will be achieved given a funding level, and help support prioritization of funds by maintenance category and district. CDOT uses its SAP Enterprise Resource Planning (ERP) system to support MLOS, as depicted below in Figure 4.2. The category in MLOS most closely related to traffic and safety assets is Striping, Signs, Signals, and Guardrails. This category also includes service patrols.

Figure 4.2 CDOT Maintenance Levels of Service Approach



Though CDOT has a well-defined approach to support maintenance budgeting, Scott reported that there is still room for improvement to better relate resource allocation to safety improvements. In this regard Scott posed the following questions to spur further discussion:

- Why are safety assets scored and not inventoried as individual assets?
- Why not manage safety as a sixth asset?
- How is safety prioritized against other investment categories?

4.3 Discussion

Participants asked questions and discussed issues related to each of the presentations. Matt Hardy of AASHTO, Ken Petty of FHWA and Martin Kidner of Wyoming DOT (WYDOT) began the discussion by asking Scott Richrath for more information on CDOT's MLOS approach. Matt asked whether the samples used in MLOS are specified by pavement section. Scott replied that there is not a one-to-one match between the two. Maintenance samples are developed largely based on the CDOT's maintenance organization, which defines maintenance patrols within each of its nine maintenance sections. Ken asked whether a consistent process is used for MLOS. Scott responded that the process used for MLOS is relatively consistent from year-to-year. In the most recent application of the approach, funds were shifted from the pavement area to achieve a higher level of service in maintenance. Martin asked for more information on how service patrols are evaluated and combined with consideration of traffic and safety assets. Scott explained that A-F scores are established for each sub-area within a category. This is a somewhat subjective approach, but allows for combining categories.

Neil Pedersen of MDSHA posed the question for all of the presenters of whether there is a linkage between asset management and the DOT's SHSP. The presenters reported that there was some linkage, in that crash and fatalities data used for the SHSP are in some cases used to support asset management, but that overall the two are weakly linked.

The participants then discussed different aspects of ODOT's approach. Hyun-A Park asked Steve Lindland about the extent of use of ODOT's map tool. Steve reported that for the last budget cycle approximately half of the intended users utilized the system, and use of the system has increased since that time. Martin asked for clarification on how frequently data are updated and the level of detail in the data collection process. Steve reported that ODOT found it was most effective to scan the corridor for a given type of data (generally by having college interns review video log data) rather than trying to collect data on all assets at once. Generally, ODOT defines 4 to 12 data items per asset. Data collection gets "bogged down" if too many data items are defined. Neil Pedersen reported that Maryland had the same experience as ODOT, finding it was more effective to focus on collecting data on individual assets. Steve also noted that updating the data in the future is a concern. Scott Zainhofsky of North Dakota DOT (NDDOT) asked Steve how the inventory of traffic and safety assets to be used for 1R projects was established. Steve reported that this was the product of discussions with FHWA. The approach was initiated in 2009 for ODOT's ARRA projects.

Hyun-A Park noted that the presentations highlighted different focus areas, with ODOT focusing on developing an asset inventory, and CDOT focusing on a high-level budgeting approach supported by a random sample of asset conditions. Jack Stickel of Alaska Department of Transportation and Public Facilities (ADOT&PF) noted that another important focus area is that of improving information availability, such as making information available throughout an organization, and integrating systems in real time in a spatial environment.

John Milton of Washington State DOT (WSDOT) added that another important concern is determining the purpose for collecting asset data. At WSDOT, the focus is on supporting performance measurement. Early efforts to collect detailed data on roadside assets were found to be too costly to sustain. It is important to consider the marginal benefit of collecting more data – what will be gained or lost by adding or subtracting a data item from an agency's inventory. The group discussed the issue of level of detail in asset data further. Katie Zimmerman of APTech, Chair of the TRB Asset Management Committee, noted that the University of Wisconsin maintains a website detailing approaches to Maintenance Quality Assurance (MQA) which has more information on states' data collection approaches. Participants noted that it can be difficult to determine what level of detail is needed without demonstrating a need for the data, but demonstrating need requires some amount of data to begin with. Scott Zainhofsky discussed NDDOT's effort to address this issue through establishing the "purpose, scope and use" for asset data. Scott expressed concern that it may be difficult to establish a purpose for some of the items in MIRE. Jack responded that many of the detailed items in MIRE are there to support Highway Performance Monitoring System (HPMS) reporting – in seeing the motivation for the data items it may be useful to compare MIRE and HPMS.

Participants then described other uses of and issues concerning asset data. Nat Coley of FHWA described two examples of asset data being put to additional, unplanned uses in Maryland. There a system was developed for tracking roadkill data, and it was found that this information could help with crash analysis. Similarly, a Maryland transit agency was able to use its supply room system to diagnose maintenance issues with buses. Steve Lindland described ODOT's experience with ADA ramps. An initial inventory was developed in the mid-1990s. The 2008 data collection effort collected updated data on ADA ramps. Through comparing the two data sets ODOT was able to identify gaps in the data and issues in adherence to standards. Martin described WYDOT's effort to develop its highway safety manual process, which helped identify data needs.

5 Prioritizing Programming and Budgeting

5.1 Prioritizing Safety Related Assets and Asset Improvements

John Milton of Washington State DOT (WSDOT) presented on WSDOT's efforts to prioritize safety related assets and asset improvements. John began by posing two questions: "What is safety?" and "Who defines safety?" – observing that different parties will have different perspectives and definitions concerning safety. Ultimately, however, it is the legislature and the public who define safety. Washington State's SHSP defines actions going forward with a goal of achieving Target Zero, defined as zero traffic deaths and zero serious injuries by the year 2030.

John described WSDOT's multi-faceted approach to achieving the objectives set forth in the SHSP. The four key factors are:

- *Solutions beyond the roadway*—4E's engineering, enforcement, education, and EMS
- *Data-driven priorities*—not constrained by silos or narrow agency focus
- *Assessment*—quantitative and scientific, not qualitative and anecdotal
- *5th E*—Evaluation

John then described WSDOT's priority setting process that supports the attainment of Target Zero goals. This is a data-driven process intended to optimize the crash reduction benefit of any investment. Four levels of priorities are defined, 1-4, with 1 being the most critical. John emphasized that rather than considering safety broadly-defined, this effort focuses on reduction in fatal and serious crashes.

Figure 5.1 WSDOT Program Risk Assessment Evaluator Table

PROGRAM RISK EVALUATOR TABLE

Safety Program: Run-Off-Road Crashes - Guardrail

Name: John Doe | Job Title: Safety Manager | Date: 7/30/2011

Description of Risk Event: Collisions involving Guardrail where penetration occurs, result in increased severity

Description of Scenarios		Likelihood	Strategic Objectives																		
			(1) Safety			(2) Preservation			(3) Mobility			(4) Environment			(5) Stewardship			(6) Economic Vitality		
			Impact			Impact			Impact			Impact			Impact			Impact		
		(1-100%)	min	ml	max	min	ml	max	min	ml	max	min	ml	max	min	ml	max	min	ml	max
A Posts	1)base condition	35	35	40	45	40	45	55	20	30	35	15	20	25	20	25	35	40	45	50
	2)risk condition	35	40	50	60	45	55	60	20	35	40	20	30	35	25	35	40	45	50	55
B Mounting Height	1)base condition	20	35	40	50	35	40	50	20	25	30	20	25	30	20	30	40	25	35	45
	2)risk condition	20	40	45	55	40	50	55	25	30	35	20	30	35	25	35	45	30	45	50
C Terminal Design	1)base condition	15	30	35	45	45	55	60	15	20	25	10	15	25	30	35	40	35	40	45
	2)risk condition	15	40	45	50	55	60	65	25	30	40	20	30	40	45	50	55	40	50	60
D Distance to travel lane	1)base condition	25	25	35	45	40	50	60	30	35	40	15	20	30	25	30	35	25	30	35
	2)risk condition	25	35	40	50	45	55	65	35	40	45	20	25	30	25	35	45	25	35	45

Impaired driving, speeding, and run-off-the-road (ROTR) collisions comprise Priority 1 areas. Each of these factors is associated with over 40% of total traffic deaths in Washington State (2006-08), generally in combination with other factors. Young drivers, unrestrained occupants, distracted drivers, intersection-related, and traffic data systems are the Priority 2 areas. Each of these factors is associated with 21-38% of total traffic deaths with the exception of traffic data systems for which this figure is not applicable. Priority 3 areas are unlicensed drivers, opposite direction multi-vehicles, motorcyclists, pedestrians, heavy trucks, and EMS. Each Priority 3 area is associated with 12-20% of total traffic deaths. Priority 4 areas are numerous and are each associated with less than 10% of total traffic deaths.

John explained that despite his agency's multi-modal orientation, pedestrians are Priority 3 and bicycles are Priority 4 because improving safety issues in these areas cannot reduce fatal and serious crashes as much as other areas. However, there are benefits to pedestrian and bicycles attained by addressing higher priority areas.

WSDOT focuses most attention on the most significant factors. ROTR crashes are a significant issue, associated with approximately 42% of total deaths. Only a small number (7.9%) of ROTR crashes are not also related to other factors such as speeding or impaired driving.

Proven strategies to reduce fatalities associated with ROTR crashes include engineering remedies such as guardrail and safe urban streetscape designs that

mitigate the consequences of leaving the roadway as well as remedies such as rumble strips that reduce the number or likelihood of ROTR collisions. WSDOT is making system wide improvements to guardrail and has the information on crashes and severity to support this investment.

John made the point that you cannot be content to just address the most critical areas—in each program there is a link to safety and it is necessary to look for these links to safety. For example, for weigh stations heavy trucks cause rutting and drainage issues that provide the linkage to safety. Similarly, there are issues associated with electrical systems and drainage systems that require comprehensive inventory and condition assessment to more completely evaluate. Slope stabilization is an example in which an asset management approach provides traction on safety issues. This approach has allowed WSDOT to track and address highest risk slopes in order of priority.

More generally, WSDOT tracks crash locations vs. assets such as rumble strips, cable barriers, etc. This data not only allows WSDOT to manage performance and risk, it also enables WSDOT to support its safety goals through strategic investments that maximize reductions in injuries and death. WSDOT's risk assessment evaluator applies a quantitative approach to risk events and maps these against WSDOT's strategic objectives of Safety, Preservation, Mobility, Environment, Stewardship, and Economic Vitality. This relates assets to strategic objectives and enhances focus on those aspects of the assets that are most important for safety.

John cautioned that these powerful, data-hungry tools come at a cost. WSDOT found data collection ground to a halt with all of the requests for more and more data. Therefore, WSDOT developed an approach for identifying the top priority data elements to collect. Elements were weighted to align with agency policies and were assessed based upon performance attributes such as: rank of related collision, time required to collect, urgency, and efficiency. WSDOT then performed a Pareto analysis to assess what data attributes are most important. For example, for slopes, is it best to precisely measure the slope (continuous data) or simply categorize the slope? Ultimately, this effort produced a value matrix used by WSDOT to determine what data to collect.

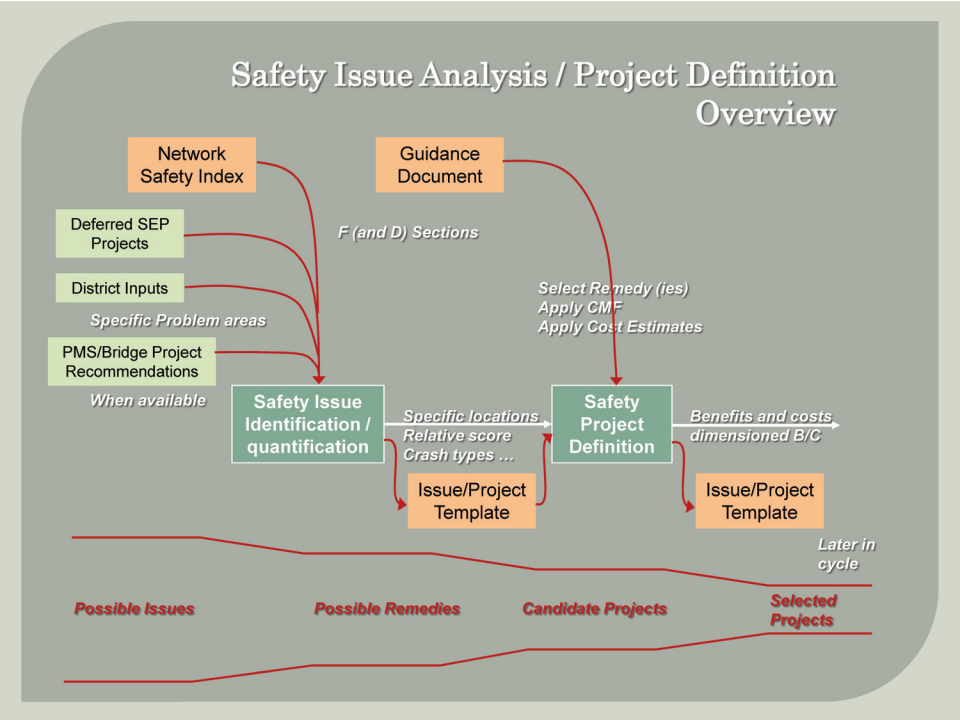
5.2 Tying Crash Types to Asset Priorities

Martin Kidner of Wyoming Department of Transportation (WYDOT) presented on tying crash types to asset priorities. He began by observing that it is not possible to make a road absolutely safe; therefore WYDOT's focus is to try to reduce serious crashes. At an organizational level there is an extensive safety presence within WYDOT. Because the governor’s representative for safety is at WYDOT, there is a less complicated structure between WYDOT and other state agencies. WYDOT has the crash data and features in-house to enable the type of analysis described in the presentation.

A significant issue for WYDOT is vehicles leaving the lane. When a vehicle starts to leave the road and the driver over-corrects, this can result a rollover. Examining road types versus crash numbers allows WYDOT to focus on areas of greatest need. However, WYDOT faces challenges of sparse population. It is hard to get a good feel for all of the locations with totals on the order of 150 fatalities/year.

One response to this challenge is to seek district input. Districts provide information on potential safety issues even if they don't have a crash at the location. This is similar to a pavement management system (PMS) or bridge management system (BMS) approach that involves looking at safety improvements when conducting pavement or bridge work.

Figure 5.2 WYDOT Safety Issue Analysis



Martin described the role of the SHSP as a guidance document. Curves are discussed as an example of WYDOT addressing a priority identified by this process. The results will be included in the next plan. In this analysis, 300 roadway curves were identified that had crash frequencies 10-times higher than the statewide average. These made up the first round of projects, targeted for completion within a three-year timeframe.

WYDOT used a Pareto optimization approach to identifying remedies and expected to have to narrow the recommended remedies down from more than 20. However, Martin reported that each district ended up examining 5-6 curves in the first round of evaluation and it turned out there was convergence around some basic remedies. Ultimately, only six remedies were ultimately recommended. This is a much more manageable set of remedies and allows a basic decision tree allows to be employed to select the most effective remedy in any given instance.

Because of this convergence WYDOT was able to establish standard crash modification factors and costs for prioritizing remedies. WYDOT used these for comparing alternatives within the safety area. The result was greater consistency with respect to recommendations and expectations.

Finally, Martin reported that WYDOT is moving to a corridor planning approach for safety improvements in which qualifications of corridor context are more systematically integrated with overall performance goals in assessing needs and developing solution sets.

5.3 Programming and Budgeting Safety-Related Assets

Dave Wresinski of Michigan DOT (MDOT) presented on how MDOT incorporates safety into its overall investment planning framework. MDOT's investment planning approach is a three-step process consisting of: developing investment strategies, an integrated Call for Projects (CFP) process, and Five-Year Transportation Program development. MDOT has utilized a rolling 5-year program for the past 15 years.

MDOT employs investment templates to support investment decision making. There are 30 template categories in the MDOT program, including safety. The state's comprehensive investment plan is captured by a statewide template. In practice, the use of investment templates allows MDOT to ensure funding is targeted toward established goals and most effectively allocated across program categories.

Dave explained how candidate projects are generated and prioritized by MDOT. Safety dollars are distributed to MDOT's seven regional offices. MDOT regional offices identify projects for inclusion in the CFP, to start in the 5th year. These candidate projects undergo review by the central office. MDOT applies a time of return analysis to safety investments and projects are evaluated relative to the overall safety goals.

Dave described MDOT's safety goals and the progress that has been made through investment in safety. MDOT's safety goals are to reduce crashes, fatalities, injuries, vehicle delay, fuel consumption, pollution, and operating costs, and to enhance elderly and non-vehicle mobility. MDOT began investing more in its safety program in 2008—particularly for cable barrier and rumble strips. Fatalities showed a reduction of 16% over a five-year period ending in 2010, while serious injuries showed a reduction of 23% over the same timeframe. Using M-57 as an example, Dave reported an overall reduction of 50% in crashes from 2003–07 associated with a centerline rumble strip project. MDOT has established 2012 goals for state trunkline routes of 250 fatalities and 1700 serious injuries. While MDOT is not yet at these levels much progress has been made. MDOT's asset management approach has worked well for past 10 years and continues to support improvements. MDOT set a target of 90% of trunklines in good condition by 2007. That target was met, but this will need to be revisited in the future.

5.4 Discussion

Steve Lindland requested clarification regarding whether cable barriers and rumble strips were the focus of MDOT’s program, or simply the focus of the additional money added to the program. Dave Wresinski responded that the additional funds obtained when the budget was increased were directed primarily to cable barriers and rumble strips, but this was not the sole focus of the safety program.

Butch Wlaschin asked the presenters how easy or difficult they found it to be to integrate asset and crash data. Martin reported that district engineers have a good sense of where improvements are needed, but the challenge WYDOT faced was in systematizing crash data and analysis to show crashes and safety features by location. Dave Wresinski added that MDOT has a datamart for combining asset and crash data, but the challenge has been in determining exactly what data were needed. Jack Stickel described a federal program underway to integrate data for real time system management, such as for relating crash data and weather. John Milton reported that University of Washington is researching this topic.

Participants next discussed issues related to law enforcement personnel, such as collecting crash data and implications on mobility. Law enforcement personnel are charged with collecting data, but there are also issues of protecting public safety and clearing lanes quickly to improve mobility. Some states have laws requiring drivers to move over a lane or slow down when passing a law enforcement officer, creating additional mobility concerns. John Milton noted that in Washington clearance time is one of the reported measures, and WSDOT has had success in working with law enforcement on this issue.

Neil Pedersen asked each of the presenters to describe the link between safety planning and asset management in their state. They responded that each has a slightly different approach, namely:

- In Wyoming the state safety engineer responsible for developing the safety plan is in the DOT, creating a tight organizational link.
- In Washington the State Traffic Safety Commission develops safety plan with input from the DOT. There is a Highway Safety Executive Committee at WSDOT. The state traffic engineer heads this committee and participates in meetings with the State Traffic Safety Commission.
- In Michigan the safety plan is developed in the safety programs area. The linkage to asset management is provided through the call for projects and through the agency's performance goals.

Katie Zimmerman noted that management of roadside assets is often more reactive than that for pavement and bridges, and asked whether the presenters had encountered organizational issues in working with maintenance staff to improve safety. John Milton responded that one challenge has been in establishing a common understanding across the organization of what is meant by operable versus non-operable and standard versus non-standard assets. Also, there can be a challenge in communicating the specific asset that needs to be addressed (e.g., the guardrail post versus the guardrail). Several participants described that there is increasing pressure to justify use of funds, and that it is becoming less tenable to assume a certain level of funding will be available for maintenance from one year to the next.

John Milton speculated that in the future there will be even greater competition for funds, and it will be important to quantify the relative benefits of investing in different traffic and safety data. For instance, is it more important to improve retroreflectivity or striping? There is a crash modification clearing house available for helping addressing safety performance of different assets, but better data are needed from the maintenance and safety perspectives.

Participants asked additional questions about WSDOT's data collection approach, including whether WSDOT inventories clear zone hazards, whether every mile of road is inventoried, and how the data collection approach relates to pavement data. John responded that WSDOT is collecting data on clear zone hazards, and does inventory every mile of road. Three phases of data collection have been established, and a complete inventory will be obtained. A Pareto analysis was used to determine what data to collect. Regarding the relation to pavement data, WSDOT can query pavement friction data by location.

Next participants discussed the frequency of data collection. Ananth Prasad noted that for assets such as guardrail, Florida DOT (FDOT) has an asset inventory and checks conditions at randomly-selected locations using a statistical approach. If problems are identified, then locations are inspected and addressed, but FDOT does not inspect all assets every year. Ananth expressed concern that comprehensive collection of condition data would simply be too labor intensive, though it may be feasible to automate collection of data for assets such as striping. Other participants described approaches to data collection in their states. Gordon Proctor of Gordon Proctor Associates reported that Ohio DOT does update conditions of its assets annually. Vanloan Nguyen of Virginia DOT (VDOT) reported that VDOT does not perform annual condition assessments. Previously VDOT used random condition assessments, and is exploring used of automated systematic assessment. Traffic engineering is attempting to establish a rating system and performance measures to use with such an approach. A basic challenge is to determine how to allocate funds to districts lacking detailed data. Vanloan further noted that pressure to improve condition data at VDOT is in part motivated by a change to require that engineering work products be "signed and sealed," which implies a more detailed level of data for traffic and safety assets. Neil Pedersen reported that MDSHA has a guardrail inventory, including information on where guardrail is needed, but not a rating system. John Milton reported that WSDOT uses random condition assessment.

Butch Wlaschin described his recent experience concerning approaches to managing guardrails from an international scan. On the scan he noted cases where agencies left damaged guardrail in place because they had already scheduled system wide replacement. Also, one agency on the scan worked with the insurance industry to identify opportunities for shared safety improvements that would be of benefit to the insurance industry through reducing insurance payouts.

6 Inventory Management

6.1 Inventory Management Migrating to Asset Management – How Sign Inventory Retroreflectivity Requirements are Leading KYTC into Asset Management

Nancy Albright of the Kentucky Transportation Cabinet (KTC) described KTC's asset management efforts. With respect to its traffic and safety assets, KTC is in the early implementation stage of asset management concepts. KTC has

been collecting inventory and inspection data for pavement and bridges for some time. For traffic and safety assets KTC has not had a well-established statewide inventory in the past. However, the sign retroreflectivity requirement in the Manual on Uniform Traffic Control Devices (MUTCD) has forced KTC to develop a sign maintenance program.

The sign retroreflectivity requirement, once phased in, will require DOTs to have a method in place for verifying that signs are maintained with specified minimum retroreflectivity. Based on the MUTCD guidance, it is important to establish an assessment or management method so that an agency is in compliance with MUTCD standards, even if an individual sign does not meet the specified minimum level. Approaches for meeting the standards include: performing visual nighttime inspections; measuring sign retroreflectivity; replacing signs based on expected life; performing blanket replacements at specified intervals; replacing signs based on performance of control signs; or other methods developed based on engineering studies.

To comply with the MUTCD requirements, KTC has purchased photolog vans, and is now using these to collect sign data. KTC will then leverage its photologs and systems to extend the inventory to include guardrails and other barrier systems, then other assets. A key issue for KTC is to build the inventory such that it can be maintained over time.

6.2 Sign Inventory and Retroreflectivity Program

Ken Kadrmas of North Dakota DOT (NDDOT) presented on NDDOT's sign inventory and retroreflectivity program. Ken first described how NDDOTs roadway information management system (RIMS) supports NDDOT's assessment method and implementation strategy for this program. NDDOT's RIMS implementation is a mainframe system that is currently being upgraded. However, the current system is widely used; it is the backbone of NDDOT's business.

Ken explained how RIMS data drives other products within NDDOT. RIMS data is exported to ArcMap. Layers exist for assets such as signs, lights, and other asset types. This data is integrated with OnRAMP, NDDOT's GIS video log system.

Figure 6.1 NDDOT GIS Video Log

Ken described how the MUTCD provides an asset management framework and requirements. For signs, NDDOT employs a program of visual nighttime inspections. Previously, inspection and replacement were done annually for regulatory signs while replacement occurred every ten years for guide and warning signs. The new program of visual nighttime inspections has changed this. Now, all signs are inspected and replaced based on measured reflectivity performance.

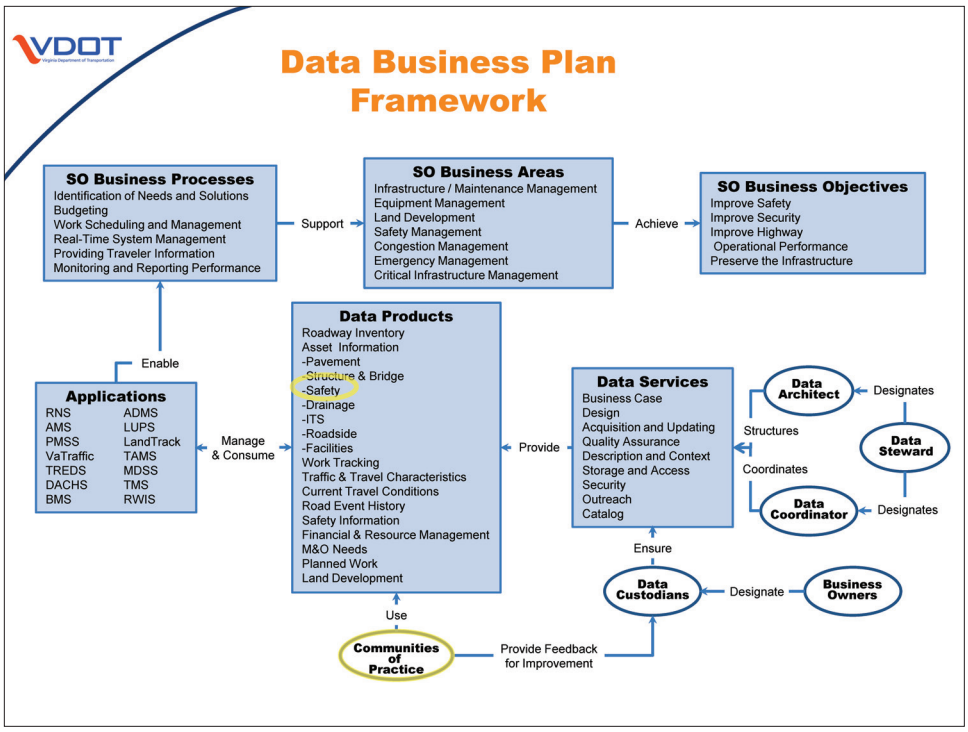
6.3 Traffic and Safety Assets Inventory Communities of Interest

Vanloan Nguyen presented on VDOT's efforts related to traffic and safety assets. She started by describing VDOT's process for developing its biennial needs assessment. The assessment are required by a state law passed in 2002. Prior to the law's passage, VDOT already had systems for managing its pavement and bridges, but relied on a patchwork of different systems for managing its traffic and safety assets. The law resulted in VDOT's implementing an asset management approach, and better characterizing its asset inventory. Regarding traffic and safety assets, VDOT defines 15 different types of assets (not including ITS devices), such as signs, signals, guardrails, pavement markings/ markers, and lighting. For the initial needs assessments VDOT relied on a sampling approach to characterize asset conditions. For the most recent needs assessment VDOT used videolog data to estimate the extent of the inventory.

Vanloan next described the VDOT System Operations Directorate's development of a data business plan. The plan was developed to define what asset and other data are needed and how they are used, improve data availability, and focus

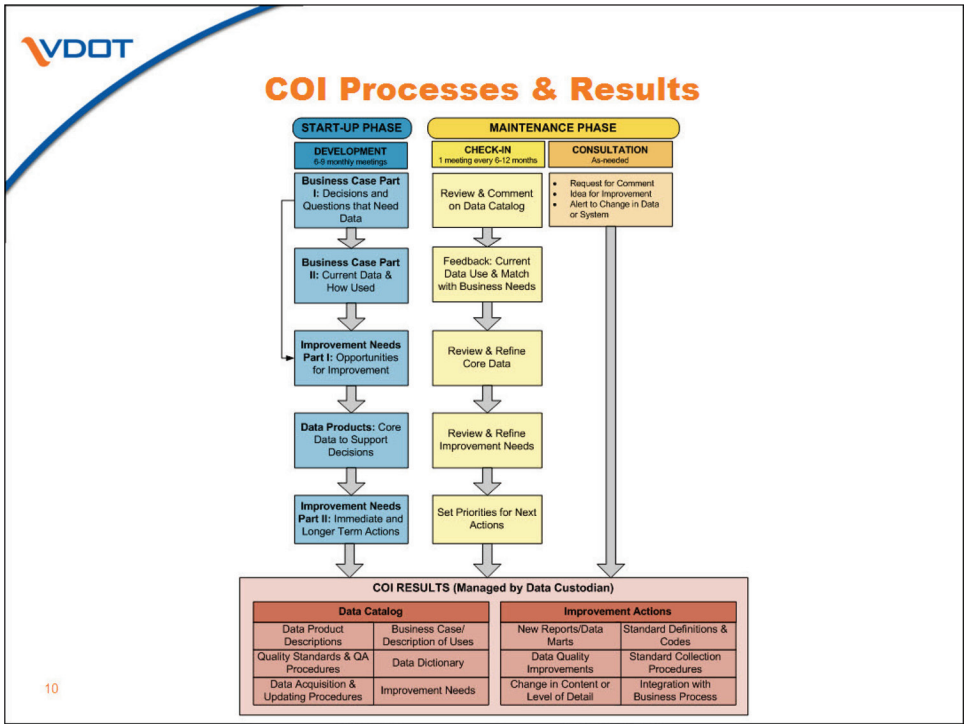
data investments where they are most needed. To develop the data business plan VDOT documented current data created and used for system operations, documented user needs for data, performed a gap assessment, and developed the framework for ongoing data planning and management illustrated in Figure 6.2.

Figure 6.2 VDOT Data Business Plan Framework



The data business plan identified several areas where further work was needed to better define VDOT's data needs. The plan recommended organizing Communities of Interest (COI) to target improvements in specific areas. The COI include representatives from across the agency: district staff, traffic engineering, structures, IT, and others. COI that have been formed include: work tracking and planning, financial data, ITS assets, and traffic and safety assets – which is ongoing. The process followed by the COI and the expected results are illustrated in Figure 6.3. The traffic and safety assets COI has reviewed the needs for asset data and is now developing improvements for traffic and safety asset data, such as defining a standard data dictionary for traffic & safety assets, building an asset data mart, and improving data on asset age and condition.

Figure 6.3 VDOT COI Process and Results



Vanloan concluded the presentation by discussing the inherent challenges in managing traffic and safety assets, summarizing issues related to pavement markings as an example. Even for seemingly straightforward assets there are numerous issues with which to contend, including issues collecting data, evaluating relevant standards, complying with federal requirements, and determining what policies to follow to maximize asset life and improve safety.

6.4 Discussion

Ken Petty asked how states are using public involvement processes for supporting traffic and safety asset decisions. Responses included the following:

- Call databases. These include reports on specific issues and general complaints.
- Surveys used to gauge public opinion.
- Public meetings and town hall meetings, such as during project development or corridor planning, to the extent these may impact traffic and safety assets.
- Outreach to pedestrian and bicycle advocacy groups, as well as to other communities providing feedback on safety.

Neil Pedersen noted that in the case of MDSHA, the call database was useful for building support for improving lighting, and survey results have been useful for identifying needs for improving pavement markings. Neil and other participants agreed that call databases have been the single most valuable tool for public involvement. Other participants reported that surveys and public meetings were the most valuable tool.

The participants then discussed other approaches for identifying safety issues. Nat Coley indicated that in Maryland, the National Traffic Highway Safety Administration (NTSHA) funded a regional safety engineer for helping to identify safety needs, but this is not a common approach. Vanloan Nguyen described VDOT's biennial budgeting process which involves staff from VDOT's central office, its five regions and nine district. The process balances needs between pavement, bridge and traffic and safety assets. Funding decisions on traffic and safety assets are based primarily on the size of inventory (given the lack of condition data). A series of checks and balances is used to make sure funds spend are consistent with plans by district and funding category.

Dave Wresinski described the approach used at Michigan DOT for involving regional office in identification of safety needs. Michigan DOT has a set of system condition goals set for freeway and non-freeway systems. Progress towards the goals is tracked by measure and system for each of Michigan DOT's seven regional offices. Annually, a call for projects is issued. The regions recommend projects, and scrutinize projects recommended by other regions to achieve a balance between regions and help make sure money is allocated where needed to best achieve Michigan DOT's goals. John Milton noted that WSDOT is starting to involve design and operations to review projects at the planning and scoping stage, which has proved useful.

Katie Zimmerman raised the topic of the new MUTCD retroreflectivity requirements. She noted that these may force a standardization of the approach to managing signs, and asked how other participants about the implications of these requirements, as well as about the implications of increased standardization of asset management approaches generally. Jack Stickel added that it is important to consider the impact of having multiple, non-standardized systems for asset/inventory management. Legacy systems, such as NDDOT's, though less advanced than newer systems in many respects, nonetheless enforced a degree of standardization through creation of enterprise linear referencing and standard data items.

Neil Pedersen responded that the retroreflectivity requirements and the standards they create are forcing DOTs to do a better job, but they are an unfunded mandate. Local jurisdictions, in particular, are struggling with these requirements. Scott Zainhofsky expressed concern that, given there are no national goals for asset management, it is difficult to determine what the basis is for standardization of approaches. Is achieving a new standard for sign retroreflectivity really a national goal, or is reducing run-off the road accidents a more important goal?

Other participants echoed Scott's concerns about the retroreflectivity requirements. Ananth Prasad noted that FDOT has made significant investments in safety and preservation at the expense of building additional new capacity, but expressed concern that making additional investments to meet the retroreflectivity requirements may not be consistent with a performance-driven approach. John Milton stated that much of the discussion of retroreflectivity is subjective, and there is a need to better understand what having additional data on retroreflectivity will accomplish, as well as the risks and consequences of changing requirements.

Matt Hardy asked whether there is a need for standard definitions of traffic and safety assets. Responses to this question included:

- There was general agreement that having a standard set of definitions for building an inventory, such as that provided by MIRE, is useful for providing a starting point for building an asset inventory.
- Some participants pointed out that MIRE is not particularly detailed with respect to traffic and safety assets.
- Other participants expressed concern about standardizing definitions too much, noting that the extent of standardization should depend on the tie to performance measures, and that standards may serve as a mandate states cannot afford to implement.

John Milton raised the issue of the approach for handling older assets that do not meet current standards. The theory of defining improved standards and designing new assets to those standards is sound, but more work is needed to determine how we should handle older assets when standards are changed. Is an asset always deemed to be unsafe if it was designed to an older standard?

Hyun-A Park asked about states' motivation for implementing new systems, and the degree to which new systems are used to address organizational issues. Scott Zainhofsky responded that in the case of NDDOT, the replacement of RIMS was motivated by the fact that the old system could no longer be maintained. Also, the old system was cumbersome to enter data into and it was not clear if users were entering data consistently. Neil Pedersen agreed that maintaining data quality is an important issue and asked for more information on NDDOT's experience keeping inventory data up-to-date. Ken Kadrmas responded that the biggest challenge in this regard was training personnel. Districts with personnel trained to use the system are diligent about keeping the inventory (e.g., on signs) up to date, while others are lax in entering data.

Ananth Prasad suggested that NDDOT's experience highlights organizational issues – it is important for the agency as a whole has to understand importance of asset management. In FDOT's case, a mainframe is still used for maintaining the road inventory, but there is a need to migrate the system to continue to maintain the inventory. Migrating to a new system will improve the usability of the system, and allow the system to be more seamless.

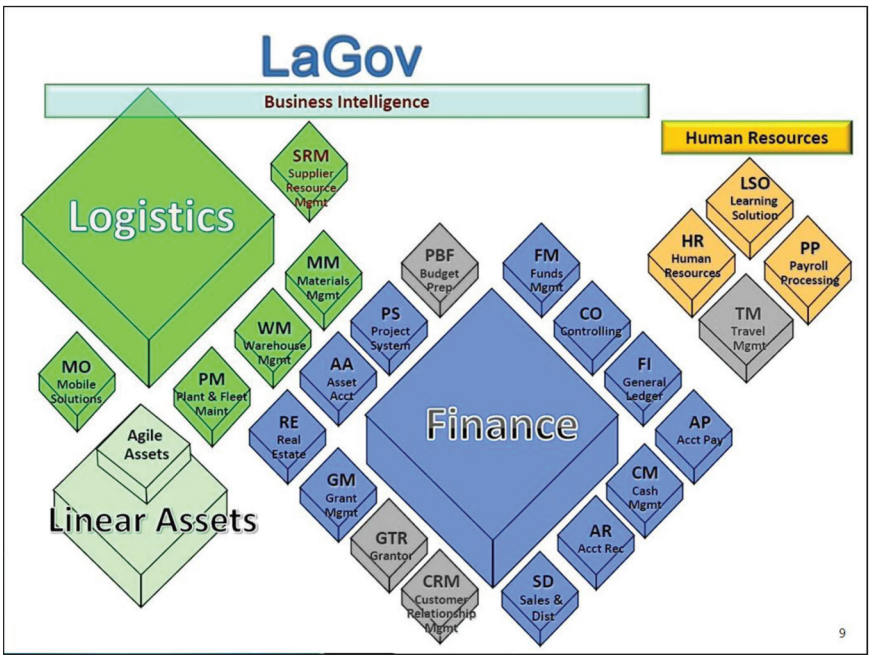
Steve Lindland described ODOT's experience migrating to a new roadway inventory system. ODOT's mainframe system was in production until very recently. It was difficult to get data in and out of this system (for instance, generating a new report might require two months), and ODOT experienced data loss with the system. Now ODOT is using Exor for maintaining its inventory. ODOT expects a number of benefits from the new system, and expects it to be less costly to support. However, Steve expressed concern that it may be costly to add sign data to the system.

7 Safety Asset Management in Context

7.1 ERP Implementation in Louisiana DOTD

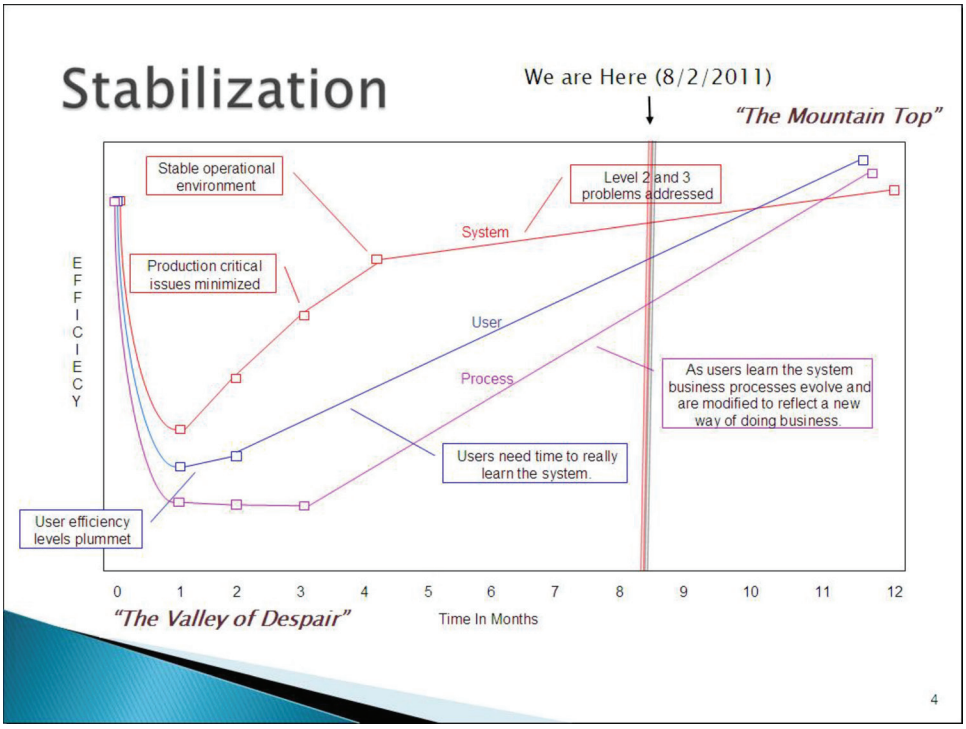
Michael Bridges described the implementation by Louisiana DOTD (LADOTD) of a new ERP system, LaGov, for managing its assets and supporting a range of other business processes. The system is being implemented for all Louisiana state agencies, with the initial implementation performed for LADOTD. Figure 7.1 below illustrates the modules of LaGov, organized into areas of finance, logistics, human resources, and linear assets. The logistics, finance and human resources modules are implementations of SAP, while functionality for linear assets is provided through implementation of Agile Assets. Modules shown in gray have not yet been implemented.

Figure 7.1 LaGov Modules



The go-live data for the system was November 15, 2010. Michael described the benefits and challenges of implementing the system. Early wins have included improving FHWA billing and authorization processes, simplifying the process of obtaining reimbursements from FHWA and the Federal Emergency Management Agency (FEMA), simplifying project structure, improving data visibility, facilitating asset reporting based on General Accounting Standards Board (GASB) Statement 34, and supporting development of an improved asset inventory. Challenges have included data conversion and accuracy issues, registering vendors in the system, supporting needed training, and addressing change management issues and organizational changes. Michael illustrated the implementation process using the idealized graph shown in Figure 7.2. The graph is a depiction of the efficiency of a new ERP in the months following initial implementation. It shows that an organization can expect to see a loss of efficiency when a system is first implemented, followed by improvements over time.

Figure 7.2 Change in Efficiency Over Time Following Implementation an ERP System



Michael also described LADOTD's experience gathering information on other state DOT ERP implementation efforts in 2006 prior to the start of the LaGov implementation effort. Also, he described LADOTD's efforts to build its asset inventory in Agile Assets, starting with populating pavement, bridge, sign and signal data. Lessons learned for LADOTD's ERP implementation include:

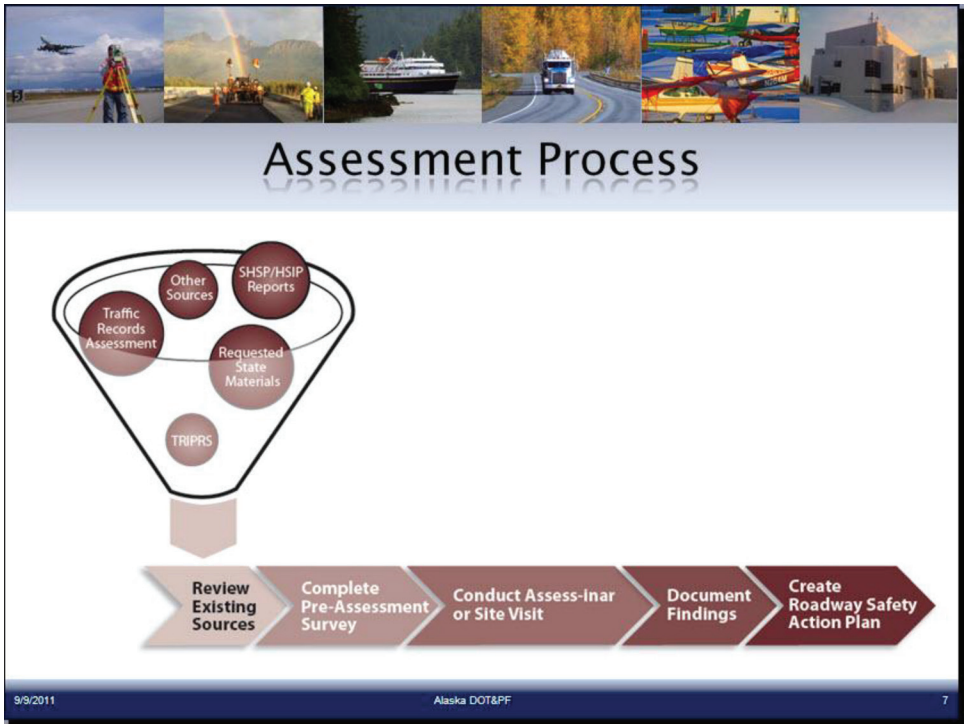
- Keep software as close to out-of-the-box as possible;
- Keep system interfaces to a minimum;
- Devote adequate resources to the implementation;
- Establish a dedicated change management support team; and
- Identify a single point of contact for issues resolution.

7.2 Roadway Safety Data Partnership – Developing Robust Data-Driven Safety Capabilities Through Effective Transportation Asset Management Practices

Jack Stickel described ADOT&PF's participation in the FHWA Roadway Safety Data Partnership (RSDP) program. The purpose of the program is to "improve DOT capabilities to collect, store, and integrate asset management and safety information; to link safety data to non-safety data; and to have a consolidated data program to address highway safety, asset management, and system performance…" The program helps states gauge their safety data capabilities,

establish an action plan, and integrate improvements into state safety plans. FHWA's Office of Safety is working to conduct an assessment with each state between 2011 and 2012. The assessment process is illustrated below in Figure 7.3.

Figure 7.3 RSDP Assessment Process



The process focuses on the following four areas related to safety data:

- Roadway data collection and technical standards
- Data analysis tools and uses
- Data management and governance
- Data interoperability and expandability

Next Jack summarized different FHWA data programs relevant to improving safety data, highlighting MIRE, HPMS, and Crash Data Improvement Program (CDIP). Finally, he described ADOT&PF's efforts to collect digital imagery of the Alaska highway network and develop its location referencing method (LRM). Digital imagery is particularly important for ADOT&PF given how large the state is, and how remote much of the network can be. ADOT&PF staff can use digital imagery to quickly review a visual image of any roadside asset, reducing the need for costly field data collection.

7.3 Asset Management in Iowa: From Promising Start to the "Dark Age" to New Light at the End of the Tunnel

John Selmer provided a history of efforts to implement asset management at Iowa DOT. He started by describing the work initiated in the mid-1990's to improve Iowa DOT's approach to asset management. Efforts that began at that time included:

- Using Roadware to collect detailed pavement condition data, including friction data;
- Exploring development of a preventive maintenance program for pavement, working in conjunction with FHWA;
- Implementing Deighton's dTIMS PMS to support analysis of pavement conditions and needs; and
- Implemented an MQA program based on review of the approach implemented in Florida.
- Initiated development of a new linear referencing system for the entire state, including state, county and local roads. John noted that work on this effort began in 1995 and took 15 years to complete.

After a promising start to implementing asset management concepts, Iowa DOT entered what John described as the "Dark Age," when a series of changes led to a de-emphasis of asset management concepts. The changes were in part a result of new leadership, and in part a result of constraints in funding. The changes included:

- Curtailing of preventive maintenance treatments for pavement. Instead emphasis shifted to thick overlays and paved shoulders.
- Commitment of a large portion of the agency's budget to a small set of corridors (over 60 percent of funds were allocated to approximately 6 corridors). This allocation resulted from a set of political commitments made to those corridors in prior years when budgets were less constrained.
- Staff cuts of 15 percent.

The net effect of these and other changes was that Iowa DOT ceased its progress towards implementing a more strategic approach to managing its infrastructure. In retrospect, the progress made in the mid-1990's was the result of efforts by different people in different offices, and was not the result of an overall implementation plan. Absent high-level support during this period, there was not institutional support for moving forward with asset management concepts. Nonetheless, Iowa DOT continued its efforts to collect pavement data, implement Pontis, and develop its LRS during this time. Districts collected data, but often did not perceive the value in their data collection activities, as they did not appear to influence resource allocation decisions. Beginning in 2005, Iowa DOT leadership began to reemphasize preservation of the existing system, but followed a "worst first" policy for its pavements, continuing to de-emphasize preventive maintenance.

John concluded by describing the recent changes at Iowa DOT. Under new leadership, the agency has recommitted to having a strong approach to asset management, and has once again begun to emphasize asset management concepts. John is now exploring opportunities to provide asset management training to Iowa DOT staff. And application of asset management concepts is badly needed to make the best use of tightly constrained funding – the agency's maintenance budget has remained flat since 2000 – a reduction in real terms considering inflation. Fortunately, the systems the agency began building have remained in use throughout this period, and Iowa DOT has a strong foundation on which to build moving forward.

7.4 Discussion

Participants began the discussion by asking whether the RSDP Jack Stickel described is a self-assessment or FHWA assessment. Jack responded that Alaska DOT&PF expected to obtain observations and recommendations from FHWA, but not a grade. Nat Coley added that the assessment is being conducted as a partnership between state representatives and FHWA, and the purpose is for state use. Jack further clarified that 6 Alaska DOT staff participated in the assessment, and that this required approximately a half-day per person. Butch Wlaschin added that a separate asset management assessment was performed requiring seven to ten days of time.

The discussion then shifted to Iowa DOT's asset management approach. Participants asked John Selmer for more information on Iowa DOT's data collection approach. John noted that Iowa DOT has:

- Quality data on pavements collected using Roadware, including Falling Weight Deflectometer (FWD) data;
- A sign database;
- Van equipped with Laserlux, as well as six handheld units for collecting retroreflectivity data;
- Pontis Bridge Management System for storing bridge inventory and inspection data;
- Statistical approach established for characterizing maintenance features (similar to that used in Florida);
- Mobile Accident Reporting System (MARS) for crash data.

John concluded that overall, Iowa DOT has good data on its assets, and has been able to use the data effectively in some cases, such as for demonstrating a correlation between nighttime pavement marker retroreflectivity and accidents. However, the data are not consistently used to support decisions. John further noted that in some cases an asset management approach can "slap you in the face" by demonstrating the extent of an agency's asset-related investment needs, as well as the gap between those needs and available funds.

Participants then discussed different approaches to communicating asset needs. Neil Pedersen indicated that it is important to consider how to best communicate asset management concepts to non-engineers. A basic approach is to use analogies, comparing a DOT's asset needs to needs for maintaining a house or a car.

Asked about LADOTD's next steps in asset management, Michael Bridges responded that LADOTD will next focus on gaining a better understanding of how funds are expended on its assets. LADOTD also intents to schedule asset management training sessions for its staff, and make use of the recently-published Volume 2 of the AASHTO Transportation Asset Management Guide. Nat Coley offered that the AASHTO Guide and Office of FHWA Office of Asset Management assessments provide a good approach for helping develop a roadmap for making improvements in asset management.

Scott Richrath commended LADOTD for moving relatively quickly to implement its ERP system and moving beyond the "valley of despair" period illustrated in Michael Bridge's presentation. At CDOT, the implementation period was approximately two years, much longer than that at LADOTD. Michael commented that one advantage LADOTD has was that it was the first state agency to go online in Louisiana, in part because its needs were most complex (e.g., for supporting linear assets and federal billing requirements). Nonetheless, implementing its ERP has been a costly effort, and much of the expense has been borne in the initial implementation for LADOTD. Asked for more information on the assets in LADOTD's inventory, Michael further noted the inventory includes roads, bridges, signals, and some signs. LADOTD is now working on adding ITS assets.

Scott Zainhofsky asked whether participants had attempted to use cross-asset optimization for analyzing asset needs. None of the participants had applied a cross-asset optimization approach in their states, but several had established trade-off approaches, in which they defined key performance measures and evaluated what performance would be achieved allocating varying amounts of funding to different asset or investment categories. Neil Pedersen discussed the fact that an agency seeks to shift funds between investments to maximize value, but avoiding asset failure is also important, and it may be that funding cannot be cut below a certain level for certain assets without increasing risk of asset failure. Ananth Prasad agreed with Neil. There is often pressure to move funding out of preservation into areas such as capacity, but it is important to retain a long-term view that considers the cost of keeping assets in operation once they have been built.

Finally, participants discussed the impact of agency leadership on management of traffic and safety assets. There was general agreement that having strong leadership is important, but it is also important to institutionalize a focus on asset management so that best practices are ingrained in the organization. Neil Pedersen and Steve Lindland both discussed the fact that agency leadership must be responsive to the political issues. Nonetheless, in their experience in Maryland and Oregon, respectively, there had been strong political support for an asset management approach despite changes in agency leadership.

8 Peer Exchange Wrap-Up

Steve Gaj discussed the mission of the AASHTO Subcommittee on Asset Management, and of the FHWA Office of Asset Management. In both cases there is an emphasis on advancing the state of the practice in asset management, and in making effective use of data to support decision-making. Steve suggested that some of the key items that emerged from the current peer exchange included how to:

- Establish an asset management approach as a way of doing business
- Collect and use data on traffic and safety assets to improve safety
- Improving asset inventories and data quality. MIRE provides a useful starting point for building an inventory.

Steve then reiterated the five questions posed by Neil Pedersen at the beginning of the peer exchange, and emphasized the need to continue to improve approaches for managing traffic and safety assets, particularly for improving safety. Finally, Steve thanked AASHTO and the Office of Planning for the sponsorship of the peer exchange.

Ananth Prasad noted additional themes and questions that emerged from the meetings, including:

- Success stories in implement an asset management approach: a number of presenters described agency successes.
- Standardization of asset data. To some extent standardization is useful, but it is important to learn from other states in this regard.
- Using data to support decisions. Many agencies can be described as “data-rich, information-poor” (DRIP). It is important to consider what data are really needed, and how data will drive better decisions. When deciding what data to collect it is important to ask “what are we collecting data to tell us?”
- Carrying asset management philosophies from the management of pavement and bridges to management of traffic and safety assets.

Meeting participants closed by discussing other upcoming national and regional meetings that peer exchange participants may wish to attend, and at which FHWA and AASHTO may wish to summarize outcomes of the peer exchange.

9 Appendix A: Survey Summary

9.1 Overview

An on-line survey of AASHTO members and FHWA stakeholders was conducted during the run up to the peer exchange. The primary purpose of the survey was to identify topics of interest for discussion, and to support the overall objectives of the peer exchange, including:

- Share lessons learned and best practices in managing safety assets
- Identify approaches to better incorporate asset management objectives into a safety programs
- Discuss how to structure policies and incentives to reflect best practices in asset management and safety

The results of this survey provided insight into issues of high importance for states and were used to focus and enhance discussion at the peer exchange. Survey questions addressed issues such as:

- Current practices linking asset management and safety
- Challenges faced in integrating asset management and safety
- Key stakeholders with respect to asset management and safety
- Use of safety asset data
- Data collection and management

In order to obtain a range of representative responses, electronic links to the on-line survey were sent to a large number of potential respondents, including:

- Peer Exchange Attendees
- Subcommittee on Asset Management
- Standing Committee on Highway Traffic Safety (SCOHTS)
- Standing Committee on Planning (SCOP)
- Standing Committee on Highways (SCOH)
- FHWA AM State Contacts

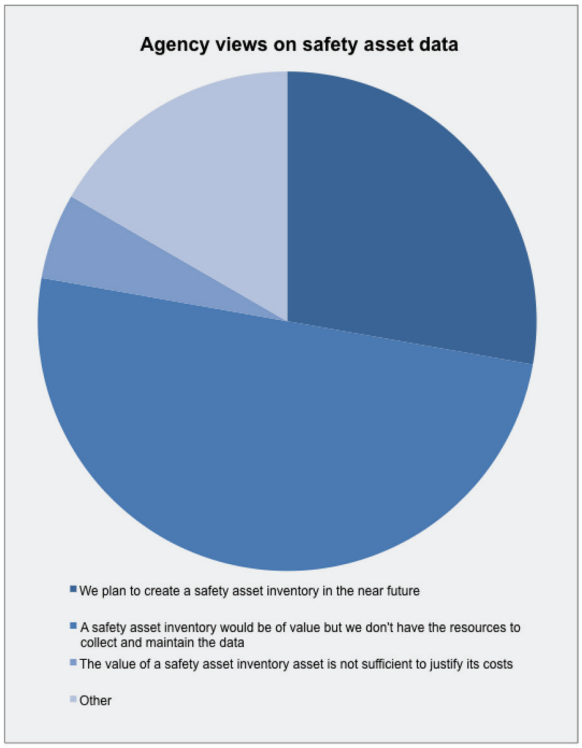
The total response rate was strong with 81 responses from 39 states. It is worth noting, however, that this total includes anonymous and/or incomplete responses. Several states were represented by more than one respondent. The histograms in the following section display numerical values indicating unweighted counts of responses. For many questions, multiple responses were permitted (i.e. respondents were requested to “Select all that apply”).

9.2 Survey Summary

This section presents some of the key findings of the survey. It presents charts displaying responses to select survey questions and includes illustrative examples of respondents’ comments.

9.2.1 Which of the following best describes your agency's views on safety asset data?

- *We plan to create a safety asset inventory in the near future*
- *A safety asset inventory would be of value but we don't have the resources to collect and maintain the data*
- *The value of a safety asset inventory asset is not sufficient to justify its costs*
- *Other*



There were 18 total responses to this survey item. Although survey respondents reported that a safety asset inventory would be of value, lack of resources is a significant obstacle for respondents.

Most comments regarding agency views on safety asset data indicated that efforts were underway to create or expand data inventories. A minority of comments indicated that costs are too high to justify the investment in a safety asset data inventory. Sample comments are given below:

"We are investigating methods, including resource requirements, to collect required data for HSM implementation. Some roadway inventory data exists, but the extent of current data and use for safety purposes has not been quantified."

"North Carolina maintains 80,000 miles of roadways. The amount of effort to collect and maintain such data would not be worth the investment."

"We are looking in to the possibility of adding the "Safety Module" to our existing Agile Assets system."

"We are working on it."

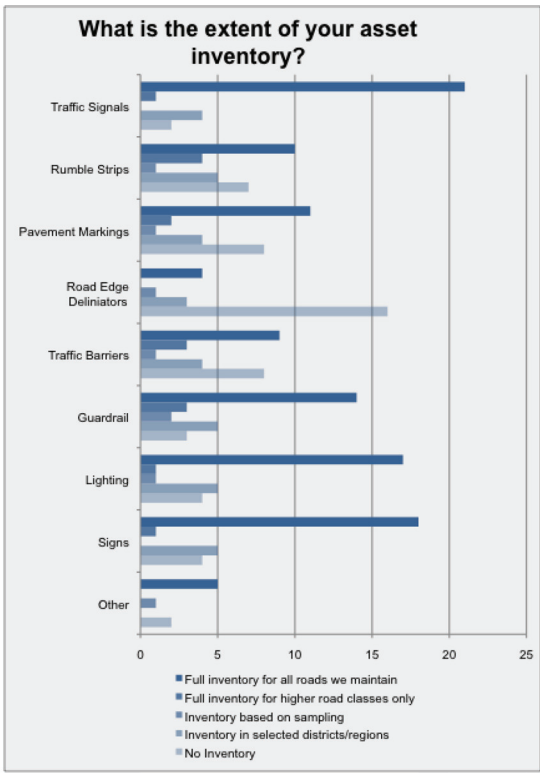
"GDOT has a maintenance system called HMMS that is used to document maintenance performed on all safety hardware, signs, pavement markings, etc. that are completed by in-house forces. It is not a comprehensive record of all our assets."

"The need has been recognized but the costs to implement is more labor and resource intensive than is possible with the current state of the state and federal funds."

"Efforts will be made to create inventory of certain items."

9.2.2 What is the extent of your asset inventory?

- *Full inventory for all roads we maintain*
- *Full inventory for higher road classes only*
- *Inventory based on sampling*
- *Inventory in selected districts/regions*
- *No inventory*



There were 29 total responses to this survey item. Survey respondents reported the most robust inventories for traffic signals, signs, and lighting. Guardrail was also well represented among the states reporting full asset inventories. In contrast, road edge delineators were not robustly inventoried. In fact, many respondents reported that they were not inventoried at all.

Sample comments are provided below:

"The question was answered for inventory programs that are ongoing. In several of the categories we have just begun the inventory process; therefore the database is not yet complete. Other types of inventory items include: 1) Culverts 2) Rest areas 3) Turnouts 4) ITS (Intelligent Transportation System) devices: traffic sensors, road weather information system sites, dynamic message signs, weigh stations, etc."

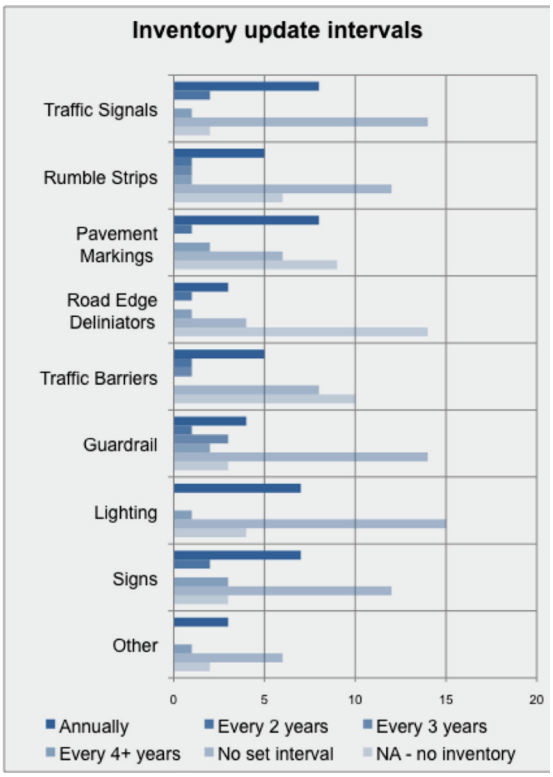
"NJDOT maintains over 70 assets in our highway feature inventory for all roadways and ramps we maintain."

"Full Inventory for Sidewalks, Bike Lanes, ADA Ramps - must think multi-modal safety, not just motorized vehicles."

"All of the above data we collect, except pavement markings and delineators, are in a Department-wide, integrated database utilizing a common referencing system. However, the Districts are responsible for updating these inventories; therefore, the consistency of some assets between Districts is not fully robust. Both delineators and pavement marking are housed in independent "data stores" in the various Districts. Rumble strip data are housed in the integrated database; however, we recently moved to inventorying centerline and shoulder/edgeline rumbles in addition to intersection rumbles, with varying degrees of completeness by District. We only maintain condition information for traffic signals, signs, and high mast lighting."

9.2.3 How often do you update your asset inventory?

- *Annually*
- *Every 2 years*
- *Every 3 years*
- *Every 4+ years*
- *No set interval*
- *NA — No inventory*



There were 29 total responses to this survey item. For most assets, the most common response indicated that asset inventories were updated at no set interval. However, those respondents who did report that asset inventories were updated at a set interval overwhelmingly reported that this was done on an annual basis. This was the case for nearly all assets, with guardrail a notable exception.

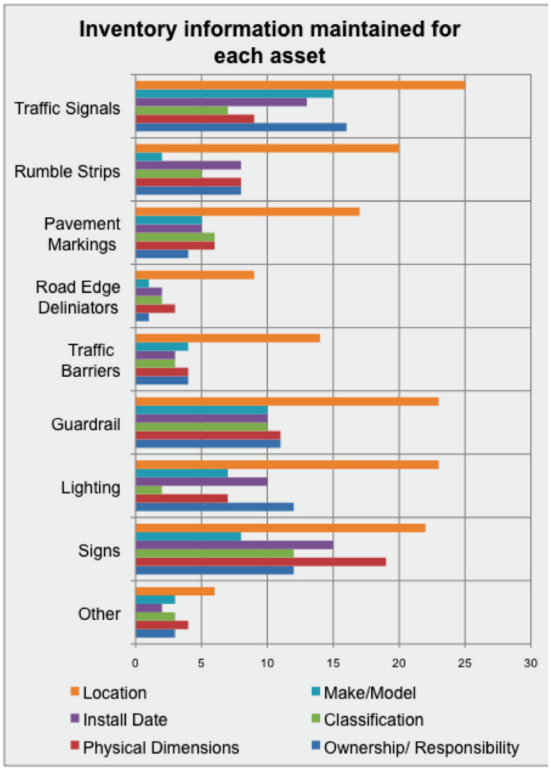
Typical responses to this survey item are:

> *"All of the above assets are updated on an on-going basis, as appropriate. We do not have specific field-verified inventory cycles. The updates are made as changes occur or as new condition inspections are done."*

> *"Some assets are inventoried annually, however our feature inventory is conducted between every 4 and 5 years."*

9.2.4 What inventory information do you maintain for each asset?

- *Location*
- *Make/Model*
- *Install date*
- *Classification*
- *Physical Dimensions*
- *Ownership/Responsibility*



There were 29 total responses to this survey item. Respondents reported the location data to be the most common data type for all assets. It is notable that for each asset, each data type was reported by at least one respondent. Most comments identified additional asset types that fell into the category "Other." These included: pipe culverts, ITS devices, turnouts, ADA curb ramps, and impact attenuators. Some responses provided additional detail, elaborating upon the inventory information maintained for a given asset. A representative sample of responses appears below:

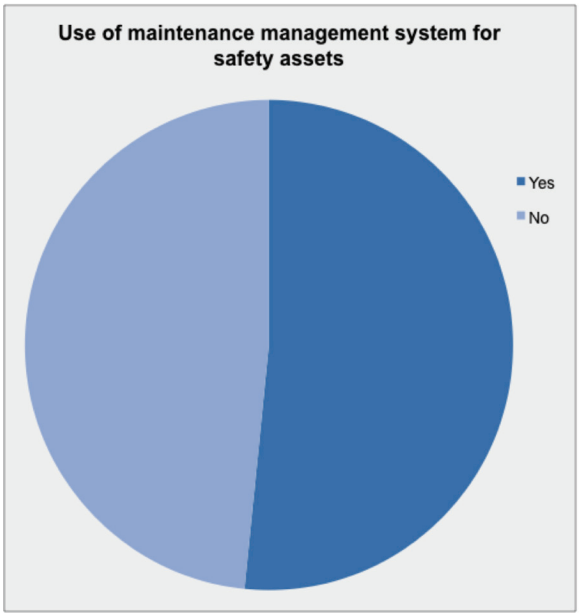
"Data stored locally provides additional characteristics. Inventory information may reflect aggregate quantity within or at a Location. Classification at broad grouping, e.g. cable vs. steel beam guiderail."

"Lighting is inventoried, a inspection is underway and anticipated to be completed in 2015. "

"The feature inventory was initially conducted to populate our Highway Maintenance Management System (MMS). MMS has unpopulated fields for most of the above information (it was never loaded)."

9.2.5 Do you use a maintenance management program for safety assets?

- *Yes*
- *No*



A total of 31 respondents answered this survey item. An approximately equal number of respondents reported that a maintenance management program was used for safety assets as reported that a maintenance management program was not used for safety assets. Of the respondents that did report the use of a maintenance management program for safety assets, there was no clear consensus as to the specific system or type of system used. Responses ranged from custom-built systems, to off-the-shelf programs, to Excel spreadsheets.

All respondents' comments addressing the specific systems used for this purpose appear below:

"We will be using a Maintenance Management System upon completion of implementation."

"Future effort."

"Excel Spreadsheet"

"We track work performed on assets through our Highway Maintenance Management System"

"MAMIS and Cartegraph"

"AgileAssets; went live November 2010, Guardrail is maintained by contract"

"MATS, a tool developed in cooperation with New Hampshire and Vermont"

"Maximo"

"Our NJDOT Highway Maintenance Management System (MMS)."

"Highway Maintenance Management System (HMMS) developed in-house for GDOT"

"Custom built systems"

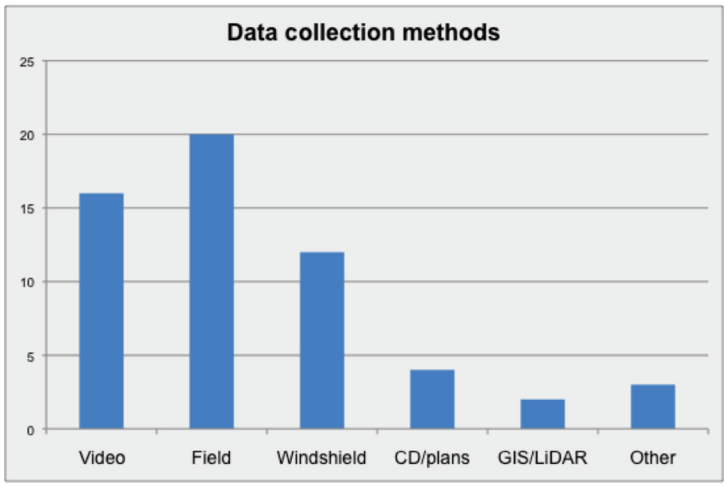
"Booz-Allen & Hamilton's HMMS"

"In the effort to upgrade the sign inventory system MDOT is looking at an enterprise solution to be applied to many of its assets allowing for contract and work order updates to the various inventories."

"Agile Assets"

9.2.6 What data collection methods do you use?

- *Video*
- *Field*
- *Windshield*
- *CD/Plans*
- *GIS/LIDAR*
- *Other*



A total of 26 respondents provided a response to this survey item. Respondents primarily reported the use of manual field inspections and video for data collection. Most responses indicated that manual field inspections were used in combination with one or more additional data collection method. One respondent reported that video was the sole data collection method used, while another respondent reported the use of all data collection methods listed.

Sample responses are provided below:

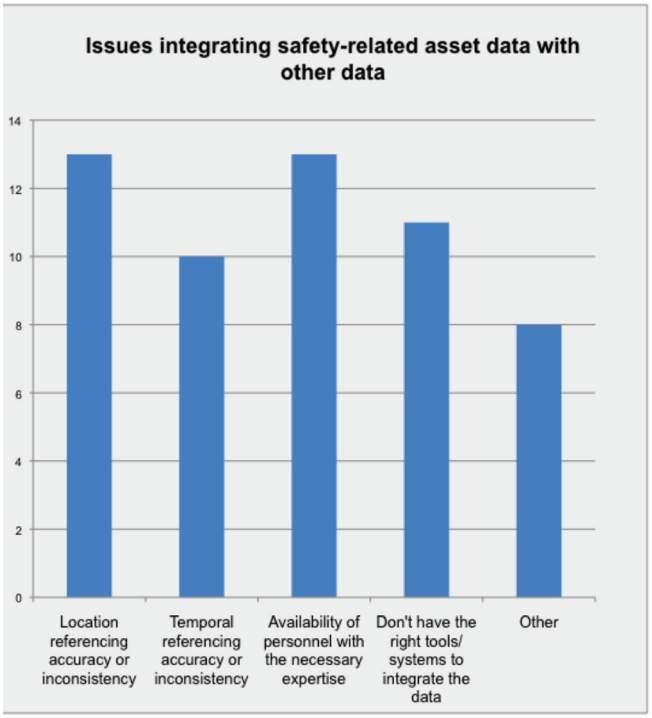
> *"Guardrail-Traffic Barriers-Sidewalks-Bike Lanes-ADA Ramps: Initially video-based followed up with field verification & additional field data collection & condition assessments. This was found to be a very cost-effective plus had personal safety benefits as staff did not have to be in the field as much nor near traffic as much. Reduced inventory time by over 50 percent. Also Sign Data Collection from Construction Contract Plans and Manual Field Inspection."*

> *"Manual field inspections for impact attenuators; windshield surveys at night for sign and pavement marking visibility on periodic basis (not using inventory; deficiencies generate work orders that will be entered into HMMS when work is completed)."*

> *"In-house staff primarily inventory pavement by driving the system. Non pavement roadway assets are primarily handled by in-house staff via GPS and ArcGIS Server technology."*

9.2.7 What issues have you faced in integrating safety asset data with other data?

- *Location referencing*
- *Temporal referencing*
- *Availability of personnel*
- *Availability of tools/systems*



There were 30 total responses to this survey item. Respondents reported that issues with location referencing accuracy/consistency, temporal referencing accuracy/consistency, availability of trained personnel, and availability of tools/systems had all been faced in integrating safety-related asset data with other data. For these four issues, the response totals were quite closely clustered. However, accuracy of location referencing and availability of trained personnel were the top issues identified by respondents.

In regards to accuracy of location referencing, an illustrative response was:

> *"Clearly getting everyone to use the enterprise linear referencing and road centerlines is our biggest challenge. There are often stovepipe applications developed that are very good, but there is no effective way to overlay data from these systems onto the enterprise centerlines. Even such simple data points as crash locations become problematic - the linear measures just don't match up. Even a difference of several hundredths of mile can put a crash on the wrong side of intersection. What is scary about this situation is there is no warning or obvious error flagged. The crash simply can wind up on the incorrect side of an intersection."*

Several respondents identified availability of personnel with the requisite expertise as a key issue. An illustrative response for this issue was:

> *"MDOT needs a coordinated effort across the department with increased communication and a champion to lead the effort due to the strong interest from all areas wanting to implement/improve their asset management."*

An additional response addressed multiple issues:

> *"Various people in our department collect data, however the ad-hoc approach to its collection makes the data useful for one particular group and not useful for others. The most important item for safety analysis is the location of the asset data, however in some instances a lot of other data about the asset COULD be collected. The need to manage data collection expectations to meaningful items must be addressed otherwise we will be collecting a lot of data that does nothing to enhance the safety analysis process (and potentially limit other data collection efforts due to lack of*

resources). Identifying what data is required and what is optional to collect would be a good start, unfortunately with some of the national desires for data collection the "more data is better" approach seems to be the current trend."

9.2.8 How have you used your safety asset information?

There were 30 total responses to this survey item. Again, response totals were quite closely clustered for most of the uses listed. However, project scoping emerged as the top use identified by respondents. Maintenance work planning and scheduling was the next-most frequently cited use. While at least one respondent indicated that safety asset information was currently not being utilized, many respondents identified several current uses of safety asset information. One illustrative response was:

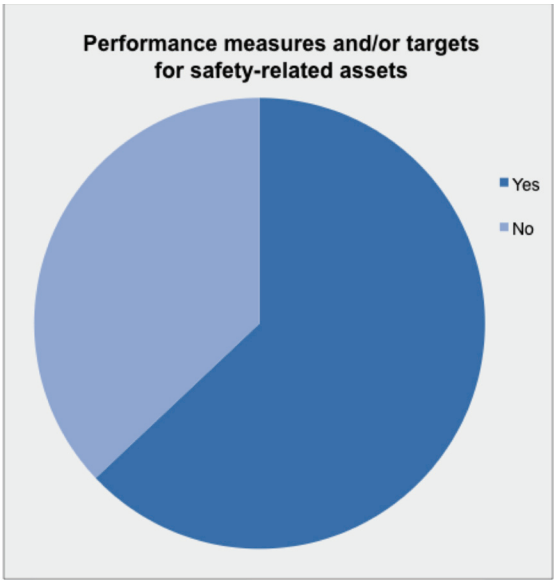
"Budget Development - The assets are reviewed to determine the value of replacement and with life cycle enable the department to set budgets for traffic signals, signs, and pavement markings. Safety Countermeasure Identification - see previous. Project Scoping - the asset information is used during the scoping of projects to determine what safety items in the limits of the project need to be replaced/ relocated/ upgraded. Project Prioritization - for traffic signal, sign, and pavement marking projects the life of the asset is used to assist in setting priority with other like projects. Maintenance - the asset information is a great help to determine what items are required in a replacement or repair of an asset."

Another example was:

"Performance Rating - we have a traffic crash goal and use the asset information to correlate the countermeasures deployed through the safety program and what impact it may have had on the overall crash distribution. Strategic Highway Safety Plan Development - The asset data is used to assess the level of installation of various safety devices on our network (i.e., miles of cable median barrier). It also provides a benchmark for correlating the impact of safety devices on the severity of crashes occurring on our road network. Project Scoping - Asset data is consulted when scoping 3R jobs to determine if any upgrades or installation are required while work is being done on this particular stretch of road."

9.2.9 Has your agency developed performance measures and/or targets for safety-related assets?

- *Yes*
- *No*



There were 27 respondents who provided a response to this survey item. Nearly two-thirds of respondents indicated that their agency had developed performance measures/ targets for safety related assets. The comments provided by respondents addressed this question at different scales (enterprise, asset-type, etc.) and with varying degrees of specificity. A sample of typical comments is provided below.

"There are three levels of ADOT&PF performance indicators: (1) those that are part of the Governor's Alaska Priorities, (2) the Department-level performance measures. and (3) the work center performance measures. The ADOT&PF performance measures for this are listed on the State of Alaska Office of Management and Budget web site and are reflected in dashboard format on the ADOT&PF home page, The Alaska Priorities, Department, and work center performance measures are part of the Performance Electronic Tracking System (PETS) on the internal ADOT&PF web site. The two key safety-related asset performance measures are: 1) Increase the centerline miles of National Highway System (NHS) roads that meet Department standards 2) Decrease the % change in bridge deck area of structurally deficient or functionally obsolete bridges."

"For multi-modal Sidewalks and Bike Lanes, performance measures reported annually to state legislature to monitor the completion of these two systems."

"Measures and targets have been set for signs to meet the new MUTCD requirements. Our other condition data is too spotty to be used to set targets and measures. Currently, we use our inventory to tell us "where", "how many", and in some instances to identify potential countermeasures for safety emphasis areas."

"MQA process measures many safety features, including signs, guardrail, pavement markings, delineators, and even illumination (although we get illumination in less than 1% of our samples)."

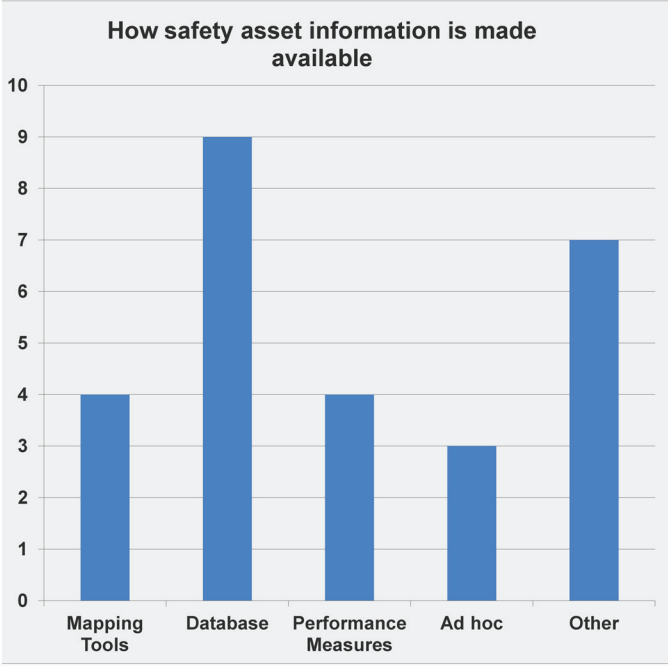
"Signs - replacement cycle of 15 years to meet MUTCD retroreflectivity requirements. Traffic signals and overhead sign structures - inspection cycles Pavement Markings - minimum levels of retroreflectivity at installation"

"All safety related features have direct performance measures tied to them"

"Not sure, we have a performance measure for crashes but not aware of a safety related asset performance measure"

9.2.10 How is safety asset information made available to stakeholders?

- *Mapping tools*
- *Database*
- *Performance measures*
- *Ad hoc*
- *Other*



There were 22 respondents who provided a response to this survey item. Most respondents indicated that safety asset information was made available through a database not directly associated with mapping or geospatial tools. While the second-most frequently given response was "Other," a number of respondents indicated that mapping tools and performance measure reporting were used for this purpose. Additional responses indicated that this information was generally made available on an ad hoc basis. A selected set of responses is provided below:

"Utilizing an Oracle database with reports."

"Through various software applications within the department."

"Through GIS maps and standard reports."

"High Accident Location reports and maps are available as well as analysis tools."

"On a case by case basis"

"Electronic Performance Measures and Reports. Commissioner's office issues a report every 2 years."

9.2.11 What has your agency's annual average expenditure been over the past five years on safety-related asset inventory and condition assessment – including both in-house and contracted resources (ballpark figure)?

There were 19 total responses to this survey item, which was an open-ended question. The wide range of responses is notable, as is the difficulty reported by several respondents of producing a ballpark estimate for this figure. All responses are included to illustrate the variety of interpretations and total estimated expenditures.

"not sure."

"Has not been tracked but will be with new MMS"

"$500,000"

"$700,000"

"$1M - this is a very rough estimate...."

"$1.5 million per year."

"Asset inventory is done in conjunction with normal work duties of personnel. $200,000 ???"

"Safety is the Number 1 priority in our SHOPP. Approx. $250 Million per year"

"unknown"

"I have no idea and doubt we could "ballpark" this figure given how decentralized this activity is.."

"Our feature inventory (all features, not just safety related) and overall data maintenance is approx. $2.3 Million."

"Unsure"

"Just started last year, ~ $20,000"

"$1.2 Million"

"not available"

"Not available at this time."

"Don't have time to look up."

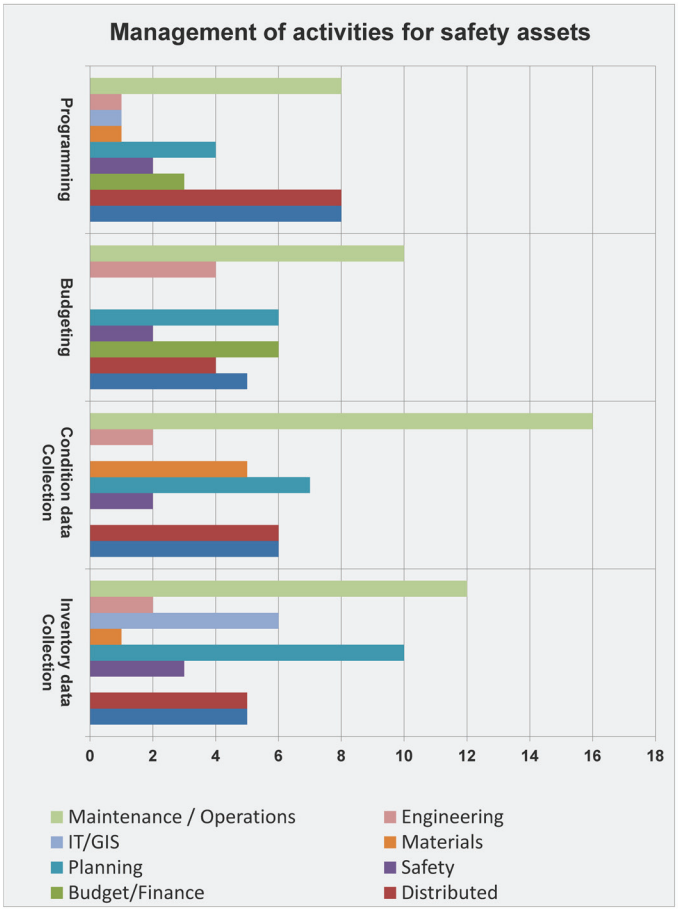
"$ 6 million."

"$ 500K +/-"

9.2.12 Which office in the State DOT manages the following activities for your safety assets?

There were 34 total responses to this survey item. Responses indicate that the most common location for the management of activities for safety assets is an Agency's Operations and Maintenance division. This was the case for all activities, most notably for Condition Data Collection. In contrast, Programming was least concentrated with Operations and Maintenance merely cited with the same frequently as Distributed (multiple locations) and Other. Planning was another frequently cited location for management of activities for safety assets.

Few comments were provided for this survey item. Those comments that were recorded primarily elaborated on agency-specific nomenclature used to refer to a given activity or business unit.

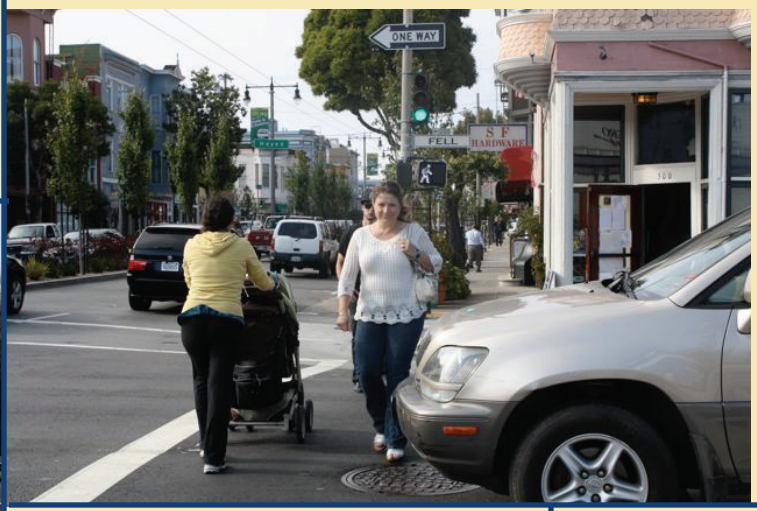


9.2.13 What questions do you have for your peers related to asset management and safety?

Respondents provided a number of common responses to this final open-ended question. These focused on:

- Experiences and best practices related to data collection, data management, database integration, and geo-referencing
- Experiences implementing transportation asset management and
- Cross-asset prioritization/optimization analyses that include safety assets
- MIRE guidelines
- Funding

Respondents expressed interest in learning more about specific data collection technologies and the advantages and disadvantages of each. Respondents were clear that they not only sought information on best practices but also wanted to hear from their peers about critical obstacles and how these were addressed.


ONE WAY
FELL
S F
HARDWARE