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Tools and Practices for System Wide Safety Improvement

Gap Analysis Report

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1. Introduction

> **A Focus on Performance-Based Management**
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> The last two decades have brought about many changes in government policies and practices that serve to encourage accountability and transparency in the management of taxpayer resources and improve the effectiveness and efficiency of government programs. The Government Performance and Results Act (GPRA) of 1993, followed by the Performance Assessment Rating Tool (PART) requirements, and the GPRA Modernization Act of 2011, have pushed federal agencies to collect comprehensive data on their program activities and report progress more frequently. Over the same time period, many state and local agencies also expanded requirements for measuring and reporting progress. These requirements have prompted government organizations at all levels to expand their use of data analytics. While government agencies have improved their data collection and analysis activities, many still struggle to link data collection to strategic decision making. New legislation, Moving Ahead for Progress in the 21st Century (MAP-21), was signed into law in July 2012. MAP-21 emphasizes the use of performance-based management for federal funding of transportation projects. This legislation contains provisions that will shape the performance-based management framework within the Department of Transportation, and broadly supports the Department's safety agenda.

The Federal Highway Administration (FHWA) is dedicated to promoting a performance-based management approach for the highway safety community. Once established, this approach will support FHWA's Safety Focused Decision Making Framework (herein also referred to as the Framework) by translating measureable goals and objectives into highway safety investment strategies, priorities, and actions at the programmatic level. To ensure maximum effectiveness, this Framework relies on consistent monitoring, reporting, evaluation, and improvement of performance goals to promote achievement of the desired safety performance across the entire roadway system – resulting in improved roadway safety nationwide.

There are a great variety of products and projects that have been developed or are being developed to assist state Department of Transportations (states) and Metropolitan Planning Organizations (MPOs) in predicting the safety impacts of various inventories of safety projects, tools, activities, and strategies. While there are differing levels of maturity along the safety planning and prediction implementation curve, most states and MPOs are not consistently predicting the safety outcomes of a suite of projects, tools, activities, and strategies at the programmatic level.

Although the programmatic approach to safety planning has yet to be broadly adopted, many states are setting performance targets to reduce fatalities and serious injuries (among other performance measures) as part of their overall roadway safety planning efforts. This study is part of a larger FHWA effort to examine the transportation safety planning environment and establish a model for program-level safety planning. The larger effort focused on first synthesizing current methods to incorporate performance management techniques in transportation planning efforts, and describing nationally available data analysis tools that support state and local efforts to plan, monitor, and report safety outcomes. The second major element of the effort included a series of in-depth case studies focused on identifying notable practices and tools used to assist states and MPOs in planning safety projects and measuring performance against established performance goals and targets.

Report Objective

This report identifies the gaps between the current safety planning environment as it relates to projects, current tools and activities, and the desired future state as defined by FHWA's Safety

Focused Decision Making Framework. It builds on prior work, tying together sub-elements (i.e., synthesis report and case studies) of the larger FHWA effort, and injects new ideas yielded from a Safety Planning Peer Exchange event attended by 13 subject matter experts representing a variety of perspectives and backgrounds. Finally, this report aims to assist federal, state, and MPO transportation planners achieve their established safety performance goals by recommending activities that could be used to expand knowledge of this topic and implementation of best practices across stakeholder groups.

Methodology

This report is part of a larger step-wise gap analysis that builds off sequential efforts and associated findings. First, the project team identified available performance management tools for roadway safety and described how states and MPOs were using them. Then, the team identified existing processes used to conduct performance management analysis and safety impact projection. Next, case studies on the application of available roadway safety predictive tools and processes were crafted, focusing on applicability in supporting a system-wide prediction of effects of safety investments on the accomplishment of performance measures. The findings were then shared as part of a Safety Planning Peer Exchange, which, through facilitated discussions, helped FHWA refine the Framework for the improved future state.

As described earlier, this report defines the gaps between the current state and the desired future state, and introduces various bridging options that may help overcome current obstacles. The project team will then develop a short guidance document and training program to educate FHWA Division Office safety planners, engineers, and other staff on the opportunities and proposed methods to improve safety planning and performance management practices. The intent of the training is to provide FHWA Division Office staff with information and tools to assist their states and MPOs in evaluating their safety performance management framework and begin forecasting the outcomes of their combined safety investments at a programmatic level.

Report Structure

This report is organized into six sections, including the *Introduction*. Section 2, *Baseline of Current Safety Planning Environment*, reviews the current tools and processes available for safety planning, and describes some of the challenges associated with their implementation. This section also includes a description of current funding sources and opportunities. Section 3, *Safety Focused Decision Making Framework* explains the desired safety performance environment as outlined by experts at the Safety Planning Peer Exchange. It also includes a discussion on fostering a safety culture through the use of change management best practices to encourage the adoption of the Safety Focused Decision Making Framework, Moving Ahead for Progress in the 21st Century (MAP-21) requirements, and various other enhancements to the environment. Section 4, *Identification of Gaps*, covers both current and anticipated gaps between current and future states of transportation safety planning. Section 5, *Suggested Bridging Options*, describes various bridging options to help overcome existing gaps. Finally, the report ends with Section 6, *Summary and Next Steps*.

2. Baseline of Current Safety Planning Environment

Measuring the impact of specific roadway safety countermeasures has historically been a challenge. This challenge is exponentially increased when attempting to measure the impact of a suite of countermeasures in a region or corridor. Expansion of predictive modeling and analysis actively support the evaluation and updating of Strategic Highway Safety Plans (SHSP) that establish statewide goals, objectives, and key emphasis areas and integrates the four Es – engineering, education, enforcement, and emergency medical services. This section focuses on those tools and processes commonly used by states and MPOs to improve safety outcomes.

Available Tools and Processes

A number of nationally available safety analysis tools were identified that can be utilized to support roadway safety performance planning. A full listing of tools reviewed is presented in *Appendix B: Tools Supporting Safety Impact Prediction* and described in more detail in the *Final Synthesis of Available Predictive Tools and Processes*, prepared as an earlier deliverable for this project. In the context of this report, tools include technical assistance materials on websites, computer-based spreadsheets and models, or geo-locating systems. The majority of these tools have been directly supported by FHWA, whether through research, funding, development, training, dissemination, or promotion. Although these tools serve different purposes, each provides transportation planners and engineers with data and information that can be used to enhance safety considerations during the transportation planning process. Table 1 presents a listing of the tools used most frequently by states and MPOs. The table provides a synopsis of each tool's primary purpose and a brief overview of where/how these tools are being applied. Although these are the most popular tools, they still have challenges associated with them and those challenges may also indicate why other tools are not as commonly used.

Table 1: Summary of Commonly Used Tools

Tool	Primary Purpose	Application Overview
Crash Modification Factors (CMF) Clearinghouse	This web-based repository provides information on all documented CMFs and Crash Reduction Factors (CRFs) in a central location to help transportation professionals properly estimate the crash reduction of selected countermeasures when applied to projects.	The CMF Clearinghouse is easy to use and provides guidance as to what CMFs have been successful in other places. Additionally, it highlights those factors that have considerable supporting research regarding their successful implementation.
FHWA Geographic Information System (GIS) Tools	This GIS software links safety event data such as crashes and geographic data such as roads and roadway features to allow for advanced spatial analysis and mapping.	The FHWA GIS Safety Analysis Tools are a suite of tools developed on the ESRI ArcGIS platform to allow for advanced safety analyses along specific roadways or road networks. This is done by linking various data elements that may impact safety performance through a common geographic reference system.

Tool	Primary Purpose	Application Overview
Highway Safety Manual (HSM)	The HSM provides a framework for safety that aids practitioners in performing data analysis, selecting countermeasures, prioritizing projects, comparing alternatives, and quantifying and predicting the safety performance of roadway elements during the planning, design, construction, and operation phases of project development.	The HSM provides a method to integrate quantitative estimates of crash frequency and severity into planning, project alternatives analysis, and program development and evaluation. This ability to connect quantifiable data with safety outcomes allows safety to become a meaningful project performance measure. The HSM assists states and MPOs in creating and achieving goals, objectives, measures, and activities, as well as determining the proper tools for data collection and analysis. It allows for full adoption or adoption of one or more parts based on the capabilities and needs of state or MPO.
SafetyAnalyst	SafetyAnalyst is a set of computerized analytical tools to identify safety improvement needs and supports use of cost-effectiveness analysis to develop a system-wide program of site-specific improvement projects.	SafetyAnalyst offers among the most advanced analysis capabilities and can be used to improve programming of site-specific roadway safety improvements. The tools integrate with the HSM and other performance analysis processes. It follows the full cycle of the roadway safety management process, starting at the ground level and moving all the way through to evaluation.

Beyond the tools described in Table 1, more states are moving toward using a systemic approach to roadway safety. This approach involves implementing low-cost, proven improvements based on high-risk roadway features correlated with specific severe crash types (e.g., installing shoulder rumble strips to keep vehicles from encroaching on the roadside or designing safer slopes and ditches to prevent rollovers if a vehicle travels off the shoulder). The systemic approach is particularly valuable on local or rural roadways where the traditional site analysis approach is difficult due to limited crash data or dispersed crash locations. This approach looks at crash history on an aggregate basis to identify high-risk roadway characteristics, which can then be used to determine different strategies that might be implemented in a widespread manner to reduce the potential for severe crashes over large sections of roadways.

FHWA is preparing to release guidance in August 2013 on using the new Systemic Safety Project Selection Tool[1]. Guidance will include a step-by-step process for conducting systemic safety analysis, analytical techniques for determining a reasonable balance between the implementation of spot safety improvements and systemic safety improvements, and a mechanism for quantifying the benefits of safety improvements implemented through a systemic approach.

Challenges with Available Tools and Processes

While each tool is useful in its own right, not all of the tools can be used by all states or localities due to innumerable differences between the states and localities. Differences impacting use of the tools can be categorized as either organizational or geographical in nature. Organizational differences are largely affected by an organization's maturity in collecting/managing data and cultural acceptance of working within a performance management framework when making transportation planning decisions. The geographical differences are primarily impacted by population density, traffic volume, and road type. Again, it is important to note that across these two categories, even those tools that are used most commonly have a diverse set of challenges associated with implementing them, often unique to a particular state or MPO.

Organizational Challenges

An organization's capacity to adopt safety analysis tools and/or performance measures and performance management techniques should be assessed to identify potential issues. Implementation of tools and processes can be inhibited if an organization cannot support the development of metrics, secure stakeholder and staff support, or facilitate analysis and reporting. Some of the organizational capacities required for successful integration of safety analysis tools and performance management practices are described below:

Data Management

Organizations must first collect good data before they can fully utilize safety analysis tools or performance measures. When using safety analysis tools, it can be a challenge to obtain genuinely useful data. A transportation department cannot realize a tool's full worth without first confirming that all necessary data to use as inputs to the tool are available in the required format.

In support of safety planning, states have been collecting and analyzing crash data for years. However, some states are less advanced when it comes to the collection and analysis of roadway and traffic data to support safety planning. Several resources that can be used to assist states with expanding their data collection processes are discussed in *FHWA's Background Report: Guidance for Roadway Safety Data to Support the Highway Safety Improvement Program*.

Data availability and collection protocols should be regularly assessed during the early stages of collection. Ongoing assessments help to ensure that all required data is obtainable and accurate. This "data baseline" can fuel an analysis of any data gaps and helps mitigate decision making reliant on poor, misleading, or non-existent data.

Reporting Structure

The reporting process should clarify the frequency of reporting, roles and responsibilities for report generation, and the intended audience. This ensures that safety, roadway, and traffic data

[1] Information at: http://safety.fhwa.dot.gov/systemic/index.htm

are reported in a manner that supports use of safety analysis tools and processes. The appropriate reporting structure for performance measures should be documented as the performance measures are being developed or revised by safety planning experts. Using process maps, schedules, or drafting a reporting plan prior to implementation clarifies how the performance measures will be used and enhances reporting processes. Furthermore, efficiencies can be gained by leveraging existing reporting requirements as a platform to share findings and progress. For example, states are already required to provide the National Highway Traffic Safety Administration (NHTSA) with annual reports for 11 core outcome and behavior measures. Reports on goals and progress are included in state Highway Safety Plans and Annual Reports. Some states, such as Washington and Connecticut, provide online quarterly performance reports through their state Department of Transportation (DOT) websites. Other states may choose to provide internal performance reports to transportation executives or lawmakers. However, given the emphasis on increasing transparency in government, states should consider proactively making at least annual performance reports available to the public like NHTSA does with the Highway Safety Plan reports.[2]

Human Capital

Assessing the characteristics of an organization with regard to its skill level and experience in data collection and analysis is essential to the successful application of most of the tools. It was reported that representatives from states and MPOs feel that staff are not being appropriately trained to use new tools upon their release. In cases where staff and key stakeholders do not have adequate knowledge or experience analyzing or reporting performance data, extensive training should be conducted prior to implementation of any safety planning tool. Furthermore, without proper training, it is difficult to differentiate between what is potentially the most useful tool, or set of tools, and what may otherwise be less effective. This leads to stagnation and prevents innovative processes and practices from taking hold as some states and MPOs feel as if they are being over inundated. Constraints on staff's time are often so burdensome due to various daily demands of the job that unless immediate potential benefits from investing time/resources in researching and learning a new tool are readily available, that tool is often overlooked as an asset to the safety planning process. That is, generally, safety planners are so busy that they do not have the time to take on a new tool and are not properly incentivized to do so.

Organizational Willingness

Organizational willingness is a key variable in planning processes. Counteracting low organizational willingness requires strong leadership; clear mission, vision, and goals; and a well-defined organizational structure. In the absence of these attributes, the adoption of these tools may not be readily accepted by an organization. Impediments to an organization's willingness to embrace new tools include:

- Cultural Resistance – Organizations that do not encourage an open or progressive culture, often find that staff are resistant to adopting new tools, technology, and work practices. To counteract any resistance, participant feedback should be solicited from across the organization to ensure that staff are able to air their concerns and feel a sense of ownership regarding any changes to management or planning processes.
- Stakeholder Resistance – Stakeholders may resist the use of some tools as they are uncomfortable with the increased transparency or administrative burden that the application

[2] NHTSA posts State Highway Safety Plans, State Annual Reports, and Management Reviews/Special Management Information at: http://www.nhtsa.gov/nhtsa/whatsup/SAFETEAweb/index.htm

of data-driven performance management creates. To counteract this resistance it is important to enlist the input of stakeholders to gain their support while selecting tools. Stakeholders should be heavily involved in testing and target setting as a way to familiarize them with the tools and to give them a feeling of ownership. Resistance is also combated by educating the stakeholders on the particular benefits of using the tool(s), as well as the potential project tradeoffs required to bring a larger overall safety benefit.

- Administration Priorities – A change in an organization's broader priorities or focus can diminish the intended effectiveness or implementation of a tool. A well-developed roadway safety performance management process allows the organization to understand how to get the best value out of each countermeasure and the safety outcomes they can expect from those countermeasures. Some states and MPOs experience political pressures for selecting a particular project or program over another that may contradict the logical value proposition. This represents a challenge in the strategic or planning prioritization process of the organization, but does not reflect the effectiveness of the predictive tool itself.

Leadership support and ongoing communication activities are critical to overcoming the potential pitfalls outlined above. An organization's senior leadership should approve the final set of tools and communicate to staff their importance. Engagement at all levels of an organization improves the likelihood of adoption and use of the most effective tools in future planning and decision making.

Geographical Challenges

Population density, be it urban versus rural areas, different concentrations of pedestrian/bicycle traffic, or different road types all impact the applicability of each tool. Large urban areas with higher concentrations of bicycles and pedestrians may face a greater number of fatalities within these roadway user groups. These areas are more likely to use the pedestrians and bicycle safety tools than a rural area.

Traffic volume also impacts tool utilization. For example, the Interactive Highway Safety Design Model (IHSDM) was initially designed for rural roads and has only recently expanded to include multilane roadways and suburban/urban arterials. IHSDM's initial focus on rural roads inhibited its early adoption by states that place a greater emphasis on urban roadway data collection and analysis. Similar to the initial release of IHSDM, the U.S. Road Assessment Program (usRAP) may work better for certain types of roads than others. The usRAP Road Protection Score (RPS) protocol that generates risk ratings based on roadway design features is typically documented with video logs. This time intensive method of collecting one-time data is most applicable to county and local road authorities that often do not have sufficient crash data to perform risk analyses.

Although high level performance measures (e.g., fatality rate) are not likely to vary by geographic difference, differences arise when states use varying definitions for crashes involving serious injuries or use unique methods to normalize data (rates per vehicle miles traveled [VMT], per population, per registered driver; proportions of crashes, injuries, or fatalities with some characteristic, such as the proportion of fatalities that are pedestrians). The number of performance measures used also varies widely from state to state. Some states report on as few as 14 measures while other states may report on over 100 measures.[3]

Variation in the numbers of and types of performance measures are due to any number of considerations. States are better positioned to track and report a mix of performance measures if they have a longer history of collecting safety data and have developed a strong organizational culture. Other states may be in the early stages of refining data collection methodologies or expanding performance measures. Despite different starting points, all states benefit from learning more about available safety analysis tools that can be used in conjunction with a performance management framework to improve safety outcomes. A move toward standardization, either by adoption of similar tools or performance measure best practices, may improve the culture of performance management among state and local government regardless of demographic differences.

Funding

Transportation safety funding comes in two forms: funds specifically designated for safety improvement projects and money designated for other purposes that has a related safety impact. These different funding channels have disparate impacts on how funds are used. Direct safety funding, like Highway Safety Improvement Program (HSIP) funds, usually has specific requirements recipients must fulfill in order to be granted funds. Money not designated explicitly for safety usually does not carry such specific safety requirements.

State DOTs are the recipients of federal safety funds and, for the most part, by means of their own choosing, distribute money to local groups. When funding is not specifically designated for safety, transportation groups may seek alternate methods to maximize safety gains. Although not a tool per se, alternate methods of funding safety projects offer opportunities to advance safety outcomes outside traditional funding channels. This section offers examples of strategies that transportation organizations have taken to fill funding gaps and insert safety considerations into broader transportation projects that are not typically considered safety projects.

[3] NHTSA requires states to set goals and report progress annually on 10 core outcome measures, one core behavior measure, and three activity measures.

Safety Funding Innovation

Developing and maintaining databases to house safety, roadway, and traffic data takes time and money. Given that federal and state funding may be limited by economy, and not all transportation project funding includes a safety component, funding innovations and alternate sources of funding may help state and local transportation organizations maximize safety gains. Exploring alternate funding sources and alternatives to incorporate safety in infrastructure projects is especially important when transportation appropriations slow or decrease.

As state DOTs and MPOs enhance their performance management processes, they are better positioned to demonstrate the success of their projects using available analysis tools to link data and results. By showing a clear link between robust data, predictive tools, project selection, and safety outcomes, these transportation organizations may be better positioned to compete for limited funds.

Maximizing Safety without Specifically Targeting Safety

Outside of specific roadway safety projects funded through HSIP, states and MPOs often report difficulties directly addressing roadway safety. A state or MPO may not directly target safety when faced with other pressing priorities, such as roads and bridges in disrepair. In these instances, states and MPOs may be able to integrate safety in construction and maintenance projects not typically considered safety projects. As states seek to achieve their safety goals, safety improvements should be considered as a core element in roadway project planning.

The Funding Paradigm: A Focus on Source Expansion

Funding opportunities may exist outside of the traditional appropriations or funds distribution process. The Orange County Transportation Authority (OCTA) successfully used the political process to fund transportation projects through a dedicated sales tax approved by the voters of Orange County. Involving transportation users (citizens) in the decision-making process may improve acceptance of new projects paid for through dedicated tax dollars.

Michigan's Department of Transportation (MDOT) set-aside funds have been valuable for the implementation of projects outside of the ascribed equity-based structure. Set-aside funding provides for greater flexibility in implementing projects that correct known problems. When using set-aside funding, organizations must clearly define the project selection criteria. Once defined, this process may work well for funding multiple low-cost, high-priority projects or a few high-cost projects with a higher expected safety impact.

Colorado's Department of Transportation (CDOT) has shown that safety can be implemented in non-safety projects. During the project design phase, CDOT identifies ways to maximize safety on projects not traditionally considered standalone safety projects.

Key Takeaways

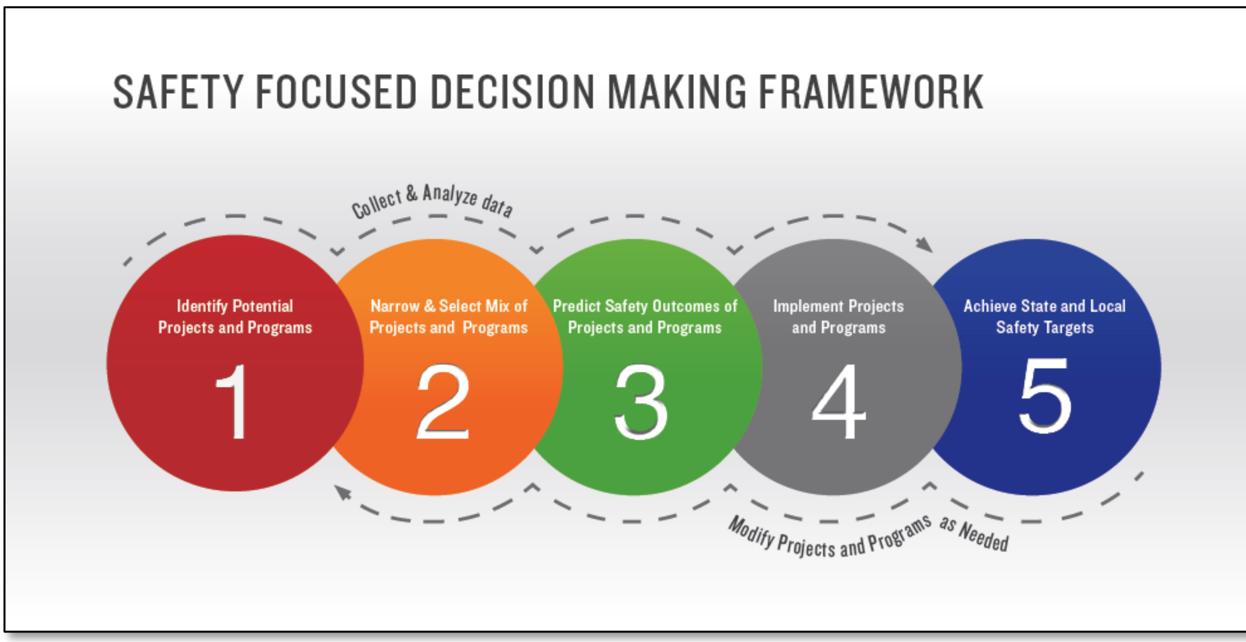
- While there are a variety of helpful roadway safety planning tools available to safety planners, some are used more commonly across the states and MPOs
- Common challenges limiting use of safety planning tools can be grouped into two categories, organizational and geographic, both with common contributing factors
- Even those tools that are used most commonly have a diverse set of challenges associated with implementing them, often unique to a particular state or MPO
- As funding for safety programs becomes more challenging to secure, safety planners must expand beyond the traditional sources upon which states and MPOs currently rely and reach to include new, innovative revenue streams

3. Safety Focused Decision Making Framework

In the future, FHWA envisions a safety planning process where transportation organizations are able to optimize the selection of roadway safety infrastructure improvements across a roadway system and use performance management practices to track progress and achieve safety performance targets. This report seeks to promote FHWA's Safety Focused Decision Making Framework as it takes a more holistic programmatic approach to traditional safety planning.

The Framework, depicted in Figure 1, is defined by five high-level activities with continuous feedback loops for data collection and analysis and project modifications to enhance safety impacts. The steps below would follow the broader planning process and assume that States and MPOs have already defined their Vision and Mission. The project identification described below would support development of and attainment of goals.

Figure 1: FHWA's Safety Focused Decision Making Framework



For the Safety Focused Decision Making Framework, States and MPOs will begin by identifying a list of potential projects, programs or strategies that will serve as the foundation of the larger safety program. Then, they will work to refine that list through a prioritization exercise designed to select the activities best suited to affect the greatest safety impact for the available funds within the given transportation environment. Following prioritization, the prediction of the safety outcomes will help provide the necessary justification for funding and implementation of the selected mix of projects, programs and behavioral strategies. Once approved and funded, states and MPOs will then work to implement the selected activities. As states and MPOs mature this process, their data collection and analysis and evaluation of program effectiveness will improve. Use of robust data sets combined with use of safety planning tools, processes and best practices allows transportation organizations to increase the accuracy with which they predict the impact of certain activities; identify the most effective approaches and will support their program evaluation frameworks, weeding out the least impactful projects and more effectively driving decision making.

Leveraging the new Safety Focused Decision Making Framework is essential to closing the current gaps as well as to achieve an improved safety planning environment. By improving the way states and MPOs conduct safety planning activities at a programmatic level, FHWA will be able to better promote the most effective new tools and practices to its various stakeholders and partners. Additionally, it will yield more robust data sets that enhance the predictive capabilities of safety analysis tools, given different parameters.

Identify Potential Projects and Programs

Selecting the right projects and programs to undertake at the appropriate times is a necessary component to improving transportation safety. Safety project selection methods vary depending on the organization, but commonly used practices include hot spot or spot analysis, road safety audits, systemic approach, and benefit/cost analysis. Adoption of specific practices generally depends on the organizational capabilities and available resources, including staff with analytical skill sets and access to the necessary sources of data. The challenge is leveraging the available data to formulate a mix of projects that lead to an effective safety program.

One notable practice is mandating performance measurement as a requirement for all program activities. Data-driven decision making and continuous review of performance is deeply ingrained in Washington State's Department of Transportation (WSDOT). Their project selection process stems in large part from state policies and governance structure, and supports the organization's emphasis on using data to drive safety program decisions. All program and project selections must be aligned to the Governor's SHSP goal of zero fatalities and serious injury collisions by 2030. This goal is also referred to as Washington's Target Zero Program. One difference between Washington State and many other state DOTs is that the Washington State Legislature specifically directs WSDOT to develop methodologies for selecting state roadway investment projects to address deficiencies on the state roadway system through Chapter 47.05 of the Revised Code of Washington (RCW). The code requires that the project selection methodologies be based on factual need and an evaluation of life cycle costs and benefits.

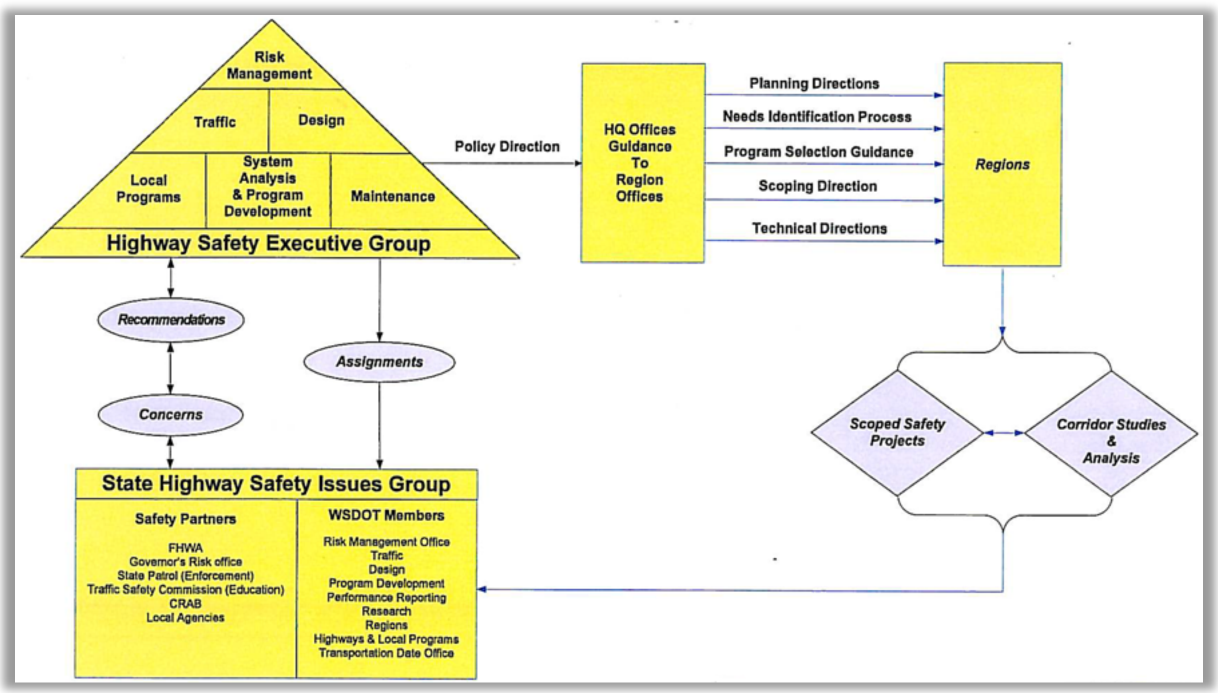
Based on this directive, WSDOT evaluates the full life cycle costs and benefits of all proposed projects in order to select projects that offer the greatest performance per dollar spent. Projects are evaluated within categories of funding so that potential safety projects are evaluated against other safety projects and capital improvement projects are evaluated against other capital improvement projects. WSDOT is currently designing and testing a Collision Assessment Tool (CAT) that automates much of the life cycle cost-benefit calculations for safety projects. When fully implemented, CAT will help WSDOT safety engineers and transportation planners more easily (1) calculate the expected crash frequency on outlined segments of roadway and intersections and (2) evaluate the economic effectiveness in cost/benefit ratio format of countermeasures.

Although WSDOT uses tools and calculations to support decision making, no decisions are made based on tools alone. Expert judgment is still an important component of the transportation planning and project selection process. WSDOT involves senior leaders and executives to help guide project selection and review performance of the state's transportation system. WSDOT's Highway Safety Executive Committee (HSEC) and its Highway Safety Issue Group (HSIG) are heavily involved in the strategic level project selection process. HSEC is a six-member executive policy team representing the major WSDOT Divisions and offices. HSEC is responsible for identifying roadway safety risks; program policy and procedures; project ranking and prioritization methods; risk and crash reduction countermeasure policies; budget targets, operations and design considerations; research and data priorities; and safety program and performance assessments.[4] HSEC approves and implements all departmental policies and procedures for planning, program development, project development, and operations of the WSDOT highway safety program in support of the governor's transportation safety policy and in accordance with the WSDOT strategic plan.

HSEC relies on WSDOT's Highway Safety Issue Group (HSIG) to provide technical expertise and recommendations on the development of policy, plans, and programs for roadway safety. HSIG members include safety experts and advocates that represent headquarters offices, the regions, and FHWA.[5] Specifically, HSEC has directed the WSDOT's Capital Program Management Office to complete an analysis of network safety performance every two years as the initial step in building the next biennium's capital budget. New locations that emerge from this analysis are sent to region offices for in-depth analysis to determine if there is a cost-effective set of solutions that can be proposed for programming.

The relationship between the two safety groups and the overall project selection and review process is captured in Figure 2.[6]

Figure 2: WSDOT Highway Safety Decision Making Process



4 WSDOT, *Highway Safety Executive Committee (HSEC) Charter* (Washington, January 2012).

5 WSDOT, *Highway Safety Issues Group (HSIG) Charter* (Washington, September 2010).

6 WSDOT, *State Highway Decision Making Process* (Washington, September 2009).

As illustrated in the figure, Washington State executives and engineers work together to provide guidance to regional offices in support of safety project selection. WSDOT's safety experts and engineers play an important role in identifying the locations and corridors on state roadways with the highest history of collisions and the greatest potential for improvement. Results of data analysis are incorporated in a strategic set of cost effective recommendations presented to HSEC. Recommendations are intended to address the engineering as well as enforcement and educational factors to reduce or prevent fatal and serious injury collisions. HSEC in turn uses these recommendations to develop policy direction and communicates guidance to regions. While not captured on the diagram shown in Figure 2, WSDOT discusses findings and recommendations with the public and solicits their feedback and support as part of the project selection process.

Although HSEC retains the ability to recommend un-programmed projects that were not included in the State Transportation Improvement Program (STIP), the group rarely exercises this option in practice. In lieu of an un-programmed project approach, WSDOT has instituted the creation of a minor capital safety category within the Traffic Operations budget to handle emerging safety situations with low cost interim solutions. If a larger scope of work is needed, WSDOT will consider it as part of developing the program for the next biennium. HSEC has also directed WSDOT's Capital Program Development and Management Office to recommend extra preliminary engineering efforts. This enables the department to more quickly identify new safety projects for implementation in the event that cost savings from other projects or additional funding comes available to fund those additional projects.

Narrow & Select a Mix of Projects and Programs

States and MPOs will almost always have a longer list of desired projects and strategies than money available to complete each of them. This necessitates a method of prioritizing activities to select those most important to complete in the short and longer term. The results of this prioritization are contained within the fiscally constrained STIP or TIP.

The Atlanta Regional Commission (ARC)[7] has developed an approach to evaluating potential projects and placing projects into one of four tiers to allow for easy comparison. This is a notable practice that could be adopted by others. ARC follows a two-stage process for identifying projects for inclusion in its RTP, contained within its long-range plan named PLAN 2040. Funding allocations are made for each of the program areas. ARC's project evaluation and prioritization process is then used to determine the priority of projects in line with available funding. During the first stage of the prioritization process, all potential projects are screened for alignment to the regional goals and visions. Projects might be discarded for reasons including not being on a regionally significant corridor; not addressing an immediate safety need; project type is not considered a priority under Georgia's Statewide Strategic Highway Safety Plan; project is already part of the Transportation Improvement Program (TIP); and significant engineering, environmental documentation, or acquisition is already underway.

[7] ARC is the regional planning and intergovernmental coordination agency for 10-counties (Cherokee, Clayton, Cobb, DeKalb, Douglas, Fayette, Fulton, Gwinnett, Henry, and Rockdale) and the City of Atlanta.

Projects that pass the first stage of evaluation are then evaluated and scored based on performance measures and expected benefit-cost analysis. Performance measures are calculated to determine each project's impact in each one of five categories including:

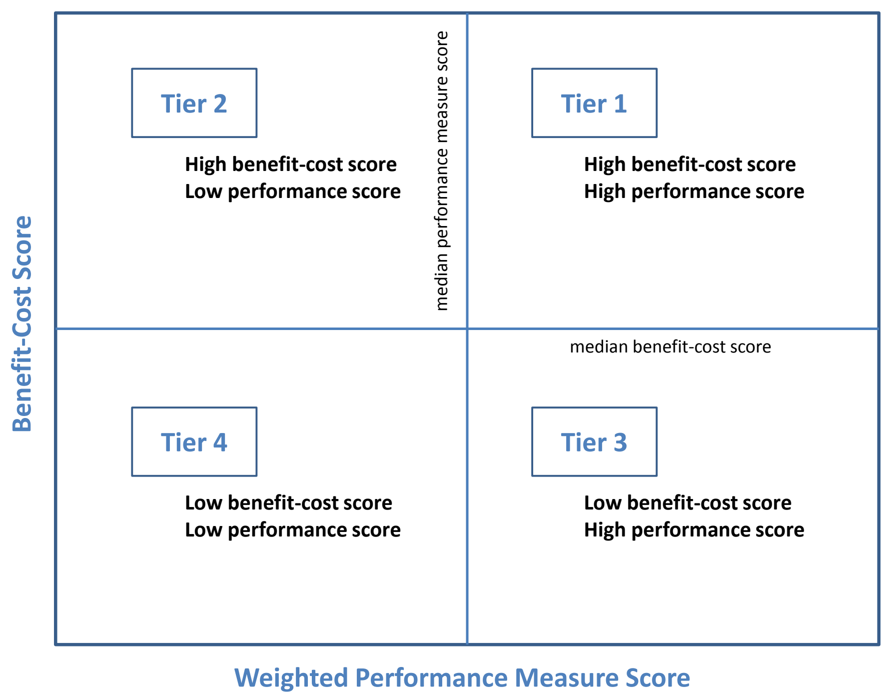
- Mobility – Project's impact on congestion
- Connections – Project's impact on movement to regional centers
- Safety – Location's safety record based on a comparison of the location's crash rate to the crash rate of a similar roadway segment elsewhere in the region
- Economic growth – Project's impact on economic development and freight movement
- Environment/Community Impact – Location's proximity to environmentally or culturally sensitive land uses

Each project receives a score for each of the five categories. The maximum score that a project could receive in any category is 100, and scores for other projects are scaled between 0 and 90. Higher numbered scores are given to those projects expected to provide the greatest impact on congestion, safety, economic growth, or least impact on sensitive land use areas.

After assessing each project's projected performance, ARC monetizes impacts and externalities for each project and conducts benefit-cost calculations. Inputs to ARC's benefit-cost equation consist of the following:

- Project Construction
- Project Maintenance & Operations
- Fuel Cost
- Delay Cost
- Criteria Pollutants
- Greenhouse Gas Emissions

Figure 3: ARC's Plan 2040 Project Evaluation Tiers



Benefit calculations are weighted toward congestion and travel time improvements and do not include a safety component. ARC tracks trends in crashes and fatalities but does not set specific performance targets for safety metrics. ARC instead considers safety as a component of project selection in the broad sense and the majority of programs funded by ARC include safety elements.

The second phase of ARC's project prioritization process involves placing projects into one of four tiers based on a combination of each project's performance measure score and the benefit-cost score. The four tiers are diagramed in Figure 3.[8] Projects in Tier 1 scored above the median

[8] ARC Regional Commission Plan 2040, Regional Transportation Plan, Appendix C-1 Project Evaluation Procedures

in both benefit-cost and performance evaluation while projects in Tier 4 scored below the median in both fields and are considered the least qualified projects. Projects in Tiers 2 and 3 scored mixed results – scoring above the median in one field and below in the other. In 2011, ARC funded all projects in Tier 1 and Tier 2. Remaining money was used to fund a few projects in Tier 3.

ARC is now conducting a data analysis effort that will culminate in customized profiles for member cities and counties. Each profile will provide information about crash rates by transit technologies as well as data findings and information related to the Georgia Department of Transportation emphasis areas. ARC intends to use these profiles to expand conversations with its local partners about ways to improve the evaluation and selection of safety projects. Over time, ARC envisions integrating CMFs and elements of the HSM into planning discussions with local members.

Predict Safety Outcomes of Projects and Programs 3

Predict Safety Outcomes of Projects and Programs

Safety planners have traditionally relied on a tool, or set of tools, supported by crash data to help them predict the impact of a particular safety improvement project or strategy. These tools were discussed at length in Section 2 of this report. The challenge for states and MPOs moving forward will be leveraging existing tools, given limited data sets, to begin predicting safety impacts across a suite of projects. That is, FHWA is encouraging organizations to take a more holistic approach to their planning processes and begin predicting outcomes at the programmatic level.

To effectively predict outcomes at the programmatic level, the outcomes for each individual project within the program must first be defined. One emerging method to accomplish this is conducting a detailed cost-effectiveness analysis for each potential project and then comparing the results to identify those with the largest pay-off in terms of lives saved and prevention of serious injuries. Elements of the analysis should include a score to quantify severity of each problem that a project would be designed to address, a score to quantify the effectiveness of an individual countermeasure given the parameters of the problem, and a cost score. Projects can then be grouped by these data points according to project type (the 4 Es). From there, they can be aggregated to form a broader understanding of how different combinations of projects may overlap or achieve additional improvements. It is important to note that simply adding up potential savings will not provide an accurate picture of the actual impact of a group of projects at the program level due to unintentional/unforeseen outcomes and overlaps. More research is needed to define a broadly accepted method for calculating the expected safety outcomes across multiple projects within a program portfolio.

Missouri's Systematic Approach to Safety

As FHWA encourages states and MPOs to take a more holistic approach to safety planning and to begin predicting outcomes at the programmatic level, Missouri is a prime example of one state that has been successful in identifying and implementing system-wide improvements. Their Blueprint to Arrive Alive, which is the state's SHSP, identifies their "Targeted 10" strategies in education, enforcement, engineering, and public policy areas. These strategies were selected based on documented evidence supporting their lifesaving and injury reduction potential. Out of these 10 strategies, five are engineering countermeasures that are being implemented on a system-wide basis.

Missouri is improving safety by implementing proven countermeasures for roadways with particular characteristics to reduce the risk of future crashes. Rather than selecting a project for one location, they are selecting a countermeasure to apply at a more programmatic level across larger sections of roadway.

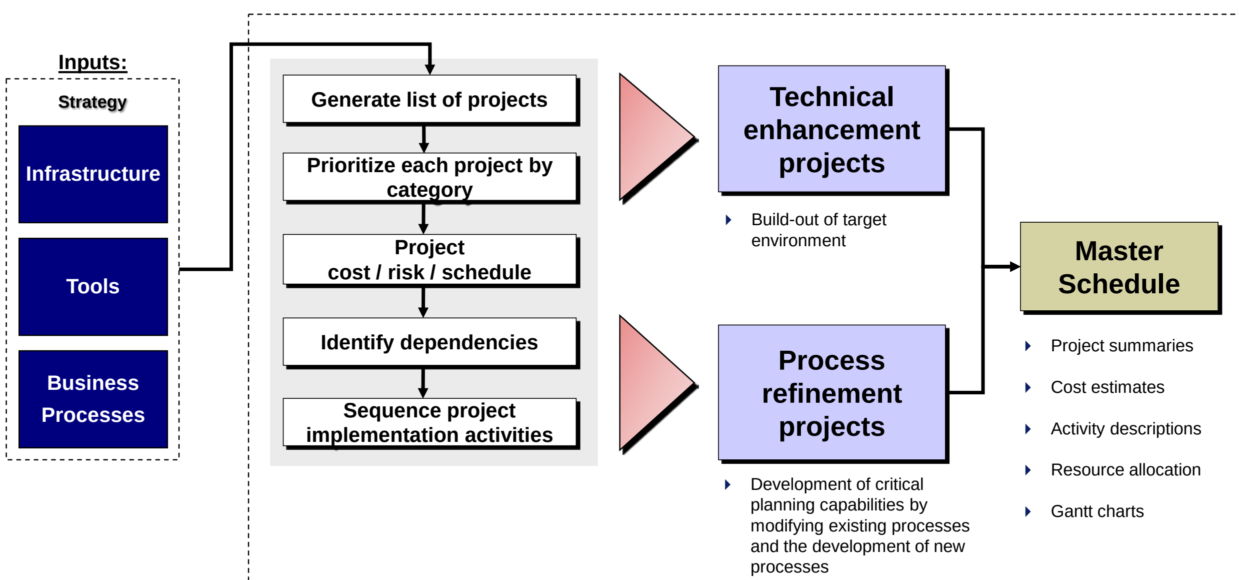
While additional research into this area is pursued, states and MPOs will have to be innovative with regards to their current processes for predicting programmatic safety outcomes. This may mean employing new tools, leveraging a combination of different tools, or sharing best practices through peer exchanges in addition to conducting advanced cost-effectiveness analyses. One example of progressive thinking is outlined in the National Cooperative Highway Research Program's NCHRP 17-46 report. This "Comprehensive Framework for Safety Investment Decisions" was designed to develop an analysis framework for all 4 E safety investment decisions transferable across federal, state, and local governments. This framework relies on multivariable cost-effectiveness analysis, considering both engineering and behavioral projects along a set of prioritization tiers.

Implement Projects and Programs

Implementation is a set of actions that accomplish goals and/or objectives. While implementing the projects that have been selected as part of the safety improvement program may seem straightforward, it is important to remember that there are several steps that need to be completed during this stage of the process. Upon project approval, it is necessary to develop a detailed implementation plan that explicitly defines timelines, budget, and roles and responsibilities for accomplishing the stated outcomes. The implementation plan organizes, integrates, and documents the necessary activities that will be carried out to support completion of a project and/or program.

The implementation plan is the blueprint for communicating the activities that are required to affect the desired change. A common reference is essential for a group of individuals to work together toward a common result. Successful completion of activities requires communication about the what, when, where, and how. An organized approach requires formulation of a step-by-step process for delivering the desired outcome for a set amount of resources, plus contingencies. Figure 4 depicts an illustrative methodology to develop an implementation plan.

Figure 4: Methodology to Develop an Implementation Plan



The organization should track the goals, objectives, and performance measures developed in the pre-implementation planning process. These become the guidelines for organizing and managing the project. This is where collecting robust data pays off. The use of strong data helps improve the predicative capabilities of the tools, leading to the realization of more accurate safety outcome estimates. Each of the key planning decisions and performance measures should be linked to one or more activities and tracked until the project is complete. This serves as the means by which outcomes can be evaluated throughout the project/program lifecycle. During implementation, it is important to conduct performance data and evaluate your projects and program on an ongoing basis. This helps mitigate risks and improves efficacy of particular projects that are repeated across similar environments.

Achieve State & Local Safety Targets
5

Achieve State and Local Safety Targets

Ideally, each program and its supporting activities, has a set of performance targets and desired outcomes established as part of the earlier planning process. Once programs are underway, states and MPOs with strong performance management frameworks track progress toward achieving their goals and intended safety outcomes through the use of reporting tools such as performance dashboards.

Dashboarding is a common method used to inform internal or external stakeholders about progress to date and supports accountability. At a minimum, a dashboard should show performance targets and the current level of performance against that target. There are a variety of ways to display dashboard information, including charts and tables, up and down arrows, and red/green/yellow indicators of progress. Figure 5 provides an example of the North Carolina Department of Transportation (NCDOT) Executive Dashboard used to track progress against strategic goals. Each goal may be supported by one or more performance measures.

Figure 5: NCDOT Executive Dashboard

Second Quarter Results for State Fiscal Year 2012

Goal	#	Performance Measure	SFY11 Result	SFY12 Target	SFY YTD Result (as of 12/31/11)	Trend
Make our transportation network safer	1.1	Statewide network crash rate	233[1]	235 or less	240	●
	1.2	Statewide network fatality rate	1.25[1]	1.64 or less	1.24	●
	1.3	Percentage of surveyed North Carolina drivers using a safety belt	89.5%[2]	90.0% or greater	89.5%[2]	●
Make our transportation network move people and goods more efficiently	2.1	Average statewide accident clearance time	66 min.	70 min. or less	63 min.	●
	2.2	Travel time index for surveyed interstates[5]	1.02	1.04 or less	1.02[5]	●
	2.3	Percentage of planned ferry runs completed as scheduled	98%	95.0% or greater	98.7%	●
	2.4	Percentage of planned passenger trains arriving on schedule[4]	New Measure	80.0% or greater	60%	●
	2.5	Percentage increase in public transit ridership[4]	New Measure	5% or greater	1.7%[7]	N/A[4]

Reporting on key metrics aligned to goals enables organizational and program leaders to see trends over time, make decisions based on performance, and evaluate the impact of various performance drivers, and enables more control of the success of their actions. Simple, easy-to-access dashboards are helpful in creating openness between an organization and its constituents. Building acceptance of data driven decisions and linking performance to results is often easier to accept when an organization publicizes early success in achieving goals.

Performance Management and Continuous Improvement Cycle

States and MPOs face increasing pressure to demonstrate that the outcomes of their roadway improvement programs meet or exceed citizen and legislative expectations. As a result, many states have instituted, or are in the process of implementing, new project planning and safety prediction tools and practices that enhance traditional data collection, analysis, and reporting capabilities. These tools and practices support data-driven decision making within a performance management framework, something that is becoming increasingly important in today's transportation environment.

The two keys to achieving the desired future state of transportation safety planning lay within the establishment and acceptance of performance management frameworks across state DOTs and MPOs, and the identification and collection of robust data sets that are used as inputs to the various safety planning tools. Combined, these two elements will enhance the predictive capability of countermeasures, improving countermeasure selection and decision making throughout the planning process, which will ultimately reduce the number of serious injuries and fatalities on our nation's roadways.

Performance Management

An enhanced performance management framework is the cornerstone of the desired future safety planning environment. Performance management focuses an organization on achieving results critical to its mission, vision, and goals. By emphasizing the performance management framework as a method to guide decision making, state DOTs and MPOs can measure and refine their actions en route to accomplishing its strategic planning goals.

Within the roadway safety industry, performance management can be defined as the practice of translating specific goals and objectives into roadway safety investment programs and projects that result in fewer deaths and injuries on the nation's roadways. Working within a performance management framework helps ensure that funds are allocated to the most effective projects that support the organization's mission and yield desired benefits to the surrounding community. In the context of transportation planning, government organizations strive to balance benefits and costs across diverse strategic priorities such as environmental protection, economic development, and increased public safety and mobility.

Performance management also supports improved accountability. Use of performance measures provides managers with a tool to hold employees, project teams, or departments accountable for completing tasks on time, within budget, and meeting all expectations of quality. A regular review of performance also helps organizations proactively identify potential problems, which provides time to address problems before excessive amounts of time or money are dedicated to an unsuccessful venture. The establishment of effective performance management frameworks is in line with the MAP-21 requirements, ensuring resources are being allocated to the most effective safety related tools, processes, and practices.

By virtue of their role as public institutions, state DOTs and MPOs have an obligation to citizens and taxpayers to demonstrate good stewardship of resources and attempt to maximize the value of outputs. Use of performance-based planning and reporting performance on a regular basis enables state DOTs and MPOs to demonstrate performance to their stakeholders.

Collecting the Right Data to Support Continuous Improvement

Normalizing data across states and MPOs is a major challenge facing transportation safety planners. Vehicle crash numbers and roadway fatality rates are commonly used measures of roadway safety. Using the fatality rate as a performance measure instead of a count of fatalities improves the ability to make comparisons across locations with differing travel patterns and driver populations. However, performance measures such as fatalities, injuries, and property damage are almost impossible to correlate to specific actions taken or projects implemented. Roadway fatalities, injuries, and property damage are impacted by a large number of factors including, but not limited to, roadway conditions, environmental or weather conditions, local law enforcement programs, and driver behavior.

Identifying Similarities to Maximize Safety Gains

Crash modification factors (CMF) and safety performance functions (SPF) are used to estimate safety gains based on crash type, crash severity, and roadway type. CMFs are multiplicative factors that can be applied to crash data to predict the expected number of crashes after implementing a specific countermeasure at a specific site. SPFs are equations that relate site characteristics of a road segment or intersection (e.g., traffic volume, lane width, shoulder width) to the number of predicted crashes at that site. The Highway Safety Manual (HSM) provides a framework on ways that state DOTs and MPOs might use SPFs and CMFs to enhance safety as part of the transportation planning process. As state DOTs and MPOs incorporate the HSM in their project selection process, many are beginning to calculate state specific SPFs. Sharing effective CMFs based on similar SPFs between and across states and MPOs will continue to help foster an improved safety culture.

In order to most effectively prioritize projects and programs while facing increased budgetary scrutiny, robust data sets must be made available to help inform decision making. Collecting metrics that do not strongly align to an organization’s ability to exert direct control can reduce the efficacy of the metric to helping track performance. Some states have begun exploring options to implement additional performance measures that relate to roadway safety but may be more directly attributable to organizational capabilities. Others are considering adding new data fields to the crash reports completed at the scene to learn more about other contributing factors.

Organizations use data analysis during the planning phase to evaluate the need for projects and programs and during the performance management phase to evaluate the success of implemented projects and programs. It is important to note that data needs should be considered on an ongoing basis to ensure the organization is collecting and maintaining the right types of information. Information sharing contributes to the spread of practical tools and practices, enhances the usefulness of available data (e.g., a state sharing crash data with a locality), and offers opportunities to provide constructive critiques regarding practices in place.

Ultimately, performance metrics are often interrelated. Performance results in one target area may result in residual gains in other areas (e.g., reduced congestion’s impact on improved safety outcomes). Proving causal links between specific projects and results is challenging in the transportation environment. It is difficult to find instances where transportation organizations have been able to specifically link individual projects to results as results may be impacted by many factors outside an organizations span of control. For example, changes in roadway fatality rates may be impacted by factors including engineering countermeasures, drivers’ behavior, and/or economic conditions and demographic changes, among others. Although additional research on these relationships may be needed, states and MPOs can help advance performance-based planning more broadly by sharing new or revised performance measures, data collection techniques, and performance results.

Using Communication and Collaboration to Foster a Safety Culture

Communication and collaboration are critical to developing and maintaining a safety culture in transportation organizations. Without communication and collaboration, dissemination of best practices is limited. Creating partnerships enhances acceptance, improves performance and diminishes the learning curve. Without partnerships, each individual organization must instead rely on internal innovation and investments to advance progress. Communication may exist in many forms including face-to-face interactions, peer exchanges, virtual meetings or teleconferences, or written forms. Commonly used methods of communication and collaboration to enhance organizational processes include cross-disciplinary or inter-organizational committee and board meetings, technical assistance documents or newsletters, and instructor-led or online training.

Key Takeaways

- FHWA envisions a safety planning process where transportation organizations are able to optimize the selection of safety infrastructure improvements and use performance management practices to track progress and promote achievement of safety performance targets
- The Safety Focused Decision Making Framework takes a programmatic approach to safety planning, and is composed of five high-level steps with an emphasis on continuous data collection and project improvement
- Acceptance of this new safety culture is reliant on the clear communication and collaboration between and among safety planning stakeholders at all levels

4. Identification of Gaps

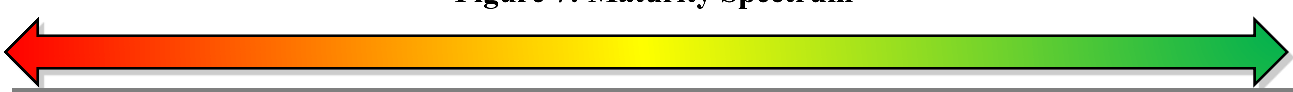
The gaps identified in this section highlight specific areas of improvement that must be addressed to move beyond the current state and toward achievement of the Safety Focused Decision Making Framework. Gaps have been categorized into two groups, current and anticipated gaps, which denote short- and long-term considerations. These areas of improvement have touch-points along each of the five steps that make up the Safety Focused Decision Making Framework, and are all interrelated. That is, it would be ineffective to focus on one category without also considering the others.

Current Gaps

The individual gaps that were identified throughout the course of this effort were grouped by theme. These themes, depicted in relative maturity ranking in Figure 6, include Performance Management of Safety Programs, Data, Communication and Knowledge Transfer, and Safety Planning. As each theme includes a litany of unique concerns, the Safety Focused Decision Making Framework is inextricably woven throughout. The following sub-sections describe the major themes and their associated maturity assignment as determined by examination of the supporting component elements. The maturity assignment range from least mature to most mature is shown in Figure 7:

Figure 6: Relative Maturity Ranking of High-Level Themes

Figure 7: Maturity Spectrum



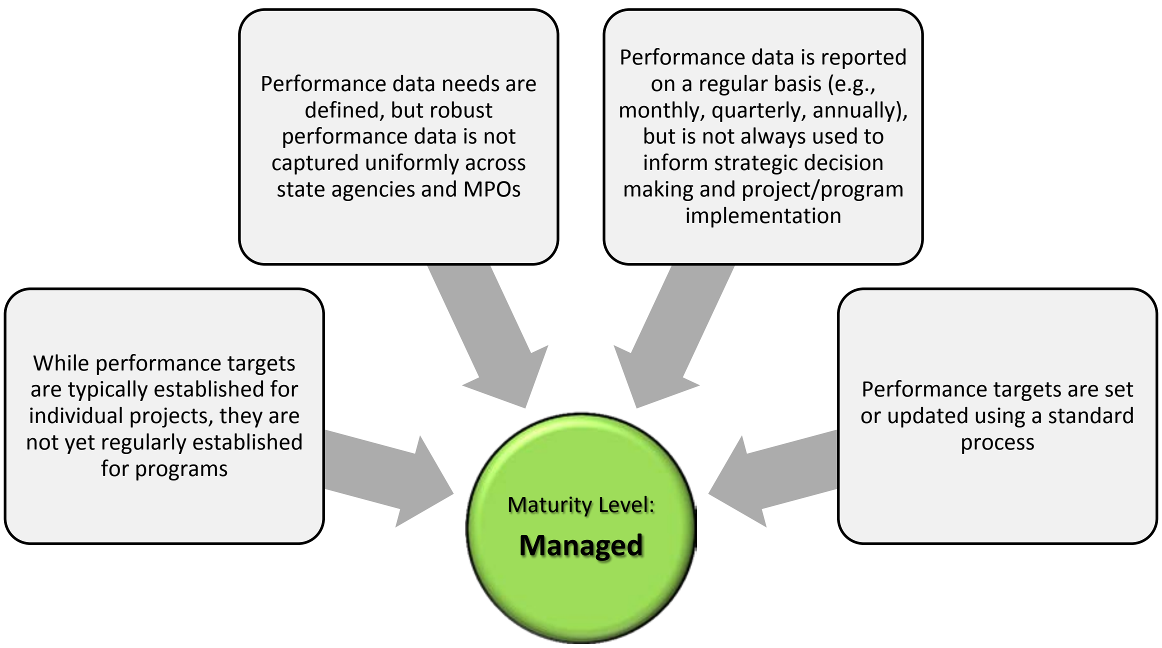
Initial	Repeatable	Defined	Managed	Optimized
organization does not possess a stable implementation environment; processes are ad hoc; no plan for interoperability or expandability	results of previous projects and the demands of the current project(s)/program may drive activities and actions; decisions are made on a case-by-case basis	organization uses standardized process; organization's standards tie to an adopted strategy; guidance and planning determine project outcomes	formal program management governs projects; processes are predictable and business rules are established; performance management exists	organization focuses on the continuous improvement; organization possesses the means to detect weaknesses and to proactively strengthen areas of concern

It is important to note that this project was not designed to complete a full organizational assessment where each organization was scored using a standard tool/rubric; instead, general maturity ratings were derived from stakeholder feedback sessions and assessments of current practices.

Performance Management of Safety Programs

Formalized performance management itself is institutionalized at varying levels of maturity among many states and MPOs with regard to their decision-making processes. Safety is often addressed in stand-alone projects, but setting performance targets and then measuring impacts across multiple projects/programs is not a common practice. Furthermore, safety is not addressed in an integrated fashion throughout planning, engineering, and operations and maintenance. The increased focus on performance based programs in MAP-21 may benefit safety programs because states and MPOs will be required to set targets and consider the impacts of their investment and strategy decisions toward achieving those targets. Figure 8 depicts a representative sample of the component elements of this capability that were examined to ultimately determine a "Managed" maturity assignment for Performance Management across the environment.

Figure 8: Performance Management Maturity Assignment

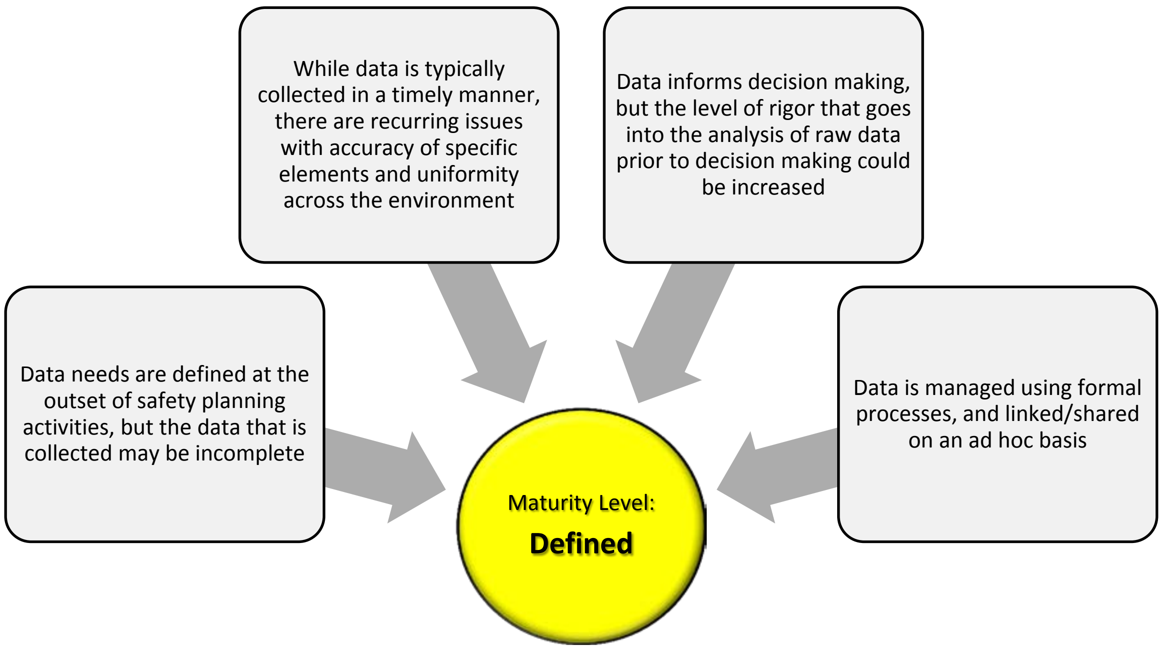


Data

Collecting data to enhance the predictive abilities of safety planning tools has historically been a challenge. Robust data sets are not always readily available for many states and MPOs, and there is often a considerable time lag in the data that is available. Therefore, safety planners are often forced to use surrogate data or make critical decision with incomplete information.

The ability to use timely and robust data enhances organizational capabilities to prioritize projects and justify decisions throughout the safety planning lifecycle. Because crash data is often used to identify countermeasures for individual high crash locations, accurate geo-location data on all crash location and roadway features is needed. The added information on roadway features will help move toward system-wide safety planning rather than just focusing on crash "hot spots." Future data sets need to be expanded and linked to other non-traditional types of roadway and crash data (e.g., university research, hospital reports, National Studies Center) to provide a more holistic view of and approach to safety. Figure 9 depicts a representative sample of the component elements of this capability that were examined to ultimately determine a maturity assignment for the Data theme across the environment.

Figure 9: Data Maturity Assignment

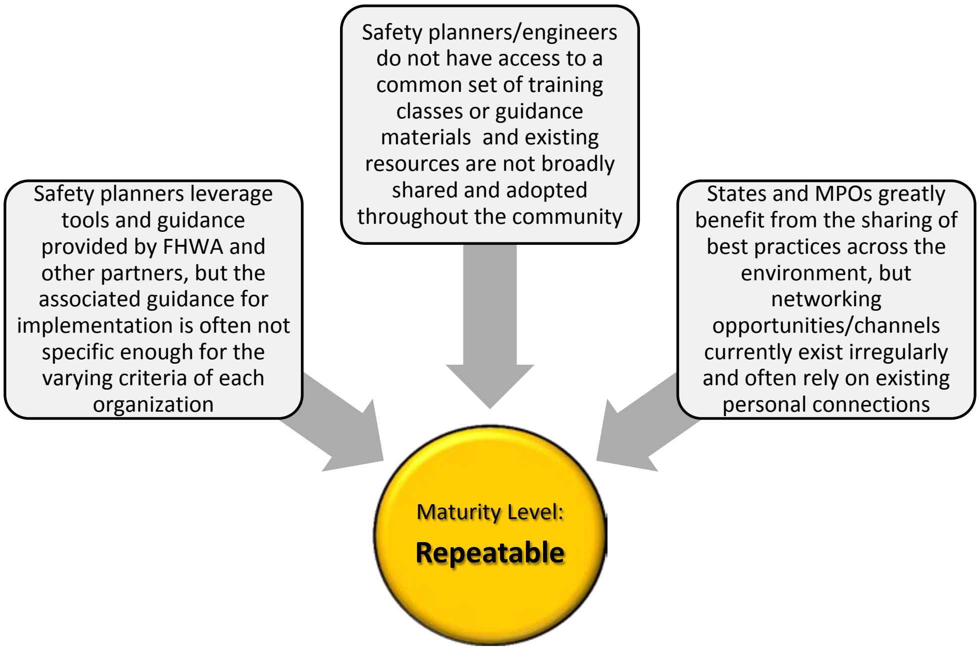


Communication and Knowledge Transfer

States and MPOs currently rely on both formal and informal communication channels for information, guidance, and best practices when it comes to the use of predictive tools over the course of safety planning activities. During the Safety Planning Peer Exchange, it was reported by several state and MPO safety planners that sheer volume of information/guidance available to them makes it difficult to down-select and prioritize projects. Additionally, many tools (e.g., SafetyAnalyst) and guidance documents (e.g., HSM) require additional training and/or data formatting before use.

Opportunities exist to improve the sharing of best practices among FHWA headquarters, states, and MPOs. *The 9 Proven Countermeasures Memo* is an example of effective knowledge transfer – simple and direct. Between states and MPOs, reporting requirements are often not formalized or leveraged to share successes, expand professional networks, and encourage knowledge transfer. That means that there are cases where the status quo continues to be accepted simply because no new perspectives have been introduced. This leads to stagnation and stifles innovative thinking. Increased collaboration is a cornerstone of FHWA's new Safety Focused Decision Making Framework, and MAP-21 will require increased coordination among all levels involved in safety planning (e.g., U.S. DOT headquarters, FHWA Division Offices, state DOTs, and MPOs). Figure 10 depicts a representative sample of the component elements of this capability that were examined to ultimately determine a maturity assignment for Communication and Knowledge Transfer across the environment.

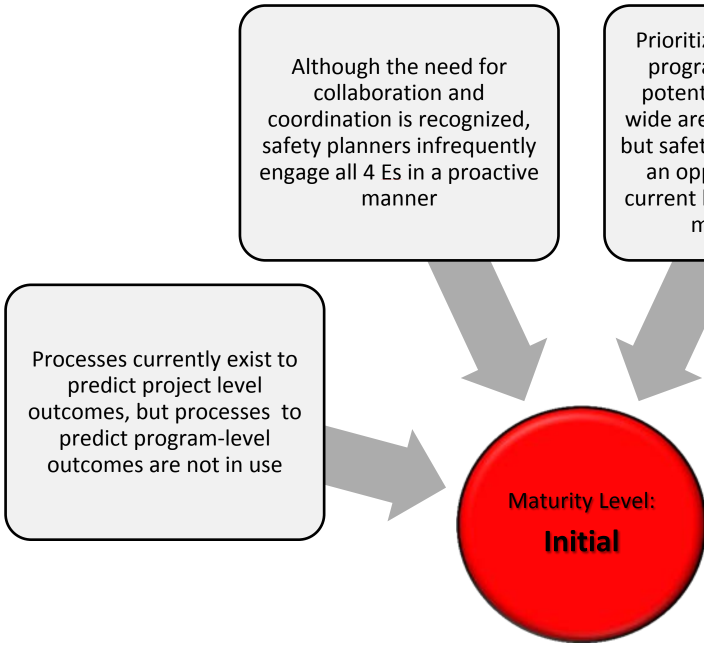
Figure 10: Communication and Knowledge Transfer Maturity Assignment



Program Approach to Safety Planning

FHWA's Safety Focused Decision Making Framework was developed to directly address this gap. Currently, safety elements are not included as a required part of all roadway planning exercises. In order to reduce serious injuries and fatalities on our nation's roads, it makes sense to integrate safety planning as a consideration for every roadway project supporting every program. Additionally, there is an opportunity to enhance collaboration between safety planners and engineers, and coordination among all 4 Es. Furthermore, safety planners have noted that there is an opportunity to refine benefit/cost analysis methodologies. This is essential to their job as planners. They cite the limited ability to accurately predict effectiveness using currently available tools and processes. This means that not only do states and MPOs have to re-examine how they leverage safety planners within the scheme of their planning processes, but they also have to consider ways to innovate so that these planners have better tools at their disposal. Looking forward, MAP-21 requires additional coordination between two key planning exercises – the SHSP and the Highway Safety Plan required by NHTSA – and the integration of this information into the statewide and metropolitan long-range transportation planning process. Figure 11 depicts a representative sample of the component elements of this capability that were examined to ultimately determine a maturity assignment for the Program Approach to Safety Planning across the environment.

Figure 11: Program Approach to Safety Planning Maturity Assignment



Anticipated Gaps

As the future of transportation safety planning is examined, and steps toward achieving the Safety Focused Decision Making Framework are taken, there will be new challenges that present themselves. In attempting to predict where some of these challenges might arise, there are several items to consider that will have bearing on the industry and its stakeholders.

Performance-Based Management of Safety Programs and MAP-21

As discussed throughout this report, establishing a performance-based management framework for safety programs is essential to achieving FHWA's Safety Focused Decision Making Framework. This emphasis is reinforced by the new MAP-21 legislation that was signed into law by President Obama on July 6, 2012. Funding surface transportation programs at over $105 billion for fiscal years 2013 and 2014, MAP-21 is the first long-term highway authorization enacted since 2005.

MAP-21 is a milestone for the U.S. economy and the nation's surface transportation program. By transforming the policy and programmatic framework for investments to guide the system's growth and development, MAP-21 creates a streamlined and performance-based surface transportation program and builds on many of the roadway, transit, bike, and pedestrian programs and policies. It also focuses on strengthening America's roadway and public transportation systems by creating jobs, supporting economic growth and the Department's safety agenda, simplifying and focusing the federal program, accelerating project delivery, and promoting innovation.

The cornerstone of MAP-21's roadway program transformation is the transition to a performance and outcome-based program. Under MAP-21, performance management will transform federal roadway programs and provide a means to more efficient investment of federal transportation funds by focusing on national transportation goals, increasing the accountability and transparency of the federal roadway programs, and improving transportation investment decision making through performance-based planning and programming.

Safety planners at the state and local levels will be held accountable to the new standards set forth by this legislation. As stakeholders, states and MPOs will be consulted during the establishment of performance measures for pavement conditions and performance for the Interstate and national highway system (NHS), bridge conditions, serious injuries and fatalities, traffic congestion, on-road mobile source emissions, and freight movement on the Interstate System. States (and MPOs, where applicable) will be required to set performance targets in support of those measures, and state and metropolitan plans will describe how program and project selection will help achieve the targets. They will report to FHWA progress in achieving targets. If a state's report shows inadequate progress in some areas – the condition of the NHS or the safety measures – the state will be required to undertake corrective actions. In addition, states and MPOs will also be impacted by MAP-21's restructuring of core roadway formula programs (funding opportunities).

Funding and Resources

In a time of increasing budget constraints and scrutiny on spending, securing funding and resources for safety planning will become more difficult. Given that federal and state funding may be limited by economy, and not all transportation project funding includes a safety component, funding innovations and alternate sources of funding may help state and local transportation organizations maximize safety gains. As stated earlier, exploring new funding sources and alternatives to incorporate safety in infrastructure projects is especially important when transportation appropriations slow or decrease. As states and MPOs enhance their performance management processes, they are better positioned to demonstrate the success of their projects. By showing a clear link between projects and results, these transportation organizations may be better positioned to compete for limited funds.

Training and Continuous Learning Opportunities

State and MPO safety planners are not currently leveraging all available training resources at optimal rates. Due the broad spectrum of highly technical tools and guidance currently at their disposal, in conjunction with competing requests for time and attention, safety planners often feel over inundated and under prepared to identify those tools that will be most useful and employ them as a regimented part of their planning processes. With limited continuous learning opportunities that reflect the highly dynamic transportation environment, leveraging new tools and processes can be daunting.

As new predictive tools are developed, it logically follows that safety planners will need to be trained on how to use them. Addressing the skill gaps will be essential to the deployment and use of all new tools. In developing training, challenges must be addressed with regards to identifying necessary training for individual staff and/or applying "canned" guidance across the environment as a whole.

Key Takeaways

- When analyzing the current gaps, four themes became apparent – Performance Management, Data, Communication and Knowledge Transfer, and Program Approach to Safety Planning
- Each theme has several key capabilities the must be matured to achieve the Safety Focused Decision Making Framework
- As the transportation environment continues to change and safety planners progress down the path toward realizing FHWA's Safety Focused Decision Making Framework, , there will continue to be new challenges that arise in the areas of performance management, funding, and training

5. Suggested Bridging Options

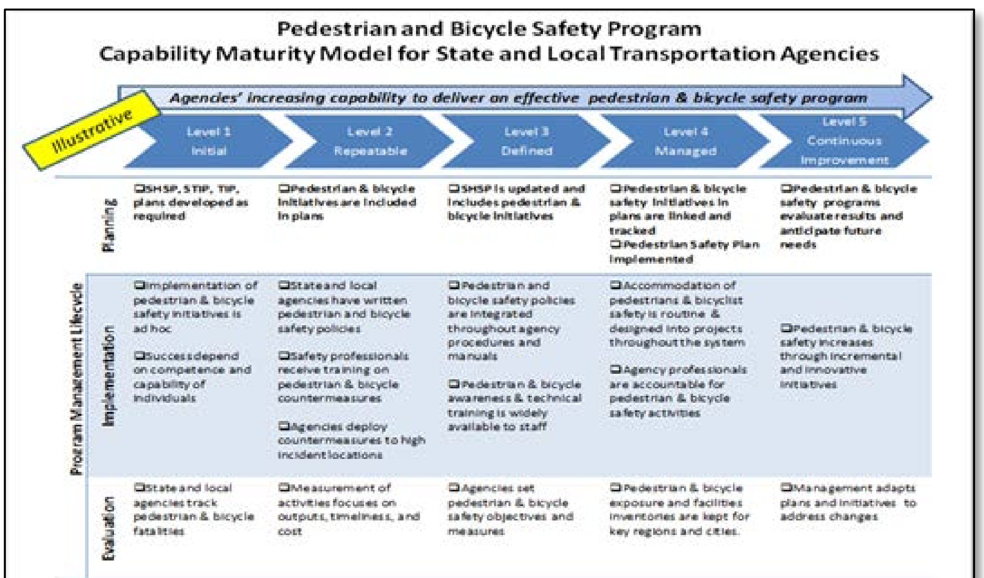
Given organizational differences, it is unlikely that there is a single solution that will adequately satisfy the needs of all states and MPOs. Consequently, entities should have the ability to choose the best course of action that satisfies their specific needs, and which can be implemented and sustained within current and anticipated resource constraints. The following is a list of items states and MPOs may be able to use to help them effectively deploy the Safety Focused Decision Making Framework.

Conduct a Capability Maturity Analysis to Determine Organizational Gaps

Capability Maturity Model Integration (CMMI) incorporates proven approaches for process improvement and organizational change management to help an organization improve the processes it uses to conduct its core business functions. To facilitate process improvement, CMMI helps an organization examine its current processes; establish priorities for improvement of those processes; and implement these improvements across the organization. CMMI is not intended to be prescriptive or to define how to achieve an optimized safety planning environment. Rather, CMMI provides the essential elements of effective processes to be used by organizations when improving their own safety planning processes. Each organization must use professional judgment to interpret the CMMI practices. Although process areas depict behavior that any organization should exhibit, practices must be interpreted using an in-depth knowledge of the CMMI model, the organization, the business environment, and the various other specific circumstances involved. To interpret the model's practices, it is important to consider the overall context in which they are used and determine how well the practices satisfy the goals of a process area within that context.

FHWA is well positioned to take the lead in developing a Capability Maturity Model to serve as a self-assessment tool for states or MPOs to determine where they are in safety program performance management continuum, and what they need to do to get to the next level. CMMI models do not imply which processes are right for a given state, MPO, or project. Instead, CMMI models establish criteria necessary to plan and implement processes selected by the organization for improvement based on business objectives. Figure 12 is an illustrative Capability Maturity Model

Figure 12: Illustrative Capability Maturity Model



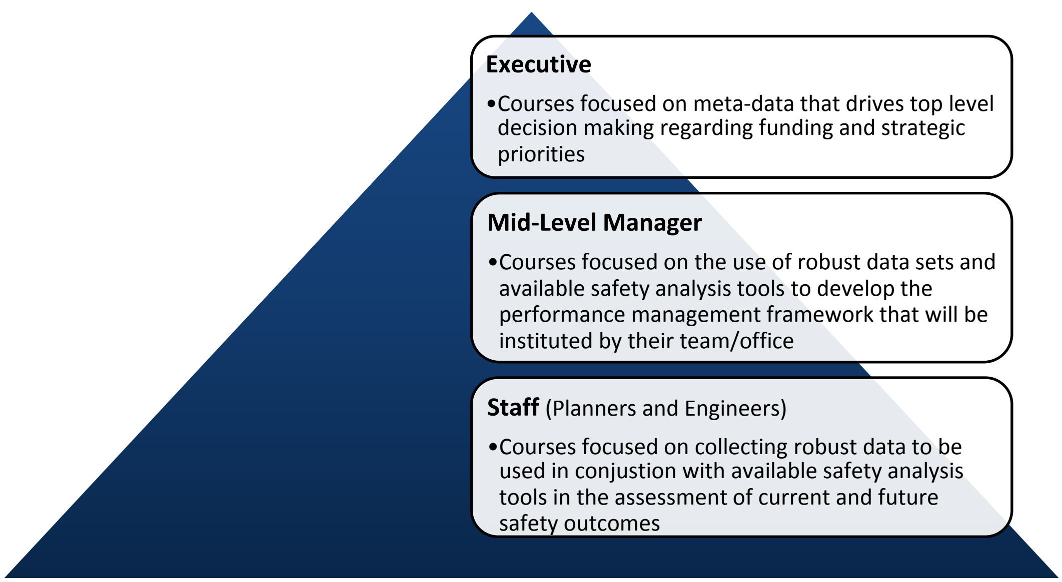
that could be used by states and MPOs in their efforts to achieve the Safety Focused Decision Making Framework.

Institute Segmented Safety Planning Courses

One of the most salient issues discussed at the Safety Planning Peer Exchange was the lack of uniformity with regard to training opportunities for safety planners at the states and MPOs. This inequity was also appreciated between varying levels of seniority and administrative responsibility within a given state or MPO (i.e., executive vs. mid-level manager vs. staff). That is to say, for multiple reasons, a one-size-fits-all training approach to the deployment of new tools and guidance is ineffective.

The safety planning environment would benefit from scalable safety planning courses made available through a respected organization such as the National Highway Institute (NHI) or other similar training academies. Figure 13 illustrates how shifting the specific focus of a class, or targeting a segment of the safety planning community would increase the applicability of lessons learned and overall usefulness of the training.

Figure 13: Illustrative Course Focus Segmented for Different Roles



As the training program matures, classes could progress from a few half-day classes and perhaps evolve to industry-recognized certifications or intensive rotations.

Providing a new formal venue for safety planners to meet and network would be an additional advantage of these courses. The intermingling of safety planners from different regions with diverse perspectives and needs would foster dissemination of best practices and could help close some of the existing gaps described earlier. If these courses were to take a true multi-disciplinary approach, ultimately, they would help bridge the gaps between engineers and planners by giving them a common understanding and approach to addressing the needs of the environment.

Develop and Distribute Knowledge and Technology Transfer (KTT) Toolkits

As discussed earlier, as federal and state funding is often uncertain, funding innovations and alternate sources of funding may help state and local transportation organizations maximize safety gains. States and local transportation agencies should also identify opportunities to include safety improvement elements into other transportation projects at the early stages (e.g., roadway design and construction). Exploring alternate funding sources and alternatives to incorporate safety in infrastructure projects is especially important when transportation appropriations slow or decrease.

To develop a KTT toolkit, safety planners would first identify target stakeholders. From there, a mix of KTT products, tools, and tactics to deliver key messages and inform/engage stakeholders would be developed. Finally, they would foster the adoption of safety planning concepts and practices through the deployment of the products, tools, tactics and activities outlined in a formal KTT plan. An effective safety planning KTT toolkit would include the following items to help familiarize stakeholders with the safety planner's paradigm and concerns:

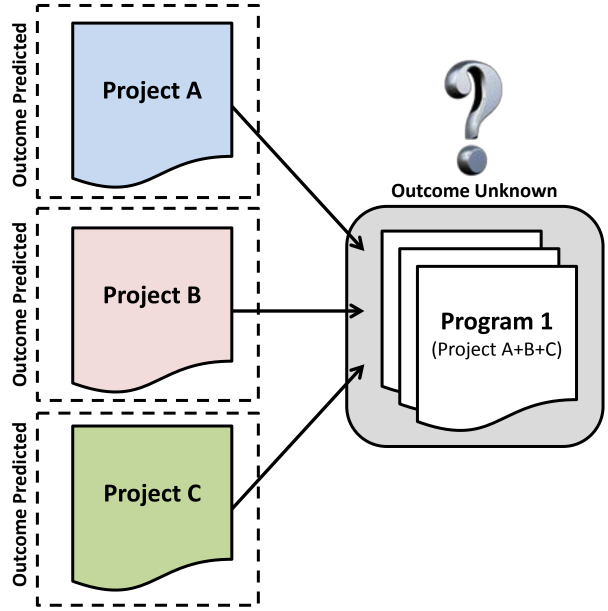
- Detailed stakeholder analysis to determine information requirements, communication preferences (e.g., location, frequency, technological availability), values/needs/concerns, preferred means of communication, and allies/resistors
- Workshops, webinars, brown bags, and focus groups
- Outreach material including newsletters, fact sheets, presentations, reports, etc.
- Formal promotional briefings
- Interactive, public-facing website

If deployed nationally, the impact that KTT toolkits would have on the safety planning environment would be substantial. The KTT toolkits would encourage the sharing of best practices, expand the availability of robust data sets, and foster innovative solutions to systemic challenges.

Expansion Beyond Traditional Funding Sources

As discussed earlier, given that federal and state funding may be limited and not all transportation project funding includes a safety component, funding innovations and alternate sources of funding may help state and local transportation organizations maximize safety gains. Exploring alternate funding sources and alternatives to incorporate safety in infrastructure projects is especially important when transportation appropriations slow or decrease. An example of a strategy to expand funding is for safety planners to collaborate with engineers during the roadway design phase to include safety elements as part of the roadway design.

Additional Research



More research is needed to define a broadly accepted method for calculating the expected safety outcomes across multiple projects within a program portfolio. Safety planners have become very adept at using available tools to help predict safety outcomes for specific projects, but have not yet effectively broadened their predictive capabilities to evaluate a larger program portfolio, as illustrated in Figure 14.

Whatever methodology is ultimately developed to meet this need, the analysis will need to take into account the additional benefits, unexpected challenges, and unintended consequences (positive and negative) of different project groupings. This will be a key element in the maturing of safety planning data collection and analysis capabilities as more accurate predictions of program level safety outcomes will help achieve FHWA's Safety Focused Decision Making Framework.

6. Summary and Next Steps

FHWA continues to promote a programmatic approach to performance-based management of the roadway safety community as part of their Safety Focused Decision Making Framework. This Framework relies upon consistent monitoring, reporting, evaluation, and improvement of performance goals to promote achievement of the desired safety performance across the entire roadway system – resulting in improved roadway safety nationwide.

The current environment has been baselined against the Safety Focused Decision Making Framework. Now that the major gaps within the tools, practices and training for system wide safety impact prediction have been identified, FHWA should take decisive steps toward the deployment of their Safety Focused Decision Making Framework. The activities discussed in the Suggested Bridging Options section outline some of the actions that are anticipated to yield the largest positive impact across the environment. FHWA will continue to work closely with safety planners at the state and local levels to mature and refine associated tools, guidance and training for the betterment of our national roadway system.

Overview of Key Takeaways

Baseline of Current Safety Environment

- While there are a variety of helpful tools available to safety planners, some are used more commonly across the states and MPOs
- The challenges can be grouped into two categories, organizational and geographic, both with common contributing factors that can be identified as themes across the states and MPOs
- Even those tools that are used most commonly have a diverse set of challenges associated with implementing them, often unique to a particular state or MPO
- As funding for safety programs becomes more challenging to secure, safety planners must expand beyond the traditional sources upon which states and MPOs currently rely and reach to include new, innovative revenue streams

Safety Focused Decision Making Framework

- FHWA envisions a safety planning process where transportation organizations are able to optimize the selection of highway safety infrastructure improvements across a roadway system and use performance management practices to track progress and promote achievement of safety performance targets
- The Safety Focused Decision Making Framework takes a programmatic approach to safety planning, and is composed of five high-level steps with a continuous emphasis on data collection and project improvement
- Acceptance of this new safety culture is reliant on the clear communication and collaboration between and amongst safety planning stakeholders at all levels

Identification of Gaps

- When analyzing the current gaps, four themes became apparent – Performance Management of Safety Programs, Data, Communication and Knowledge Transfer, and Safety Planning
- Each theme has several key capabilities that must be matured to reach the Safety Focused Decision Making Framework
- As the transportation environment continues to change and safety planners progress down the path toward realizing FHWA's Safety Focused Decision Making Framework, indicators suggest that there will continue to be new challenges that arise in the areas of performance management, funding, and training

Appendix A: List of Acronyms

AADT	Average Annual Daily Traffic
ARC	Atlanta Regional Commission
CAT	Collision Assessment Tool
CMF	Crash Modification Factors
CMMI	Capability Maturity Model Integration
CPM	Crash Prediction Module
DOT	Department of Transportation
FHWA	Federal Highway Administration
FI	Fatality and Injury
GIS	Geographic Information System
HPMS	Highway Performance Monitoring System
HSEC	Highway Safety Executive Committee
HSIG	Highway Safety Issue Group
HSIP	Highway Safety Improvement Program
HSM	Highway Safety Manual
IHSDM	Interactive Highway Safety Design Model
ISAT	Interchange Safety Analysis Tool
KTT	Knowledge and Technology Transfer
MS	Microsoft
NCDOT	North Carolina Department of Transportation
NHI	National Highway Institute
NHS	National Highway System
NHTSA	National Highway Traffic Safety Administration
PBCAT	Pedestrian and Bicycle Crash Analysis Tool
PDO	Property-Damage Only
RCW	Revised Code of Washington
RPS	Road Protection Score
RTP	Regional Transportation Plans
SHSP	Strategic Highway Safety Plans
SSAM	Surrogate Safety Assessment Model
STIP	State Transportation Improvement Plan
TIP	Transportation Improvement Program
TOT	Total
VMT	Vehicle Miles Traveled
WSDOT	Washington State Department of Transportation

Appendix B: Tools Supporting Safety Impact Prediction

The matrix below provides a list of all nationally available tools discussed in this report. The matrix also provides the primary purpose of each tool, key data inputs, outputs, and recommended expertise of the users. Please note that the required expertise need not exist in a single user, but a group of users should have the collective expertise required in order to utilize the tools successfully.

Tool	Primary Purpose	Key Data Inputs	Outputs	Recommended Expertise
Safety Data Analysis Tools				
Highway Safety Manual (HSM)	Attachment A Provides a framework for safety that aids practitioners in selecting countermeasures, prioritizing projects, comparing alternatives, and quantifying and predicting the safety performance of roadway elements during the planning, design, construction, and operation phases	Attachment B Crash Data: road location, date, crash type, severity, relationship to intersection, distance to intersection Attachment C Roadway Data: road type, segment identification, intersection type Traffic volume data such as Average Annual Daily Traffic (AADT): for intersections, major and minor street entering AADT	A method to estimate crash frequency and severity and then conduct economic appraisals of improvements to use for prioritizing projects and calculating the effects of design alternatives	Basic understanding of traffic engineering, statistical analysis, transportation planning, and safety management
Crash Modification Factors (CMF) Clearinghouse	Provide transportation professionals with a web-based repository of CMFs and documents /training materials to support the proper application of CMFs	Search parameters to determine appropriate crash modification factors	Crash modification factors	Basic understanding of traffic engineering, statistical analysis, transportation planning, and safety management

Tool	Primary Purpose	Key Data Inputs	Outputs	Recommended Expertise
Interactive Highway Safety Design Model (IHSDM)	Provides estimates of a highway design's expected safety and operational effects of geometric design decisions on rural two-lane highways with some applications to rural multilane highways and urban/suburban arterials	Crash Data: specific road location of crash, collision type, severity Roadway Data: lane width, shoulder width/type, horizontal curve length and radius, gradation, driveway density, passing lanes, roadside hazard rating Intersection Data: traffic control, intersection skew angle, turn lanes, sight distance Traffic volume data (AADT)	The IHSDM-HSM Predictive Method 2011 Release includes six evaluation modules: Crash Prediction, Policy Review, Design Consistency, Intersection Review, Traffic Analysis and Driver/Vehicle Modules. The Crash Prediction Module (CPM) supports implementation of Part C (Predictive Method) of the Highway Safety Manual (HSM) for rural two-lane highways (HSM – Chapter 10), multilane rural highways (HSM – Chapter 11) and urban and suburban arterials (HSM – Chapter 12). The other IHSDM evaluation modules are applicable to rural two-lane highways.	Basic understanding of geometric design concepts, ability to input data in Microsoft (MS) Windows environment through conversion of detailed geometric designs from other software or comma-separated file format (*.csv)
SafetyAnalyst	A set of computerized analytical tools to identify safety improvement needs and supports use of cost-effectiveness analysis to develop a system-wide program of site-specific improvement projects	Crash Data: location, date, collision type, severity Roadway Data: segment number, segment location (in a form linkable to crash locations), segment length (mi), area type (rural/urban) Intersection Data: intersection number, intersection location (in a form linkable to crash locations), area type (rural/urban), number of intersection legs, type of intersection traffic control, major-road traffic volume (AADT), minor-road traffic volume (AADT)	The Network Screening Tool identifies sites with potential for safety improvements. The Diagnosis Tool diagnoses the nature of safety problems at specific sites. The Countermeasure Selection Tool assists users in selecting countermeasures to reduce crash frequency and severity at specific sites. The Economic Appraisal Tool performs an economic appraisal of a specific countermeasure or alternative countermeasures for a specific site. The Priority Ranking Tool provides a priority ranking of sites and proposed improvement	Understanding of traffic engineering, statistical analysis, transportation planning, and safety management

Tool	Primary Purpose	Key Data Inputs	Outputs	Recommended Expertise
		Ramp Characteristics Data: ramp number, ramp location (in a form linkable to crash locations), area type (rural/urban), ramp length (mi), ramp type, ramp configuration (diamond/loop/directional/etc.), ramp traffic volume (AADT)	projects based on the benefit and cost estimates determined by the economic appraisal tool. The Countermeasure Evaluation Tool provides the capability to conduct before/after evaluations of implemented safety improvements.	
Systemic Safety Project Selection Tool	The systemic approach to safety involves widely implemented improvements based on high-risk roadway features correlated with specific severe crash types. The approach provides a more comprehensive method for safety planning and implementation that supplements and compliments traditional site analysis. It helps agencies broaden their traffic safety efforts and consider risk as well as crash history when identifying where to make low-cost safety improvements.	Crash Data Roadway Data Cost/Benefit data for specific roadway treatment strategies	Reduced risk of and the potential for the occurrence of future crashes.	Basic understanding of traffic engineering, statistical analysis, transportation planning, and safety management
Highway Performance Monitoring System (HPMS) Viewer and Geographic Information System (GIS) Tools	GIS software turns statistical data such as crashes and geographic data such as roads and crash locations into meaningful information for spatial analysis and mapping	Crash Data Roadway Data Traffic Operations Data	Provides graphical displays to support: • Spot/Intersection Analysis • Strip Analysis • Cluster Analysis • Sliding-Scale Analysis • Corridor Analysis	Experience using GIS software

Tool	Primary Purpose	Key Data Inputs	Outputs	Recommended Expertise
PlanSafe	Forecasting tool that enables state DOTs and MPOs to account for sociodemographic induced changes and infrastructure changes when forecasting safety impacts	Demographic Data: population, travel patterns, infrastructure (residential, commercial, etc.) Crash Data	Predictive crash data based on expected changes to population	Experience using GIS software, statistical modeling, statistical analysis
U.S. Road Assessment Program (usRAP)	A method to benchmark the safety performance of specific roadway segments in comparison to similar roadways	Crash Data: specific road location of crash Roadway Data: road type, section length, traffic volume (ADT)	Color coded maps that show: • fatal and serious injury crashes per mile of road, • fatal and serious injury crashes per hundred million vehicle-miles of travel, • ratio of fatal and serious injury crash rate per hundred million vehicle miles of travel to the average crash rate for similar roads, • potential number of fatal and serious injury crashes saved per mile in a specified time period if crash rate per hundred million vehicle-miles were reduced to the average crash rate for similar roads, • supplemental maps (similar to types above) that address specific crash types (e.g., roadway departure, drug or alcohol involved)	GIS cartography to assign crash coordinates to a specific roadway segment is preferred

Tool	Primary Purpose	Key Data Inputs	Outputs	Recommended Expertise
Pedestrian and Bicycle Safety Tools				
Pedestrian and Bicycle Crash Analysis Tool (PBCAT)	Software to assist state and local pedestrian/bicycle coordinators, planners and engineers with improving walking and bicycling safety through analysis of a database containing details associated with crashes between motor vehicles and pedestrians or bicyclists	Crash Data: date, time, location, demographics of involved parties, subject actions, and other attributes	Analysis reports in spreadsheet form	Basic understanding of MS Office, transportation planning, and safety management
Bicycle Countermeasure Selection System – BIKESAFE	Online tool provides practitioners with a process for determining possible engineering, education, and/or enforcement treatments to help mitigate known bicycle crash problems and/or to help achieve a specific performance objective	Crash Data: date, time, location, demographics of involved parties, subject actions, and other attributes	List of potential countermeasures based on bicycle crash types and performance objectives	Basic understanding of transportation planning and safety management
Pedestrian Safety Guide and Countermeasure Selection System – PEDSAFE	Online tool provides practitioners with a process for determining possible engineering, education, and/or enforcement treatments to help mitigate a known pedestrian crash problem and/or to help achieve a specific performance objective	Crash Data: date, time, location, demographics of involved parties, subject actions, and other attributes	List of potential countermeasures based on pedestrian crash types and performance objectives	Basic understanding of transportation planning and safety management

Tool	Primary Purpose	Key Data Inputs	Outputs	Recommended Expertise
Intersection/Interchange Safety Analysis Tools				
Interchange Safety Analysis Tool (ISAT)	ISAT provides design and safety engineers with an automated tool for assessing the safety effects of geometric design and traffic control features at an existing interchange and adjacent roadway network. ISAT can also be used to predict the safety performance of design alternatives for new interchanges and prior to reconstruction of existing interchanges.	Intersection Data: area type (rural/urban), analysis years Crash Data: dates, total number of crashes Roadway Data: length of segment, number of lanes, traffic volume data (ADT), major-road traffic volume (AADT), minor-road traffic volume (AADT) Ramp Characteristics Data: ramp type, ramp configuration (diamond/loop/directional/etc.), ramp traffic volume (AADT)	The primary outputs from an analysis include: • Number of predicted crashes for entire interchange area • Number of predicted crashes by interchange element type • Number of predicted crashes by year • Number of predicted crashes by collision type Outputs are reported for three severity levels: total (TOT), fatal and injury (FI), and property-damage only (PDO) crashes.	Basic understanding of geometric design concepts, and working knowledge of MS Excel spreadsheets
Surrogate Safety Assessment Model (SSAM)	SSAM is a tool for traffic engineers to perform comparative safety analysis of highway design alternatives using traffic simulation models	Detailed vehicle trajectory data exported from traffic simulation software (i.e., AIMSUN, Paramics, TEXAS, VISSIM)	Simulated conflict data including: total number of conflicts, number of conflicts by type (i.e., crossing, lane-change, or rear-end events), and conflict severity indicators (e.g., average TTC, PET, Delta-V values)	Experience with traffic simulation software and automated traffic conflict analysis

Appendix C: Safety Planning Peer Exchange

Peer Exchange Overview

The Federal Highway Administration (FHWA) hosted a Safety Planning and Performance Management Peer Exchange event in Atlanta, Georgia, on October 16–17, 2012. This Peer Exchange was designed to provide an opportunity to present and discuss FHWA's Framework for System-Wide Safety Impact Prediction, as well as various tools and methods that states and MPOs are using to identify and prioritize projects for safety improvement.

Peer Exchange Background

Peer Exchange participants were selected for their involvement in instituting proactive safety planning and performance management practices within their state DOTs and Metropolitan Planning Organizations (MPOs). Nearly all Peer Exchange participants had been involved with an earlier phase of FHWA's case study research on system-wide safety performance tools and practices and had participated in multiple phone calls with the research team to describe their organizations' safety planning practices, use of safety data as part of the planning process, and use of performance measures and performance targets.

Presentation and group discussion modules were designed to highlight current methods being used to incorporate safety into transportation projects and share new, innovative ideas for expanding collaboration and implementing new tools. Over the course of the Peer Exchange, attendees met in small groups to identify gaps and challenges to predicting safety outcomes and accurately measuring success of their highway safety programs. Individuals also shared their visions for highway safety prediction tools in the future and the research needs and opportunities to enhance safety prediction practices across a suite of projects, and reported back to the larger audience. This document summarizes the information captured during the Peer Exchange. Information from the Peer Exchange will be incorporated into a final report delivered to FHWA in the summer of 2013.

Discussion Themes

The discussion over the two-day Peer Exchange broke out into four thematic areas – performance management of safety programs, data, communication, and effective knowledge transfer. Attendees each brought to bear their unique experience, describing wants, needs, challenges and best practices across each theme. Many of the key points that were discussed here reinforced findings from earlier case studies the research team identified.

Theme	Key Points Discussed at Peer Exchange
Performance Management of Safety Programs	• Use and projected impacts of individual safety countermeasures is well understood; projecting the results of system-wide suite of safety countermeasures has not been done. • Performance measurement is institutionalized in many states and MPOs decision-making processes; the number and rate of highway fatalities and injuries are common measures used.

	However, setting performance targets and measuring the impact of projects/programs on achieving those targets is not a common practice. • Safety is often addressed in standalone projects rather than integrated through planning, engineering, operations, and maintenance. • The increased focus on performance-based programs in MAP-21 may benefit safety programs because fatality and injury data is often more available than other highway performance measures.
Data	• Because crash data is often used to identify countermeasures for individual high crash locations, accurate geo-location data on all crash location and highway features is needed. • The ability to use timely and robust data enhances organizational capabilities to prioritize projects and justify decisions throughout the safety planning lifecycle. • It is difficult to collect exposure data on the number and amount of pedestrian and bicycle travel. That limits comparison capabilities for fatality and injury data for ped/bike crashes. • Future data sets need to be expanded and linked to other non-traditional types of roadway and crash data (e.g., university research, hospital reports, National Studies Center) to provide a more holistic view of and approach to safety. • Many tools (e.g., SafetyAnalyst) and guidance documents (e.g., HSM) require additional training or data formatting before use.
Communication	• States and MPOs rely on both formal and informal communication channels for information, guidance, and best practices. • The sheer volume of information/guidance available to states and MPOs makes it difficult to down-select and prioritize projects. • Events such as this peer exchange reinforce the need to continue expanding professional networks and encourage knowledge transfer.
Effective Knowledge Transfer	• Opportunities exist to improve the sharing of best practices among FHWA headquarters, states, and localities. • The 9 Proven Countermeasures Memo is an example of effective knowledge transfer – simple and direct. • MAP-21 will require increased coordination among all levels involved in safety planning (e.g., U.S. DOT HQ, FHWA Division Offices, state DOTs, and MPOs).

Participants

The follow table contains a list of participants who attended the Peer Exchange, as well as their organization. Special thanks to all of those who participated in this important event.

Name	Organization
Kyung-Hwa Kim	Atlanta Regional Commission
Alia Awwad	was Atlanta Regional Commission (now Jacobs Engineering)
Bala Akundi	Baltimore Metropolitan Council
Joe Santos	Florida Department of Transportation
Norm Cressman	Georgia Department of Transportation
Kajal Pater	Southeast Michigan Council of Governments (Michigan)
Pat Morin	Washington State Department of Transportation
Greg Morris	FHWA Georgia Division Office
Esther Strawder	FHWA Headquarters
Heather Rothenberg	FHWA Headquarters
Danena Gaines	Cambridge Systematics
Susan Knisely	Booz Allen Hamilton
Jocelyn Lewis	Booz Allen Hamilton
Alex Jendzejec	Booz Allen Hamilton