

# Statewide Opportunities for Integrating Operations, Safety and Multimodal Planning

**A Reference Manual**



U.S. Department of Transportation  
**Federal Highway Administration**  
**Federal Transit Administration**

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U.S. Department  
of Transportation  
**Federal Highway  
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Dear Colleague,

The Federal Highway Administration's (FHWA) Office of Planning, Environment, and Realty, Office of Operations, the Federal Transit Administration's (FTA) Office of Planning and Environment, along with professionals in the planning and operations communities nationwide, are pleased to present three significant new products that work together to advance an outcomes-driven, performance-based approach in the area of Planning for Operations. These three products, "Advancing Metropolitan Planning for Operations: An Objectives-Driven, Performance-Based Approach – A Guidebook," "Advancing Metropolitan Planning for Operations: The Building Blocks of a Model Transportation Plan Incorporating Operations – A Desk Reference," and "Statewide Opportunities for Integrating Operations, Safety, and Multimodal Planning: A Reference Manual" have been developed to act as a companion package of documents and reflect the strong continuing collaboration among FHWA, FTA, and professionals in the planning and operations communities nationwide.

The Advancing Planning for Operations Guidebook provides an approach focused on operations outcomes that metropolitan area transportation planners and operators can utilize to advance performance-driven regional thinking for metropolitan areas. This Guidebook utilizes requirements for the Congestion Management Process (CMP) and Management and Operations that are contained in the Federal legislation, "Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users" (SAFETEA-LU).

The Model Transportation Plan Desk Reference is intended to be a "toolbox" document that provides to planners and operators types of possible operations objectives, with associated performance measures, data needs, and strategies, that a metropolitan area can utilize as a starting point towards advancing Planning for Operations in their area. In addition to providing types of operations objectives to advance, the document includes an illustrative plan to visually show "how the pieces fit together," incorporating outcomes-driven operations into the metropolitan planning process. This document was developed in close collaboration with a number of metropolitan planning organizations (MPOs) from across the country and it is intended to be an easily accessible reference document.

The Statewide Opportunities Reference Manual is designed to assist managers and staff within State DOTs to integrate their functions and to partner with other agencies, such as metropolitan planning organizations (MPOs), transit agencies, and local jurisdictions to more effectively integrate operations, safety, and planning. Specifically, this manual is designed as a "how to" reference that provides practical information on implementing these opportunities, and case




study examples with “toolkits” to help get started. This document also expands the focus of integration to include planning, operations, and safety in a multimodal context. This document was developed working closely with the support of a number of State DOT organizations, as well as AASHTO, to create a product that is intended to be a readily accessible resource document for promoting this Statewide collaboration.


Each of these three documents can be viewed electronically by visiting our U.S. DOT website on Planning for Operations at “<http://www.plan4operations.dot.gov>.” On this website one can also find additional associated resources for advancing an outcomes-driven, performance-based approach as part of the Planning for Operations program.

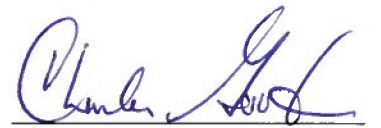
We look forward to receiving your feedback, reactions, and experiences in implementing this concept and utilizing these resources. Please direct any comments, questions, and suggestions to any of the following members of our staff:

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# Executive Summary

State departments of transportation (DOTs) face a wide range of challenges in their missions to provide safe and efficient transportation systems. In the United States, roadway fatalities and serious injuries – to vehicle occupants, bicyclists, and pedestrians – continue to be unacceptably high. Traffic congestion continues to challenge our Nation’s transportation system, resulting in billions of gallons of wasted fuel, hours of wasted time, and costs to the economy. Affordable and safe options for transit, bicycling, and walking are still limited in many communities, and the public wants transportation to support more livable, economically vibrant, and sustainable communities. While the needs for transportation investments to support all these goals are substantial, the reality is that funding for needed improvements is limited. Consequently, State DOTs are increasingly seeking innovative ways to get the most out of their investments.

## Win-Win Solutions

Integrating operations, safety, and multimodal planning offers a win-win approach that maximizes cost-effective solutions for the transportation system:

- Multidisciplinary teams help craft plans and programs that simultaneously improve safety and system operations while meeting community, environmental, and economic goals.
- Sharing operations and safety data helps planners pinpoint locations for the investments that get the biggest bang for the buck. Data from Intelligent Transportation Systems (ITS) and crash reporting, for instance, can be used to better understand the sources of congestion and focus on the most cost-effective investments.
- Collaboration is multimodal, accounting for a full range of technology and capital investments. For instance, bus transit signal priority and “next bus” information can be integrated into corridor improvements. ITS components can be integrated into road and transit investments, helping to provide more effective traveler information and improved incident detection and response.

Although all parts of the DOT organization work in support of the agency mission and goals, the areas of planning, operations, and safety have all too often functioned separately, and the perspective of those who work in these areas can be quite different largely due to their day-to-day responsibilities. Multimodal planning must consider not only the existing needs of the system but also long-term forecasted needs for infrastructure investments. In contrast, system operation focuses primarily on the short-term response to system needs utilizing technology and staff solutions. Transportation safety focuses on reducing highway fatalities by making our roads safer through a data-driven, systematic approach and addressing all “4 E’s” of safety: engineering, education, enforcement, and emergency medical services. Each of these functions holds an essential role in meeting the larger agency mission.

Integration of operations, safety, and multimodal transportation planning offers great potential for helping State DOTs stretch their limited dollars, maximize the value of their investments, and achieve positive outcomes for the transportation system. While new infrastructure takes a long time to plan and construct, operations strategies are often available in the near term to help address mobility needs at lower cost. Moreover, it is estimated that more than half of congestion experienced by travelers is caused by nonrecurring events, such as weather conditions (e.g., snow, ice, rain), work zones, special events, and major incidents and emergencies, that are not directly addressed through adding infrastructure capacity.

This reference manual is designed to provide “how to” information to assist transportation professionals in taking action to integrate these activities. It identifies and describes opportunities at various levels of decisionmaking – statewide,

regional, corridor, and project level – and the benefits of these approaches. It also highlights overarching themes such as the important role of multidisciplinary teams; data collection, sharing, and analysis; and broad use of performance measures within each of these levels. The term “operations” is applied differently across State DOTs: here it refers to an integrated program to optimize the performance of State roadways and transit systems by implementing projects and programs that will improve the throughput, as well as the security, safety and reliability of the transportation system.

## Organizing Structure

A structured approach is present throughout the reference manual to allow users to easily navigate this information and find what is most appropriate for their needs. **Section 1 (Introduction)** introduces the underlying importance of integration for each functional area and organization of the reference manual. Each of the subsequent sections contains information on specific opportunities, arranged in the following format.

- **Opportunity fact sheets:** Describe the individual opportunities along with associated challenges, benefits, and who is involved, and recommended steps to implement.
- **Relevant case studies:** Illustrate how some DOTs have approached integration, and include contact information for further support.
- **Toolkits:** Provide useful takeaway information that may be a helpful starting point for practitioners in implementing an associated opportunity.
- **Self-assessment checklist:** Helps identify where the agency may have current practices in place to support integration, and where more focus may be needed.

It is important to remember that *these opportunities or steps are often not independent of each other*. Instead, opportunities often build upon one another and link together. Users should explore the entire manual to identify connections and relationships as well as take advantage of what they are already doing. Self-assessments may be useful to consider early in the process or to assess achievement over time. This feature supports a “gap analysis” that may quickly guide the user to the greatest need. The toolkits contain references to other supporting information outside of the reference manual itself.

## Top-Down and Bottom-Up

Integration of operations, safety, and multimodal planning within a State DOT requires leadership from executives and managers. However, integration does not necessarily require large-scale change within the organization. Efforts to coordinate among functional areas can be undertaken by individuals at all levels within the organization.

**Role of Leadership** – At the executive level, even a simple statement of intent provides support for efforts to break down silos. Setting policies and strategies toward implementation through agency-wide plans will move the agency further along this path. Ultimately, an environment within the agency that supports enhanced cross-functional collaboration in conjunction with policy statements provides the most sustained support for this intent. The presence of a champion to encourage others toward implementing a new policy or action is strongly supportive.

**Staff Level Actions** – At the same time, staff working within the agency are critical to fully implement and sustain an integrated approach. In many cases, staff with a strong sense of the potential benefits can propel the concept forward. The case studies included in the manual in many instances began with actions at the staff or supervisor level. Staff within State DOTs can also use the reference manual to provide recommendations to managers.

## Opportunities Across Multiple Levels of Decisionmaking

To provide a user-friendly reference, this document is divided into sections that enable users – from operations, safety, and planning functional areas – to go directly to appropriate sections based on the focus of their efforts at different levels of decisionmaking.

**Section 2 (Creating an Environment for Integrating Operations, Safety, and Multimodal Planning)** of the reference manual focuses on business processes, institutional issues, and human resource considerations that can support agency-wide change led at the executive level. It also is a useful starting point for readers who wish to gain a high-level appreciation of opportunities before reading other sections of this document. The opportunities described in section 2 are cross-cutting in supporting integration at the statewide, corridor and sub-area, regional, and project levels.

**Section 3 (Statewide Level Opportunities)** supports integrating operations, safety, and multimodal planning at the statewide level and may enhance integration at other levels. The statewide level provides an opportunity to establish goals, objectives, and strategies that support the larger agency mission. Required planning documents can form the basis for programming and demonstrate accountability by setting performance measures. Opportunities for integration can occur by developing links between safety-focused efforts (such as

the Strategic Highway Safety Plan), operations-focused efforts (such as operations or ITS plans), and other multimodal transportation planning efforts with the State Long Range Transportation Plan. This is particularly true when interdisciplinary teams, performance measures, and data collection and analysis methods are brought into these efforts.

**Section 4 (Regional Level Opportunities)** focuses on interaction between the State DOT – often at a regional or district-level office – to address operations, safety, and planning in coordination with Metropolitan Planning Organizations (MPOs), rural planning organizations, Federal lands agencies, tribal governments, transit agencies, and other partners. Data sharing and analysis tools provide key opportunities for advancing integration at this level.

**Section 5 (Corridor and Sub-Area Level Opportunities)** considers integration at the corridor and sub-area level both within planning studies and corridor system management and operations activities. Best practices that have developed within this planning level tend to be highly inclusive of many partners and stakeholders as well as consider a wide range of potential solutions. Key opportunities at this level include use of operations/safety data and tools in planning studies and multidisciplinary teams to develop solutions that include operations and safety strategies. Corridor System Management Plans directly tie together operations, safety, and planning through coordinated system monitoring and evaluation, demand management, traveler information, operational improvements, and planning for needed capacity enhancements.

**Section 6 (Project Level Opportunities)** considers integration at the project level, where representatives of each function commonly interact. Within project development are opportunities to effectively address operations, safety, and multimodal planning needs. Strategies can also be developed to address traffic management and system performance issues during project construction.

## Conclusion

Integrating operations, safety, and multimodal planning within a State DOT is a way to increase both efficiency and effectiveness of transportation decisionmaking. This reference manual is designed to support transportation professionals toward integrating their functions and partnering with other agencies, such as MPOs, transit agencies, and local jurisdictions, resulting in a safer, more reliable, multimodal transportation system.



# Section 1

## Introduction

### 1.1 Purpose

Transportation agency missions are changing and expanding to meet new needs and new requirements; however, reduction of congestion and safe operation of the system remain the highest priorities. As congestion becomes more widespread and places more demand on the transportation system, funding for needed transportation improvements is increasingly insufficient to meet all identified needs. To address this dynamic, State departments of transportation (DOTs) are seeking innovative ways to make the most of investments in the transportation system.

The DOT is often one of the largest public agencies in a State, with hundreds of employees supporting both short- and long-term needs of the traveling public and movement of freight. Each part of the agency has a different role in support of this mission; however, the direct responsibility to address system capacity, mobility, access, and safety lies with multimodal planning, system operations, and safety. Because the agencies are so large and complex, staff in each of these functional areas is often not aware of the plans and actions of the other parts of the organization. In some cases this lack of integration may lead to inefficiencies and duplication of effort, or may even involve working at cross purposes. In either instance, the agency is not taking advantage of opportunities to increase both efficiency and effectiveness in decisionmaking.

This reference manual on *Statewide Opportunities for Integrating Operations, Safety, and Multimodal Planning* is intended to assist managers and staff at State DOTs in their efforts to more effectively integrate operations, safety, and planning. The manual builds on a previous Federal Highway Administration (FHWA) document, *Statewide Opportunities for Linking Planning and Operations: A Primer*. While the primer identifies broad opportunities for State DOTs to integrate planning and operations, the reference manual extends this information to provide practical instruction on how to implement these opportunities and others along with case study examples and “toolkits” to help get started. The reference manual also expands the focus of integration to include operations, safety, and planning in a multimodal context.

### 1.2 Why Integrate Operations, Safety, and Multimodal Planning?

Highway fatalities and serious injuries are at unacceptably high levels in the United States. Although great strides have been made in improving highway safety, in 2008 there were 37,261 roadway fatalities in the United States, including vehicle occupants, bicyclists, and pedestrians.<sup>1</sup> Traffic congestion continues to challenge our Nation’s transportation system. It is estimated that traffic congestion costs the Nation 2.8 billion gallons in wasted fuel and 4.2 billion hours of wasted time per year.<sup>2</sup> While communities are increasingly focusing on quality of life and livability, affordable and safe options for transit, bicycling, and walking are still limited in many places.

Integration of operations, safety, and multimodal transportation planning offers great potential for helping State DOTs stretch their limited dollars, maximize their investments, and achieve positive outcomes for the transportation system. These benefits can be system-wide and enable more effective decisionmaking.

<sup>1</sup> FHWA, Office of Safety. Web site available at: <http://safety.fhwa.dot.gov/>.

<sup>2</sup> Texas Transportation Institute, *2009 Urban Mobility Report*. Citing data for 2007.

Traditionally, transportation planning and programming have focused largely on increasing system capacity to meet travel demand. However, there is neither the funding available nor the widespread support needed to build all the lane-miles and transit infrastructure needed to accommodate demand. New infrastructure takes a long time to plan and construct and is often disruptive to communities. In addition, it is estimated that more than half of congestion experienced by travelers is caused by nonrecurring events, such as weather conditions, work zones, special events, and major incidents and emergencies that are not directly addressed by adding infrastructure capacity.<sup>3</sup> With increased communication technologies, travelers have come to expect more choices for travel and better information with which to make those choices.

Transportation system management and operations (M&O) strategies are designed to optimize the performance of the transportation system and provide a more immediate response to traveler needs than capacity projects. However, these strategies have not been routinely considered in system-wide improvements identified in transportation planning.

In contrast, safety has always been a key consideration in transportation planning. Introduction of the Strategic Highway Safety Plan (SHSP) supports integration of safety more comprehensively in the planning process. When safety issues are considered in setting of goals and selecting plan scenarios, projects selected for programming in the State Transportation Improvement Program (STIP) are more likely to address safety needs. Safety enhancements that reduce crashes also address nonrecurring congestion, and therefore result in improved transportation system operations. Efforts to improve system operations, such as through better work zone management, weather information, and traveler information, can also improve safety by helping travelers avoid unexpected roadway and traffic conditions that can lead to crashes.

When operations and safety issues and strategies are considered comprehensively along with capacity additions, the mobility, security, safety, and reliability of the multimodal transportation system can be enhanced more quickly and cost-effectively.

Benefits to the individual functions are summarized in exhibit 1.

### Benefits of Operations and Safety Strategies

- **Traffic signal optimization** can decrease delay substantially (13–94%) while improving safety (by reducing speeding and red-light running), at a fraction of the cost of infrastructure capacity expansion. The Texas DOT's Traffic Light Synchronization Program reduced delay by 25%, resulting in a benefit-to-cost ratio of 62:1.
- **Roundabouts** are a strategy that can be used at unsignalized intersections that are experiencing high rates of right-angle, rear-end, and turning crashes. They can decrease fatalities at an intersection by 90%, reduce injuries by 76%, and reduce all crashes by 35%. They also help to improve traffic flow.
- **Traffic incident management** can decrease incident duration by 30–40%. Combined traveler information and incident management systems can increase peak period freeway speeds by 8–13%, reduce crash rates, and improve trip time reliability by 1–22%.
- **Road weather information systems** can reduce traveler delay and lower crash rates by 7–83%.
- **Electronic Toll Collection (ETC)** can yield substantial savings in travel time. A 10–30% participation rate in electronic toll collection yielded benefit-to-cost ratios from 2:1 to 3:1.
- **Managed lanes** provide an option for more reliable travel and can significantly improve transit service speeds. Express lanes on I-95 in Miami resulted in express bus route travel times falling from 25 to 8 minutes on a 7.5-mile section, and a 30% increase in route ridership.
- **Transit signal priority (TSP)** can yield a 2–18% saving in transit running time, and can reduce the number of buses needed in service.

Sources: USDOT, Intelligent Transportation Systems Joint Program Office, *Investment Opportunities for Managing Transportation Performance through Technology*, January 2009. FTA, *Miami Urban Partnership Agreement (UPA) Project: Phase 1A – Transit Evaluation Report*, November 2009. Transit Cooperative Research Program Report 118: *Bus Rapid Transit Practitioners Guide*, 2007.

<sup>3</sup> FHWA. *Traffic Congestion and Reliability: Linking Solutions to Problems*. Estimates based on past and ongoing congestion research studies.

**Exhibit 1: Roles and Benefits of Integration to State DOT Operations, Safety, and Planning Functions**

Operations	Safety	Planning
<b><i>Roles</i></b>		
<p>“Operations” refers to those organizational areas responsible for transportation system M&amp;O such as traffic engineering, ITS and work zone management. Operations staff focus on active management of the existing transportation system using real-time data, analysis, and monitoring of dynamic system performance. Operations activities focus on daily movement of vehicles through use of technology including incident management systems, ITS, and traveler information systems. Operations staff coordinate with law enforcement, toll authorities, transit agencies, and others to respond to incidents, weather conditions, and special events.</p>	<p>Safety is the highest priority for a transportation system. The mission of safety personnel is to reduce highway fatalities by making roads safer through a data-driven, systematic approach and addressing all “4 E’s” of safety: engineering, education, enforcement, and emergency medical services. Increasing awareness of the need for roadway safety improvements is important for development of plans and programs that improve transportation safety. Safety staff strive to provide decisionmakers with important information, tools, and resources that will improve the safety roadways. Safety should be considered every time and at every stage of a project. Safety data is relied on by both planning and operations staff for their individual responsibilities.</p>	<p>By Federal mandate, multimodal planning considers both the existing deficiencies of the system and the forecasted long-range (20-year) needs. Planners consider potential strategies in response to identified needs in order to select and prioritize improvement strategies and projects. State DOT planning staff often coordinate with MPOs, transit agencies, tribal governments, and local governments. These actions are incorporated into multiple planning documents:</p> <ul style="list-style-type: none"> <li>▪ Statewide Long-Range Transportation Plan (SLRTP);</li> <li>▪ Statewide Transportation Improvement Program (STIP);</li> <li>▪ Modal plans and other statewide plans and studies including transit plans, freight plans, and other plans; and</li> <li>▪ Corridor and sub-area plans.</li> </ul>
<b><i>Benefits of Integration</i></b>		
<ul style="list-style-type: none"> <li>▪ Improve understanding of the long-range planning process and programming in support of operations activities.</li> <li>▪ Identify how operations activities fit into the context of statewide priorities and goals.</li> <li>▪ Provide a systems-level structure that helps prioritize individual operations goals and projects.</li> <li>▪ Direct attention to the value of operations efforts in meeting both short-term and long-term goals.</li> <li>▪ Include operations considerations in project planning and design in order to leverage scarce project funding to meet operational needs.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Build safety considerations into system planning efforts to ensure safety goals, objectives, and strategies from the SHSP are integrated into statewide planning efforts.</li> <li>▪ Build safety considerations into system operations activities, such as through traffic, work zone, and incident management.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Ensure that statewide investment priorities are aligned with safety and operations goals for the system.</li> <li>▪ Provide access to detailed system-wide travel data to better characterize existing system performance and travel conditions, as well as to identify the most critical transportation needs in order to prioritize funding.</li> <li>▪ Support better analysis of issues such as reliability, security, and safety that are difficult to analyze with traditional planning methods.</li> <li>▪ Provide a greater understanding of ways that operations and safety strategies can address transportation needs and identify the most effective strategies for achieving intended outcomes.</li> </ul>

## Benefits for System Users

Ultimately, greater integration of operations, safety, and planning provides direct benefits to users of the transportation system, including the traveling public and freight shippers. Rather than having uncoordinated safety programs, operations programs, and multimodal investment plans, an integrated approach yields investments and strategies that simultaneously result in safety benefits, improve system operation, and enhance traveler choices. When integration is effective, it results in transportation system improvements that may be implemented more quickly using available funding to meet multiple needs.

Transportation infrastructure investments will build in operations components, such as ramp metering, transit signal priority, and technology to monitor real-time traffic flow, as well as safety enhancements addressing issues such as intersection safety and pedestrian and bicyclist safety. Operations and safety programs will reduce crashes and improve incident response time, resulting in fewer injuries and reduced traveler uncertainty and delay, while also accounting for multimodal planning considerations, such as nonmotorized access, transit access, and community livability.

Outcomes for system users include:

- Fewer crashes, injuries, and fatalities on the transportation network;
- Improved transportation system reliability and reduced traveler delay; and
- More multimodal options, enhanced mobility, support for economic vitality, preservation and protection of the environment, and other benefits to communities.

## Challenges of Integration

While there are many benefits to integration, State DOTs also face several key challenges.

- **State DOT long-range planning has traditionally been concerned with identification of needed infrastructure, and less frequently incorporates consideration of operational improvements.** The SLRTP may recognize the importance of system operations and safety as goals for the transportation system; however, this is typically at the policy level and may not be tied to specific investment decisions. State DOTs may not have a systematic process for prioritizing investments in operations, safety, and infrastructure projects. Decisions may be based on data and fiscal analyses to focus on achieving performance objectives. There has generally been a lack of tools and performance measures to enable consideration of traffic and transit operations strategies alongside more conventional highway infrastructure investments.
- **DOT programming within the STIP relies on funding programs that often apply to very specific types of improvements.** These programs are most commonly directed to the addition of infrastructure rather than operational improvements. The narrow definitions of these programs may inhibit the ability to integrate funding across the functional areas.
- **When operations or safety work is performed, it is often targeted to specific locations, without a systems perspective or incorporation of long-term system-wide planning goals and objectives.** Traditionally, operations and safety efforts have focused on specific problem points rather than on developing long-term and system-wide goals, objectives, and strategies. The division of operational and safety responsibilities within various parts of the State DOT, county and local transportation agencies, and nontransportation agencies (e.g., law enforcement) can inhibit consensus on a long-term direction. The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) requirement to develop an SHSP creates a new framework for advancing all of the State's safety activities in a coordinated manner, consistent with the overall SLRTP goals. However, there is no legislative mandate for a similar system-wide plan for operations.
- **Large agencies often have difficulty making connections across different functional areas.** This may be due to dispersed staff locations or a strong focus on meeting individual missions without the opportunity for regular collaboration. Moreover, some State DOTs are decentralized, making it difficult to tie together operations, safety, and planning efforts.
- **Daily job requirements provide a different perspective for each of the functional areas.** While planners typically focus on the long-range future of the transportation system, operations and safety staff



focus on the more immediate needs. These different outlooks create challenges in getting operators and safety experts involved in long-range planning.

- **Planning and safety have dedicated funding resources to draw on.** The operations function within the State DOT is funded from many different resources without ongoing consistency. This situation makes it difficult for operations staff to work outside the primary mission in order to collaborate across functions.

Efforts to integrate operations, safety, and planning should recognize these challenges and consider ways to overcome them. There is no simple “fix”; however, there are a range of opportunities that can be explored.

## Opportunities to Advance Integration

Integration of operations, safety, and multimodal planning within a State DOT requires leadership from executives and managers to foster an environment within the organization that supports greater integration. However, it also requires participation among staff at all levels within the organization.

**Management and Political Support** – Having high-level management and elected official support is important to create an environment for advancing integration efforts. At the executive level, even a simple statement of intent provides support for advancing integration. Setting policies and strategies toward implementation through agency-wide plans will move the agency further along this path. Experience suggests that having a champion at a high level in the agency and decisionmaker support is often critical.

**Staff Level Actions** – At the same time, all members of the DOT play an important role in the success of any management-initiated effort. Staff-level employees often play a key role in advancing efforts to foster collaboration among functional areas through informal or formal relationships. In many cases, staff with a strong sense of the potential benefits can propel the concept forward.

Overarching themes include the important role of the following elements:

- **Building relationships / developing integrated teams** – Effective integration stems from building relationships among the functional areas within a State DOT, as well as between the DOT and MPOs, transit agencies, local transportation agencies, toll authorities, and law enforcement. Many of the opportunities described in this manual demonstrate ways in which relationships are developed. Developing integrated teams that include operations, safety, and planning staff often is a critical component of developing goals, objectives, and performance measures that support investment decisionmaking.
- **Data collection and sharing** – A large amount of data on traffic and transit conditions are collected and used by operations staff and safety specialists. Data presents an important opportunity for planners to better understand travel-time reliability and other operations and safety performance issues in order to develop more effective solutions. Many of the opportunities described in this reference manual rely on data sharing.
- **Use of performance measures and analysis tools** – Performance measures addressing reliability, nonrecurring congestion, incidents, crashes, and other operational and safety issues help to draw attention to operational strategies for improvement. As noted throughout this manual, performance measures can be applied at all levels to identify system deficiencies. Performance measures also can be used to support tracking progress over time and can enable planners to compare and prioritize investment strategies in order to communicate the benefits to decisionmakers.
- **Linking planning and programming** – Integrating planning, operations, and safety will not yield measurable benefits unless planning and programming are closely linked. Funded projects and programs need to support the agency goals and performance objectives as identified in planning documents. Consequently, the programming and budgeting processes are critical elements for attaining the benefits of integration.

## 1.3 Getting Started – How to Use This Reference Manual

### Select the Appropriate Sections Based on Your Role in the Agency

In this reference manual, opportunities for integration are organized into sections according to the levels at which specific opportunities for integration can be realized: statewide, corridor, regional, and project levels. This structure will help practitioners identify specific sections of the document that correspond to their roles and responsibilities:

- **Section 2. Creating an Environment for Integrating Operations, Safety, and Multimodal Planning** reviews broad-level opportunities for integration that exist within State DOTs at all levels. These opportunities involve fostering practices that advance integration across the DOT and are cross-cutting in supporting integration at the other levels. This section will be particularly helpful for senior and mid-level management, as it focuses on business processes, institutional issues, and human resource considerations. It also is a useful starting point for readers who wish to gain a high level of appreciation of opportunities before reading other sections of this document.
- **Section 3. Statewide Opportunities** focuses on integration opportunities and challenges that exist at the statewide level, applying a statewide perspective of safety and operations that can be incorporated into planning and programming. This section addresses the SLRTP, other statewide plans, STIP, and the linkages between these documents and efforts. It should be noted that many of the statewide opportunities and activities will influence opportunities at other levels, as the SLRTP and other statewide planning efforts form the basis for corridor, regional, and project-level efforts.
- **Section 4. Regional Level Opportunities** highlights opportunities such as initiatives within DOT regional or district offices that bring together planners, operators, and safety personnel for data sharing and consideration of operational strategies with MPOs, rural areas, tribal governments, and Federal lands.
- **Section 5. Corridor and Sub-Area Level Opportunities** discusses opportunities and challenges surrounding integrating safety and operations into corridor and sub-area planning activities and in corridor system management and operations.
- **Section 6. Project Level Opportunities** discusses opportunities that may arise when integrating operations, safety, and planning considerations at the project level within project development and design, as well as traffic management and demand management strategies incorporated into project construction.

## Review Specific Opportunities for Integration

Within each section, specific opportunities or steps for integration are identified and described. It should be noted that these *opportunities or steps are often not independent of each other*. They often build on other opportunities and link together. Therefore, while the user may scan this reference manual to identify different opportunities, *it is recommended that consideration be given to information about the various opportunities within a specific level – and across levels – to see the connections*.

Each opportunity is explained in three parts:

A “**fact sheet**” that includes the following information:

- Brief description of the opportunity or linkage between operations, safety, and planning;
- Associated benefits and challenges;
- Who is involved; and
- Recommended implementation actions.

It should be noted that because steps will vary from one State DOT to another, this information is intended to provide some direction on how to implement the opportunity, but is not intended to be prescriptive or imply that every State should follow the same procedures. Since the various opportunities are often inter-related or linked, these steps often refer to or repeat steps that may be identified under other opportunities.

Following the summary description are **case study examples** of State DOTs that have either begun implementing or have successfully realized the opportunity. These case study examples are intended to provide more detail on how to implement the opportunity listed, along with sources for additional information.

To provide practitioners with useful takeaway information, “**toolkits**” have been included following many of the opportunities. The toolkits are designed to provide users with helpful information on beginning to implement integration efforts. The toolkits are not comprehensive but should help users develop ideas regarding implementation. Available and pertinent references to resources also are included.

“Self-assessment checklists” are provided at the end of all sections. The self-assessments are designed to help the reader assess progress in integrating operations, safety, and planning. A self-assessment can be used in the following way:

- **After reading the section content** – To evaluate the user’s agency success in achieving integration in the opportunities outlined within the section’s fact sheets.
- **Prior to reading the section content** – Based on a user’s response to the questions asked, the self-assessment can serve as a roadmap to direct the user to those opportunities that are most relevant to promoting integration efforts within his or her agency.

In addition, **Appendix A** lists relevant plans in which integration efforts can be incorporated to encourage cross-over efforts between different parts of the agency. **Appendix B** provides a compilation of all the self-assessment checklists from each section, and may be a helpful starting point for some users.

### A Quick Reference for Getting Started

1. **Select Appropriate Sections** – Based on your role within the State DOT, identify the most appropriate sections of the document for review.
2. **Review Specific Opportunities** – Start by reading the section introductions and self-assessment checklists; these may help provide direction to specific opportunities. For each opportunity, read the fact sheets and corresponding information to determine what opportunities offer the most potential for your specific responsibilities.
3. **Consider How these Opportunities Can Be Fostered** – Use the self-assessments to assess current activities and areas of potential increased integration. Review toolkits, resources, and case studies to identify what is most applicable.
4. **Share the Information** – Share information with appropriate management and other staff to create buy-in to the concept. Refer to the “Benefits” and “Challenges” noted for each opportunity.
5. **Implement** – Meet with appropriate management and other staff to develop a working group to explore specific opportunities, or to build these practices into ongoing or upcoming efforts (e.g., development of statewide plans, corridor plans, ITS program plans, SHSPs, etc.). Refer to the information in “Who Is Involved” and “Recommended Implementation Steps.”



## Section 2

# Creating an Environment for Integrating Operations, Safety, and Multimodal Planning

Section 2 focuses on integration opportunities at an agency-wide level, rather than on specific transportation plans or geographic areas within a State. It is unrealistic to expect that these opportunities can be implemented without support of high-level DOT management. As a result, this section is primarily targeted at senior and mid-level management within an agency. The motivation for these approaches must be sufficient to initiate the implementation actions required. In addition, these opportunities will require a greater long-term commitment on the part of the agency, as well as a degree of change management that is not necessary in many other opportunities identified in the reference manual.

The existence of a champion within the agency to facilitate the integration of planning, operations, and safety can provide strong support for approaches that involve institutional change. Individuals within the organization who have adopted practices in support of integration can be enlisted as advocates or resources. Because these opportunities may reflect significant change within the agency, to be successful the approaches will require buy-in at all levels of staff. The self-assessment provided at the end of section 2 may be useful at the outset to evaluate the existing climate within the agency with regard to significant change. In some cases it would be feasible for lower-level staff within the agency to create less formal working arrangements that meet some of the integration opportunities. Staff may also consider approaching their supervisors and others with ideas and recommendations to formalize integration working arrangements into standard operating practices.

The opportunities described in this section may be viewed as overarching or cross-cutting themes that are important within an organization and affect decisions that are made at multiple levels. These opportunities have the potential to provide an agency-wide culture of integration that in turn will facilitate the likelihood of integration in specific activities within each of the levels described in the other sections of this document – statewide, regional, corridor and sub-area, and project.

### Section Content

This section describes four overarching opportunities:

- Develop Multidisciplinary Teams/Initiatives
- Use an Objectives-Driven, Performance-Based Approach
- Use a Strategic Business Plan to Focus on Integration of Operations, Safety, and Planning
- Foster Multimodal Coordination

Collaboration across functional areas is essential to moving beyond handoffs of data and information to the integration of goals and objectives as well as strategies and programs. The first two opportunities in particular reflect themes that recur frequently in opportunities described in subsequent sections of this document. Establishing multidisciplinary teams and a performance-based approach to planning at all levels will result in the setting of realistic and measurable objectives as well as improved and focused data collection. The second two opportunities relate to the DOT's strategic focus and structure. In all cases, if these themes are pervasive within the agency, it will benefit decisionmaking at all levels.

## 2.1

## Develop Multidisciplinary Teams / Initiatives

Description	<p>The use of multidisciplinary teams is intended to provide an understanding of multiple perspectives and achieve consensus on approaches and solutions. Team members can extend beyond the State DOT headquarters planning, safety, and operations offices to include regional offices, transit agencies, MPOs, and local transportation agencies, as well as State and local law enforcement officials, freight shippers, and other stakeholders.</p> <p>Multidisciplinary teams can be utilized to advance integrated approaches at various levels and are identified throughout the other sections of the document as an implementation step. There will be a need to ensure inclusiveness of ideas and a willingness to understand different perspectives. Multidisciplinary teams require a sense of trust among team members in order to work together effectively and achieve desired outcomes, as well as a strong sense of support from agency management. Management may formalize the multidisciplinary teams in a working group or other structure, or it is possible for teams to function on a more informal basis through initiation at the staff level.</p> <p>Examples of multidisciplinary teams include working groups that may be established to develop the SLRTP, SHSP, corridor planning studies, performance measures initiatives, or integrated operations and safety programs.</p>
Benefits	<ul style="list-style-type: none"> <li>▪ Brings in different perspectives and can help build off the expertise of different staff.</li> <li>▪ Can yield more efficient and effective use of resources.</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>▪ A commitment to the process from top agency officials is required since it may require staff to go outside their standard job responsibilities.</li> <li>▪ Since personnel may change over time, there may be a need to develop a formal process, team, or working group to sustain communication and collaboration.</li> <li>▪ Startup activities may be needed to build understanding of different roles and responsibilities among team members.</li> <li>▪ Relevant staff may be in different locations, which may make it difficult to collaborate.</li> </ul>
Who Is Involved	<p>The composition of multidisciplinary teams will depend on the particular initiative that is being undertaken. For instance, development of the SLRTP will involve staff and stakeholders who bring a statewide perspective regarding safety, operations, and planning, while project-level planning activities will involve a different set of staff involved in project planning, design, and operation.</p>
Recommended Implementation Steps	<ol style="list-style-type: none"> <li>1) Identify the purpose of the team or initiative; specifically, what it is setting out to accomplish. It is important to have clear goals so the team understands what it is intending to achieve.</li> <li>2) Identify who should be involved, from what disciplines and organizations, based on the purpose of the effort.</li> <li>3) Convene and maintain a multidisciplinary team of operations, safety, and planning staff.</li> <li>4) Develop formal processes as necessary to establish ground rules for participation.</li> <li>5) Develop a methodology to review the performance of the multidisciplinary team approach.</li> <li>6) Monitor progress and prepare periodic reports.</li> </ol>

## Relevant Examples

Examples of multidisciplinary teams are described throughout this document within the sections on statewide, regional, corridor and sub-area, and project level opportunities. The two examples below highlight initiatives that involve collaboration among operations, safety, and planning staff from State DOT headquarters and district offices along with local governments and other stakeholders.

### Florida DOT: Transportation System Management and Operation Program

Florida DOT's (FDOT) Transportation System Management and Operation (TSM&O) program is establishing partnerships among the FDOT district offices, county transportation agencies, transit agencies, MPOs, and FDOT planning and operations offices. The goal is to reduce congestion through real-time active management and operation of the State's existing roadways. Its main components include performance measures, network composition, data collection and analysis associated with the performance measures, management/operation strategies, and resource planning. The program includes user-based performance measures, which reflect the priorities of the State roadways' main user groups (commuters, freight/goods movers, etc.). These performance measures will be used to assess management effectiveness, return on investment, and the cost effectiveness of future investment. They will ultimately be applied over a well-defined transportation system network, including arterials, interstates, public transportation, and other components.

Interagency partnering is highly critical to the success of TSM&O because transportation networks, and therefore the deployment of the TSM&O program, fall under the jurisdiction of various public and private entities with potentially different management priorities. Partnering efforts will include effective communication, coordination, and collaboration. FDOT is assisting partnership development efforts through a series of workshops where the major components of TSM&O will be explained in further detail. The first workshop was held in District Four and included representatives of the Broward County Traffic Engineering Division, Broward County Transit, Broward County MPO, FDOT planning offices, FDOT Office of Modal Development, and FDOT Traffic Operations. If successful, the resulting partnerships could ultimately lead to greater support for performance-driven management and increased interest in, and political support for, TSM&O strategies and investment.

More information is available at *Editorial Corner—A Change in the Way We Solve Urban Transportation Problems*, [http://www.dot.state.fl.us/trafficoperations/Newsletters/2008/08\\_2008/08\\_2008.shtm](http://www.dot.state.fl.us/trafficoperations/Newsletters/2008/08_2008/08_2008.shtm). Contact: Mark Plass, District 4 Traffic Operations Engineer, [Mark.Plass@dot.state.fl.us](mailto:Mark.Plass@dot.state.fl.us), (954) 777-4399, or Melissa Ackert, TSM&O Program Manager, [Melissa.Ackert@dot.state.fl.us](mailto:Melissa.Ackert@dot.state.fl.us), (954) 777-4156.

### Virginia DOT: Strategically Targeted Affordable Roadway Solutions

Planners and engineers from the Virginia DOT (VDOT), various Virginia MPOs, the Governor's Highway Safety Office, and local government officials joined together to form the innovative Strategically Targeted Affordable Roadway Solutions (STARS) program. Funding for the program comes from the Highway Safety Improvement Program (HSIP), in the form of either designated funds or in coordination with planned maintenance improvements. VDOT's planning division initially began the STARS program as a way to eliminate bottlenecks. The program involves State and local transportation planners, traffic engineers, and operations staff who work together to identify "hot spot" areas along State roadways where safety and congestion issues overlap and where short-term operational improvements are feasible. Planners began by mapping the highest crash locations along State roadways together with those segments with low Level of Service (LOS). Potential problem areas were identified as those segments where the data overlapped.

Planners create maps from the available data for each of VDOT's five regions. Each region has a multidisciplinary team that is tasked with validating the data, conducting Road Safety Assessments, and suggesting feasible low-cost, high-benefit improvements that will target safety and congestion problems. The types of countermeasures considered include access management, reconfiguration/reconstruction of intersections (roundabouts, realignment, signaling), bicycle and pedestrian accommodations, installation of medians or shoulders, ITS, signage and road striping and turn lanes. These short-term safety and operational improvements are then applied to the corresponding roadway sections. A key component to the program is an innovative, Geographic Information System (GIS)—based methodology that analyzes roadway locations within Virginia's five Systems Operations Regions to identify and prioritize those areas where improvements in safety and congestion would be most effective.

Sample improvements that have been made as a result of the STARS program include traffic signal modernization, construction and/or extension of turn lanes, extending acceleration or deceleration lanes on ramps, assisting with access management by consolidating entrances, closing crossovers, improving interparcel access, improving sight distance, reconfiguring or reconstructing intersections by installing roundabouts, realigning approaches, installing signal systems, installing shoulders or medians, and installing traffic control devices such as signs and pavement markings.

The program's final recommendations under Phase I for roadway improvements have been incorporated into the 2035 State Highway Plan, which was completed in early 2010. While that plan identifies long-term transportation improvements to Virginia's Federal functional roadways, the STARS program focuses on Virginia's interState and primary highway systems to identify short/mid-term operational and safety improvements that:

- Are low cost (less than \$5 million for interstates, \$2 million for primaries);
- Address identified severe crash hot spots and/or congestion problems;
- Require minimal preliminary engineering and right-of-way; and
- Can be implemented quickly (12–24 months).

Phase 2 of the project will focus on reviewing the hot spots identified by the program and outlining countermeasure strategies that would be appropriate to implement. In Phase 3, staff will review the data and select those hot spots that will be focused on for improvements.

More information is available at *Spotlight: Virginia's STARS Program*, [http://safety.fhwa.dot.gov/newsletter/safetycompass/2008/sept08\\_v2/](http://safety.fhwa.dot.gov/newsletter/safetycompass/2008/sept08_v2/). Contact: Robin Grier, Assistant Division Administrator for Transportation and Mobility Planning for VDOT, [Robin.Grier@vdot.virginia.gov](mailto:Robin.Grier@vdot.virginia.gov), (804) 786-2964, or Mena Lockwood, ITS Development for Operations and Security Division, VDOT, [Mena.Lockwood@vdot.virginia.gov](mailto:Mena.Lockwood@vdot.virginia.gov), (804) 371-0849.



## 2.2

## Use an Objectives-Driven, Performance-Based Approach

Description	<p>An objectives-driven, performance-based approach to transportation planning and system operation provides a strong foundation for integration. A critical component of this approach is development of specific, measurable objectives for transportation system performance that inform investment decisions. These objectives may relate to mobility, reliability, safety, access, traveler information, incident management, transit operations, or other issues. Performance measures are used to measure progress in meeting objectives and help to:</p> <ul style="list-style-type: none"> <li>▪ Understand deficiencies in system performance;</li> <li>▪ Prioritize competing investments;</li> <li>▪ Demonstrate progress toward meeting objectives; and</li> <li>▪ Communicate among the DOT, policymakers, and the public.</li> </ul> <p>The objectives and performance measures established at the statewide level can help to inform objectives and performance measures used at lower levels.</p>
Benefits	<ul style="list-style-type: none"> <li>▪ The approach provides a more objective (rather than subjective) way to allocate resources and screen improvement strategies.</li> <li>▪ Through development of safety and operations objectives and performance measures, the approach helps to engage the operations and safety communities, as well as law enforcement, freight, and private sector, in transportation planning.</li> <li>▪ The result is a focus on both short-range and long-range needs related to the safety and operation of the transportation system.</li> <li>▪ Performance measures provide increased accountability with the public and stakeholders.</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>▪ The wide range of transportation system operators, jurisdictions, and stakeholders involved can make it difficult to develop consensus on appropriate system-level performance objectives.</li> <li>▪ Data and analysis capability limitations may make it difficult to develop appropriate performance measures or use them for planning applications.</li> </ul>
Who Is Involved	<p>Development of objectives and selection of performance measures should be conducted in collaboration with DOT planners, operations, and safety specialists, as well as other stakeholders, such as transit agencies, MPOs, law enforcement agencies. Operations and safety staff can help identify data that can be used to support tracking performance measures.</p>
Recommended Implementation Steps	<ol style="list-style-type: none"> <li>1) Maintain or convene a multidisciplinary team of operations, safety, and planning staff for the planning effort (e.g., developing the SLRTP, modal plan, or operations plan).</li> <li>2) Develop objectives – specific, measurable statements of performance related to operations and safety – that will lead to accomplishing goals.</li> <li>3) Develop performance measures considering data availability and adequacy to monitor the measures.</li> <li>4) Using a systematic approach, analyze transportation performance issues and recommend strategies.</li> <li>5) Select strategies within available funding to meet objectives.</li> <li>6) Implement strategies, including program investments, collaborative activities, and projects.</li> <li>7) Monitor and evaluate the effectiveness of implemented strategies and track progress toward meeting objectives.</li> </ol>

## Relevant Examples

Examples of objectives and performance measures are described throughout this document within the sections on statewide, regional, corridor and sub-area, and project level opportunities (particularly *sections 3.1 to 3.4*). The two examples below highlight performance measure frameworks that are being used across multiple levels within State DOTs.

### California DOT: Smart Mobility Framework

California DOT (Caltrans) has developed the Smart Mobility Framework, which will serve as an implementation action plan for the current adopted *2030 California Transportation Plan*. This planning framework will be used to assess plans, programs, and projects to evaluate their success in addressing challenges associated with mobility and sustainability in the Caltrans surface transportation system. The framework is comprised of a series of place types (e.g., urban centers, close-in compact communities, suburbs, rural towns) and performance measures that evaluate the success of strategies aimed at solving the identified mobility and sustainability challenges.

The framework itself is concerned with six principles: location efficiency, reliable mobility, health and safety, environmental stewardship, social equity, and robust economy. These principles are integrated into policies, planning, and project development activities through place types and performance measures focused on achieving the following five objectives:

- 1) Multimodal focus
- 2) Speed suitability
- 3) Activity connectedness
- 4) Network management
- 5) Land use efficiency

The 17 measures associated with the principles and objectives above emphasize travel choices; healthy, livable communities; reliable travel times for people and freight; and safety for all users. Some of the smart mobility performance measures are listed below:

Smart Mobility Performance Measures <sup>4</sup>	
	Smart Mobility Measure
Health and Safety	<ul style="list-style-type: none"> <li>▪ Pedestrian and Bicycle Mode Share</li> <li>▪ Design and Speed Suitability</li> <li>▪ Multimodal Safety</li> </ul>
Reliable Mobility	<ul style="list-style-type: none"> <li>▪ Multimodal Travel Mobility</li> <li>▪ Multimodal Travel Reliability</li> <li>▪ Multimodal Service Quality</li> </ul>
Robust Economy	<ul style="list-style-type: none"> <li>▪ Congestion Effects on Productivity</li> <li>▪ Network Performance</li> <li>▪ Efficient Use of System Resources</li> <li>▪ Return on Investment</li> </ul>
Environmental Stewardship	<ul style="list-style-type: none"> <li>▪ Climate and Energy Conservation</li> <li>▪ Emissions Reduction</li> </ul>
Social Equity	<ul style="list-style-type: none"> <li>▪ Equitable Distribution of Impacts</li> <li>▪ Equitable Distribution of Benefits</li> </ul>
Location Efficiency	<ul style="list-style-type: none"> <li>▪ Support for Sustainable Growth</li> <li>▪ Transit Mode Share</li> <li>▪ Accessibility and Connectivity</li> </ul>

<sup>4</sup>“Smart Mobility 2010: A Call to Action for the New Decade” PowerPoint presentation to the Joint Project Management Team Technical Advisory Committee. November 19, 2009. <http://www.dot.ca.gov/hq/tpp/offices/ocp/smf.html>. Accessed February 5, 2010.

An important component of the Smart Mobility Framework is its inclusion of multimodal considerations that emphasize evaluating the concerns of all transportation system users regardless of travel mode. The metrics used to evaluate multimodal considerations include the following:

- Percentage of trips within a corridor or region occurring by bus, rail, or other form of high-occupancy vehicle
- Accessibility and connectivity (e.g., number of households within a 30-minute transit ride of a major employment center, within walking distance of schools, etc.)
- Travel times and costs by mode between representative origins and destinations, aggregated over corridor or region
- Day-to-day variability of travel times between representative origins and destinations by mode, aggregated by region
- Mode-specific and blended LOS measures of pedestrian and bicycle accommodation and comfort, transit availability and reliability, and auto travel efficiency
- Collision rate and severity by travel mode and facility
- Percentage of trips within a corridor or region occurring by walking or cycling
- Comparative travel times and costs by income groups and by minority and nonminority groups for work/school and other trips
- Time lost to congestion by trips that are economically productive and/or sustain essential mobility, measured as vehicle hours of delay (VHD)
- VHD per capita, per lane-mile, per private vehicle-mile, per freight vehicle-mile, per transit revenue-mile, and in total

More information is available at <http://www.dot.ca.gov/hq/tpp/offices/ocp/smf.html>. Contact: Chris Ratekin, Senior Transportation Planner, [Chris\\_Ratekin@dot.ca.gov](mailto:Chris_Ratekin@dot.ca.gov), (916) 653-4615.

### Florida DOT: Mobility Performance Measures Program

FDOT developed a framework for performance measurement designed to characterize mobility in a manner understandable to the general public and decisionmakers. The performance measures describe the following dimensions of mobility:

- Quantity of travel (reflects the magnitude of the use of a facility or service);
- Quality of travel (describes travel conditions and the effects of congestion);
- Accessibility of service (the ease with which customers can use the service and engage in their community's activities); and
- Utilization (the amount of the service's capacity that is used).

FDOT uses the mobility performance measures in three basic types of applications: functional systems (e.g., interstates), area-wide systems (facilities and services that are defined by geographical boundaries), and corridors. Examples of mobility "quality" measures for highway systems include average speed, average delay, average travel time (distance/speed), reliability (percentage of travel times that are acceptable), and maneuverability (vehicles per hour per lane); measures for metropolitan transit systems include auto/transit travel time ratio (door-to-door trip time) and reliability (on-time performance). Estimation of measures is based on data collected by local transit agencies, and in some cases (such as reliability) special data collection strategies, although FDOT is moving toward incorporating data collected through ITS.

The performance measures are used in the Florida Transportation Plan as well as systems planning and metropolitan planning.

More information is available at <http://www.dot.state.fl.us/planning/statistics/mobilitymeasures/>. Contact: Doug McLeod, FDOT Systems Planning Office, [Douglas.McLeod@dot.state.fl.us](mailto:Douglas.McLeod@dot.state.fl.us), (850) 414-4932.

## 2.3

## Use a Strategic Business Plan to Focus on Integration of Operations, Safety, and Planning

Description	<p>Many State DOTs have Strategic Business Plans.<sup>5</sup> The content and format of a plan may vary depending on its purpose and audience. The audience could include State legislators, customers, and employees. Such plans typically State the organization’s vision, mission statement, goals, and objectives for a given period of time. The plan will likely include specific actions that will allow the agency to achieve each objective. The Strategic Business Plan offers the opportunity to encourage integration in several ways:</p> <ul style="list-style-type: none"> <li>▪ Integration can be defined as a vision for the agency, allowing goals and objectives to be defined to support that vision, as well as performance measures;</li> <li>▪ Goals and performance measures in the Strategic Business Plan can be tied to those in the SLRTP;</li> <li>▪ Action plans can be developed for individual departments that are consistent with the overall agency goals but tailored to suit each department’s functions; and</li> <li>▪ Action plans can be tied to employee performance reviews.</li> </ul> <p>Given that many State DOTs already have Strategic Business Plans, enhanced collaboration could be a feature that is added during the established plan updating process.</p>
Benefits	<ul style="list-style-type: none"> <li>▪ Helps create a consistent perspective of collaboration across agency functions and a focus on key objectives related to safety and/or operations.</li> <li>▪ Provides an effective way to engage and communicate with stakeholders and citizens on an agency’s commitment to collaboration.</li> <li>▪ Provides a basis to tie employee performance to collaboration. For instance, staff job descriptions and periodic employee performance reviews can reflect that collaborative practices are expected.</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>▪ Requires top-level management support/champion to initiate, and plan needs to be tied to internal performance tracking.</li> <li>▪ Potential resistance to modified job descriptions and increased responsibilities and/or accountability.</li> <li>▪ Where a Strategic Business Plan does not currently exist, establishing a new plan will be necessary.</li> </ul>
Who Is Involved	<p>Top-level management support is needed to either modify an existing plan or initiate a new plan. The Human Resources (HR) department will need to update job descriptions of operations, safety, and planning staff, and possibly modify the performance review process to ensure linkage with collaboration. Management staff will likely lead the rollout and supervisory staff will need to be trained to ensure that affected staff understand the linkage between their responsibilities and the agency’s intent.</p>
Recommended Implementation Steps	<p><b>If a Strategic Business Plan already exists:</b></p> <ol style="list-style-type: none"> <li>1) Core team of operations, safety, and planning staff propose to senior management that plan be modified to embrace collaboration.</li> <li>2) Consider the linkage between established vision, goals, objectives, and employee job descriptions, as well as linkages with SLRTP goals and objectives, and identify the need for changes to any of the above.</li> <li>3) Develop modifications to the plan to embrace collaboration.</li> <li>4) Engage HR department and develop modified job descriptions.</li> </ol>

<sup>5</sup> [http://www.transportation.org/sites/quality/docs/AASHTO%20SCoQ%20Presentation%20052407%20Draft%20v10%20Present.ppt#358,1,So,What's the Big Deal About Strategic Planning?](http://www.transportation.org/sites/quality/docs/AASHTO%20SCoQ%20Presentation%20052407%20Draft%20v10%20Present.ppt#358,1,So,What's%20the%20Big%20Deal%20About%20Strategic%20Planning?) Accessed April 22, 2010.

- 5) Develop rollout, implementation, and maintenance processes. HR rollout of changes to job descriptions and performance review process. Leadership representing the operations, safety, and planning functions will be involved to guide and support the activities of HR staff.
- 6) Implement and train supervisors and staff.
- 7) Clearly define and track roles and responsibilities of those affected, as well as the actual performance of the plan toward increased collaboration.

**If a Strategic Business Plan does not exist:**

- 1) Core team of operations, safety, and planning staff agree to develop informal plan to embrace collaboration to bring to management, or a case for the value of developing a Strategic Business Plan.
- 2) Leadership agrees to develop a Strategic Business Plan.
- 3) Follow steps 1 to 7 listed above.

## Relevant Examples

### Maryland State Highway Administration

Within the Maryland DOT, the Maryland State Highway Administration (MDSHA) publishes its own business plan. The *Fiscal Year 2008 Through Fiscal Year 2011 Business Plan (2007)* identifies the agency's mission, vision, and values, and includes a set of objectives and performance measures designed to achieve the agency's goals. The business plan includes a "Safety" section, which includes eight objectives, and a "Mobility and Congestion Relief" section, which includes six objectives. Each objective includes a number of associated performance measures used for tracking progress. Examples of the objectives in these two sections include:

- Reduce the annual number of traffic fatalities on all roads in Maryland from 651 in 2006 to fewer than 550 by December 31, 2010 (16% reduction), and reduce the annual number of persons injured on all roads in Maryland from 53,615 in 2006 to fewer than 50,000 (7% reduction);
- Reduce the annual number of pedestrian fatalities on all roads in Maryland from 93 in 2006 to fewer than 85 by December 31, 2010 (9% reduction), and reduce the annual number of pedestrians injured on all roads in Maryland from 2,594 in 2006 to fewer than 2,300 (11% reduction);
- Reduce the annual number of temporary traffic control zone (TTC) traffic fatalities on all roads in Maryland from 11 in 2006 to fewer than 11 by December 31, 2010 (10% reduction), and reduce the annual number of TTC traffic injuries on all roads in Maryland from 1,070 in 2006 to fewer than 1,000 by December 31, 2010 (7% reduction);
- Reduce incident congestion delay to achieve a user cost savings of at least \$580 million annually;
- Reduce delay along State roadways by an average of 5% annually for all mobility improvement projects; and
- Provide reliable and accessible real-time traffic information to travelers and other stakeholders at all times.

While the business plan does not specifically discuss integration of safety and operations considerations into planning, it notes that the plan will be used to make decisions about policies, programs, and allocation of resources, and it includes budget information where possible to identify particular sources of funding to support objectives. The business plan also identifies objectives and performance measures related to organizational effectiveness, environmental stewardship, and customer communications and service satisfaction.

More information on the business plan is available at <http://www.sha.maryland.gov/index.aspx?PageId=691>, *SHA Business Plan*. Contact: Cathy Rice, Chief, SHA Performance Excellence Division, [CRice@sha.state.md.us](mailto:CRice@sha.state.md.us), (410) 545-0413, or Allison Hardt, Office of Policy and Research, [AHardt@sha.state.md.us](mailto:AHardt@sha.state.md.us), (410) 545-2916, or Steven Gaudio, Office of Policy and Research, [SGaudio@sha.state.md.us](mailto:SGaudio@sha.state.md.us), (410) 545-0343.

### Michigan Department of Transportation

The Michigan DOT (MDOT) has developed internally a statewide strategic business plan that aims to manage the State transportation system's assets more effectively by increasing integration across the entire MDOT

organization. The most recent version of the plan was developed from the bottom up, a different approach than the top-down approach of previous years. It focuses on policy changes that can be applied to the organization as a whole so that integration efforts can be promoted within various agencies of the department. The plan also includes a data business plan component to support integration and organizational efforts. The plan integrates considerations from a variety of existing statewide plans, including goals and objectives from the SLRTPs and performance measures from the performance management plans. The performance measures included in the plan are revised each time a new edition of the plan is developed. They include considerations beyond planning, including operations and safety, that are quantifiable and can be measured across the system. Some sample measure categories include safety, customer stakeholder involvement, work zone management, and mobile connectivity.

Representatives from all departments (from the central as well as regional offices) have been involved in the plan development effort, which has increased the plan's value as well as its effectiveness. One of the first members of the plan development team was the Department of Safety, and its involvement with the State's planning efforts has helped to increase the plan's effectiveness. All MDOT employees (beyond Planning Department employees) are required to be familiar with the plan and to "buy in" to the process.

More information is available at [http://www.michigan.gov/mdot/0,1607,7-151-9622\\_11045-220589--,00.html](http://www.michigan.gov/mdot/0,1607,7-151-9622_11045-220589--,00.html). Contact: Susan Gorski, Section Manager, Statewide & Urban Travel Analysis Section, [gorskis@michigan.gov](mailto:gorskis@michigan.gov).

### Ohio Department of Transportation

The Ohio DOT's (ODOT) most recent version of its business plan, *2010–2011 Business Plan*, continues a strong focus on safety and multimodal planning, as well as including many other important initiatives. The plan outlines the department's overall vision for ODOT, includes updated project selection criteria and prioritization policies, details statewide initiatives, and describes the budget for the upcoming year.

The updated business plan includes a revised vision for ODOT as the agency moves into the 21<sup>st</sup> century. One of the significant changes from the 2009 business plan to the 2010 business plan is creation of the Division of Transportation System Development, which is responsible for developing a complete, multimodal, 21<sup>st</sup> century transportation system. ODOT also notes its creation of the new Office of Innovation, Partnership, and Energy, which identifies new transportation technologies, policies, and public-private partnerships, and the new Office of Multi-Modal Planning, which is tasked with "leading ODOT's statewide comprehensive efforts to develop a strategic and holistic transportation futures plan."

ODOT's projects are selected through a nine-member Transportation Review Advisory Council (TRAC), which was created in 1997 to help prioritize ODOT's largest investments. The updated project selection criteria are split as follows: 55% for transportation factors that emphasize multimodalism, 25% to community economic growth and factors that emphasize economic development, and 20% for local and investment factors, focusing on innovative financing. The transportation factors will evaluate projects according to their contribution to road intermodal freight, public transit, and intercity passenger rail. Scoring will also take into consideration intermodal connectivity, and whether or not projects will connect transportation modes.

There is a strong safety focus in the business plan. The first initiative listed is "Target: Zero—Focus on safety in the workplace, on the construction site, and with the traveling public to ensure ZERO tolerance for any safety hazard." Plans to accomplish this goal include using new technologies to increase safety for the traveling public, using rumble stripes on highways, installing reflective backplates on traffic signals at select intersections, updating median barrier warrants, and adding safe work zone policies to the current list. Following the multimodal focus, ODOT's third initiative is "All Systems Go: Identify critical freight and passenger transportation corridors by mode and prioritize public investment to facilitate the seamless, safe, efficient movement of people and goods." The plan discusses securing additional funding to increase multimodal options and assisting private and public sector entities through new financing tools.

More information is available at: <http://www.dot.state.oh.us/policy/2010-2011businessplan/pages/default.aspx>. Contact: Paul Staley, Policy Coordinator, [Paul.Staley@dot.state.oh.us](mailto:Paul.Staley@dot.state.oh.us), (614) 728-5078.

## 2.4

## Foster Multimodal Coordination

Description	<p>Traditionally, State DOTs have had a limited role with regard to planning and operating public transportation. Although public transportation divisions, sections, and agencies may be part of a DOT, they have often functioned largely independently, with limited interaction with highway operations, safety, and/or planning functions. While public transportation divisions often play a very important role in rural transit, they have not often been well-integrated with other State DOT planning functions. With increasing recognition of the importance of a balanced, multimodal transportation system, there are opportunities to build transit, bicycle, pedestrian, and freight considerations more effectively into all DOT functions. For instance, statewide priorities can emphasize the safe, efficient movement of people through transit. Corridor studies can more effectively consider strategies to advance transit efficiency (e.g., transit signal priority), manage demand, and create safer bicycling and pedestrian options. Operations activities, such as work zone management and traveler information systems, can more fully incorporate transit alternatives and information about transit system performance. Highway safety projects can also involve improvements that support safe and efficient transit, bicycling, and pedestrian activity. Each of these functions can also involve coordination to improve freight connections, high-speed rail, and aviation. For instance, diversion of freight from road to rail can be a strategy to address traffic congestion and safety.</p>
Benefits	<ul style="list-style-type: none"> <li>▪ Advances transit, bicycle, and pedestrian safety and efficiency as part of operations, safety projects, and planning efforts.</li> <li>▪ Supports sustainability, livability, and transportation choices.</li> <li>▪ Improves effective use of resources (financial, personnel, infrastructure).</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>▪ Traditional functional separation of transit and highways (and secondary role of transit) at the State DOT level.</li> <li>▪ Public transportation divisions have traditionally been primarily grants-related divisions, with limited long-range planning.</li> <li>▪ Engineering, planning, and operations have traditionally focused primarily on vehicle movements rather than personal mobility.</li> </ul>
Who is Involved	<ul style="list-style-type: none"> <li>▪ Policymakers will assist in incorporating transit into statewide policy to help realize greater coordination among the various internal functions.</li> <li>▪ Public transportation staff can help identify opportunities for transit to address mobility, economic, and climate change goals, and to be incorporated into operations and safety programs.</li> <li>▪ Operations, safety, and planning staff will work with public transportation staff and others to ensure full consideration and integration of these issues.</li> </ul>
Recommended Implementation Steps	<ol style="list-style-type: none"> <li>1) Convene or maintain a multidisciplinary team of operations, safety, planning, and public transportation staff.</li> <li>2) Consider possible future roles of public transportation and approaches for enhanced integration into traditional planning and operations approaches.</li> <li>3) Integrate these interdisciplinary and multimodal considerations into the SLRTP and other statewide planning efforts, including operations plans and the SHSP. Identify strategies, policies, and programs to advance safety and operations as they relate to public transportation and freight.</li> <li>4) Consider relevant examples and recommendations from research projects, other States' experiences, and existing studies to inform decisions.</li> <li>5) Clearly define and track roles and responsibilities of those involved.</li> <li>6) Monitor progress and prepare periodic reports.</li> </ol>

## Relevant Examples

### Iowa DOT: Long-Range Transportation Plan

The Iowa DOT's latest update of its long-range transportation plan includes a strong focus on multimodalism. Among the top priorities listed, “balance” between the transportation systems and services being provided is noted. “Modal Key Points” highlight main focus areas in the system. For bicycles and pedestrians, these key points are to provide funding for recreational trails and ensure that bicycle improvements are considered when designing highways and improvements. For transit, the identified key points are to provide support for public transportation, particularly in those areas with disadvantaged populations, to focus on services running between cities, balance the availability of service in both rural and urban areas, purchase additional buses and vans, and provide more assistance for commuter services.

The plan has a section devoted to transit, which outlines guidelines the agency will follow in striving to achieve the key points it outlined earlier in the plan. These guidelines are:

- **Safety**—Enhance safety by continued replacement and upgrading of transit vehicles, equipment, and facilities.
- **Preservation**—Support preservation of existing services that are essential for the transportation-disadvantaged.
- **Efficiency**—Focus on efficiency through support of coordinated, cost-effective transportation services.
- **Balance**—Ensure balance by supporting transit services in both rural and urban areas, as well as providing alternative transportation choices.

The plan notes that it is supported by modal implementation plans, which include performance measures to evaluate program success.

More information is available at: [http://www.iowadot.gov/iowainmotion/pub\\_trans.html](http://www.iowadot.gov/iowainmotion/pub_trans.html) and <http://www.iowadot.gov/iowainmotion/state.html>. Contact: Craig O’Riley, Office of Systems Planning, [Craig.ORiley@dot.iowa.gov](mailto:Craig.ORiley@dot.iowa.gov), (515) 239-1669.

### Minnesota DOT: Minneapolis Urban Partnership Agreement

The planning for the Minneapolis-St. Paul area’s Urban Partnership Agreement shows a strong connections between highway and transit planning, with a focus on improving multimodal system operations. The effort involves a wide range of partners, including the Minnesota DOT (Mn/DOT), the Metropolitan Council, Metro Transit, the Minnesota Valley Transit Authority, city of Minneapolis, county governments, and transportation management organizations. As part of this grant, Mn/DOT is converting narrow, bus-only shoulder lanes along the northbound portion of I-35W into downtown Minneapolis to wider priced dynamic shoulder lanes (PDSL). Buses and high-occupancy vehicles operate at no charge in the PDSLs, and single-occupant vehicles that pay a toll are allowed to use the lanes during peak times, with toll prices set to ensure free-flow travel. The PDSLs will create a new option for drivers for a more reliable travel time, and will enable bus speeds to increase to 50 mph from the bus-only shoulder lane speeds of 35 mph or less. The plan is for the PDSLs to link with new, dynamically-priced high-occupancy toll (HOT) lanes on I-35W, resulting in a new, 15-mile, dynamically priced managed-lane corridor connecting downtown Minneapolis with communities to the south, including the Mall of America, Minneapolis/St. Paul International Airport, and the University of Minnesota. Dynamic message signs provide information on transit alternatives to allow comparisons with the time and cost of driving alternatives. In and around the I-35W corridor, a bus rapid transit (BRT) network is being created, including new BRT stations, priority for transit vehicles at signalized intersections, and electronic signs at stations with estimated bus arrival times. Additional park-and-ride spaces have also been created.

Buses purchased by Metro Transit for the corridor also are fitted with technology, developed at the University of Minnesota, which relies on both visual and physical signals to assist drivers in making quick and intelligent decisions that are critical to maintaining highway safety. It surrounds bus operators with tools that will help them keep the bus centered in the lane.

More information is available at: <http://www.upa.dot.gov/agreements/minneapolis.htm> and <http://www.dot.state.mn.us/upa/>.



## 2.5

## Self-Assessment Checklist: Creating an Environment for Integration

The following checklist may be used as a self-assessment to identify opportunities for creating an environment for integrating operations, safety, and multimodal planning. The user should consider the questions, whether or not the State DOT is undertaking the activity, and what can be done to improve integration.

Checklist: Creating an Environment for Integration				
Question	Yes	No	If no, what can be added or improved?	Relevant Subsection
Does the agency currently have multidisciplinary teams involving staff from operations, safety, and planning?				2.1
Has the agency developed specific, measurable objectives to measure its success?				2.2
If so, are objectives for system operations (e.g., congestion, reliability) and safety used to support planning and investment decisions?				2.2
Has the agency developed performance measures related to operations and safety that can be measured using available data and used to support planning?				2.2
Does the agency have a completed strategic business plan?				2.3
If so, does the strategic business plan foster integration of operations, safety, and multimodal planning?				2.3
Is public transportation represented in a number of multidisciplinary agency efforts?				2.4
Are public transportation choices, and the efficient operation and safety of transit, identified as priorities in the SLRTP?				2.4
Do operations and safety programs consider implications for multimodal options, including transit, bicycling, and walking?				2.4



## Section 3

# Statewide Level Opportunities

This section focuses on opportunities for integrating operations, safety, and multimodal planning at the statewide level. Greater integration at the statewide level should flow into strengthened integration of operations, safety, and planning at the lower levels, particularly when interdisciplinary teams and performance measures are brought into these efforts.

There are a number of required documents as part of the transportation planning process, including the SLRTP, SHSP, and STIP. State DOTs may also develop other specialized plans focusing on specific issues, such as operations, transit, bicycle and pedestrian activity, and freight. Opportunities for integration occur by developing links between safety-focused efforts (such as the SHSP), operations-focused efforts (such as operations or ITS plans), and other multimodal transportation planning efforts with the SLRTP, and ultimately in influencing projects and investments that are programmed in the STIP. These opportunities are briefly described below.

### Overarching Themes

- Bringing together multidisciplinary teams
- Developing and using performance measures
- Utilizing operations and safety data in tracking performance measures
- Tying planning to programming
- Ensuring that various statewide plans relate back to the SLRTP

### Statewide Long-Range Transportation Plan

The SLRTP sets the direction for investments and should be a focus for DOTs that wish to integrate operations, safety, and multimodal planning. The statewide transportation planning process varies widely across the country. Unlike metropolitan transportation plans, the SLRTP is often a policy document or investment strategy and therefore does not contain information on specific projects and programs. A recommended approach to integrate operations and safety in the SLRTP involves the following steps:

- **Develop goals and objectives that relate to operations and safety in order to fully integrate these considerations into statewide priority setting** – These goals and objectives should draw from goals and priorities developed in the SHSP, as well as efforts being undertaken to develop goals and priorities for system management and operations. Objectives should be specific and measurable statements related to attaining goals.
- **Develop operations and safety performance measures** – Performance measures can be used as part of the SLRTP process to help track progress in meeting objectives and to prioritize investments. Developing and using multimodal performance indicators that address operations and safety draws attention to performance in these areas and helps to prioritize investments.
- **Develop strategies and programs to attain stated objectives** – The SLRTP should identify strategies, policies, programs, and/or projects that are tied to attainment of operations and safety objectives. Broad policies and strategies can lead to more specific corridor, sub-area, or regional studies and investment plans, and projects that are programmed in the STIP (discussed further below).
- **Monitor system performance and evaluate implemented strategies** – Tracking performance measures for the transportation system will help to identify trends and analyze the effectiveness of investments in meeting objectives. These efforts can in turn help to support revisions to goals and objectives.

### Statewide Long-Range Transportation Plan (SLRTP)

Goals and Objectives



Performance Measures



Policies, Strategies & Programs



### Statewide Transportation Improvement Program (STIP)

## Other Statewide Plans

There are a range of statewide plans that State DOTs develop outside of the SLRTP (see appendix A for a list). These plans should be linked to the SLRTP goals and policies. Development of specialized plans focusing on safety and operations provides opportunities for integration of these issues into long-range planning. Examples include:

- **Strategic Highway Safety Plans** – The SHSP is a statewide-coordinated safety plan that provides a comprehensive framework for reducing highway fatalities and serious injuries on all public roads, and is required to be developed in each State. It strategically establishes statewide goals, objectives, and key emphasis areas developed in consultation with Federal, State, local, and private sector safety stakeholders. The goals and objectives of the SHSP should be reflected in the SLRTP to ensure full integration of safety goals as a component of the transportation plan as well as operations strategies that relate to safety. The SHSP also can be used to identify recommendations for projects that can be carried forward and funded.
- **Statewide operations and/or Intelligent Transportation System Plans** – Statewide operations plans are not required. However, these plans can provide an effective mechanism for focusing on operations issues and long-term strategic priorities, building on the expertise of system operations staff. These plans can build on the statewide ITS architecture and inform development of other plans.
- **Modal plans (e.g., transit plans, rail plans), freight plans, and other planning documents** – These documents include State DOT plans as well as needs analyses sponsored by Governors’ offices, State legislatures, and the business community. While these plans typically focus primarily on infrastructure needs, improvements identified ideally include safety and operations elements. Plans should be influenced by the SLRTP and coordinated with identified priorities in operations plans and strategies in an SHSP action plan.

## Statewide Transportation Improvement Program

The STIP is the programming document for the State DOT, and identifies the projects to be implemented in order to reach the vision for the State’s transportation system and services. It represents a commitment for Federal-aid transportation and transit funding. The Transportation Improvement Program (TIP) from each of the State’s metropolitan areas flows directly into the STIP; however, the STIP also contains projects from other sources, including non-metropolitan areas of the State.

Linking planning and programming is key to ensuring achievement of intended outcomes. If investments are not programmed to support the plan vision and specific objectives, it is likely that intended outcomes will not be achieved. Linking planning and programming occurs when projects in the STIP originate from strategies in the SLRTP. Fiscal constraint and a realistic assessment of available funding may raise awareness of cost-effective operations and safety strategies.

## Section Content

Eight opportunities for integration of operations, safety, and multimodal planning at the statewide level are identified in this section:

- Develop Statewide Operations & Safety Goals and Objectives
- Develop Performance Measures and Targets in the SLRTP
- Collect Data and Monitor System Performance
- Develop Strategies and Programs to Support Established Goals and Objectives
- Take Full Advantage of the SHSP
- Develop Operations or ITS Plans
- Incorporate Operations and Safety Into Multimodal Plans and Other Related Plans
- Link Statewide Planning Efforts With Programming

As noted above, these opportunities are linked and may be considered steps in an overall approach to integration.

## 3.1

## Develop Statewide Operations &amp; Safety Goals and Objectives

Description	<p>Goals represent desired outcomes for the transportation system as a whole. Objectives are specific, measurable statements that identify what is to be accomplished in order to attain goals. An ideal objective starts with an action (e.g., “reduce,” “increase,” “attain,” “maintain”) and contains specific targets (e.g., “reduce fatalities by 10% by 2020,” “increase the share of trips on nonmotorized modes to 30% for work trips statewide”).</p> <p>At a minimum, a statewide plan that seeks to integrate operations, safety, and multimodal planning should reflect the importance of operations and safety within the goals in the SLRTP. Ideally, these goals should be multimodal. Establishing supporting objectives in the SLRTP should yield more focus on operations and safety investments.</p>
Benefits	<ul style="list-style-type: none"> <li>▪ Communicates and demonstrates to the public the importance of operations and safety in the transportation system.</li> <li>▪ Places increased emphasis on operations and safety in project and program decisionmaking.</li> <li>▪ Can increase multimodal integration if goals and objectives are written in ways that emphasize multimodal considerations.</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>▪ May be difficult for operations and safety staff to participate in the long-range transportation planning process, and for planners to engage these staff due to limited resources to meet the individual missions.</li> <li>▪ May be difficult to develop robust operations and safety objectives that are measurable and specific, particularly if data are limited.</li> <li>▪ Developing agreement on objectives with targets may be challenging.</li> <li>▪ Process may get bogged down if trying to incorporate too many goal areas.</li> </ul>
Who Is Involved	<p>Planning staff working collaboratively with staff from operations and safety are essential to establishing goals and objectives. In order to effectively collaborate, each functional area will require a clear understanding of the planning process as well as the interests and responsibilities of the other functions.</p>
Recommended Implementation Steps	<ol style="list-style-type: none"> <li>1) Establish a working group with representatives from safety, operations, transit, and planning to discuss development of the SLRTP and the overall planning process.</li> <li>2) Utilize the working group to identify and/or develop goals at the statewide level (e.g. efficiency, integration, increased economic development, and balanced investment priorities). A key consideration is keeping it simple. It has been found that, in general, plans with four to six goal areas were easier to understand and abide by than those with numerous or obtusely named elements.<sup>6</sup></li> <li>3) Utilize the working group to develop specific, measurable objectives in relation to the goals. Objectives may include specific targets. Developing measurable objectives requires examining what data are available for tracking performance. Operations and safety staff may be able to identify data (on travel times, crashes, incident delay, etc.), which may not otherwise be accessible to planners.</li> <li>4) Ensure that the established goals and objectives (including the operations and safety-focused ones) reflect the overall State vision. They should also reflect those in the SHSP and collaborative efforts of the transportation operations community.</li> <li>5) Ensure that the established objectives carry forward and are used in helping to prioritize investment decisions (<i>see opportunities 3.2, 3.3, and 3.4</i>).</li> </ol>

<sup>6</sup> Wilbur Smith Associates. “State Long-Range Transportation Plan 2005-2030: Goals, Objectives, and Performance Measures Report.” Prepared for the Michigan Department of Transportation. November 2006. Available at: [http://www.michigan.gov/documents/mdot/MDOT\\_SLRP\\_rept\\_Goals\\_Objectives\\_Performance\\_Report\\_11-17-06\\_180916\\_7.pdf](http://www.michigan.gov/documents/mdot/MDOT_SLRP_rept_Goals_Objectives_Performance_Report_11-17-06_180916_7.pdf). Accessed June 29, 2009.

## Relevant Examples

### Oregon DOT Transportation Plan: “Management of the System” and “Safety and Security” Goals

The Oregon DOT’s *Oregon Transportation Plan*, updated in 2006, is the overarching policy document among a series of plans that together form the State transportation system plan. One of the plan’s seven goals focuses on system management: *to improve the efficiency of the transportation system by optimizing the existing transportation infrastructure capacity with improved operations and management.*<sup>7</sup> This goal provides a direct linkage to operations strategies with a focus on a combination of both supply and demand management strategies to improve operational efficiency through activities such as:

- Techniques that reduce peak period travel to help shift traffic volumes away from the peak period and improve traffic flow. Some examples include high occupancy vehicle lanes with express transit service, truck-only lanes, van/carpools, park-and-ride facilities, parking management programs, telework, flexible work schedules, peak period pricing, ramp metering, traveler information systems, traffic signal optimization, route diversion strategies, incident management, and enhancement of rail, transit, bicycling and walking.
- Advanced traveler information devices, incident management, speed management, improvements to signaling systems, and other technologies to extend the efficiency, safety and capacity of transportation systems.
- Evaluating the benefits of constructing tolled express lanes for purposes of ensuring consistent trip reliability in congested corridors.

The plan also includes a “Safety and Security” goal, “to plan, build, operate, and maintain the transportation system so that it is safe and secure,” along with corresponding policies. The plan outlines a “Safety Policy” focused on improving safety leadership in government, and public and private entities, and developing a Strategic Transportation Safety Action Plan to more effectively use resources to remedy system problems. Safety goals will be achieved through planning, education, engineering, enforcement, and emergency response efforts. Planning efforts include addressing safety and security issues through “planning, design, construction, operation, and maintenance of new and existing transportation systems, facilities, and assets.”

More information is available at [www.oregon.gov/ODOT/TD/TP/ortransplanupdate.shtml](http://www.oregon.gov/ODOT/TD/TP/ortransplanupdate.shtml). Contact: Robert A. Maestre, Long-Range Planning Manager, [Robert.A.Maestre@odot.state.or.us](mailto:Robert.A.Maestre@odot.state.or.us), (503) 986-4165.

### Michigan State Long Range Transportation Plan (LRTP): Goals, Objectives, and Performance Measures

The Michigan DOT’s (MDOT) SLRTP, *MI Transportation Plan Moving Michigan Forward: 2005-2030 State Long-Range Transportation Plan*, adopted June 2007, directly supports efficient and effective operations. Its vision specifically states that Michigan’s future transportation system will be:

- *Prioritized*: Capacity improvements will be needed, but the first priority will be physical or technological improvements to enhance efficiency, mobility, and access.
- *Coordinated*: All transportation providers will work together to address the system’s needs holistically. All modes will be maintained, preserved, operated, and protected as one system, one of the State’s most important physical assets.
- *Safe*: Safety will be a primary goal. It will be addressed as each improvement is planned and implemented. Personal and system wide security will be enhanced, including border security.

One of the plan’s goals is: to improve the efficiency and effectiveness of the transportation system and transportation services and expand MDOT’s coordination and collaboration with partners. This goal reflects MDOT’s desire to optimize the performance from Michigan’s existing transportation system, with objectives focusing on the application of technology, stronger coordination and cooperation with public and private sector partners, and improved intermodal transfers. Another goal is: Continue to improve transportation safety and ensure the security of the transportation system. The plan also lists those projects that are prioritized under each goal. Measuring performance for all modes, with a focus on highway operations, safety, and the condition

<sup>7</sup> Oregon Department of Transportation, *Oregon Transportation Plan (OTP)*, Adopted September 20, 2006. <http://www.oregon.gov/ODOT/TD/TP/ortransplanupdate.shtml>. Accessed January 14, 2009.

and performance of other modes, is identified as a strategy, and the separate Goals, Objectives, and Performance Measures Report provides a detailed discussion of the plan's four goals and associated objectives.

More information is available at [www.michigan.gov/slrp](http://www.michigan.gov/slrp) or [http://www.michigan.gov/documents/mdot/MDOT\\_SLRP\\_rept\\_Goals\\_Objectives\\_Performance\\_Report\\_11-17-06\\_180916\\_7.pdf](http://www.michigan.gov/documents/mdot/MDOT_SLRP_rept_Goals_Objectives_Performance_Report_11-17-06_180916_7.pdf). Contact: Susan Gorski, Section Manager, Statewide & Urban Travel Analysis Section, [gorskis@michigan.gov](mailto:gorskis@michigan.gov).

### Toolkit: Sample Operations- and Safety-Focused Goals and Objectives

Sample Goal Types	Sample Objectives
Mobility and Travel Options	<ul style="list-style-type: none"> <li>Improve personal mobility and access to transportation.</li> <li>Increase the share of trips by transit, carpooling, bicycling/walking.</li> <li>Improve transit travel time compared to auto travel time in major travel corridors.</li> <li>Increase the share of population with access to high-frequency transit services.</li> </ul>
System Efficiency	<ul style="list-style-type: none"> <li>Reduce delay experienced by travelers on highways and transit.</li> <li>Reduce the share of highways that are congested during peak hours.</li> <li>Reduce the number of hours per day that highways exceed LOS F.</li> <li>Reduce the cost of congestion on the transportation system.</li> <li>Increase average vehicle occupancy for work trips.</li> <li>Increase transit load factors and fare-box recovery ratio.</li> </ul>
System Reliability	<ul style="list-style-type: none"> <li>Improve travel time reliability on the freeway system.</li> <li>Improve travel time reliability on the freight network.</li> <li>Improve on-time performance for transit services.</li> </ul>
Safety	<ul style="list-style-type: none"> <li>Reduce the number of total fatalities on the transportation system.</li> <li>Reduce the number of injuries on the transportation system.</li> <li>Reduce the number of pedestrian fatalities and injuries.</li> <li>Reduce the number of fatalities and injuries in traffic accidents involving heavy-duty trucks.</li> <li>Reduce the number of alcohol-related fatalities and injuries.</li> </ul>
Innovation / New Technology	<ul style="list-style-type: none"> <li>Improve the training and professional capacity of traffic signal operations and maintenance staff through stewardship of regional training programs.</li> <li>Provide the capability to monitor transit vehicle location using an Automated Vehicle Location System. The location data can be used to determine real-time schedule adherence and update the transit system's schedule in real-time.</li> </ul>
Traveler Information	<ul style="list-style-type: none"> <li>Ensure that reliable, multimodal, real-time traveler information is disseminated consistently throughout the region.</li> <li>Provide roadway operations data (e.g., speed, travel times) to real-time traveler information services to better inform the public in real time.<sup>8</sup></li> </ul>
Work zone management	<ul style="list-style-type: none"> <li>Reduce the number of work zones (e.g., through system preservation/preventative maintenance, combining of work zones) or duration of work zones (e.g., full road closures, completion time incentives).</li> <li>Coordinate planned projects to facilitate improved traffic flow through construction zones and minimize traffic impacts.</li> </ul>

### Relevant Resources

Federal Highway Administration, Office of Operations and Office of Planning, *Planning for Operations*, <http://plan4operations.dot.gov/index.cfm>.

National Cooperative Highway Research Program (NCHRP), *Report 546: Incorporating Safety into Long-Range Transportation Planning*, [http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp\\_rpt\\_546.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_546.pdf).

<sup>8</sup> FHWA. "Model Transportation Plans for Operations and Safety: Preliminary Operations Objectives and Performance Measures." July 2008.

## 3.2

## Develop Performance Measures and Targets in the SLRTP

Description	<p>Incorporating performance measures into the SLRTP serves an important function for communicating and coordinating between a DOT's decisionmakers, policymakers, and the public and for assessing progress toward achieving the goals and objectives outlined in the SLRTP. Performance measures focused on safety and operations issues, such as reliability, access to traveler information, incident management, and transit operations, will help to focus attention on these issues and enable tracking performance. Combined with data and analysis tools, performance measures serve an important role in helping to provide a basis for prioritizing investments.</p> <p>When coordinated with planned operations activities such as the implementation of ITS infrastructure, the data collection efforts required for performance measures can be supported with limited additional cost. These performance measures can then be utilized in other documents, including operations plans, the SHSP, and modal plans, as well as regional and corridor planning efforts.</p>
Benefits	<ul style="list-style-type: none"> <li>▪ Elevate attention to specific issues (e.g., pedestrian fatalities, nonrecurring delay) that may not otherwise receive the same level of attention.</li> <li>▪ Enable the agency to track success toward goals and objectives.</li> <li>▪ Help in communicating agency work with the public and other stakeholders, including the benefits of investment.</li> <li>▪ Provide an internal accounting system that allows the agency to gauge where resources (staffing and financial) are most needed.</li> <li>▪ Create an opportunity for improved data, data collection, and estimation procedures when there is strong reliance on this information.</li> <li>▪ Result in more effective use of resources (financial, personnel, infrastructure).</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>▪ Expanding the traditional highway LOS, pavement condition, and other engineering-oriented performance measure to include multimodal measures, measures addressing nonrecurring delay, and specific safety issues can be difficult.</li> <li>▪ Data and analysis capability limitations (coverage, quality, needs, accessibility, transfer between agencies) may limit use of performance measures.</li> <li>▪ Gaining agreement on appropriate targets to set can be difficult. Performance targets should be realistic, but it may be difficult to determine what is an appropriate target for fatalities or injuries (given an ultimate goal is to have zero deaths and debilitating injuries in the transportation system).</li> </ul>
Who is Involved	<ul style="list-style-type: none"> <li>▪ Operations, safety, and planning staff should work together to identify and develop performance measures to support goals and objectives.</li> <li>▪ Operations and safety staff in particular can help identify data that can be used to support tracking the performance measures.</li> <li>▪ Policymakers will assist in incorporating performance measures into statewide policy to help realize greater coordination among the various internal functions.</li> </ul>
Recommended Implementation Steps	<ol style="list-style-type: none"> <li>1) Maintain or convene a multidisciplinary team of operations, safety, and planning staff focused on developing performance measures.</li> <li>2) Consider vision, goals, and objectives that have been established in order to select appropriate performance measures that relate to these objectives.</li> <li>3) Evaluate data availability and adequacy to monitor performance measures.</li> <li>4) Ensure that performance measures capture the impacts of operational or ITS strategies on system reliability and safety considerations such as incident management and road fatalities as well as planning objectives and system long-term needs.</li> </ol>



- 5) Consider relevant examples and recommendations from research projects, other states' experiences, and existing studies (see toolkit and resources below).
- 6) Develop and implement the established performance measures.
- 7) Clearly define and track roles and responsibilities of those involved in the performance measurement as well as the actual performance of the system.

## Relevant Examples

### New Hampshire DOT Transportation Plan: Mobility and Safety Objectives and Performance Measures

The New Hampshire DOT's transportation plan, *A Framework for Transforming Transportation in New Hampshire*<sup>9</sup> (public draft, May 2008) is built on a vision, goals, objectives, and strategies, which lead to performance measures that are used to assess progress. The plan's vision and goals were developed by the Community Advisory Committee through a facilitated, consensus-based process and appear to put a high emphasis on operations and safety. The vision indicates that *transportation in New Hampshire provides safe and secure mobility and travel options for all the state's residents, visitors, and goods movement; it is well maintained, efficient and reliable; and provides seamless interstate and intrastate connectivity*. Under the goal of "Mobility and Modal Choice," selected objectives include:

- Meet and maintain system-specific level of service targets on the interstate highway and State roadway systems.
- Improve the reliability of the freight and passenger transportation networks.
- Expand the emphasis on transportation systems and demand management measures in lieu of system expansion.
- Increase connectivity between transportation modes for passenger and freight modes.

Under the goal of "Safety," objectives include:

- Reduce the number of transportation-related fatalities and injuries.
- Increase the quality and availability of traveler information.
- Implement the SHSP recommendations in a timely fashion for the NHDOT emphasis areas.

A key initiative in the SLRTP is use of performance measurements to allow the DOT to track and communicate the effectiveness of policies, programs, and investments. For each goal area, the plan identifies performance measures categories and draft "dashboard" metrics. Examples of these include reliability (travel time variability, transit on-time performance), traveler safety (number of fatalities, fatality rate, serious injury crash rate), incident response (incident response and clearance duration), and customer satisfaction (overall satisfaction from annual customer surveys).

The New Hampshire DOT is currently in the process of finalizing updates to its 2008 SLRTP. This updated draft includes some minor edits that continue to emphasize and strengthen the areas of safety, operations, and multimodal planning, as well as strengthen discussions on security, climate change, and financial challenges. This plan is anticipated to be completed in fall 2010.

More information is available at <http://www.nh.gov/dot/org/projectdevelopment/planning/lrtbp.htm>. Contact: Bill Watson, Planning and Community Assistance Administrator, [bwatson@dot.state.nh.us](mailto:bwatson@dot.state.nh.us), (603) 271-3344.

<sup>9</sup> New Hampshire Department of Transportation. *A Framework for Transforming Transportation in New Hampshire*. 2008. <http://www.nh.gov/dot/org/projectdevelopment/planning/lrtbp.htm>.

### Minnesota DOT Statewide Transportation Plan: Incorporating Operations Policies, Measures, and Targets<sup>10</sup>

Mn/DOT's recently updated transportation plan from 2009, *Minnesota Statewide Transportation Policy Plan 2009-2028: Your Destination... Our Priority*, focuses on statewide efforts to achieve a new vision that “is broad and far-reaching... [and] speaks to transportation as a critical ingredient for the continued economic vitality of the entire state and livability of its communities.” Previously, Mn/DOT addressed operations as a separate policy within its long-range plan, but, in the new plan, operations is emphasized as a strategy to help effectively manage the transportation system, particularly as it relates to congestion in Minnesota’s major metro area, the Twin Cities. The 2009 plan update highlights safety, operations, and transit as areas within which transportation improvements will be made in order to achieve their long-range planning vision.

One of the opportunities Mn/DOT outlines for improvement, “new approaches to safety and congestion,” notes using a systematic, data-driven approach to help solve safety and congestion problems. It highlights a new approach where the funding priority will be elevated for those projects that are low-cost, high-benefit, and utilize innovative solutions that are both effective and can be implemented in the short term. Mn/DOT has already begun to implement some of these solutions, which include rumble strips, cable-median barriers, high-occupancy toll lanes, expanded capacity through shoulder lane conversions, and lane remarkings within existing rights of way.

Complementing its discussion of opportunities to improve safety and congestion, Mn/DOT identifies a number of policies for realizing these opportunities, which are further supported by performance measures to keep Mn/DOT accountable and transparent to the public. Policy 1, *Traveler Safety*, focuses on improving safety by “reduc[ing] the number of fatalities and serious injuries for all travel modes.” Policy 5, *Statewide Connections*, focuses on statewide travel and improving the connections between major centers of commerce within the State. Mn/DOT has supported this by developing corridor-wide average travel speed performance targets specifically for the Greater Minnesota Interregional Corridor (IRC), one of the State’s main connectors. Policy 6, *Twin Cities Mobility*, emphasizes effective management and operations, focusing on transit, within the Twin Cities. Due to the limited potential for capacity expansion within the cities, Mn/DOT notes the priority for projects that are high benefit and low cost, reduce incident duration to help reduce congestion, and improve traveler communication efforts. Policy 7, *Greater Minnesota Metropolitan and Regional Mobility*, focuses on improving travel outside of metro regions, at the subregional level, through improved coordination between jurisdictions and decisions regarding land use and transportation.

Performance measures associated with these policies include:

Performance Measure	Relevant Policy
Annual number of vehicle-related fatalities on all State and local roads	Policy 1
Annual number of severe or incapacitating injuries on all Minnesota roads	Policy 1
Annual number of bicycle- and pedestrian-related fatalities and injuries	Policy 1
Dollars spent on Highway Safety Improvement Program (HSIP) stand-alone safety projects	Policy 1
Percent of Greater Minnesota IRC miles meeting or within 2 mph of target speed	Policy 5
Percent of Level 1 and 2 Regional Trade Centers with scheduled intercity bus service	Policy 5
Twin Cities’ ranking among metropolitan areas for peak to off-peak travel times	Policy 6
Percent of freeway miles congested in weekday peak periods	Policy 6
Number of transit passengers served in the Twin Cities region	Policy 6
Miles of bus-only shoulder lanes	Policy 6
Average clearance time for urban freeway incidents	Policy 6
Metro signal retiming frequency on arterial routes	Policy 6
Total miles covered by the Freeway Incident Response Safety Team	Policy 6
Number of park-and-ride spaces in the Twin Cities region	Policy 6
Total number of public transit bus service hours provided compared to the total number of hours needed to meet transit demand	Policy 7
Number of counties in Greater Minnesota with county-wide transit service	Policy 7
Percentage of Minnesota workers commuting by a mode other than automobile	Policy 7

<sup>10</sup> Mn/DOT. *Minnesota Statewide Transportation Policy Plan 2009-2028: Your Destination... Our Priority* 2009. <http://www.dot.state.mn.us/planning/stateplan/index.html>. Accessed February 5, 2010.

The Plan's framework of opportunities and policies is supported by a variety of plans: *Greater Minnesota Transit Implementation/Investment Plan*, *Greater Minnesota Transit Plan*, *Intercity Bus Study*, and the *Statewide Freight and Passenger Rail Plan*.

More information is available at <http://www.dot.state.mn.us/planning/stateplan/background.html>. Contact: Peggy Reichert, Director, Minnesota DOT Statewide Planning Unit, [Peggy.Reichert@state.mn.us](mailto:Peggy.Reichert@state.mn.us), (651) 284-0501.

### Toolkit: Sample Operations and Safety Performance Measures<sup>11</sup>

Type	Measure	Definition	Sample Units of Measurement
Satisfaction with transportation system operations, safety, and service quality	Customer satisfaction	Qualitative measure of customers' opinions related to roadway and/or transit management and operations services.	Very satisfied Somewhat satisfied Neutral Somewhat dissatisfied Very dissatisfied Don't know / Not applicable
	Extent of congestion—spatial	Miles of roadway within a predefined area and time period where average travel times are congested (30% longer than unconstrained times).	Lane miles of congested conditions Percent of congested roadways
	Extent of congestion—temporal	Measure of time during which more than 20% of the roadway sections in a predefined area are congested (see definition above).	Hours of congestion
	Recurring Delay	Repetitive vehicle delays for the current time frame (time of day, day of week, day type).	Vehicle-hours
	Non-recurring delay	Vehicle delay in excess of recurring delay for the current time frame (time of day, day of week, day type).	Vehicle-hours
Mobility	Speed	Average speed of vehicles measured in a single lane for a single direction of flow, at a specific location on the specified roadway.	Miles per hour Feet per second Kilometers per hour
	Throughput (Person)	Number of persons traversing a roadway section in a specified direction in a given unit of time (includes vehicle occupants, pedestrians, and bicyclists).	Persons per hour
	Throughput (Vehicle)	Number of vehicles traversing a roadway section in a specified direction in a given unit of time.	Vehicles per hour
	Travel Time—Link	Average time required to traverse a section of roadway in a single direction.	Minutes per trip
	Travel time—Reliability (Buffer time)	Buffer time is the additional time that must be added to a trip (measured according to the "travel time" definition above) to ensure that travelers making the trip will arrive at their destination at, or before the intended time at least 95% of the time.	Minutes Percent of total trip time Index
	Travel Time—Trip	The average time required to travel from an origin to a destination on a trip that might include multiple modes of travel.	Minutes per trip
	Incident Management	Incident Duration	Time between incident notification and complete incident clean-up.
Incident Clearance Time		Average clearance times for major (90+ minutes) incidents on identified roadway.	Minutes

<sup>11</sup> U.S. Department of Transportation. "Data Collection and Sharing." Available at: [http://www.plan4operations.dot.gov/data\\_coll.htm](http://www.plan4operations.dot.gov/data_coll.htm). Accessed July 7, 2009.

## Toolkit: Sample Operations and Safety Performance Measures<sup>11</sup>

Type	Measure	Definition	Sample Units of Measurement
Safety	Traffic Fatalities	Number of traffic fatalities.	Number of fatalities
	Pedestrian/Bicycle Fatalities	Number of pedestrian and bicycle fatalities.	Number of fatalities
	Transit Fatalities	Number of fatalities for passengers on transit services.	Number of fatalities
	Fatality rate	Number of fatalities per 100 million vehicle or passenger miles (for each mode).	Number of fatalities per vehicle mile or passenger mile
	Injuries	Number of serious injuries (for each mode).	Number of injuries
	Injury rate	Number of serious injuries per 100 million vehicle or passenger miles (for each mode).	Number of injuries per vehicle mile or passenger mile
	Crashes	Number of (fatal and non-fatal) crashes.	Number of crashes
Connectivity	Connectivity to Intermodal Facilities (driving)	Number of miles away from an identified intermodal facility.	% within 5 miles (1 mile for metropolitan areas)
	Dwelling Unit Proximity	Number of miles away from identified dwelling units.	% within 5 miles, 1 mile for metropolitan areas (driving), % within ¼ mile (walking)
	Employment Proximity	Number of miles away from identified places of employment.	% within 5 miles, 1 mile for metropolitan areas (driving), % within ¼ mile (walking)
	Percentage of Miles With Bicycle Accommodations	Number of miles on identified roadway with bicycle accommodations.	% miles with bike lane/shoulder coverage
	Percentage of Miles With Pedestrian Accommodations	Number of miles on identified roadway with pedestrian accommodations.	% miles with sidewalk coverage
	Service Coverage (walking/biking)	Number of transit stops within walking distance (less than ¼ mile) and/or biking distance (less than 2 miles) for an identified percent of the local population.	Number of transit stops

### Relevant Resources

Federal Highway Administration, *Operations Performance Measures*, [http://ops.fhwa.dot.gov/perf\\_measurement/index.htm](http://ops.fhwa.dot.gov/perf_measurement/index.htm).

Federal Highway Administration, Office of Safety, *A Primer on Safety Performance Measures for the Transportation Planning Process*, <http://safety.fhwa.dot.gov/hsip/tsp/fhwahep09043/cs4.cfm>.

Federal Highway Administration, *Traffic Safety Performance Measures for States and Federal Agencies* (DOT HS 811 025), August 2008, Available at: <http://www.nhtsa.gov/>.

National Cooperative Highway Research Program, *Synthesis 311: Performance Measures of Operational Effectiveness for Highway Systems and Segments*. Transportation Research Board. 2003. Available at: [http://onlinepubs.trb.org/Onlinepubs/nchrp/nchrp\\_syn\\_311.pdf](http://onlinepubs.trb.org/Onlinepubs/nchrp/nchrp_syn_311.pdf).

National Transportation Operations Coalition. *Performance Measurement Initiative: Final Report*. July 2005. Available at: [http://www.ampo.org/assets/40\\_ntocfinalreport.pdf](http://www.ampo.org/assets/40_ntocfinalreport.pdf).

### 3.3 Collect Data and Monitor System Performance

Description	<p>Once performance measures have been established, agencies should collect data and develop a tracking system to evaluate progress in relation to these measures. Performance measure tracking can also be used to identify deficiencies, which can feed into regional and corridor and sub-area planning.</p> <p>Data are a critical element of the analysis that serves as the foundation for safety and operations planning. For many years, the quality and timeliness of crash data were lacking, constraining the ability of safety and transportation planners to understand what was happening on the road network. Similarly, the quality and availability of data on travel time reliability, incidents, and the sources of non-recurring delays have been a gap in knowledge regarding the system. The advent of geographic information systems (GIS) and global positioning systems (GPS) has provided much more effective and efficient ways of handling data. Many states are now requiring common police crash reporting forms so that data are consistent from one part of the State to another. Some states are using new communications technologies to provide crash information within a few days of the crash having occurred.<sup>12</sup> ITS technologies now provide a wealth of real-time data on travel speeds and volumes 7 days per week, 24 hours per day, allowing greater information on reliability problems and the sources of delay. Integrating these and other improvements in data management into planning help in prioritizing investments and more effectively address operations and safety strategies. (<i>See opportunities 4.2 and 5.1.</i>)</p>
Benefits	<ul style="list-style-type: none"> <li>▪ Enables the agency to track success toward goals and objectives.</li> <li>▪ Allows for a more data-driven approach to identifying system deficiencies and prioritizing specific projects and programs.</li> <li>▪ Provides an effective format for communicating an agency's progress in various areas to internal users as well as the public, and for evaluating the effectiveness of implemented strategies.</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>▪ Transferring data in a format that is useful to planners can be difficult. The vast amount of data potentially available requires coordination to determine who will use the data and how, what data are needed, in what format, and for what periods.</li> <li>▪ Tying performance measures to investment decision making and programming can be a gap. It may be difficult to make tradeoffs between competing investments, particularly those with long-term and short-term impacts.</li> </ul>
Who Is Involved	<ul style="list-style-type: none"> <li>▪ Operations, safety, and planning staff should work together to identify data and develop system monitoring plans using established performance measures.</li> <li>▪ Operations and safety staff in particular can help identify data that can be used to support tracking the performance measures.</li> </ul>
Recommended Implementation Steps	<ol style="list-style-type: none"> <li>1) Develop a working group to define data needed to support performance measures in planning applications and potential availability from operations and safety divisions.</li> <li>2) Convene the working group to discuss evaluation criteria for each of the established performance measures as well as an appropriate schedule for performance measure evaluation. Draw on other states' experiences.</li> <li>3) Implement procedures for effectively sharing and tracking data.</li> <li>4) Publicly or internally report on the status of established performance measures, as appropriate.</li> </ol>

<sup>12</sup> FHWA, "Implementing the Strategic Highway Safety Plan." Transportation Planning Capacity Building Program, Hosted by Institute of Transportation Engineers, March 20, 2006. Available at: <http://www.fhwa.dot.gov/planning/scp/impstrhwsp.htm>.

## Relevant Examples

### Maryland DOT: Annual Attainment Report on Transportation System Performance

Since 2002, the Maryland DOT (MDOT) has published the *Annual Attainment Report on Transportation System Performance*.<sup>13</sup> The report details MDOT's tracking efforts to date for evaluating Maryland's transportation network performance. The performance measures outlined in the report directly link back to the goals and objectives of the Maryland Transportation Plan (MTP). This tracking tool is particularly useful for Maryland's transportation agencies when they are determining their overall management strategies. The report outlines current performance measures, their evaluation, and future performance strategies.

For example, in the "System Preservation and Performance" section, performance measures for the 2010 report include user cost savings for the traveling public due to incident management and operating cost per passenger trip, which evaluates Maryland Transit Administration's (MTA) ability to effectively and efficiently meet passenger needs on various travel modes such as bus, light rail, metro service, light rail service, and paratransit and taxi services.

In the "Connectivity for Daily Life" section, performance measures include the percent of freeway lane-miles and arterial lane-miles with average annual volumes at or above congested levels, percentage of state-owned roadway centerline miles within urban areas that have sidewalks, percentage of state-owned roadway centerline miles with a Bicycle Level of Comfort (BLOC) grade "D" or better and mileage of MDSHA-owned highways with marked bike lanes, annual vehicle revenue miles of service provided (measures miles on bus, light rail, metro service, light rail service, and paratransit and taxi services), and average weekday transit ridership.

The "Safety and Security" section includes performance measures such as customers perceptions of safety on the MTA system while riding, waiting at stops, and while walking to a vehicle in an MTA parking lot, preventable accidents per 100,000 vehicle-miles, and the number and rate of bicycle and pedestrian fatalities and injuries on all Maryland roads.

More information is available at <http://www.mdot.state.md.us/Planning/Plans%20Programs%20Reports/Index.html>, *Annual Attainment Report on Transportation System Performance*. Contact: Mike Haley, Office of Planning and Capital Programming, [MHaley@mdot.state.md.us](mailto:MHaley@mdot.state.md.us), (410) 865-1011.

### Virginia DOT: Data Business Plan for System Operations

VDOT completed the Data Business Plan for System Operations in June 2008 to support data operations within the maintenance and operations functional area, and to ensure that investments in data coincide with VDOT's business needs. VDOT decided to develop the plan after performing an internal assessment of data collection and data use within the department. It found that while data sharing occurred in the areas of planning and environment and construction, in all other sectors of the department, data use was not integrated and often duplicated. The data business plan has been used to evaluate the contribution of data to VDOT's operations, establish a programmatic approach to planning for future investments in data collection, provide an understanding of available data resources across all levels of the maintenance and operations directorate, identify data needs, and define the roles and responsibilities related to data collection.

VDOT is also encouraging data stewardship as a way to improve accountability for data quality and data management and encourage collaboration among user groups, executives, information technology personnel, and other stakeholders related to data needs.

In developing its plan and facilitating the associated stewardship, VDOT aims to achieve the following:

- Make more effective investments in data collection efforts and technologies;
- Focus on data and business process rather than systems as the key component of data collection;
- Eliminate duplicate data collection efforts by creating a data warehouse where useful and usable data is stored and is available to all within the department who need to use it;
- Effectively manage data; and
- Foster communication on data needs and improvements to the data collection process.

<sup>13</sup> Maryland Department of Transportation. *2009 Annual Attainment Report on Transportation System Performance*. [http://www.e-mdot.com/Planning/Plans%20Programs%20Reports/Index.html#Attainment\\_Report](http://www.e-mdot.com/Planning/Plans%20Programs%20Reports/Index.html#Attainment_Report). Accessed 2/6/09.

This plan will ultimately integrate data collection as a business process integral to the operation of the VDOT business itself.

More information is available at <http://webservices.camsys.com/trbcomm/2009PresPap.htm>, *VDOT's Approach to Aligning Data Program*. Contact: Jeff Price, Assistant Director—Operations Planning Division, VDOT, [Jeff.Price@vdot.virginia.gov](mailto:Jeff.Price@vdot.virginia.gov), (804) 786-2826.

### Washington State DOT: *Gray Notebook*

The Washington State Department of Transportation (WSDOT) is a known leader in system performance measurement and transportation systems operations. WSDOT began developing the *Gray Notebook* (formerly titled *Measures, Markers, and Mileposts*)<sup>14</sup> in 2001 to communicate agency and system performance to legislators and citizens alike. The publication links performance measures from the agency's *Strategic Plan* policy direction from the State's legislative and executive branches, and Federal reporting requirements. This type of aggressive reporting is an important step to transportation planning accountability, which will likely become a key part of the next surface transportation bill. (An example of a performance dashboard is shown on the next page.)

The *Gray Notebook* presents articles in a way that makes the topics' relationship to the five Legislative policy goals – and WSDOT's own strategic goals – clear. The notebook is organized into five sections devoted to those strategic goals, each marked by a page that recaps WSDOT's goals for Safety, Preservation, Mobility/Congestion Relief, Environment, and Stewardship. The first four sections feature quarterly and annual reports on key agency functions, providing regularly updated system and program performance information. The Stewardship section reports on delivery of capital projects funded by the three main State funding programs and the 2009 American Recovery and Reinvestment Act (ARRA). They contain summary tables, detailed narrative project summaries, and financial information. The information in these articles can be used by planners to update priorities and focus investments where performance improvements are needed.

Among the 23 subjects addressed in the *Gray Notebook* are:

- Commute options;
- Congestion on State highways;
- Traffic operations on State highways;
- Travel information; and
- Truck freight.

The system performance updates are rotated over four quarters based on data availability and relevant data cycles. Annual reports provide in-depth analysis of topics and associated issues. Examples of mobility measures include average clearance times for major (90+ minute) incidents on key Puget Sound corridors, percentage of Washington State Ferries trips departing on time, percentage of Amtrak Cascades trips arriving on time, and annual weekday hours of delay statewide on highways compared to maximum throughput (51 mph).

The *Gray Notebook* uses several important styles to better convey its performance to the reader: “no surprises reporting”, “performance journalism,” and good graphing technique. “No surprises” refers to a philosophy of reporting on news both good and bad so that decisionmakers can be well informed. “Performance journalism” refers to using a journalistic writing style to aid in conveying detailed and sometimes complex performance information to a reader that they will be able to understand and utilize. Finally, the notebook emphasizes good graphing technique to ensure that data is correctly, fairly, and clearly displayed to convey performance, whether using charts, tables, or maps.

Each edition of the *Gray Notebook*, as well as each performance measure going back to 2001, is archived quarterly on WSDOT's Accountability Web site at [www.wsdot.wa.gov/accountability](http://www.wsdot.wa.gov/accountability).

<sup>14</sup> Washington State DOT. “The Gray Notebook: Quarter Ending March 31, 2009.” May 2009. Available at: [www.wsdot.wa.gov/accountability/](http://www.wsdot.wa.gov/accountability/). Accessed June 30, 2009.

### Performance Dashboard



Policy goal/Performance measure	Previous reporting period	Current reporting period	Goal	Goal met	Progress	Comments
<b>Safety</b>						
Rate of traffic fatalities per 100 million vehicle miles traveled (VMT) statewide (annual measure, calendar years: 2007 & 2008)	1.00	0.94	1.00			The rate of highway fatalities continues to decline (a lower rate is better)
Rate of sprains and strains / hearing-loss injuries per 100 WSDOT workers <sup>1</sup> (quarterly measure: FY10 Q2, FY10 Q3 <sup>7</sup> )	3.0/ 0.4	2.4/ 0.4	2.4/ 0.4			Both goals met for the quarter, but agency is not on track to meet FY 10 goals
<b>Preservation</b>						
Percentage of state highway pavements in fair or better condition (annual measure, calendar years: 2007 & 2008)	93.3%	94.0%	90.0%			Recovery Act-funded projects are contributing to reductions in "due" rehabilitations
Percentage of state bridges in fair or better condition (annual measure, calendar years: 2007 & 2008)	97.0%	97.0%	97.0%			Performance level meets goal - trend remains steady
<b>Mobility (Congestion Relief)</b>						
Highways: annual weekday hours of delay statewide <sup>2</sup> (annual measure: calendar years 2006 & 2008)	37 million	32 million	N/A	N/A		Delay reduction of 13% due to gas prices, economic downturn, and completed mobility projects
Highways: Average clearance times for major (90+ minute) incidents on 9 key western Washington corridor <sup>3</sup> (quarterly: FY10 Q2, FY10 Q3 <sup>7</sup> )	154 minutes	173 minutes	155 minutes	---		The high percentage of fatalities and truck-related incidents contributed to increased clearance times
Ferries: Percentage of trips departing on-time <sup>3</sup> (quarterly, year to year: FY09 Q3, FY10 Q3 <sup>7</sup> )	97%	91%	90%			WSF exceeds goal; new initiatives are under way to continue improving on-time performance
Rail: Percentage of Amtrak Cascades trips arriving on-time <sup>4</sup> (quarterly, year to year: FY09 Q3, FY10 Q3 <sup>7</sup> )	66%	59%	80%	---		Increased demand and new service affected performance
<b>Environment</b>						
Cumulative number of WSDOT stormwater treatment facilities constructed or retrofitted <sup>5</sup> (annual measure: calendar years 2008 & 2009)	850	1,037	N/A	N/A		Stormwater facilities will now be constructed under a new permit, with new requirements
Cumulative number of WSDOT fish passage barrier improvements constructed since 1990 (annual measure: calendar years 2008 & 2009)	226	238	N/A	N/A		Twelve additional retrofits completed in 2009.
<b>Stewardship</b>						
Cumulative number of Nickel and TPA projects delivered, and percentage of on-time (quarterly: FY10 Q2, FY10 Q3 <sup>7</sup> )	240/ 88%	264 <sup>8</sup> / 89%	90% on-time	---		Currently at the peak of the Nickel and TPA programs - performance is steady
Cumulative number of Nickel and TPA projects completed and percentage on-budget (quarterly: FY10 Q2, FY10 Q3 <sup>7</sup> )	240/ 87%	264 <sup>8</sup> / 91%	90% on-budget	---		Currently at the peak of the Nickel and TPA programs - performance is steady
Variance of total project costs compared to budget expectations <sup>6</sup> (quarterly: FY10 Q2, FY10 Q3 <sup>7</sup> )	over-budget by 0.4%	under-budget by 0.08% <sup>8</sup>	on-budget			Total Nickel and TPA construction program costs are within 1% of budget

1 Sprains/strains and hearing loss are current high priority focus areas for WSDOT. Hearing loss rate based on preliminary data.  
 2 Compares actual travel time to travel time associated with 'maximum throughput' speeds, where the greatest number of vehicles occupy the highway system at the same time (usually 50 miles per hour)  
 3 'On-time' departures for Washington State Ferries includes any trip recorded by the automated tracking system as leaving the terminal within 10 minutes or less of the scheduled time.  
 4 'On-time' arrivals for Amtrak Cascades are any trips that arrive at their destination within 10 minutes or less of the scheduled time.  
 5 Facilities in Clark, King, Pierce, and Snohomish counties.  
 6 Budget expectations are defined in the last approved State Transportation Budget.  
 7 Washington's fiscal year (FY) begins on July 1 and ends on June 30. FY10 Q3 refers to the quarter ending March 31, 2010.  
 8 See page 61 for more information on the expanded view of capital projects in the current 2010 Legislative Transportation Budget for highway construction.

Source: Washington State DOT. "The Gray Notebook." March 2010. Available at: <http://www.wsdot.wa.gov/NR/rdonlyres/BD26D6F0-B554-497C-9D0E-35C546BF179F/0/GrayNotebookMar10.pdf>. Accessed June 23, 2010.

More information is available at [www.wsdot.wa.gov/accountability](http://www.wsdot.wa.gov/accountability). Contact: Tyler Winchell, Performance Specialist, Washington DOT Strategic Assessment Office, [WincheT@wsdot.wa.gov](mailto:WincheT@wsdot.wa.gov), (360) 705-7907.



## 3.4

## Develop Strategies and Programs to Support Established Goals and Objectives

Description	Goals and objectives identified in the SLRTP, SHSP, and other planning documents should lead to development of policies, strategies, programs, and investments that support attainment of objectives. Performance measures are a useful tool to help prioritize investments because they provide a means to identify system deficiencies where investments are warranted. In this way funding can be allocated based on investment priorities that are measurable and can be tracked over time. Analysis tools can also be used to help develop tradeoffs between different kinds of strategies.
Benefits	<ul style="list-style-type: none"> <li>▪ Goals, objectives, and performance measures assist in justifying and prioritizing projects.</li> <li>▪ Provides for an avenue where projects that will result in system-wide improvements will receive funding priority, and result in a more effective use of available funds.</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>▪ Given the variety of goals and objectives, it can be difficult to make tradeoffs.</li> <li>▪ Need to better understand the impacts of operations and ITS strategies in relation to policy goals and objectives.</li> <li>▪ Strategies, projects, and policies included in plans might not get funded or implemented; it is important to tie planning with fiscal programming.</li> </ul>
Who is Involved	<ul style="list-style-type: none"> <li>▪ High-level decisionmakers typically determine statewide investment priorities based on recommendations and data presented by staff.</li> <li>▪ Traditionally this consideration in the SLRTP has been supported by planning staff, but should include operations and safety as well. Planners, operators, and safety specialists should work together to identify effective approaches (e.g., policy, programs, projects) to address objectives.</li> </ul>
Recommended Implementation Steps	<ol style="list-style-type: none"> <li>1) Utilize a multidisciplinary working group with representatives from safety, operations, transit, and planning that has been involved in development of the SLRTP in order to identify strategies, policies, programs, and investments to meet goals and objectives.</li> <li>2) Consider funding and fiscal constraint in developing implementation strategies in order to ensure that the identified strategies are realistic.</li> <li>3) If useful, develop a specific plan or plans addressing key issues (e.g., operations, transit, freight) that involves more detailed data analysis and/or modeling in order to help identify and prioritize projects for funding.</li> <li>4) Develop a comparison matrix that can be used by decisionmakers to see the tradeoffs and benefits of transportation systems management and operations strategies in relation to SLRTP goals and objectives.</li> </ol>

## Relevant Examples

## New Jersey Transportation Plan: Strong Transit and Intermodal Operations Focus

New Jersey's SLRTP, called *Transportation Choices 2030* (October 2008)<sup>15</sup> is developed jointly by the New Jersey Department of Transportation (NJDOT) and NJ Transit. This policy plan provides broad direction for the transportation system, with a heavy emphasis on integrating transportation-land use planning (smart growth) to support transit, walking, and biking. It also emphasizes the importance of ITS to improve operations; facilities to move more freight by rail and policies that support moving freight during nonrush hours; travel demand management measures to shift travel out of cars and shift travel times; and strategic improvements to address bottlenecks in the highway system. The New Jersey SLRTP supports continued implementation of NJDOT's

<sup>15</sup> New Jersey Department of Transportation. *New Jersey Department of Transportation Long-Range Transportation Plan: Transportation Choices 2030*. <http://www.state.nj.us/transportation/works/njchoices/>. Accessed 2/8/09.

ITS Master Plan, which calls for significantly expanding the number of closed-circuit television cameras, electronic message signs on the state’s highways, and continually improving the NJ511 free phone and Web service for transportation information. In addition, NJ Transit is applying ITS to improve safety, including Automatic Train Control (ATC) to monitor speed and apply brakes automatically if necessary.

One of the plan’s goals is to “Improve Mobility, Accessibility, and Reliability,” through operational and multimodal strategies such as improving the speed and reliability of bus service by establishing bus priority corridors and implementing preferential treatments for buses to reduce delays due to congestion; sustain efforts to improve the on-time performance and reliability of all public transit services; and aggressively pursue transportation demand management by giving greater emphasis to the work of transportation management associations. Another goal is to “Operate Efficiently” through strategies such as providing customers with real-time travel information about current conditions and the availability of choices; reducing the duration of incidents through increased coverage of emergency service patrols and increased coordination with local emergency responders; improving traffic signal operations; and making transit fare payment easier and more seamless.

More information is available at <http://www.state.nj.us/transportation/works/nichoices/>. Contact: Brent Barnes, Director of Statewide Planning, [brent.barnes@dot.state.nj.us](mailto:brent.barnes@dot.state.nj.us), (609) 530-2866.

### Virginia DOT: Northern Region Operations Program Development

VDOT’s Northern Region Operations (NRO) has pioneered an integrated, full-cycle process for investing in, implementing, maintaining, evaluating, and enhancing ITS and operations projects. Over the course of several years, NRO developed and refined a process that can serve as a model for public agencies all across the United States. This integrated process flows from initial strategic program-level planning to tactical project planning and prioritization, investment decisions, ITS architecture and FHWA Rule 940 compliance, through project implementation, evaluation, and feedback to the ongoing strategic planning process. Along the way, some sophisticated approaches and methodologies developed by VDOT NRO are utilized to ensure that a high-quality, robust, and well-ordered ITS program is delivered to its customers.



Source: Virginia DOT. *Northern Virginia ITS Architecture*. <http://vdot-itsarch.com/planningprocess/planningprocess.html>. Accessed April 26, 2010.

In a resource-constrained environment with increased calls for accountability and growing mobility and safety needs, the delivery of the operations program requires VDOT NRO to make sound investment decisions between various projects with competing priorities. VDOT NRO’s Planning and Program Delivery (PPD) Process consists of five phases: Planning, Program Development, Fiscal Programming, Program Delivery, and Program Evaluation.

VDOT NRO uses a three-step process for its annual Program Development phase: (1) identify program and project needs, (2) develop the Annual Strategic Focus, and (3) prioritize the system needs based on the identified annual goals and objectives. NRO begins by identifying its program and project needs through the objectives and goals of the long-range plan and Strategic Plan, and use of the ITS Decision Support Tool ([www.vdot-itsdst.com](http://www.vdot-itsdst.com)) and ITS Device Master Plans. Once the program and project needs have been identified, NRO develops its Annual Strategic Focus, an identified subset of the goals and objectives contained in the Strategic Plan. The goals and objectives from the plan are assigned weights by NRO section managers during the Annual Program Planning Workshop. The weights are based on the current strategic focus, each manager’s experience, recent technological advances, direction from administrators within the District and Central Office, and other factors. The weights are compiled and a rank order for the goals and objectives is established for the upcoming fiscal year. The result of the 2009 Annual Strategic Focus for Fiscal Year 2010 is on the next page.

## FY-10's Annual Strategic Focus – Weighting of NRO's Strategic Plan Goals



Source: Virginia DOT. *NRO FY2010 Strategic Investment Program Plan (SIPP)*. Available at <http://www.vdot-itsarch.com/docsandfiles.html>.

Following the Annual Strategic Focus process, projects are mapped back to their associated goals and objectives, and the weights of each associated goal and objective are applied, resulting in a project prioritization score. This score provides a guideline for allocation during the fiscal programming phase when projects are linked with eligible funding sources.

More information on projects in Northern Virginia is available <http://www.vdot-itsarch.com/planningprocess/planningprocess.html>. Contact: Amy Tang McElwain, Northern Region Operations, [AmyTang.McElwain@VDOT.Virginia.gov](mailto:AmyTang.McElwain@VDOT.Virginia.gov).

## 3.5 Take Full Advantage of the Strategic Highway Safety Plan

Description	<p>Each State must develop an SHSP as mandated in SAFETEA-LU, 23 USC 148. An SHSP is a statewide-coordinated safety plan that provides a comprehensive framework for reducing highway fatalities and serious injuries on all public roads. The SHSP strategically establishes statewide goals, objectives, and key emphasis areas developed in consultation with Federal, State, local, and private sector safety stakeholders, and should be directly linked to the SLRTP and STIP. The SHSP must address engineering, education, enforcement, and emergency services elements of highway safety as key factors in evaluating highway projects. Through the establishment of statewide goals and objectives, the SHSP and SLRTP have a natural synergy. By collaborating on the setting of goals, planning and safety functions are integrated at the highest level within the organization. Linked goals and objectives allow the setting of strategies and monitoring that reinforce the relationship, and provide a mechanism for integrating safety considerations into long- and short-range transportation planning. The SHSP also can provide a potential opportunity for integrating operations considerations with safety.</p>
Benefits	<ul style="list-style-type: none"> <li>▪ Integrated statewide goals and objectives for safety, and operation.</li> <li>▪ Greater integration in strategies, monitoring, and identified improvements.</li> <li>▪ Data on crashes collected for the SHSP can also be used to help advance operations strategies related to incidents and incident management, along with infrastructure and educational strategies.</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>▪ Update schedules for the SHSP and SLRTP may not be aligned.</li> <li>▪ Separate financial resources to support each plan may result in a disconnect in focus, which requires coordination.</li> </ul>
Who is Involved	<ul style="list-style-type: none"> <li>▪ Safety staff and stakeholders – Collaborative relationships among safety partners, including State and local transportation agencies, law enforcement, and others, are vital to developing a successful SHSP.</li> <li>▪ Planning staff – Planners ensure that the safety goals and objectives in the SHSP and SLRTP are aligned to support projects funded in the STIP.</li> <li>▪ Operations staff – Operators can identify opportunities to align operations considerations with SHSP goals and objectives.</li> </ul>
Recommended Implementation Steps	<ol style="list-style-type: none"> <li>1) Establish a multidisciplinary working group of safety partners, operators, and planners to consider existing goals and objectives in the SHSP and SLRTP.</li> <li>2) Identify potential overlap, synergies, and commonalities. Incorporate SHSP goals and objectives into the SLRTP, or update new goals and objectives for each plan based on a collaborative understanding.</li> <li>3) Determine the overlap between existing safety and operations problems.</li> <li>4) Identify relevant and appropriate strategies, policies, action plans, and countermeasures that will help remedy safety and operations problems. Examine potential future safety and operations issues.</li> <li>5) When updated plans are adopted, monitor system performance in each area to identify improvements.</li> <li>6) Prioritize projects, programs, and policies according to data analysis and funding availability.</li> <li>7) Ensure that safety priorities are adequately reflected in funded projects and programs in the STIP, and built into project development.</li> </ol>

## Relevant Examples

### Virginia DOT's Strategic Highway Safety Plan

The Virginia SHSP includes a section, “Transportation Safety Planning,” that recognizes the important role of integrating safety within the transportation planning process. It notes: “Individual jurisdictions, as well as state and regional agencies have widely varied transportation safety planning practices...To make informed decisions about highway crash trends, state, regional, and local agencies need current data and analysis for accurate problem identification. With good crash records, strategies can be implemented to address the causes of crashes. In addition, safety between modes of transportation needs to be more fully addressed.”<sup>16</sup>

The SHSP also makes a tie between highway safety and operations. For instance in an emphasis area focusing on preventing roadway departures, Virginia’s plan notes that the Commonwealth aims to improve the operations, maintenance and design process to incorporate safety reviews and to facilitate better design decisions. The plan also includes a section focusing on work zone safety, which includes operations strategies. Some examples of strategies in the SHSP that integrate operations, safety, and planning include:

- Pedestrian and Bicycle Safety—Target infrastructure improvements around areas with existing non-motorized travel and high density such as: schools and community facilities, commercial development, mixed use development, and public transit stops.
- Intersection Safety—Focusing capacity and traffic control upgrades on the top 5% of high-crash intersections in each jurisdiction each year.
- Roadway Departures—Improve the operations, maintenance and design project process to incorporate safety reviews and to facilitate better design decisions.
- Work Zone Safety—
  - Provide motorists real-time work zone information and traffic conditions through the use of Smart Travel technology on high volume roadways. Up-to-date queue lengths, travel times, or delays provide advance warning enabling motorists to choose another route and reduce congestion.
  - Deploy speed display trailers in high-volume, high-speed construction projects and coordinate increased enforcement with the Virginia State Police. The combined use of speed display trailers and the presence of law enforcement should reduce excessive speeds and tailgating.

More information is available at: <http://www.virginiadot.org/info/hwysafetyplan.asp>. Contact: Mike Sawyer, Assistant Division Administrator, VDOT Central office, Traffic Engineering Division, [Mike.Sawyer@VDOT.Virginia.gov](mailto:Mike.Sawyer@VDOT.Virginia.gov), (804) 786-4196.

### Ohio DOT's Strategic Highway Safety Plan

ODOT’s SHSP identifies its focus on integration up front. In the Introduction, it notes that the SHSP “is considered *comprehensive* because it asks government agencies and safety advocates to work across jurisdictional boundaries to address crash problems regardless of where they occur.”<sup>17</sup> Examples of strategies included in the SHSP that relate to operations and planning include:

- Highway/Railroad Crossings—Market existing programs that expand the use of alternative crash prevention methods, such as improved street lighting at approaches, rumble strips, warning signs and flashing lights.
- Incident and Congestion-Related Crashes—Target congested highway segments for improvements, including adding roadway capacity and Intelligent Transportation Systems, as well as deploying access management techniques.
- Work Zone Crashes—Utilize new and innovative ITS technologies to obtain traffic count data, verify traffic queue lengths in order to deploy a reliable traffic alert system.

ODOT has developed comprehensive efforts to integrate operations, safety, and planning, which include a multidisciplinary safety review committee that includes representatives from roadway design, traffic operations,

<sup>16</sup> Virginia SHSP <http://www.virginiadot.org/info/hwysafetyplan.asp>. Accessed February 4, 2009.

<sup>17</sup> Ohio Department of Transportation. “Ohio’s Road Map to Fewer Fatalities.” Available at: <http://www.dot.state.oh.us/Divisions/TransSysDev/ProgramMgt/CapitalPrograms/Documents/Safety/SHSP/SHSP%20January%202008.PDF>. Accessed July 1, 2009.

and safety planning and data analysis. This committee is directly involved in project selection for projects that are funded through the Safety Program (largely the Highway Safety Improvement Program (HSIP) as well as other funding sources).

Additional integration efforts include ODOT’s statewide Systematic Signal Timing & Phasing Program (SSTPP), which was launched in 2008 and is designed to evaluate and update the timing and phasing of signal systems in congested, high-crash corridors where signal timing can be linked to crashes. The program was developed based on a number of national studies that demonstrated a link between improved signal timing and significant reductions in crashes, travel times, fuel costs, and air quality improvements. The program is funded through Ohio’s Safety Program (HSIP as well as State and local funding). Once the analysis is complete, ODOT uses this information to make decisions regarding improvements.

ODOT has made efforts to link its SHSP with other efforts such as its project development process, which now requires a work zone design review by the Ohio State Highway Patrol in major construction zones. This review will provide ODOT with input on how the work zone design could be improved in order to encourage safer speeds and to facilitate enforcement efforts during construction.

More information is available at:

<http://www.dot.state.oh.us/Divisions/TransSysDev/ProgramMgt/CapitalPrograms/Pages/SHSP.aspx>.

Contact: Jennifer Townley, Systems Planning and Program Management Administrator, [Jennifer.Townley@dot.state.oh.us](mailto:Jennifer.Townley@dot.state.oh.us), (614) 466-7493.

### Toolkit: Sample Operations-related Strategies to Consider in the SHSP

Focus Area	Operations Strategies
Aggressive drivers	<ul style="list-style-type: none"> <li>▪ Speed cameras</li> <li>▪ Message signs about enforcement</li> </ul>
Work zone safety	<ul style="list-style-type: none"> <li>▪ Real-time work zone information and traffic conditions</li> <li>▪ Variable speed limits</li> <li>▪ Incident alert system for work zones</li> </ul>
Intersection safety	<ul style="list-style-type: none"> <li>▪ Traffic signal improvements</li> </ul>
Roadway safety	<ul style="list-style-type: none"> <li>▪ Speed management</li> <li>▪ Access management</li> <li>▪ Traffic signal coordination</li> <li>▪ Incident management</li> <li>▪ Traveler information systems, including road weather information</li> </ul>
Transit bus safety	<ul style="list-style-type: none"> <li>▪ Traveler information system</li> <li>▪ Demand management programs</li> </ul>
Pedestrian and bicycle safety	<ul style="list-style-type: none"> <li>▪ Count down crosswalk signals</li> <li>▪ Speed management</li> <li>▪ Traffic signal timing</li> </ul>

**Relevant Resources:**

AASHTO and NCHRP Project 17-18, *Implementing the Strategic Highway Safety Plan*, <http://safety.transportation.org/>.

Federal Highway Administration, Office of Safety, *Strategic Highway Safety Plan*, <http://safety.fhwa.dot.gov/hsip/shsp/>.

Federal Highway Administration, Office of Safety, *Strategic Highway Safety Plans: A Champion’s Guide to Saving Lives, Interim Guidance to Supplement SAFETEALU Requirements*. <http://safety.fhwa.dot.gov/safetealu/toc.htm>.

## 3.6

## Develop Operations or Intelligent Transportation System (ITS) Plans

Description	<p>Operations and/or Intelligent Transportation System (ITS) plans are developed to provide a statewide framework for enhancing the operational performance of the transportation system. The plan enables State DOTs to assess challenges they may experience in managing and operating the State’s transportation infrastructure, goals and objectives for effective management and operations (M&amp;O), and strategies. In order to maximize the opportunity for integration with the planning process, an operations/ITS plan should be developed with the intention of complimenting other existing statewide planning efforts and should be linked to the SLRTP. It can build off of the ITS Architecture. The operations/ITS plan can also include performance measures or analysis to help support regional and corridor plans and investment decision making. Although this type of plan is not required by statute, it can build upon the model of the SHSP as a comprehensive planning effort that ties into the SLRTP.</p>
Benefits	<ul style="list-style-type: none"> <li>▪ Brings together a diverse set of operators to develop an overall strategic vision, goals, and objectives related to the short- and long-term performance of the transportation system.</li> <li>▪ Forms a basis for integrating operations goals, objectives, and strategies into the broader statewide planning context, and can directly tie to regional and corridor specific plans.</li> <li>▪ May assist in identifying needed funding for operational improvements.</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>▪ Operations staff tend to focus on near-term issues, and changing technologies and other factors makes it difficult to plan over a long-range time period.</li> <li>▪ It may be difficult to get a diverse set of operations staff and agencies to the table to develop the plan.</li> <li>▪ Even when an operations plan is developed, there is a need for data and analysis to better understand the impacts of operations and ITS strategies in relation to infrastructure strategies in helping to attain statewide goals and objectives.</li> </ul>
Who Is Involved	<ul style="list-style-type: none"> <li>▪ Operations staff and stakeholders play a primary role in developing goals, objectives, and strategies to improve the efficient operation of the transportation system. A broad range of operations staff and stakeholders should be involved, including emergency medical services (EMS), law enforcement, highway maintenance, toll authorities, DOT staff at a headquarters and district level, transit agencies, and local transportation agencies.</li> <li>▪ Planning staff provide an understanding of the long-range planning process and the SLRTP vision and goals.</li> <li>▪ Safety staff should also be involved to draw connections between operations strategies and safety goals.</li> </ul>
Recommended Implementation Steps	<ol style="list-style-type: none"> <li>1) Define “operations”; obtain buy-in from top-level managers to develop such a plan.</li> <li>2) Establish a working group made up of staff/managers from long-range planning and traffic operations, and bring in a broader set of operations partners and stakeholders.</li> <li>3) Provide educational opportunities for those involved: <ul style="list-style-type: none"> <li>- Planners can educate operators on the long-range planning process;</li> <li>- Operators can educate planners on the short-range operations considerations.</li> </ul> </li> <li>4) Identify operations goals and objectives, and both short-range and long-range operations needs and investments. Utilize data and analysis to help enable more effective consideration of operations strategies in comparison to other types of investments in attaining performance objectives.</li> </ol>

## Relevant Examples

### Pennsylvania DOT: Transportation Systems Operations Plan (TSOP)

The scale and magnitude of investment made in Pennsylvania's existing infrastructure compelled the Pennsylvania DOT (PennDOT) to start thinking "operationally." The agency's initial steps toward creating a more operations-oriented system began with its Transportation Systems Operations Plan (TSOP), which was developed in 2005 to direct project development in ITS and operations. It provided a coordinated approach to operations under a statewide framework that defined project areas and set up guidelines for including operations projects within PennDOT's capital program. TSOP was intended to be considered before projects were planned, funded, and procured. As projects were developed, TSOP was intended to be considered in the development stage so that projects would ultimately emphasize information sharing among transportation stakeholders to ensure all relevant information was used in generating a solution.

TSOP was replaced in 2008 with the statewide ITS Strategic Plan, which in turn generated the Intelligent Transportation Program. This program was developed through coordination between the maintenance, planning, and research divisions within PennDOT, and focuses on identifying future ITS needs, increasing communication, and streamlining potentially duplicate project effort among various departments within the agency. The program is run by a working group made up of representatives from a number of bureaus within PennDOT including Business Solutions and Services, Construction and Materials, Design, Highway Safety and Traffic Engineering, Infrastructure and Operations, Maintenance and Operations, and Public Transportation. The group meets weekly to discuss recommendations and strategies to how to implement strategies and develops roadmaps for taking projects from the planning stages to gaining dedicated funding and approval. Due to program organization, which guarantees extensive involvement from various bureaus within PennDOT, projects are developed efficiently with input from all stakeholders from the very beginning of the process.

The program is currently being developed further and the Bureau of Highway Safety and Traffic Engineering is currently putting together a program plan. Moving forward in the future, the program will work to accurately assess needs within Pennsylvania's transportation system and coordinate data sharing efforts among the bureaus within PennDOT as well as between statewide and local and county level efforts. As a result of this program, PennDOT has seen a greatly improved relationship between their business department and ITS division, as well as a more efficient use of financial and staff resources.

More information is available at <http://www.dot.state.pa.us/Internet/Bureaus/PennDOTROP.nsf/default?TSOP?OpenPage> and <http://www.dot.state.pa.us/Internet/Bureaus/pdBHSTE.nsf/BHSTEHomepage?OpenFrameset>. Contact: Douglas Tomlinson, Acting Chief, ITS Division, PennDOT Bureau of Highway Safety and Traffic Engineering, [DTomlinson@state.pa.us](mailto:DTomlinson@state.pa.us), (717) 787-3657.

### Minnesota DOT: Highway Systems Operation Plan

The Mn/DOT Highway Systems Operation Plan (HSOP) was developed in 2005 to help the agency better understand the operations and maintenance needs of its highway system. The HSOP identifies the relevant ways that Mn/DOT operations programs connect to its strategic directions and statewide transportation plan policies. The HSOP uses performance measures to help capture how different levels of investment impact operations and maintenance activities and overall system performance. The HSOP aims to:

- Document major trends and key factors that directly affect and/or influence operations work activities;
- Identify linkages between operations activities and Minnesota's Statewide Transportation Plan and District 20-year plans;
- Identify performance measures in the operations area, and gather supporting data for tracking Mn/DOT's progress toward achieving the performance measures;
- Based on identified trends and present performance levels, identify funding gaps and/or changes in maintenance operations activities to meet performance measures;
- Based on different levels of investment, identify, if possible, level of service changes and/or priorities for various maintenance operations work activities; and
- Provide guidance and strategies to Mn/DOT Districts and Offices for implementing the plan.



More information is available at <http://www.dot.state.mn.us/planning/program/hsop.html>. Contact: Timothy Henkel, Division Director, Modal Planning and Program Management, [Tim.Henkel@dot.state.mn.us](mailto:Tim.Henkel@dot.state.mn.us), (651) 366-4829 or Mitch Webster, Mn/DOT Office of Investment Management, [Mitch.Webster@state.mn.us](mailto:Mitch.Webster@state.mn.us), (651) 366-3787.

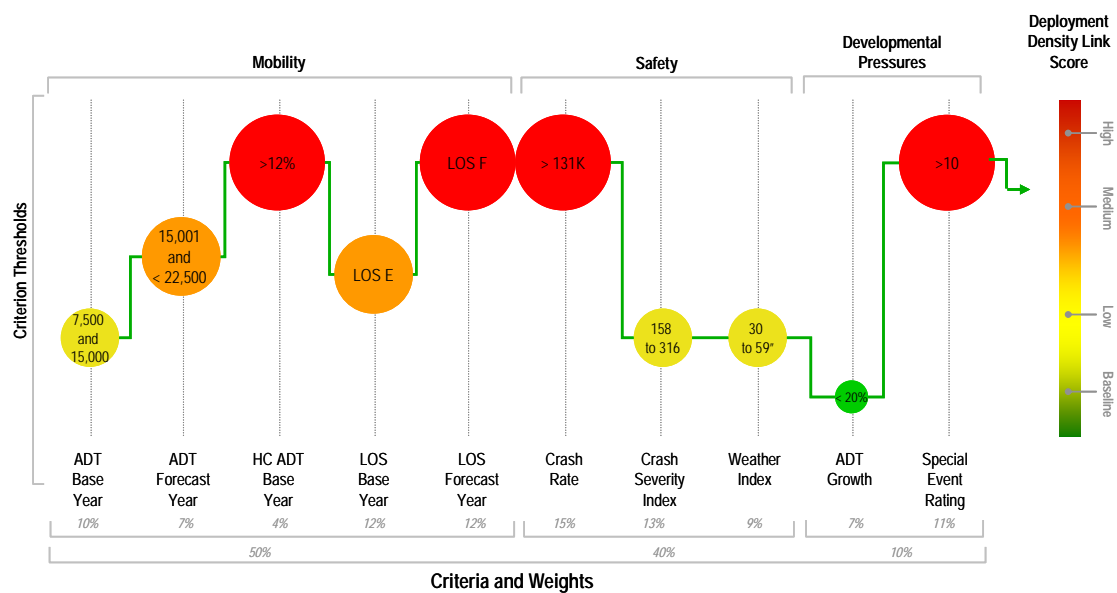
### Wisconsin DOT: Traffic Operations Infrastructure Plan

To better integrate operations projects into long-range planning, the Wisconsin Department of Transportation (WisDOT) developed a Traffic Operations Infrastructure Plan (TOIP) in collaboration with several partners. The TOIP is a long-range planning effort undertaken by the Bureau of Highway Operations with the following goals: (1) to develop a methodology to evaluate operations projects in the same manner as traditional infrastructure projects, and (2) to integrate operations into the WisDOT planning process. It outlines Wisconsin's statewide traffic operations infrastructure needs and opportunities, resulting in a set of operational technology recommendations and associated costs. Recommendations are given on a statewide level and are further broken out by corridor.

In developing TOIP, it was recognized that the plan had to be based on traditional WisDOT planning perspectives, and had to speak to bureaus within WisDOT's Central Office, as well as the Region Planning staff. Consequently, input was gathered from the Central Office and all five regions, including staff from planning, programming, and operations. The plan also built on the structure of the 2030 update to the Wisconsin Long Range Plan, which used a strategic corridor approach that segmented the State trunkline system into 37 multimodal corridors.

The basis of the TOIP is a quantitative, data-driven methodology used to assess transportation corridors and determine levels of necessity for operations improvements. In this methodology, ten operationally oriented criteria were selected addressing recurring and nonrecurring congestion, including safety-related considerations, using both traditional and nontraditional data sources such as weather conditions and the number of major special events. These factors include ADT, LOS, as well as crash rate, crash severity index, a weather index, and a special event rating. The result of this assessment was a score that prioritized corridors for different intensities of operations technology improvements. The results were then incorporated into Wisconsin's Long Range Plan, fostering inclusion of operations needs within planning activities such as feasibility studies and environmental analyses.

#### Sample of Roadway Segment Scoring



Source: Hedden, Christopher. *Wisconsin DOT ITS Sketch Plans: Corridor Sketch Plan Methodology*. Cambridge Systematics, Inc. October 2008. Available at <http://www.dot.state.oh.us/engineering/QTEC/2008%20QTEC%20Presentations/48A-Hedden.pdf>. Accessed April 26, 2010.

By creating a long-term vision for statewide investment in traffic operations infrastructure, the TOIP allows WisDOT to prioritize locations for operations deployment and more efficiently allocate limited resources. It also makes it easier to compare operations needs within the entire transportation network that WisDOT

manages, and has facilitated communication and collaboration between WisDOT's central and regional offices since all staff now use the same basis when conducting more detailed corridor analyses.

More information is available at <http://www.topslab.wisc.edu/workgroups/toip.html> or *Wisconsin DOT ITS Sketch Plans: Corridor Sketch Plan Methodology*, <http://www.dot.state.oh.us/engineering/OTEC/2008%20OTEC%20Presentations/48A-Hedden.pdf>. Contact: John Corbin, State Traffic Engineer, [John.Corbin@dot.wi.gov](mailto:John.Corbin@dot.wi.gov) or Peter Rafferty, ITS Program Manager, University of Wisconsin-Madison, Traffic Operations and Safety Lab, [PRafferty@wisc.edu](mailto:PRafferty@wisc.edu), (608)890-1218.

### Toolkit: Sample Statewide Operations and Safety Strategies

Strategy	Considerations		Applicability
	Operations	Safety	
Access management	Improves traffic flow	Improves safety through reduced potential vehicle entry/exits	<ul style="list-style-type: none"> <li>▪ Arterials</li> </ul>
Active traffic management (e.g., variable speed limits, managed lanes, advanced signal systems)	Increases throughput	Decreases accident rate	<ul style="list-style-type: none"> <li>▪ Freeways</li> <li>▪ Arterials</li> </ul>
Incident management	Improves traffic flow and reliability	Reduces potential for secondary crashes	<ul style="list-style-type: none"> <li>▪ Freeways</li> </ul>
Transit signal priority	Improves transit operations, may encourage mode shift to transit	Mode shift to transit may improve safety, since transit tends to be a safer mode	<ul style="list-style-type: none"> <li>▪ Transit</li> <li>▪ Arterials</li> </ul>
Transportation demand management	Improves mobility and may reduce congestion	May improve safety through less vehicle exposure (i.e., for measures that result in reduced vehicle travel)	<ul style="list-style-type: none"> <li>▪ Freeways</li> <li>▪ Arterials</li> </ul>
Traveler information	Improves mobility, reduces unexpected travel delay	Improves safety by advising the public of adverse weather, work zones, and other potential safety hazards	<ul style="list-style-type: none"> <li>▪ Freeways</li> <li>▪ Arterials</li> </ul>

#### Relevant Resources

Federal Highway Administration, Office of Operations, Facilitating Integrated ITS Deployment Program, [http://ops.fhwa.dot.gov/int\\_its\\_deployment/index.htm](http://ops.fhwa.dot.gov/int_its_deployment/index.htm).

Federal Highway Administration, Office of Safety, *Transportation Safety Planning*, <http://safety.fhwa.dot.gov/hsip/tsp/>.

Transportation Research Record, *Number 2065: Regional Transportation Systems Management and Operations; Managed Lanes 2008*, December 2008, <http://www.trb.org/OperationsTrafficManagement/Blurbs/RegionalTransportationSystemsManagementandOpe160506.aspx>.

Research and Innovative Technology Administration, *National ITS Architecture*, <http://www.iteris.com/itsarch/>.

## 3.7

## Incorporate Operations and Safety Into Multimodal Plans and Other Related Plans

Description	There are a range of statewide plans that State DOTs develop outside of the SLRTP. While these additional plans should have a linkage to the overall SLRTP goals and policies, the development of specialized plans offers opportunities to integrate planning, operations, and safety considerations. These specialized plans include freight plans, bicycle/pedestrian plans, and transit plans.
Benefits	<ul style="list-style-type: none"> <li>▪ Incorporating operations and safety considerations helps to broaden the focus of these plans from simply infrastructure to also consider how the system will operate in the future.</li> <li>▪ May result in consideration of new strategies and approaches (e.g., pricing, demand management, etc.).</li> <li>▪ Results in more effective use of financial resources.</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>▪ Effectively linking these specialized plans with the overall SLRTP and statewide investment strategy may be a challenge; making tradeoffs can be difficult in these plans.</li> <li>▪ Developing performance measures and objectives to accompany these plans can present a challenge, as many of the plans contain visionary goals.</li> </ul>
Who is Involved	<p>Developing a specialized plan benefits greatly from multifunctional and multijurisdictional collaboration.</p> <ul style="list-style-type: none"> <li>▪ Planning staff can use their knowledge of the planning process to educate staff from other functional areas such as operations and safety on the planning process—specifically as it relates to the modal plan being developed.</li> <li>▪ Operations and safety staff can begin to identify areas where operations and safety strategies/programs/policies could help to achieve some of the goals outlined in the specific plan.</li> <li>▪ The public and other stakeholders (e.g., transit agencies, freight shippers, etc.) should also be involved, based on the focus of the plan, to help provide a sense of current deficiencies in the transportation system and what improvements would be most important to its most frequent users.</li> </ul>
Recommended Implementation Steps	<ol style="list-style-type: none"> <li>1) Develop a working group comprised of operations, safety, and planning personnel to support development of the plan, in order to integrate all of these considerations.</li> <li>2) Initiate the plan development process.</li> <li>3) Ensure that the plan incorporates a variety of functional areas (safety, operations, planning) and addresses fiscal constraints.</li> </ol>

## Relevant Examples

South Carolina DOT: Statewide Transit Plan<sup>18</sup>

The South Carolina DOT (SCDOT) recognizes that transit alternatives cannot be an either/or proposition when considered with highway construction. The State's transportation infrastructure could greatly benefit from improvements in *both* areas. In order to incorporate transit to the greatest extent possible in new construction projects, the State analyzes opportunities for transit at the environmental stage of highway projects before the project's construction funding has been determined. Considerations include Transportation Demand Management–based alternatives such as bus pullouts, queue-jumping capabilities, and transit vehicle

<sup>18</sup> *South Carolina Statewide Transit Plan*. Prepared for the South Carolina Department of Transportation by URS and TranSystems. February 2008. <http://www.scdot.org/inside/multimodal/pdfs/StatewideTransitPlanExecutiveSummary.pdf>. Accessed 1/29/09.

HOV lanes that would support existing or future BRT service within the right-of-way. In addition to BRT, the State is also considering implementing high-speed rail along various corridors as well as supporting a more extensive commuter rail service. The increased transportation network will be evaluated alongside planning efforts in an effort to align increased density with increased transit service. As of yet, no State or local funding has been identified to address the capital needs for increased transit service.

The transit plan outlines particular goals in the areas of improving the viability and accessibility of transit, increasing economic growth, and using transit as a way to increase sustainable land use decisions. When it comes to improving the viability and accessibility of transit, SCDOT plans to address cost allocation among operations to facilitate greater coordination and cooperation. The State's needs assessment indicates that transit can and will play a larger role in maintaining mobility by providing alternatives to increasingly congested roadways and increasing the options for transit-dependent populations.

More information is available at <http://www.scdot.org/inside/multimodal/transit-coord-plans.shtml#StatewideTransitPlan>. Contact: Douglas Frate, Statewide Intermodal Planner, [FrateDW@dot.state.sc.us](mailto:FrateDW@dot.state.sc.us), (803) 737-1436.

### The Texas Metropolitan Mobility Plan (Texas Department of Transportation, TxDOT) and the Texas Transportation Needs Summary (Texas 2030 Committee)

The Texas Metropolitan Mobility Plan (TMMP) and follow-up Texas Transportation Needs Summary provide an example of long-range transportation planning<sup>19</sup> that includes both planning for operations and using operations data to plan. Developed outside of the SLRTP process itself, the TMMP Program, led by the Texas Department of Transportation (TxDOT), is a compilation of regional TMMPs for Texas' largest metropolitan areas. TMMPs were developed by Texas' Metropolitan Planning Organizations under the direction of TxDOT to show the effect on spending to reduce congestion, and to quantify the magnitude of each region's funding shortfalls and unmet needs. The outcome of the TMMP was to show what can be done to develop goals and objectives related to congestion reduction and match those goals to a total cost. Performance goals were set in TMMP development using regional travel time index and a congestion index. The TMMPs were used by the metropolitan areas to characterize unfunded congestion needs documented as the elimination of level-of-service F.

In addition to the aggressive congestion-reduction goal-setting that the TMMPs supported, the analysis also provided a backdrop for the initial incorporation of transportation system management and operations (TSMO) strategies into the planning processes. The Texas TMMP analysis provided the basis of a more recent 30-year needs summary developed by the 2030 Committee under the direction of Texas Governor Rick Perry and Texas Transportation Commission Chair Deidre Delisi. Led by the Texas Transportation Institute, this unique needs analysis incorporates TxDOT's original TMMP analysis to estimate the costs necessary to allow each Texas urban region to have a mobility level:

- To maintain economic competitiveness;
- To prevent worsening congestions; and
- To reduce congestion.<sup>20</sup>

While the original TMMP analysis relied heavily on the use of highway construction costs as a proxy for congestion relief, the 2030 needs summary allows the effects of TSMO strategies to be modeled, including ramp metering, incident management, signal coordination, and access management. This analysis allows for infrastructure enhancements to be compared to operations improvements, essentially helping State leadership better understand the importance of TSMO strategies in supporting the economic health of the state.

More information is available at <http://www.nctcog.org/trans/mtp/tmmp/>. Contact: Michael Burbank, [MBurbank@nctcog.org](mailto:MBurbank@nctcog.org), (817) 695-9251. More information on the Texas Transportation Needs Summary is available at <http://texas2030committee.tamu.edu/>.

<sup>19</sup> It should be noted that these activities are not part of Texas' SLRTP and were developed outside the long-range transportation planning process.

<sup>20</sup> Texas 2030 Committee. *Texas Transportation Needs Summary*. <http://texas2030committee.tamu.edu/>. Accessed 1/24/09.

## Toolkit: Sample Operations & Safety Strategies to Consider for Specialized Plans

Type of Plan	Sample Strategies
Freight Plans	<ul style="list-style-type: none"> <li>▪ Adjust truck speeds on common freight routes.</li> <li>▪ Vary the speed limit for cars versus trucks.</li> <li>▪ Measure truck sensitivity to toll rates. Potentially adjust tolling for trucks along common freight routes to encourage use of particular routes over others.</li> <li>▪ Implement electronic toll collection for trucks.</li> <li>▪ Increase weight enforcement efforts on routes parallel to freeways commonly used by freight traffic.</li> </ul>
Transit Plans	<ul style="list-style-type: none"> <li>▪ Develop bus lanes with intermittent priority to enhance bus transit by reducing travel time.</li> <li>▪ Install bike racks at transit stops to encourage/facilitate bike riding rather than driving among transit riders.</li> <li>▪ Install transit information panels at transit stops to alert passengers of upcoming transit vehicle.</li> <li>▪ Implement bus rapid transit.</li> </ul>
Bicycle / Pedestrian Plans	<ul style="list-style-type: none"> <li>▪ Install pedestrian crosswalks in (major) intersections with audible messaging systems for hearing-impaired persons.</li> </ul>

### Relevant Resources

Transit Cooperative Research Program, *Report 84: Improving Public Transportation Technology Implementation and Anticipating Emerging Technologies*, [http://onlinepubs.trb.org/Onlinepubs/tcrp/tcrp\\_rpt\\_84v8.pdf](http://onlinepubs.trb.org/Onlinepubs/tcrp/tcrp_rpt_84v8.pdf).

Federal Highway Administration, Office of Operations, *Freight Management and Operations: Technology and Operations*, <http://ops.fhwa.dot.gov/freight/technology/index.htm>.

Federal Transit Administration, *Transit Safety*, <http://transit-safety.fta.dot.gov/Safety/Safety.asp>.

Federal Highway Administration, Office of Safety, *Pedestrian and Bicycle Safety*, [http://safety.fhwa.dot.gov/ped\\_bike/](http://safety.fhwa.dot.gov/ped_bike/).

## 3.8

## Link Statewide Planning Efforts With Programming

Description	<p>Integrating planning and programming is essential to ensuring that the SLRTP and other statewide plans are realistic in their assessments of available resources and that they result in the identification of implemented projects that support goals and objectives. Programming at the statewide level in order to produce the STIP requires the careful balancing of projects identified to meet system needs with the appropriate funding resource. Funding available from both federal and State sources has specific requirements in the ways in which it can be used. Although the federal resources apply across all states, each State will have different restrictions on its transportation funding. This requires action at the statewide level, which has implications for each region and proposed project.</p> <p>Because the SLRTP is often a policy plan or investment strategy, it relates indirectly to the identified projects by establishing goals and objectives as well as criteria for prioritizing projects. A strong relationship between the SLRTP and STIP will allow available revenue to most effectively meet the goals and objectives. When this relationship is strong, it will also support the “trickle down” effect of regional TIPs supporting statewide goals as well as those specific to the region.</p>
Benefits	<ul style="list-style-type: none"> <li>▪ Funded projects and programs that support goals and objectives.</li> <li>▪ Projects are prioritized through a more objective process that relates to the attainment of goals.</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>▪ There may be limited availability of statewide data and analysis to support performance measurement.</li> <li>▪ There may be limited models and tools for prioritizing projects for funding with respect to all strategies.</li> </ul>
Who Is Involved	<p>Planning and programming staff, along with technical experts in operations and safety, are central for making the link between planning and programming, but it is also important to bring in operations and safety staff to help identify potential performance measures related to operational and safety goals and objectives as well as the data needed to support these measures.</p>
Recommended Implementation Steps	<ol style="list-style-type: none"> <li>1) Start with goals and objectives for the transportation system. These should be the foundation for planning and programming decisions.</li> <li>2) Early in the planning process, bring in an understanding of the reality of funding limits within individual funding categories. Assess needs in the context of available funding.</li> <li>3) Develop a system for the prioritization of projects that address the adopted goals, objectives, and priorities within the SLRTP.</li> <li>4) Identify performance measures and available data that can support system monitoring to evaluate the success in meeting the goals and objectives.</li> <li>5) Apply prioritization and performance measurement strategy and evaluate success on a regular basis.</li> </ol>

## Relevant Example

### North Carolina DOT: Program and Resource Plan

The North Carolina DOT (NCDOT) is currently finalizing its Program and Resource Plan, which will help it determine the appropriate funding allocation for their programs. The plan includes a strategic planning element as well as a financial element. The strategic planning element includes identified objectives and needs developed from discussions with internal divisions and business units as well as input from MPOs and Rural Planning Organizations. Project prioritization is based on the evaluation of performance measures using planning, operations, and safety related data. The financial element includes a forecast of available funds and expenditures, a trend analysis of previous years' commitments and revenues, as well as a budget that considers constrained funding and fund distribution. The Program and Resource Plan projects funding over a 10-year timeframe and is updated every 2 years.

Funding is assigned by grouping programs together into related categories. The program categories include the following:

- Construction and engineering
- Maintenance
- Operations
- Administration
- Other (debt service, transfer to others)

Major construction project are classified according to their primary purpose (safety, mobility, and infrastructure health), the appropriate component of the State system (statewide, regional, and subregional), and mode (highway, rail, public transportation, ferry, aviation, and bicycle and pedestrian). As implementation of the department's first Program and Resource Plan is still in development, an initial sample of the organization tool to show funding for project categories is illustrated below.

In order to determine funding for program groups, each one is associated with specific objectives and goals, as outlined in the SLRTP. The objectives and goals are assigned weights in terms of priority for addressing challenges facing the state's surface transportation system. Performance measures are used to evaluate the expected return on investment of various strategies used by individual programs to help achieve these objectives and goals.

NCDOT's first Program and Resource Plan is anticipated to be approved in June 2010.

More information is available at <http://www.ncdot.org/performance/reform/>. Contact: David Wasserman, NCDOT Strategic Planning Office of Transportation, [DSWasserman@ncdot.gov](mailto:DSWasserman@ncdot.gov), (919) 715-1273.

## 3.9 Self-Assessment Checklist: Statewide Opportunities

The following checklist may be used as a self-assessment to identify statewide opportunities for integrating operations, safety, and multimodal planning. The user should consider the questions, whether or not the State DOT is undertaking the activity, and what can be done to improve integration.

Checklist: Statewide Level Opportunities				
Question	Yes	No	If no, what can be added or improved?	Relevant Subsection
Are operations and safety staff involved in the development of the SLRTP?				3.1
Does the SLRTP include a vision and goal(s) that address operational and safety considerations?				3.1
Is there recognition of the importance of linkages between operations and safety considerations in the SLRTP?				3.1
Are there specific objectives in the SLRTP that relate to system operation and safety?				3.1
Have system-wide performance measures been developed in the SLRTP, including those focused on operations and safety?				3.2
Are performance measures for livability, multimodal choice, and other planning considerations utilized in operations and safety programs?				3.2
Are performance measures being tracked?				3.2
Are safety and/or operations data being utilized to monitor system performance?				3.3
Are operations and safety strategies, policies, and programs highlighted in the SLRTP?				3.4
Are the SHSP's goals, objectives, and priorities reflected in the SLRTP?				3.5
Has an effort been undertaken to develop statewide operations goals and priorities, such as development of a statewide operations or ITS plan?				3.6
Do other plans outside of the SLRTP (e.g., modal plans, freight plans, etc.) relate back to the overarching goals and objectives in the SLRTP? Do these plans include operations and safety considerations?				3.7
Are goals and objectives helping to inform projects that are programmed in the STIP?				3.8
Are fiscal constraints being considered in the development of the SLRTP and other plans?				3.8



## Section 4

# Regional Level Opportunities

State DOTs work to support regional planning, operations, and safety efforts, focused on both urban and rural areas. Regions may be identified by common interests or perspectives, political influence, or geography.

In urban areas, there is a structured metropolitan transportation planning process in accordance with federal planning regulations. The Metropolitan Planning Organization (MPO) plays a lead role in this process, and also provides a structure that may facilitate collaboration among transportation system operations staff, including transit agencies. MPO planners usually have an established relationship with the regional DOT planning staff. Regularly scheduled meetings and committees provide opportunities for the sharing of ideas to meet common needs. In particular the requirement for larger MPOs to have a congestion management process (CMP) provides a natural interface point for operations, safety, and planning.

### Overarching Themes

- Bringing together multidisciplinary teams
- Utilizing operations and safety data in planning
- Coordination between the State DOT operations and planning staff with MPOs, transit agencies, tribal governments, and other partners.

In rural areas, Rural Planning Organizations (RPOs) and/or Tribal DOTs may play a role in integration efforts by providing a structured forum for the consideration of transportation needs. If an RPO or Tribal DOT is not present, an initiative may be needed to focus on advancing operations, safety, and planning goals. Rural transit or human service providers may offer a regional structure that may support a larger initiative. Because county governments partner with these agencies, there is an established interface with local governments that can further enhance transportation groups and initiatives.

Many states have major destinations such as national parks that are located in primarily rural areas. High traffic volumes are often associated with these venues on highways that do not have sufficient capacity. This type of traffic represents a surge effect, and is well suited to traffic management in the absence of the ability to increase capacity. This is a strong opportunity for cooperation between operations, safety, and multimodal planning. Many areas have found transit to be a strong resource for addressing these needs.

Operations personnel are usually the most familiar to local entities, as most DOTs operate the system through regional, division, and/or district offices. The regional operations staff is the front line interface with the local stakeholders whether these are the public, transportation providers, citizen advocacy groups, or special interest groups. These professionals represent the problem solvers in a region because their actions usually address an immediate need. If DOT planning support is not located in the regional office, interface with the operations and safety staff will need to be initiated. However, whether or not the functions are co-located, this relationship offers the ability to develop solutions for both near term and long range system needs that consider operations and safety as well as system capacity.

One challenge to the incorporation of operations and safety solutions for specific transportation needs is a difference in analytical methods. As the primary transportation planning tool, the travel demand model does not provide the finer scale of analysis needed to consider operational strategies. In recent years, the transportation industry has been attempting to overcome this disconnect through more extensive use of meso and micro analysis tools for transportation planning at the regional level.

### Section Content

Three opportunities have been identified for integrating operations, safety, and multimodal planning at the regional level.

- Develop Regional Initiatives and Programs
- Support Data Sharing and Analysis Tools for Use by MPOs
- Support Integration for Federal Lands, Native American Tribes, and Rural Areas

## 4.1

## Develop Regional Initiatives and Programs

Description	<p>In order to more fully collaborate on common transportation interests and needs within a region, it can be advantageous to formalize a regional initiative. A regional initiative will involve many partners including the regional DOT staff, and can focus on coordinated efforts to address transportation system operations and safety while considering a broad range of solutions. For instance, a regional initiative may involve development of an integrated safety and incident management program through collaboration of system operators and law enforcement. A regional group can work on a “regional concept of transportation operations” (RCTO), which helps to define a vision, goals, operations objectives, and strategies for a specific operational issue, such as work zone management or incident management, and can be integrated into regional planning activities. Participation of both local and State DOT planning staff is often important to ensure inclusion of identified strategies in plans and programs consistent with regional and statewide goals.</p>
Benefits	<ul style="list-style-type: none"> <li>▪ Regional initiatives focus on a well defined set of common interests, and offer potential for local funding to support solutions of value to the region.</li> <li>▪ The presence of a regional group can assist the DOT when projects are in development.</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>▪ In many States, DOT regional boundaries do not match MPO planning boundaries.</li> <li>▪ Rural areas have no formal boundaries although there may be common interests.</li> <li>▪ DOT staff may find it difficult to attend meetings on a regular basis.</li> </ul>
Who Is Involved	<p>Regional initiatives can be started by any transportation or stakeholder group that identifies common interests.</p> <ul style="list-style-type: none"> <li>▪ It is important to include all relevant transportation agencies and providers as well as the DOT regional staff from operations, safety, and planning.</li> <li>▪ Local / regional planners often play an important role in this group.</li> <li>▪ Other relevant stakeholders, such as police and fire officials, EMS officials, emergency managers, and port authority managers may be important, depending on the focus of the initiative.</li> <li>▪ In some areas local citizen groups such as the Chamber of Commerce are strong advocates.</li> </ul>
Recommended Implementation Steps	<ol style="list-style-type: none"> <li>1) Identify a common interest or need in the regional transportation system.</li> <li>2) Identify a broad group of potential participants and hold an initial meeting.</li> <li>3) Formalize the group structure and mission through a memorandum of understanding or some other document.</li> <li>4) Continue meeting regularly and publicize meetings to encourage broad participation.</li> <li>5) Identify potential funding sources such as grants, public-private partnerships, matching or in-kind funds, special DOT programs that assist short term implementation of solutions.</li> </ol>

## Relevant Examples

### Arizona DOT: AZTech™ Partnership

AZTech™ is a partnership of Federal, State, local, and private entities led by the Maricopa County Department of Transportation and Arizona DOT (ADOT) to address a variety of regional operations issues in the Phoenix metropolitan area. The group is closely connected to regional transportation planning and includes many of the same agencies represented in the Maricopa Association of Governments' ITS Committee.

AZTech™ began in 1996 when partners in the Phoenix region were awarded the ITS Metropolitan Model Deployment Initiative (MMDI) grant from the U.S. Department of Transportation. Guiding the direction of AZTech™ and the implementation of its programs is the AZTech™ Executive Committee, which meets every other month. In addition, AZTech™ members participate on an operations committee, an advanced traveler information systems (ATIS) working group, and a TMC operators working group that all meet on a regular basis to share information and carry out joint initiatives.

Joint initiatives that the region is pursuing include center-to-center communications, traffic signal optimization, and freeway and arterial incident management, traffic management, joint ITS procurements, and improving traveler information and system performance measurement. The traffic management system relies on a data exchange between the Phoenix Fire Department, Maricopa County Department of Transportation, and ADOT to help inform public safety efforts in the Phoenix metropolitan area. This data sharing effort is intended to be expanded so that real-time transit data will be integrated with the AZTech™ Regional Archived Data Server. The ongoing study investigating this opportunity is considering the following aspects: “availability of real-time data transit data attributes; hardware and software requirements; potential ATIS applications and/or services; requirements for ongoing public agency staff support, and initial and ongoing costs.”<sup>21</sup>

To assist in freeway and arterial incident management, AZTech™ has developed a new system called the Emergency Vehicle Infrastructure Integration system, which works to assist emergency-responder vehicles by researching and developing new technologies. Research efforts include investigating ways that emergency vehicles could share real-time data with other emergency vehicles in order to reduce the number of crashes.

More information is available at <http://www.aztech.org/>. Contact: Faisal Saleem, ITS Branch Manager, Maricopa County Department of Transportation, [faisalsaleem@mail.maricopa.gov](mailto:faisalsaleem@mail.maricopa.gov), (602) 506-1241.

### Missouri and Kansas DOTs: Kansas City Scout

In 1999, planners and district engineers from the Missouri DOT (MoDOT) and Kansas DOT (KDOT), the Mid-America Regional Council MPO, FHWA representatives from both States, ITS personnel, and local government representatives formed a planning committee to collaborate on the development of a bi-state comprehensive traffic and incident management system. At the first meeting, the members considered how to place the necessary funding in each State's STIP. The committee used the three to five year transportation plan for construction projects that would start in 2001 to determine the amount of federal earmarked funds each State would receive and the amount each State would have to match. It took approximately two years to construct the effort and put it into the STIP. The cost was \$50 million with 80% Federal funding and 20% State funding shared between the two States. This was the first program with designated ITS funding.

The Kansas City Scout (KC Scout) program began operating in 2003, and by 2004 it was fully operational. Initially the system addressed traffic on 75 miles of contiguous freeways in the Kansas City metropolitan area. By December 2008, the program had expanded to cover more than 100 miles of contiguous highway and fed information to electronic message boards, the Scout Web site, and the radio system. The Traffic Management Center operators continually communicate with MoDOT's Motorist Assist Programs and the Kansas Highway Patrol to respond to thousands of incidents per year including clearing vehicle accidents and disabled vehicles in a timely manner, and alerting motorists of travel times, weather conditions, scheduled roadwork and Amber alerts.

The Scout program was designed consistent with the concepts of the USDOT's National ITS Architecture, which provides a common framework for planning, defining, and integrating ITS. A regional ITS architecture

<sup>21</sup> AZTech Partnership. *Data Exchange with Transit*. [http://www.aztech.org/trafmgmt/data\\_transit.htm](http://www.aztech.org/trafmgmt/data_transit.htm). Accessed February 4, 2010.

developed by the MPO already exists, which was based on existing conditions and projections for what the region would look like in the future.

Working across State lines was particularly challenging considering each state's separate budgets and everyone had to be comfortable with the amounts that were programmed into the STIP. Operational costs were established based on the amount of infrastructure being built. Each DOT decided to provide their own full time employees rather than consultants in order to manage staff more effectively.

The DOTs are conducting a cost benefit analysis using the ITS Deployment Analysis System; however, they have already seen tremendous improvements with an estimated 8:1 benefit back to the taxpayers. The success of the program is dependant on the active participation in operations among all partner agencies including, MoDOT Motorist Assist, Kansas Highway Patrol, local law enforcement and incident management agencies, and internal DOT maintenance/construction personnel. The strategic plan and the business plan are continually updated and expansion of the Scout project is programmed through 2010.

More information is available at [www.kcscout.net](http://www.kcscout.net). Contact: Jason Simms, Traffic Center Manager, [ervin.sims@modot.mo.gov](mailto:ervin.sims@modot.mo.gov).

### Indiana DOT: Indiana Traffic Incident Management Effort (IN-TIME)

The Indiana Quick Clearance Working Group was formed in 2008 to develop and recommend policy and operational protocols for the safe and efficient mitigation of traffic incidents. The Group takes a multidisciplinary approach to addressing traffic incidents and has worked to develop a common framework for the development of traffic incident management policies and training programs across the various responder disciplines. The Group is comprised of public and private sector stakeholders, and is jointly led by the Indiana State Police, Indiana Department of Transportation, Federal Highway Administration, Indiana Department of Homeland Security, and the Indiana Department of Emergency Management. Others they hope to get involved include insurance companies, the Department of Education, the Coroner's office and any other organization that has a stake in the improved operation and safety of Indiana roads. Members of the Working Group were divided into three multidisciplinary task forces to focus on specific issues including emergency management systems, law enforcement, transportation, towing/recovery, health/environment, and homeland security. Each task force was then asked to document common practices and provide recommendations for improving traffic incident management policies and training programs across the various responder disciplines.

The Quick Clearance, later renamed the Indiana Traffic Incident Management Effort (IN-TIME), is modeled after the FHWA Traffic Incident Management program (TIM), which is the organized cooperative effort of multiple agencies to detect and verify incidents, respond and manage the scene, and manage traffic. IN-TIME also uses "Quick Clearance," which is the practice of safely and rapidly removing temporary obstructions from the roadway. Because Indiana traffic incident responders from all disciplines (ISP/LE, INDOT, Fire/Rescue/EMS, and Towing recovery cleanup) respond differently to incidents, the objective is to get all first responders to follow agreed-upon multilateral policies and procedures to provide the traveling public safety by reducing congestion and the higher risks of secondary crashes by clearing vehicles, victims, and debris from the travel lanes of all Indiana roadways. Policy changes and training are the two biggest challenges for the future. Many opportunities to address these challenges will likely be captured through improved legislation and improved standard operating procedures, which do not necessarily require funding.

The Working Group is starting to reach out to the planning community, but have not yet gotten them on board, however, a representative from the Fort Wayne MPO attends the monthly meeting. Although IN-TIME is not funded through the long-range plan, it is an excellent example of a cooperative effort that looks to be successful in managing traffic incidents to reduce congestion and improve highway safety without using funds that are then available for other transportation needs.

More information is available at [www.indianaquickclearance.org/](http://www.indianaquickclearance.org/). Contacts: Guy Boruff ([GBORUFF@indot.IN.gov](mailto:GBORUFF@indot.IN.gov)), Jay Wasson ([JWASSON@indot.IN.gov](mailto:JWASSON@indot.IN.gov)), Kimberly Peters ([kpeters@indot.IN.gov](mailto:kpeters@indot.IN.gov)), Jason Sewell ([JLSEWELL@idem.IN.gov](mailto:JLSEWELL@idem.IN.gov)), Karen Stippich ([Karen.Stippich@fhwa.dot.gov](mailto:Karen.Stippich@fhwa.dot.gov)).

## 4.2

## Support Data Sharing and Analysis Tools for Use by MPOs

Description	<p>Data collection for support of regional analysis is a major effort for the planning staff, whether this staff resides within the DOT, an MPO, or a local planning agency. State DOTs' operations and safety divisions often have a great wealth of data from Intelligent Transportation System (ITS) technologies and crash reporting systems that can help to advance planning, specifically focused on congestion and safety, at the MPO level.</p> <p>The MPO Congestion Management Process (CMP), required for transportation management areas (TMAs), represents a substantial opportunity for considering operations and safety data and analysis in planning. The CMP requires development of congestion objectives, a definition of congestion, development of congestion objectives, performance monitoring and data collection, identification of strategies, and analysis of strategy effectiveness. Operations and safety data can be used to help identify congestion problems (including recurring and non-recurring congestion), to support performance measures, and to evaluate the effectiveness of implemented strategies.</p> <p>State DOTs can also support planning in metropolitan areas through the development of tools and procedures for analyzing operations strategies. Since regional travel demand forecasting models are primarily geared toward capacity analyses, there is a need for effective analysis techniques to analyze and predict the effectiveness of operations strategies. Strategies developed within the CMP should be integrated into the metropolitan transportation plan and Transportation Improvement Program (TIP), which is incorporated into the Statewide Transportation Improvement Program (STIP).</p>
Benefits	<ul style="list-style-type: none"> <li>▪ Helps facilitate more effective analyses of congestion problems, including both recurring and non-recurring congestion caused due to incidents, work zones, weather, and other factors.</li> <li>▪ Helps to support statewide goals for mobility and safety identified in the SLRTP.</li> <li>▪ Can be an effective and efficient use of existing resources, including ITS technologies that are already capturing travel information for real-time operations support that can be used for planning applications.</li> </ul>
Challenges	<p>Operational data are often collected to support technology and analysis requirements that are very different from those used by the planning staff. Sharing of completed analysis may be necessary rather than the raw data. This may require operations staff to perform analysis not required for their specific function, impacting the staff workload.</p>
Who is Involved	<ul style="list-style-type: none"> <li>▪ Operations, safety, and planning staff at any level in the organization.</li> <li>▪ MPO staff, transit agencies, and other organizations involved in regional planning.</li> </ul>
Recommended Implementation Steps	<ol style="list-style-type: none"> <li>1) Establish interface between operations, safety, and planning staff to identify data being collected and available for use.</li> <li>2) Identify ways in which existing data may support planning efforts as well as data needs that are not currently collected.</li> <li>3) Consider how individual technologies or analyses may enhance both perspectives.</li> <li>4) Based on the level of need, resource requirements, and the overall opportunities for improvement, operations staff may provide the required data analysis for use by the planning staff.</li> <li>5) Ongoing collaboration on data needs and availability.</li> </ol>

## Relevant Examples

### New York State DOT: Data Sharing and Coordination with Albany MPO

During the 2007 update to the Albany, New York long-range regional transportation plan, called “New Visions for a Quality Region”, the Capital District Transportation Committee (CDTC) convened five working groups to address emerging issues and help staff analyze those that required further study. One of the groups, Working Group B,<sup>22</sup> focused on investigating expressway function and operational needs as well as physical infrastructure needs and projected costs. Working Group B was made up of representatives of the Capital District Transportation Authority – the designated MPO for the Albany-Schenectady-Troy metropolitan area, New York State DOT (NYSDOT), the New York State Thruway Authority and a Quality Region Task Force member. Working Group B noted the expressway system was in need of repair, yet estimated costs just to maintain the system were much greater than the anticipated funding. At the same time, increasing traffic volumes and congestion were expected to lead to increasingly longer congested peak periods. Working Group B also found “that incident related delay is more severe and more unacceptable than recurring delay.” However, traffic congestion related to incident delays and the magnitude of its effect on congestion could not be predicted using the MPO’s standard data and travel demand model.<sup>23</sup>

In an effort to address these congestion issues, the CDTC analyzed the Management Information System for Transportation (MIST) data routinely collected by the NYSDOT. MIST provides real-time speed, volume, and incident data on each lane of a designated expressway segment every 15 minutes throughout the year. The data were also used to reconstruct incidents and understand how they were handled.<sup>24</sup> CDTC staff used the MIST data to model future demand under two growth scenarios in an attempt to qualify and quantify how the expressway system operated during incidents and identify alternative strategies and solutions. The results showed that no feasible capital improvements such as widening would eliminate the daily recurring congestion in peak hours. However, it also concluded “that ITS, incident management and operational improvements were the most effective strategies for expressway congestion management.” ITS improvements on arterials would also have direct benefits to expressway travel by providing alternative routes during expressway incidents.

The process of using existing data routinely collected by NYSDOT Operations and providing it to the CDTC has allowed the MPO to take a more holistic approach to planning that addresses the day-to-day operations of the expressway system. Armed with this information, the MPO can facilitate building consensus among operating agencies about priorities and project programming within their limited budgets. A bi-product of the data exchange has been the proactive collaboration between NYSDOT and CDTC and other participants, to give the interpretation of the data meaning and legitimacy.<sup>25</sup> This collaboration is being continued with the CDTC Regional Operations Committee, which also includes cities and towns and their operations departments. The NYSDOT Regional Director has been supportive of operations data exchange between CDTC and NYSDOT, which has led to cooperation at the staff and management levels at both agencies.<sup>26</sup>

More information is available at <http://www.cdtcmpo.org/rtp2030/b-materials.htm>. Contact: Mary Ivey, Regional Director, New York State DOT, [MIvey@dot.state.ny.us](mailto:MIvey@dot.state.ny.us), (518) 388-0388 or Mary Anne Marriotti, P.E., Regional Asset Manager, New York State DOT Region 1, [MAMariotti@dot.state.ny.us](mailto:MAMariotti@dot.state.ny.us), (518) 388-0439.

### Virginia DOT: Data Sharing and Coordination with Hampton Roads Transportation Planning Organization (HRTPO)

The Hampton Roads Transportation Planning Organization (HRTPO), the MPO for the Hampton Roads metropolitan area, aggressively compiles and uses operations data (including crash data, incident data, continuous count data, and volumes for both CMP and non-CMP roadways) from the Virginia DOT (VDOT) to identify congested locations, which ultimately influences its Congestion Management Process (CMP).

HRTPO was the first MPO in its region to complete a comprehensive travel time study using global positioning system (GPS) technology for data collection and geographic information system (GIS) technology for data analysis. Travel time data was collected on more than 1,100 miles of roadway. HRTPO compiled this

<sup>22</sup> The final Working Group B report is available at <http://www.cdtcmpo.org/rtp2030/materials/wb-doc.pdf>.

<sup>23</sup> Capital District Transportation Committee. *Working Group B Report : Expressway System Options*. April 2007.

<sup>24</sup> Bryan Menyuk, New York State Department of Transportation. Telephone interview with C. Paulsen, ICF on Jan. 30, 2009.

<sup>25</sup> Ibid.

<sup>26</sup> Christopher O’Neill, Capital District Transportation Committee. Email to L. Wallis, ICF on January 19, 2009.

data on its GIS maps using a customized ArcView application to generate travel time contour maps, which they ultimately used to assess the performance of the area's transportation system. HRTPO also compared travel time contour maps from previous studies to determine improvements or degradation in travel time for each area. HRTPO is planning to begin collecting ITS data from VDOT and local jurisdictions included within the planning district area to conduct travel time analysis on a system-wide basis. The MPO will also be using Automated Vehicle Location (AVL) data from express transit routes to support this effort. HRTPO anticipates that this analysis will be complex, and will be constrained by the pace of ITS infrastructure deployment. One issue with which they are grappling is that of accuracy; loop detectors can malfunction frequently enough to skew the data collected. VDOT currently operates a regional Transportation Operations Center, which provides ITS coverage for 120 miles of the interstate system. Volume and speed data from the Center is archived by VDOT and made available to outside parties for research purposes.

HRTPO has created an incident management plan for the region, and also developed a Regional Concept of Transportation Operations (RCTO) in coordination with VDOT. The RCTO states the shared regional objective for transportation operations and what is needed to achieve that objective – physical improvements, relationships and procedures, and resource arrangements. The RCTO process helps to coordinate between regional planners and transportation operations managers. Hampton Roads' motivation for developing an RCTO came from high profile incidents at bridges/tunnels and within other high traffic volume corridors that caused major delays and led the HRTPO Board to request HRTPO staff and VDOT find ways to improve incident management. The RCTO's guiding principles include broadening operational cooperation, elevating Quick Clearance principles, expanding and enhancing existing MOUs, and reducing congestion caused by crashes and disabled vehicles. Hampton Roads uses clearance time, lane blockages, and diversion response as performance measures. The final RCTO is a document that describes common procedures and concepts, focusing on incident management.<sup>27</sup>

More information is available at <http://www.hrtpo.org>. Contact: Stephany Hanshaw, Hampton Roads Smart Traffic Center, [Stephany.Hanshaw@VDOT.Virginia.gov](mailto:Stephany.Hanshaw@VDOT.Virginia.gov), (757) 424-9907 or Mike Corwin, Regional Traffic Engineer for the Hampton Roads District, [Mike.Corwin@VDOT.Virginia.gov](mailto:Mike.Corwin@VDOT.Virginia.gov), (757) 925-6020 or Keith Nichols, Hampton Roads Transportation Planning Organization, [KNichols@hrpdcva.gov](mailto:KNichols@hrpdcva.gov), (757) 420-8300.

### Florida DOT: FITSEVAL Planning Tool

Florida DOT (FDOT) developed an analysis tool called FITSEVAL that is designed for regional sketch planning analysis to assess the benefits of ITS strategies. The tool is a collaborative effort between FDOT's System Planning Office and its ITS Section, and was created to support assessment of ITS scenarios together with infrastructure investments within regional long-range transportation planning. The tool can be used in connection with regional travel demand forecasting models to analyze a wide range of ITS deployments, including ramp metering, signal control, transit vehicle signal priority, emergency vehicle signal priority, transit electronic payment systems, smart work zones, and road weather information systems. The modeler inputs information on deployment locations and other parameters, and the tool provides outputs in terms of savings in delay (vehicle hours), safety (fatalities, injuries, property damage only), fuel consumption, and vehicle emissions, as well as a monetized estimate of benefits. The default ITS impact parameters were derived from a review of previous evaluation studies, the U.S. Department of Transportation's ITS benefits database, and the values used in existing ITS sketch planning tools. The user is also able to change the default ITS impact parameters and perform sensitivity analysis.

More information is available at <http://www.dot.state.fl.us/planning/systems/> and <http://www.dot.state.fl.us/trafficoperations/ITS/ITS.shtm>. Contact: Vidya Mysore, Systems Planning Office, [vidya.mysore@dot.state.fl.us](mailto:vidya.mysore@dot.state.fl.us), (850) 414-4924.

<sup>27</sup> AASHTO Congestion Management Workshop: Meeting Report. Prepared for FHWA by ICF International, November 15, 2007. Presented by Keith Nichols, Hampton Roads Planning District Commission.

## 4.3

## Support Integration for Federal Lands, Native American Tribes, and Rural Areas

Description	Rural areas, national parks and other tourist destinations, and Native American tribal lands often experience unique congestion and safety challenges. For instance, national parks may have major traffic congestion issues during vacation periods for several weeks or months of the year. These traffic congestion problems often also create safety issues, but are not effectively addressed through highway capacity solutions, given environmental and aesthetic issues, and limited periods of high volumes. Transportation system management strategies and planning, through use of transit shuttles, park-and-ride lots, and traveler information systems often are particularly effective in this context. Tribal lands also often have unique transportation and coordination challenges that can benefit from improved collaboration with State DOT operations, safety, and planning functions.
Benefits	<ul style="list-style-type: none"> <li>▪ Reduced congestion without the need to increase capacity, and improved modal options.</li> <li>▪ Increased safety for motorists.</li> <li>▪ Improved air quality and environmental outcomes.</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>▪ Limited relationships and on-going coordination may exist with key entities, such as Native American tribes, and federal lanes, in comparison to with MPOs.</li> <li>▪ These organizations may have limited staff and resources.</li> </ul>
Who is Involved	DOT operations, safety, and planning staff must work together with the organizations or agencies responsible for the region, such as tribal governments, federal lands, and local governments. Transit providers may be a resource for providing service or assistance in identifying appropriate infrastructure.
Recommended Implementation Steps	<ol style="list-style-type: none"> <li>1) As applicable, meet with Rural Planning Organization (RPO), Tribal DOT, or venue management agency or organization to establish full understanding of the needs, issues, resources, and other potential partners.</li> <li>2) Identify full list of potential solutions by holding discussions among functional areas.</li> <li>3) Vet solutions with venue management and other local partners as well as DOT management to eliminate solutions which cannot be supported.</li> <li>4) Engage the local public for review of potential solutions and input.</li> <li>5) Identify preferred solution and develop planning documents.</li> <li>6) Submit solution to appropriate organization/ agency for TIP or other funding.</li> </ol>

### Relevant Examples

#### South Dakota DOT: Safety Study with Local Tribes<sup>28</sup>

Safety issues continue to be a concern for both the State and Tribes, as South Dakota has one of the highest motor vehicle crash rates in the country. Road-specific safety issues have traditionally been addressed at the annual STIP process, with Tribes presenting information on unsafe roadways in their area to SDDOT officials. However, recent research of motor vehicle crash reporting on South Dakota's nine reservations identified opportunities for increased coordination with the State to more effectively report crashes and use crash data to identify hazardous roadways across both the State and IRR systems. The Lower Brule Sioux Tribe proposed that SDDOT fund a statewide study to investigate the extent of crash underreporting, identify factors contributing to underreporting, and recommend ways to encourage and enable more complete reporting. SDDOT agreed that a multiyear crash reporting analysis was necessary and procured consultants for the study.

<sup>28</sup> South Dakota Department of Transportation. *Public Involvement Plan*. July 2009. <http://www.sddot.com/docs/PublicInvolvementPlan7102009.pdf>. Accessed February 4, 2010.



The final recommendations from the study identified a need for the South Dakota Department of Public Safety (SDDPS) to provide training tailored to Tribal law enforcement; for SDDOT and SDDPS to work with Tribal councils and governments to establish crash reporting as a priority for tribal and BIA law enforcement; for SDDPS to provide funding opportunities for tribes to improve crash reporting and tracking; and for SDDPS to make reporting as easy as possible for tribes. Since the research was completed, SDDOT has emphasized crash reporting in its ongoing Tribal consultation process, and SDDPS has initiated collaborative efforts and grants to improve manual crash reporting and to enable Tribes to use the state's automated crash reporting system.

Contact: David Huft, Research Program Manager, South Dakota DOT, [Dave.Huft@state.sd.us](mailto:Dave.Huft@state.sd.us), (605) 773-3358 or James Carpenter, Office of Highway Safety, South Dakota Department of Public Safety, [James.Carpenter@state.sd.us](mailto:James.Carpenter@state.sd.us), (605) 773-4949.

## 4.4 Self-Assessment Checklist: Regional Opportunities

The following checklist may be used as a self-assessment to identify regional opportunities for integrating operations, safety, and multimodal planning. The user should consider the questions, whether or not the State DOT is undertaking the activity, and what can be done to improve integration.

Checklist: Regional Opportunities				
Question	Yes	No	If no, what can be added or improved?	Relevant Sub-Section
Are operations, safety, and planning staff working together to address regional challenges, such as incident management, work zone management, or emergency management?				4.1
Has a regional concept for transportation operations (RCTO) been developed?				4.1
Are operations and/or safety data being shared with MPOs, transit agencies, and other agencies responsible for regional planning?				4.2
Are State DOT planners, operations, and safety staff participating in the Congestion Management Process?				4.2
Are congestion and safety challenges in rural areas, tribal lands, and national parks being addressed through a cooperative approach involving State DOT operations and safety staff?				4.3
Is coordination with tribal governments, federal lands, transit agencies, and other agencies on planning and investment studies incorporating operations and safety considerations?				4.3

## Section 5

# Corridor and Sub-Area Level Opportunities

Corridor and sub-area, or sub-regional, planning represents a highly flexible aspect of long range planning. Best practices that have developed within this planning level tend to be highly inclusive and consider a wide range of potential solutions. Another basis for this flexibility is the ability to apply the term to many different types of studies: urban or rural and/or large geographic areas or relatively small congestion “hot spots.” Regardless of the specific study area under consideration, it is highly beneficial to consider all potential strategies for improving mobility, providing access, or relieving congestion.

Sub-regional planning also offers a wide range of opportunities to integrate operations, safety, and multimodal planning, largely due to the finer scale at which potential improvements can be considered and the greater potential for more short-term action.

Considering opportunities for improvement supports the inclusion of many partners and stakeholders. The creation of a multidisciplinary team is highly recommended for integrating operations and safety into planning, and is very appropriate at the sub-regional level. In addition, the opportunity for public-private partnerships is most obtainable at the corridor level where stakeholders can see a more direct impact and are willing to support a positive change.

### Overarching Themes

- Bringing together multidisciplinary teams
- Developing and using performance measures
- Utilizing operations and safety data in tracking performance measures

There are several challenges to integration of operations and safety into multimodal planning at the sub-regional level. Some examples are:

- Operations staff is stretched very thin on directly supporting their mission and have little time to devote to providing planning assistance.
- Planning staff are often unfamiliar with the analysis and tools used to support the use of operational strategies.
- Operations and safety data may not be compatible with planning analysis needs.
- The regional travel demand model may not be sufficient to support corridor operations and safety analysis.

### Section Content

Three opportunities or steps are described for integrating operations, safety, and multimodal planning at the corridor and sub-area level.

- Utilize Operations/Safety Data and Tools within Corridor Studies
- Develop Operations and Safety Strategies within Corridor Plans
- Develop Corridor System Management Plans

While these opportunities can be considered individually, they are best considered in combination. The development of Corridor System Management Plans (CSMPs) is a strategic application of data and tools, and identification of operations and safety strategies. Several of these strategies may be adjusted to both the regional and project levels given that corridor planning spans the gap between these two levels of planning. The following sections describe these opportunities as well as supporting information on implementation.

## 5.1

## Utilize Operations/Safety Data and Tools Within Corridor Studies

Description	<p>Operations and safety data are continuously collected for a variety of specific purposes. For example, traffic cameras are placed to continuously record in areas of ongoing high congestion for real-time traffic monitoring and incident response. These data – addressing issues such as the number and type of crashes, amount of incident-based delay, and variability in speeds – can be used within corridor and sub-area studies to identify the key sources of congestion, causes of safety problems, and to pinpoint problem areas. These data, and tools for analyzing data, can be used to help identify potential solutions, including operations and safety strategies that may not commonly be considered in the planning process.</p>
Benefits	<ul style="list-style-type: none"> <li>▪ Real-time data provides a better understanding of the baseline condition needed for long range planning.</li> <li>▪ Supports the ability to establish trend lines with respect to crash history, congestion, and other traffic flow attributes.</li> <li>▪ Provides a baseline for comparison of existing and future conditions, including support for systematic safety improvements.</li> <li>▪ Operations technology provides a more detailed analysis of traffic flow characteristics, including addressing reliability and issues such as incident-based, work-zone, and weather-related delays.</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>▪ Data collected by operations and safety staff is intended for specific uses within those functions. Using this data more broadly may require the data to be reformatted or otherwise adjusted to support planning needs and interests.</li> <li>▪ In addition to the need for data manipulation, it may be necessary for planners to receive training or otherwise rely on operations staff for analysis that uses this data.</li> </ul>
Who is Involved	<p>Data collection and management personnel within each of the functional areas will be needed to share a full understanding of data available as well as data needs. Staff who use the data should be included to validate the usefulness of the data identified for planning use.</p>
Recommended Implementation Steps	<ol style="list-style-type: none"> <li>1) Operations and safety provide a detailed list of available data, its attributes, and relevant timeframe.</li> <li>2) Operations and safety identify available tools and technology that are currently used to support analysis using this data.</li> <li>3) Planners consider how identified data and analysis techniques may be used to support planning level analysis/information needs.</li> <li>4) Conduct a multidisciplinary meeting to discuss data sharing and potential collection and analysis activities. Future data collection can be informed by this exchange of information.</li> <li>5) Consider cross-training or internal collaboration on data analysis to allow full use of collected data and analysis methods.</li> </ol>

## Relevant Examples

### Virginia DOT: Virginia Tech I-66 Congestion Tracking Application

VDOT's Real-Time Freeway Performance Monitoring System provides an example of the type of operations information that planners and senior managers can use to make better investment decisions. VDOT partnered with Virginia Tech to implement this system and deploy the congestion tracking application in Northern Virginia. Data and performance information are now available on I-66 and I-395.

The system provides transportation performance information such that the operators can make critical real-time decisions, including the reversal of HOV lanes. Data are provided on network links (generally 1 to 2 miles in length) and include speed, volume, occupancy, and flow for the current time as well for each hour for the previous 3 hours. In addition, travel time, delay, and vehicle-miles traveled can be viewed in real time, but can also be compared to yesterday or any day last week, last month, or last year. Data has been archived since the system was implemented.

This application provides an opportunity to support transportation planning efforts by strengthening the understanding of congestion on these facilities in the present as well as identify those operational strategies which may help to relieve congestion. The lessons learned may be applicable to similar areas outside of this specific corridor. While VDOT views this tool as critical to facilitating real-time systems management and operations, the types of data collected and processed have important planning implications as well. These data can be used to easily understand the before-and-after measurements of programmed improvements and can help make the case for additional operational enhancements.

More information is available at *Short Presentations from Transportation Agency Committee Members on Hot Topics or Research/Development Needs, Virginia DOT*, <http://www.trb-freewayops.org/reports.html>. Contact: Ling Li, VDOT Northern Virginia Regional Operations Center, [Ling.Li@VDOT.Virginia.gov](mailto:Ling.Li@VDOT.Virginia.gov).

### California DOT: Freeway Performance Measurement Project and Performance Management System (PeMS)

The Performance Measurement System (PeMS) is the result of a research project partnership involving the University of California, at Berkeley, California DOT (Caltrans), California Partners for Advanced Transit and Highways (PATH), and Berkeley Transportation Systems. The intent of this project is to create and refine a performance measurement system that receives and preserves real-time data from all automated traffic sensors located on the State Highway System. The PeMS then uses the real time data to calculate a variety of performance measures. More specifically, the PeMS is used to determine the exact location and extent of delay and to investigate potential causes of delay. The PeMS also offers the added benefit of assisting in determining the operating performance of Caltrans' roadway data collection and dissemination systems.

The data that are gathered and the resulting information provided are critical for conducting timely, detailed analyses on historical State Highway performance as well as for pinpointing bottlenecks to assist in determining the potential impact of strategies to alleviate bottlenecks either by operations strategies or investing in capital improvements. With PeMS, Caltrans managers can instantaneously obtain uniform and comprehensive assessments of State Highway System performance measures at each detector location. Measures include vehicle miles traveled, vehicle hours traveled and delay. The PeMS also provides vital information from other data sources including the California Highway Patrol (CHP) Incident Collection, which publishes incidents on its web page, which is updated every few minutes and the Traffic Accident Surveillance and Analysis System (TASAS), which is an accident database created and maintained by Caltrans.

The data are transferred through the Caltrans wide area network (WAN) to which all districts are connected. Traffic engineers are able to both determine operational inefficiencies and base operational decisions by using knowledge of current conditions. The system also helps to evaluate optimal placement for traffic control equipment, such as ramp-metering devices, variable message signs, and/or active traffic management devices. In short, PeMS serves to provide the data and information that is critical for assessing the need for and guiding the deployment of ITS.

The PeMS obtains 30-second loop detector data in real-time from each Caltrans District Transportation Management Center (TMC) that has automated detector data. The 30-second data received by PeMS consist of traffic count (number of vehicles crossing a loop), and occupancy (the average fraction of time a vehicle is

present over a loop). The software processes the data in real-time, performs diagnostics on the data to determine if a loop detector is faulty; calculates speed for each lane; imputes for any missing data; and computes performances measures.

In an effort to assist engineers and planners alike in taking advantage of the PeMS capabilities, Caltrans frequently offers PeMS training where individuals from the Planning and Operations Divisions are encouraged to come together to better understand each other's data and informational needs and the technologies and techniques used to acquire them. A separate PeMS training has also been used to support Corridor System Management Plans development (*see section 5.3*). The system is particularly beneficial for Web users, the primary target audience for the PeMS data, because it allows personnel from various job types to access the data and use it for a variety of purposes.

More information is available at: <http://pems.dot.ca.gov/>. Contact: Dr. Nick Compin, PeMS Operations Branch, Caltrans Division of Traffic Operations, [Nicholas\\_Compin@dot.ca.gov](mailto:Nicholas_Compin@dot.ca.gov), (916) 651-1247.

### Toolkit: Sample Data for Monitoring System Performance<sup>29</sup>

Data System	Associated Data
Traffic monitoring and detection systems	<ul style="list-style-type: none"> <li>▪ vehicle volume</li> <li>▪ speed</li> <li>▪ travel time</li> <li>▪ classification</li> <li>▪ weight</li> <li>▪ position trajectories</li> </ul>
Traveler information systems	<ul style="list-style-type: none"> <li>▪ current traffic conditions (e.g., travel time, speed, level of congestion)</li> <li>▪ traffic incidents</li> <li>▪ work zone and/or lane closures</li> </ul>
Traffic control systems	<ul style="list-style-type: none"> <li>▪ time and location of traffic control actions (e.g., ramp metering, traffic signal control, lane control signals, message board content)</li> </ul>
Incident and emergency management systems	<ul style="list-style-type: none"> <li>▪ location</li> <li>▪ cause</li> <li>▪ extent</li> <li>▪ time history of roadway incident/emergency detection and clearance</li> </ul>
Advanced public transit systems	<ul style="list-style-type: none"> <li>▪ transit vehicle passenger boardings by time and location (using automatic vehicle location (AVL) or global positioning system (GPS))</li> <li>▪ route travel time (time spent in-transit versus dwell time)</li> <li>▪ passenger origins and destinations</li> <li>▪ percentage of seats occupied (capacity utilization)</li> <li>▪ schedule adherence</li> <li>▪ automatic passenger counts (APCs) to measure the number of people that board at each stop</li> <li>▪ percentage of residences within a specified distance from a transit stop</li> </ul>

#### Relevant Resources

Federal Transit Administration, *Transit Performance Monitoring System*, [http://www.fta.dot.gov/publications/reports/other\\_reports/publications\\_5677.html](http://www.fta.dot.gov/publications/reports/other_reports/publications_5677.html).

Federal Highway Administration, *Corridor Traffic Management*, [http://ops.fhwa.dot.gov/program\\_areas/corridor\\_traffic\\_mgmt.htm](http://ops.fhwa.dot.gov/program_areas/corridor_traffic_mgmt.htm).

Research and Innovative Technology Administration, *Integrated Corridor Management Systems*, <http://www.its.dot.gov/icms/index.htm>.

<sup>29</sup> U.S. Department of Transportation. "Data Collection and Sharing." Available at: [http://www.plan4operations.dot.gov/data\\_coll.htm](http://www.plan4operations.dot.gov/data_coll.htm). Accessed July 7, 2009.

## 5.2

## Develop Operations and Safety Strategies Within Corridor Plans

Description	At the corridor study level, there is the potential to effectively integrate operations and safety strategies and to address a full range of solutions to congestion, access, or mobility issues. This opportunity can be supported through the use of multidisciplinary teams from the outset of sub-regional planning, and use of performance measures, data analysis, and tools (see <i>section 5.1</i> ). To ensure integration, it is useful to make corridor studies broadly visible within the DOT and identify a full list of both internal and external participants.
Benefits	<ul style="list-style-type: none"> <li>▪ Offers potential for a wider range of solutions to be considered.</li> <li>▪ Helps to address the most pressing needs through improvements that can be quickly implemented.</li> <li>▪ May reduce the need for additional capacity both in the short and long term.</li> </ul>
Challenges	Operations and safety staff have heavy workloads and specific missions which are outside of the planning effort. Including these individuals in planning efforts may put an additional workload burden on staff. Participation may be hampered by other responsibilities.
Who is Involved	Mid-level management or supervisory staff is the most useful interface for this opportunity in each of the functional areas as well as local staff and stakeholders.
Recommended Implementation Steps	<ol style="list-style-type: none"> <li>1) Develop a list of internal functional representatives / units to be notified when a sub-regional study is initiated.</li> <li>2) Convene a working group of both internal and external participants to guide the study.</li> <li>3) Hold a scoping meeting and encourage all study participants to identify data, plans, analysis available within the study area.</li> <li>4) As the group considers the existing information, identify all potential solutions to address needs.</li> </ol>

## Relevant Example

## North Carolina DOT: U.S. Route 64 Corridor Study

NCDOT's study on the US 64 corridor is part of its Strategic Highway Corridors initiative to improve mobility and connectivity, foster economic development, and promote environmental stewardship. The purpose of the study is to develop a master plan to preserve and enhance mobility and safety along US 64, while balancing community access and interests. This plan will be used to guide development and improvements along the corridor in this rapidly growing area. NCDOT is partnering with the MPO, local towns, and counties along the corridor in order to reach consensus on the study recommendations.

The master plan includes two distinct components to improve mobility, safety and pedestrian accessibility at major intersections: a short-term plan, which focuses on operational strategies and includes modifications to medians, constructing turn lanes, and improving traffic signals coordination through the use of such designs as the superstreet intersection concept; and a 30-year long-term plan, which is focuses on strategies needed to serve the anticipated amount of traffic in the year 2035 and later, primarily by converting many of the major intersections to interchanges or overpasses. The intent is to implement the short-term solutions first to take advantage of the congestion relief, safety, and access management benefits that they offer. When these solutions can no long serve the amount of traffic, the proposed long-term solutions will be considered for implementation. This approach puts system operation ahead of capacity additions, and can be implemented with considerably less funding. In the event these operational strategies are no longer adequate in the future, infrastructure needs can be programmed for the period when the need is present. In addition to allowing

existing funding to be applied to the more direct needs, this approach supports the realistic scheduling of transportation improvements in the STIP.

More information is available at: [www.ncdot.org/~us64study](http://www.ncdot.org/~us64study). Contact: Dan Thomas, North Carolina DOT Transportation Planning Branch, [danthomas@ncdot.gov](mailto:danthomas@ncdot.gov), (919) 715-5482 ext. 389.

### Toolkit: Sample Strategies to Consider in Corridor and Project-Level Planning

Strategy	Description	Considerations		
		Operations	Safety	Applicability
Access management	Controls and manages the level of access permitted to adjacent land use based on the intended function of the highway that supports this use. This strategy can be considered in the design of a new facility or can be implemented through strategic changes to an existing roadway and adjacent development.	Can improve traffic flow on major roadway by reducing turning movements, but can create traffic issues at the more limited number of access points	Can improve safety by limiting the number of conflict points	Arterials
Traffic signal coordination	Coordinating traffic signals so that stops are minimized and vehicles can move efficiently through the system.	Improves mobility and trip duration.	Could improve safety by reducing rear-end accidents at intersections; should consider implications on pedestrian/bicycle crossings	Arterials Transit
HOV/HOT lanes	HOV is an acronym for High Occupancy Vehicle. Lanes designated to be HOV are only open to vehicles carrying a specified number of persons (generally 2 or 3). HOT is an acronym for High Occupancy Toll. HOT lanes are HOV lanes that allow vehicles carrying less than the specified number of persons to travel in the lane by paying a toll.	Promotes carpool and transit usage by offering reduced travel time. Works to maximize lane capacity.	Improves safety by reducing congestion and the potential for crashes.	Freeways
Ramp metering	Using traffic signals at freeway on-ramps to control the rate at which vehicles enter the freeway. Proven success in the areas of congestion reduction, reduced travel time, and increased safety.	Works to optimize freeway flow and to minimize congestion. Adjustable system that can respond to local or system-wide conditions.	Increases safety by regulating the flow of vehicles onto freeways. Able to adapt to incident management conditions and regulate traffic flow.	Freeways
Pedestrian signals	Illuminated “WALK” and “DON’T WALK” symbols to indicate when pedestrians can cross intersections. To assist persons with disabilities, audible pedestrian signals emit specific sounds denoting north-south or east-west crossings.	Encourages and facilitates pedestrian use of the system.	Reduces pedestrian injuries and fatalities by clearly notifying drivers and pedestrians alike when an intersection is safe to cross.	Arterials



## Toolkit: Sample Strategies to Consider in Corridor and Project-Level Planning

Strategy	Description	Considerations		Applicability
		Operations	Safety	
Variable message signs	An electronic traffic sign that alerts travelers about special events and traffic conditions.	Improves mobility by giving travelers advanced warning about system conditions related to delay.	Notify travelers of necessary reductions in speed due to congestion, construction, and location of incidents. Adaptable to changes in the system.	Freeways  Arterials
Bus priority strategies	Can shorten travel time on buses by applying a bus priority network control either through extending a green light or providing an early green light for buses. Can accommodate changes in traffic conditions.	Can reduce trip duration and improve congestion by ensuring that buses move efficiently throughout the system.	Increases safety by regulating the flow of buses along arterials. Can adapt to incident management conditions.	Transit

### Relevant Resources

Federal Highway Administration, Corporate Research and Technology, *Integrated Corridor Management Systems Program Plan*, <http://www.fhwa.dot.gov/crt/roadmaps/icmprgmplan.cfm>.

NCHRP, Project 05-58: *Development of a Multimodal Statewide Corridor Planning Guidebook*, <http://144.171.11.40/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=934>.

NCHRP, Report 435: *Guidebook for Transportation Corridor Studies: A Process for Effective Decision-Making*, <http://pubsindex.trb.org/view.aspx?id=639918>.

## 5.3

## Develop Corridor System Management Plans

Description	<p>A Corridor System Management Plan (CSMP) is a comprehensive, integrated management plan for increasing transportation options, decreasing congestion, and improving transportation system performance in a transportation corridor. A CSMP can address the entire network of travel options and technologies in a defined corridor – freeways, managed lanes, parallel arterials and connecting roadways, and public transit, along with technologies and operations programs such as ramp metering, coordinated traffic signals, variable message signs, and incident management. CSMPs are typically multijurisdictional, and provide for the integrated management of travel modes and roadways. A CSMP involves an analysis of existing and future traffic conditions, and considers how to best meet identified needs through current and near-term management strategies, operational improvements, and additions to capacity. The CSMP will build on the coordination with the MPO and other partners in this process.</p>
Benefits	<ul style="list-style-type: none"> <li>▪ Takes a more comprehensive view of near-term and long-term strategies involving operations strategies, safety programs, and capital enhancements.</li> <li>▪ Addresses a network of systems (road infrastructure, technology, transit services) rather than just individual components or jurisdictions.</li> <li>▪ Assists in the decision making process to identify which improvements should be funded and in what priority order.</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>▪ Requires support / consensus from potentially large number of stakeholders.</li> <li>▪ System performance data may be complex and take time and funding to utilize effectively.</li> </ul>
Who is Involved	<ul style="list-style-type: none"> <li>▪ Operations and safety staff, who will provide performance data, inventory existing management strategies, and participate in development of plan.</li> <li>▪ Planning staff at the State DOT, MPOs, RPOs and other stakeholders.</li> <li>▪ Transit providers, who operate services and bring planning perspectives.</li> <li>▪ Freight companies, major employers, bicycle and pedestrian interests, and other stakeholders who use the corridor.</li> </ul>
Recommended Implementation Steps	<ol style="list-style-type: none"> <li>1) Identify which corridors will be considered for developing a plan, based on existing information on mobility challenges (potentially through a CMP).</li> <li>2) Identify appropriate partners/stakeholders to be included in the process and establish a multijurisdictional, multimodal, and multifunctional team.</li> <li>3) Analyze existing and future year traffic conditions for a clear understanding of present and future deficiencies.</li> <li>4) Identify potential solutions for the short term and long term for addressing mobility challenges. Along with the potential solutions, the team should consider the impacts these solutions have on multiple planning goals (e.g., environmental, community development) and the resources (both financial and staffing) that will be needed to implement the solutions.</li> <li>5) Engage the public. Public comments, impacts, and necessary resources should all be considered when the team compares alternative solutions.</li> <li>6) Compare alternative solutions in order to identify preferred set of solutions. When all criteria have been evaluated, the team should select which solutions will be implemented, their order of prioritization, and how solutions will be monitored.</li> <li>7) Implement solutions following established prioritization.</li> <li>8) Monitor on-going system performance, and set in place on-going mechanisms to adapt the plan over time.</li> </ol>

## Relevant Example

### California DOT: Multimodal Integrated Corridor Management Through Corridor System Management Plans

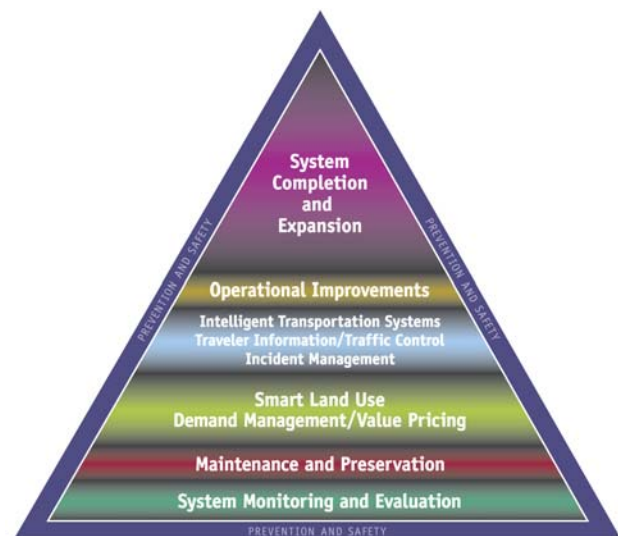
Multimodal Integrated Corridor Management represents a new California DOT (Caltrans) policy implemented through Corridor System Management Plans (CSMPs) in each District.<sup>30</sup> The idea of integrated management is based on the linkage of system planning and systems operation management. Caltrans uses system planning in its long-range transportation planning process to determine the current State and the future needs of its statewide transportation system. The system planning process takes into account the entire transportation system on and off the State Highway System (SHS), including highways and arterials, inter- and intra-city transit services, railroads, airports, seaports, as well as bicycling, walking, goods movement, ITS, and local land use. The information provided by this evaluation process is used to make recommendations regarding necessary improvements that are needed to maintain mobility.

Systems operation management uses existing methods and technologies that have been proven to maximize the efficiency and effectiveness of the existing statewide transportation infrastructure. The methods and technologies that are used are generally low-capital in comparison with added infrastructure—ramp metering, traffic information collection and distribution, incident management, high occupancy vehicle lanes, increased use of local arterial roadways that parallel service within an existing corridor, and demand management strategies including transit and rideshare marketing, flexible work hour schedules, and telecommuting. In addition to more efficiently and effectively using existing resources and planning activities, CSMPs assist in the decision making process to identify which improvements should be funded and in what priority order.

Development of each CSMP involves a system management approach, which can be visualized through Caltrans' Mobility Pyramid, depicting the major types of actions necessary to manage the SHS in a systematic way (above). Improvements, including system expansion, are recommended by evaluating each part of the corridor, from infrastructure conditions to operations needs.

Supporting this strategy are several key technology components, including large scale traffic management centers. As a part of development of the CSMP detection projects are implemented early. Twenty-six corridors are currently in the planning process with seven detection projects underway.<sup>31</sup> Within systems planning, Caltrans uses several types of tools along with sketch-planning and travel demand modeling which are typically used in operations such as HCM-based capacity analysis, signal optimization, and simulation. The range of tools used by Caltrans helps to ensure that the selected transportation solutions have a sound objective basis. Caltrans has also been working with the University of California at Berkeley and other related institutions to develop a real time performance measurement system (PeMS), which uses data obtained from detectors along the state's freeways to provide historical and real-time information on freeway performance (*see section 5.1*). The information that is gathered is useful for conducting rapid, detailed response analyses on historical freeway performance. This system provides the foundation for the CSMP development.

More information is available at <http://www.dot.ca.gov/dist3/departments/planning/corridorplanning.html>. Contact: John Wolf, Assistant Division Chief, Traffic Operations, [John.Wolf@dot.ca.gov](mailto:John.Wolf@dot.ca.gov).



Source: California DOT. *District 4: Corridor System Management Plans*. <http://www.dot.ca.gov/dist4/transplanning/csmpl.htm>. Accessed April 26, 2010.

<sup>30</sup> California Department of Transportation. *Corridor System Management Planning Website*. <http://www.dot.ca.gov/dist3/departments/planning/corridorplanning.html>. Accessed 1/31/09.

<sup>31</sup> Wolf, John. *California Corridor Congestion Management Practices*. <http://www.dot.ca.gov/newtech/modal/micm/micm-jwolf.ppt#281,33,CSMP>Status>. Accessed 2/1/09.

## 5.4 Self-Assessment Checklist: Corridor and Sub-Area Opportunities

The following checklist may be used as a self-assessment to identify corridor and sub-area opportunities for integrating operations and safety into multimodal planning. The user should consider the questions, whether or not the State DOT is undertaking the activity, and what can be done to improve integration.

Checklist: Corridor and Sub-Area Level Opportunities				
Question	Yes	No	If no, what can be added or improved?	Relevant Subsection
Are operations and/or safety data being used in assessing corridor system performance?				5.1
Are reliability and other operations considerations (e.g., incident management, traveler information) as well as safety being considered within corridor studies?				5.2
Is analysis being conducted to assess the benefits of operations and safety strategies?				5.2
Are analysis tools being applied, such as simulation, to assess reliability and other operations considerations?				5.2
Are operations and safety strategies and multimodal options being included in corridor plans?				5.2
Do corridor system management and operations activities link back to planning efforts?				5.3

## Section 6

# Project Level Opportunities

### Introduction

The project development process provides opportunities to bring together operations, safety, and planning considerations. At this level, representatives of these functions commonly interact in order to consider detailed information and take more immediate action. Often this interaction is through a handoff in responsibility as each functional area applies the level of expertise necessary to develop a transportation improvement project. True integration would greatly enhance the steps throughout the project development phase. This begins with the concept of a multidisciplinary team, which is a cornerstone of integration of operations, safety, and planning. Project planning differs greatly from long range planning; however, the long range planning considerations of system-level effects and community considerations are essential to a successful project.

At the project level, based on support for the project purpose and need, operations and safety staff often have a more established role than planning staff. The present condition of the facility identified for improvement requires an understanding of the level of service as well as the crash history. Operational improvements, such as ITS infrastructure, that are under consideration, can be identified and included in project planning. The consideration of project alternatives involves the consideration of both the short and long term benefits of the improvement.

There has been a focus for many years on linking the planning and project development phases, and a great deal of guidance has been developed to support this interest. Many of the concepts for integrating planning into the National Environmental Policy Act (NEPA) process also apply to integrating operations and safety into planning. Multimodal considerations are specifically addressed at the project level.

Potential benefits to integrating operations, safety, and planning at the project level include:

- Increased options for sharing identified funding—ultimately results in more cost-effective project.
- Reduced need for additional/multiple projects with a solely operations or safety focus—more efficient, effective use of resources (funding, construction time and resulting delay, project development staff time).
- Increased efficiency of the overall transportation system during project construction.
- Reduced inconvenience to the system’s users by minimizing disruption and improving traffic flow.
- Reduced potentially negative effects on businesses’ operations and sales through improved access.
- Depending on the traffic management strategies selected, increase in work zone safety.

#### Overarching Themes

- Bringing together multidisciplinary teams
- Incorporating multimodal considerations into projects
- Integrating fiscal considerations into project development
- Incorporating operations- and safety-based strategies into projects

### Section Content

Integration of operations and safety into each of the previously identified levels of planning sets the stage for successful integration at the project level. This section outlines project level opportunities in two particular areas:

- Incorporate Operations and Safety into Project Planning
- Incorporate Operations- and Safety-Related Traffic Management/Transportation Demand Management Strategies During Project Construction

## 6.1

## Incorporate Operations and Safety Into Project Planning

Description	<p>In the project development process, there are several opportunities for linking planning, operations, and safety beginning with the scoping stage where operations and safety considerations can be incorporated. Operations considerations could include consideration of pricing, ramp metering, traveler information systems, and other ITS components. Safety considerations could include installing signs and pavement markings and maintaining visibility along roadways. Moreover, these considerations should include transit services and other multimodal aspects, such as bicycle, pedestrian, and transit access, safety, and efficiency of operations. Including these components from the very beginning of the project design and development process ensures that operations and safety considerations will have an identified, important role. Collaboration allows each functional area to benefit from projects and improvements being considered within other areas that already have identified funding.</p>
Benefits	<ul style="list-style-type: none"> <li>▪ Increases options for combining identified funding—ultimately results in more cost-effective and comprehensive projects, addressing mobility and other community needs.</li> <li>▪ Reduces the need for additional/multiple projects with a solely operations, safety, or transit focus—more efficient, effective use of resources (funding, construction time and resulting delay, project development staff time).</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>▪ Flexing funds from different functional areas for planning purposes may not be possible and pose a barrier to collaboration.</li> <li>▪ Gaining consensus from all stakeholders that project considerations encompass identified needs, are necessary, and will improve the system.</li> </ul>
Who is Involved	<ul style="list-style-type: none"> <li>▪ Project development and environmental staff.</li> <li>▪ Operations and safety staff can offer insight on including nontraditional planning considerations that can make projects more effective and potentially reduce the need for additional projects in the future.</li> <li>▪ Planning staff, to link planning goals and considerations into project development.</li> <li>▪ Transit, bicycle, and pedestrian specialists to consider these aspects.</li> </ul>
Recommended Implementation Steps	<ol style="list-style-type: none"> <li>1) Identify a project need using the SLRTP. At the State level, projects are often selected that will help maintain the overall transportation system, improve mobility, or increase safety.</li> <li>2) Prepare initial and final scoping document. As part of this preparation process, develop a multifunctional team to provide input on scoping components. The team should be composed of planners, operations staff, and safety staff to ensure that multifunctional considerations are incorporated initially in the process.</li> <li>3) Secure funding. The multifunctional team members should offer insight on operations of safety projects with secured funding. This will result in cost-effective solutions.</li> <li>4) Prepare environmental documentation.</li> <li>5) Gain public input on project characteristics.</li> <li>6) Gain consensus from all stakeholders (planners, operations staff, safety staff, and public) on project characteristics.</li> <li>7) Begin project construction. This stage lends itself to operations and safety strategies.</li> </ol>

## Relevant Examples

### Virginia DOT and the Northern Regions Operation Staff: ITS Tools and Plans in Support of Project Development

VDOT NRO staff has made some significant progress in integrating operations components into the planning process for “nonoperations” or conventional transportation projects. This is primarily due to the outreach efforts of operations planning staff to proactively engage transportation planners, construction design staff, and other regional stakeholders with VDOT NRO’s plans and tools. VDOT NRO is a meld of planning and operations regions that includes the Virginia portion of the Metropolitan Washington MPO and the Fredericksburg MPO. The operations staff has significant ITS and signal-timing optimization experience and knowledge that can greatly enhance the efficiency and effectiveness of nonoperations alternatives and projects.

One tool developed by operations planning staff is the ITS Decision Support Tool ([www.vdot-itsdst.com](http://www.vdot-itsdst.com)). The tool helps transportation professionals identify potential ITS solutions for conventional transportation problems. Within this tool, ITS alternatives are centralized and organized to facilitate the identification of ITS solutions in response to transportation needs. This tool considers hundreds of various solutions and then uses cost-benefit information to help inform decision-making. When used within the planning process, the ITS Decision Support Tool helps bridge the gap between ITS awareness and the decision-making knowledge required by project-level staff. Additionally, it guides transportation professionals and practitioners in the consideration of ITS solutions when developing design alternatives.

In addition to the ITS Decision Support Tool, VDOT NRO staff also developed ITS Device Master Plans for Dynamic Message Signs (DMS), Closed Circuit Television (CCTV) Cameras, and Detection. These master plans can be overlaid with construction plans to identify opportunities to include ITS deployments in construction projects. VDOT NRO staff is also looking to complete master plans for other devices such as ramp metering, RWIS, and other active traffic management (ATM) strategies. All plans are consolidated in GIS. With these tools and through cooperation between operations planning staff and transportation planners and traffic engineers, VDOT’s NRO division is able to consider potential low-cost and effective ITS strategies that improve safety and increase the capacity of the existing transportation network.

At this time, most of VDOT NRO’s success has been limited to engaging stakeholders at the project development level. Project funding supports full consideration of opportunities to include the addition of ITS enhancements in defined projects as well as the ability to take advantage of planned construction activities to install or upgrade ITS devices. The travel demand model, as the primary tool for long-range planning, does not interface well with the more micro-level analysis that supports operations planning. This deficiency can be most easily overcome at the corridor level, and the operations planning staff has sought opportunities to become involved at that level. The NRO operations staff has taken advantage of opportunities to participate in planning activities, as well as raise awareness throughout the region of the value that their tools and the ITS Master Plans can bring to the planning and implementation of conventional transportation projects.

More information is available at <http://www.vdot-itsarch.com>. Contact: J.D. Schneeberger, Northern Region Operations Planner, [John.Schneeberger@VDOT.Virginia.gov](mailto:John.Schneeberger@VDOT.Virginia.gov) or Amy Tang McElwain, Northern Region Operations, [Amytang.Mcelwain@VDOT.Virginia.gov](mailto:Amytang.Mcelwain@VDOT.Virginia.gov) or James Witherspoon, Northern Region Operations, Planning and Programming, [James.Witherspoon@VDOT.Virginia.gov](mailto:James.Witherspoon@VDOT.Virginia.gov).

### Utah DOT: Operational Safety Report Process

The Operational Safety Report (OSR) was traditionally solely used to provide information on the safety-related aspects of a proposed project, but these safety considerations did not play a role in the development of the scope of projects. After listening to feedback received from those using the report, Utah DOT (UDOT) decided the OSR information could play an important role much earlier in the project development process—during the concept development and scoping phase.

The process has been refined so that now, once the Traffic and Safety Operations Engineer has completed the OSR, a copy will be sent to the Project Manager overseeing the project for the particular region. The Project Manager reviews the OSR recommendations for inclusion into the project. If the recommendations are not included in the project, the decision is documented through the UDOT design exception process.

The ultimate goal of aligning these processes is to provide the Project Manager with the valuable safety information contained in the OSR while the final concept and scope for a project is being developed. It is hoped that this will lead to safer projects and minimize project re-evaluation or design exceptions.

More information is available at: <http://www.udot.utah.gov/main/f?p=100:pg:0:::1:T,V:2938>. Contact: Robert Hull, Traffic and Safety Engineer, [rhull@utah.gov](mailto:rhull@utah.gov), (801) 965-4273.



## 6.2

## Incorporate Operations- and Safety-Related Traffic Management / Transportation Demand Management Strategies During Project Construction

Description	<p>Construction on roadways with existing high traffic demand presents a challenge in the short term in terms of maintaining safe and efficient travel conditions during the construction period. Work zone safety is often a major concern, as well as maintaining mobility and access during the construction period. Coordination among project development, operations, safety, and planning staff on project scheduling and funding for construction mitigation can help to minimize adverse impacts to the transportation system.</p> <p>There are many traffic management/transportation demand management strategies that can be implemented to help minimize the negative effects of construction on system users and simultaneously address operations and safety concerns. These include variable message signs, dynamic lane closure system, coordinating with adjacent construction sites, incident/emergency response plans, and ridesharing/carpooling incentives, and marketing and implementation of transit services. If fully integrated, some of these short-term strategies, such as transit services and demand management programs, could also be considered for inclusion in longer-term corridor management.</p>
Benefits	<ul style="list-style-type: none"> <li>▪ Increase the efficiency of the overall transportation system during project construction, while reducing inconvenience to system users and improving safety.</li> <li>▪ Reduce potentially negative effects on businesses' operations and sales through improved access.</li> </ul>
Challenges	<ul style="list-style-type: none"> <li>▪ Major, long-term projects (“mega projects”) may require substantial resources for effective traffic management.</li> <li>▪ It may be difficult to balance multiple objectives, such as reducing construction time and minimizing lane closures during peak periods. While night-time construction is often helpful, this needs to be considered in the context of issues such as construction noise on adjacent communities.</li> </ul>
Who Is Involved	<ul style="list-style-type: none"> <li>▪ Operations staff will play a key role in identifying opportunities for implementing strategies to improve system efficiency. They should be consulted on simple, cost-effective ways to improve mobility in work zones and on ways to minimize delay by maximizing lane capacity.</li> <li>▪ Safety staff can offer insight on ways to combine operations and safety strategies to maximize the safety benefits.</li> <li>▪ Planning staff will offer assistance on how best to incorporate safety and operations strategies into local and statewide plans.</li> </ul>
Recommended Implementation Steps	<ol style="list-style-type: none"> <li>1) Identify potential impacts on the system resulting from construction. Once a project scope has been identified and the project characteristics are known, estimate the likely impacts that will result by analyzing data on project characteristics. Based on these impacts, identify what scope of traffic management strategies should be considered.</li> <li>2) Develop goals and objectives to be achieved by the traffic management strategies.</li> <li>3) Develop a team of involved groups and interested parties to evaluate potential strategies to be implemented.</li> <li>4) Select traffic management strategies to be implemented.</li> </ol>

## Relevant Examples

### Colorado DOT: I-25 and I-225 Reconstruction / Construction Demand Management<sup>32</sup>

In an effort to confront congestion along I-25, the Colorado Department of Transportation (CDOT) and Regional Transportation District (RTD) initiated a multimodal design-build project called the Transportation Expansion Project, or T-REX. The T-REX Project was a \$1.67 billion venture that transformed the way people in the metro Denver area travel along the southeast corridor of Interstates 25 and 225. The T-REX project added 19 miles of light rail and improved 17 miles of highway through southeast Denver, Aurora, Greenwood Village, Centennial and Lone Tree with capacity and safety improvements. T-REX construction began in fall 2001 and finished on-time and within budget in 2006.

The contractor hired to complete the T-REX Project, Southeast Corridor Constructors, made it a primary goal to reduce inconvenience to the public. As a result, \$3 million of the budget was set aside for Transportation Demand Management activities during construction. Due to the fluid nature of a design-build project and the foresight of those involved, a number of project features were deployed to manage travel demand during construction. In November 2002, T-REX opened a temporary bus/HOV lane on I-25 to promote the benefit of higher occupancy modes. In May 2003, T-REX launched a real-time instant email alert system utilizing project ITS components as they became operational. Transportation Solutions partnered with other organizations in the area to provide outreach and incentives to encourage motorists to use alternative modes of transportation.<sup>33</sup> TransOptions built on the success of the TMAs and TMOs and established demand-side programs implemented by local jurisdictions including the Denver Regional Council of Government's RideArrangers.

More information is available at [http://www.ops.fhwa.dot.gov/publications/mitig\\_traf\\_cong/denver\\_case.htm](http://www.ops.fhwa.dot.gov/publications/mitig_traf_cong/denver_case.htm). Contact: Reza Akhavan, Region 6 Transportation Director, [Reza.Akhavan@dot.state.co.us](mailto:Reza.Akhavan@dot.state.co.us), (303) 757-9459.

### Iowa DOT: Demand Management Strategy for I-235 Reconstruction<sup>34</sup>

A comprehensive transportation demand management (TDM) strategy was part of the reconstruction of I-235 in Des Moines. Based on local public input and traffic count data showing that congestion was only an issue during the morning and afternoon peak periods, the decision was made to do a limited build rather than a more expensive full build project, and to establish a goal to reduce travel demand by 10% during peak hours by the year 2020 in order to maintain roadway performance. As part of the reconstruction, the Iowa DOT helped implement the Transportation Management Center and a Transportation Management Association (TMA) in 2002 to reduce traffic during the reconstruction project and to implement the long-range TDM plan. The TMA was tasked with promoting strategies such as flexible work hours, carpools, vanpools, and mass transit. Changes were also made to transit services, including adding routes, increasing park-and-ride services, and publicizing the rideshare program and other incentive programs. The TMA is now funded by the Des Moines Area Regional Transit Authority, city of Des Moines, Downtown Community Alliance, and Des Moines Area MPO.

More information is available at <http://www.iowadot.gov/i-235/>. Contact: Lorne Wazny, District 1 Transportation Planner, [Lorne.Wazny@dot.iowa.gov](mailto:Lorne.Wazny@dot.iowa.gov), (515) 239-1996.

### Utah DOT: Using Technology and Demand Management Approaches During Reconstruction of I-15<sup>35</sup>

UDOT reconstructed 17 miles of I-15 in July 2001 using a design-build approach in order to rebuild the entire corridor before the 2002 Olympic Games. The project was completed in four and a half years at a cost of about \$1.52 billion, with an initial ATMS investment of \$70 million. An integral component of reconstruction involved enhancing the capacity of I-15 by adding two general purpose lanes, two HOV lanes and auxiliary lanes between interchanges. The project also involved improving access to downtown Salt Lake City, providing

<sup>32</sup> Transportation Solutions. *T-REX Project and Southeast Light Rail*. <http://www.transolutions.org/?q=trex>. Accessed 1/28/09.

<sup>33</sup> USDOT, Federal Highway Administration, Office of Operations. *I-25 & I-225 Reconstruction – Denver, CO*. [http://www.ops.fhwa.dot.gov/publications/mitig\\_traf\\_cong/denver\\_case.htm](http://www.ops.fhwa.dot.gov/publications/mitig_traf_cong/denver_case.htm). Accessed 1/16/09.

<sup>34</sup> American Association of State Highway and Transportation Officials. *Combating Congestion through Leadership, Innovation, and Resources: A Summary Report on the 2007 National Congestion Summits*. September, 2007. p. 30.

<sup>35</sup> US DOT, Federal Highway Administration Office of Operations. *I-15 Reconstruction—Salt Lake City, UT*. [http://www.ops.fhwa.dot.gov/publications/mitig\\_traf\\_cong/slc\\_case.htm](http://www.ops.fhwa.dot.gov/publications/mitig_traf_cong/slc_case.htm). Accessed 1/16/09.

railroad grade-separations, replacing deficient bridges and utilizing single-point interchange design. The project mitigated conflicting merging traffic movements and significant traffic congestion.

UDOT used a combination of demand-side strategies to maintain traffic during reconstruction, one of which was the ITS system, CommuterLink. CommuterLink consists of a Traffic Operations Center, control software, and field equipment (VMS signs, cameras, and signal controllers). The comprehensive system includes a 511 Traveler Information Line, coordinated signals, ramp meters, and speed, volume, weather and pavement sensors. UDOT installed the bulk of the \$70 million worth of ATMS equipment using a design-build procurement method. CommuterLink was funded mostly by State funds (\$52 million) with local (\$1 million) and federal (\$17 million) contributions.

ATMS technology enabled jurisdictions to monitor construction impacts, respond to traffic accidents faster, and communicate with the motoring public. The UDOT TOC is directly linked to both the Salt Lake City and Salt Lake County Traffic Control Centers and the Utah Transit Authority (UTA) Radio Center to provide seamless communication between jurisdictions. UDOT also undertook a marketing campaign recognizing that one of the best ways to minimize traffic conflicts and delays on the interState during reconstruction was to reduce the number of vehicles on the road. Employers and employees were encouraged to participate in ridesharing opportunities provided by UTA and commuter transit services, the Telecommuting Directive, and the Corridor Business Program. Informational services included the use of the internet, highway advisory radio, media outlets, signing, seminars and open houses.

The ATMS was put to the test for the 2002 Winter Olympic Games. After the conclusion of the games, program components were assessed. It was determined that by adjusting daily working hours, increased transit use, carpools, and utilizing alternate routes, the needs of residents, athletes, and spectators were successfully met. Beyond the games, CommuterLink has proven to be a very effective tool. During its first years of operation, it was attributed with the following successes:

- Increased peak hour freeway speeds by 20%;
- Decreased freeway delay by 36%;
- Decreased traffic signal stops by 15%; and
- Decreased Intersection delay by 27%.

Overall, CommuterLink is estimated to save Utah more than \$100 million annually.

More information is available at [http://www.ops.fhwa.dot.gov/publications/mitig\\_traf\\_cong/slc\\_case.htm](http://www.ops.fhwa.dot.gov/publications/mitig_traf_cong/slc_case.htm). Contact: Christina Davis, Utah DOT I-15 Core Project Communications Manager, [ChristinaDavis@utah.gov](mailto:ChristinaDavis@utah.gov), (801) 341-6426.

## Toolkit: Work Zone Management Strategies by Category

### I. Temporary Traffic Control

A. Control Strategies	B. Traffic Control Devices[2]	C. Project Coordination, Contracting, and Innovative Construction Strategies
IA1. Construction phasing/staging	IB1. Temporary signs	IC1. Project coordination
IA2. Full roadway closures	▪ Warning	▪ Coordination with other projects
IA3. Lane shifts or closures	▪ Regulatory	▪ Utilities coordination
▪ Reduced lane widths to maintain number of lanes (constriction)	▪ Guide/ information	▪ Right-of-way coordination
▪ Lane closures to provide worker safety	IB2. Changeable message signs (CMS)	▪ Coordination with other transportation infrastructure
▪ Reduced shoulder width to maintain number of lanes	IB3. Arrow panels	IC2. Contracting strategies
▪ Shoulder closures to provide worker safety	IB4. Channelizing devices	▪ Design-build
▪ Lane shift to shoulder/median to maintain number of lanes	IB5. Temporary pavement markings	▪ A+B bidding
IA4. One-lane, two-way operation	IB6. Flaggers and uniformed traffic control officers	▪ Incentive/disincentive clauses
IA5. Two-way traffic on one side of divided facility (crossover)	IB7. Temporary traffic signals	▪ Lane rental
IA6. Reversible lanes	IB8. Lighting devices	IC3. Innovative construction techniques (precast members, rapid cure materials)
IA7. Ramp closures/relocation		

- IA8. Freeway-to-freeway interchange closures
- IA9. Night work
- IA10. Weekend work
- IA11. Work hour restrictions for peak travel
- IA12. Pedestrian/bicycle access improvements
- IA13. Business access improvements
- IA14. Off-site detours/use of alternate routes

**II. Public Information**

**A. Public Awareness Strategies**

- IIA1. Brochures and mailers
- IIA2. Press releases/media alerts
- IIA3. Paid advertisements
- IIA4. Public information center
- IIA5. Telephone hotline
- IIA6. Planned lane closure web site
- IIA7. Project web site
- IIA8. Public meetings/hearings
- IIA9. Community task forces
- IIA10. Coordination with media/schools/businesses/ emergency services
- IIA11. Work zone education and safety campaigns
- IIA12. Work zone safety highway signs
- IIA13. Rideshare promotions
- IIA14. Visual information (videos, slides, presentations) for meetings and web

**B. Motorist Information Strategies**

- IIIB1. Traffic radio
- IIIB2. Changeable message signs (CMS)
- IIIB3. Temporary motorist information signs
- IIIB4. Dynamic speed message sign
- IIIB5. Highway advisory radio (HAR)
- IIIB6. Extinguishable signs
- IIIB7. Highway information network (web-based)
- IIIB8. 511 traveler information systems (wireless, handhelds)
- IIIB9. Freight travel information
- IIIB10. Transportation management center (TMC)

**III. Transportation Operations**

**A. Demand Management Strategies**

- IIIA1. Transit service improvements
- IIIA2. Transit incentives
- IIIA3. Shuttle services
- IIIA4. Ridesharing/carpooling incentives
- IIIA5. Park-and-ride promotion
- IIIA6. High-occupancy vehicle (HOV) lanes
- IIIA7. Toll/congestion pricing
- IIIA8. Ramp metering
- IIIA9. Parking supply management
- IIIA10. Variable work hours
- IIIA11. Telecommuting

**B. Corridor/Network Management Strategies**

- IIIB1. Signal timing/coordination improvements
- IIIB2. Temporary traffic signals
- IIIB3. Street/intersection improvements
- IIIB4. Bus turnouts
- IIIB5. Turn restrictions
- IIIB6. Parking restrictions
- IIIB7. Truck/heavy vehicle restrictions
- IIIB8. Separate truck lanes
- IIIB9. Reversible lanes
- IIIB10. Dynamic lane closure system
- IIIB11. Ramp metering
- IIIB12. Temporary suspension of ramp metering
- IIIB13. Ramp closures
- IIIB14. Railroad crossings controls
- IIIB15. Coordination with adjacent construction site(s)

**C. Work Zone Safety Management Strategies**

- IIIC1. Speed limit reduction/variable speed limits
- IIIC2. Temporary traffic signals
- IIIC3. Temporary traffic barrier
- IIIC4. Movable traffic barrier systems
- IIIC5. Crash-cushions
- IIIC6. Temporary rumble strips
- IIIC7. Intrusion alarms
- IIIC8. Warning lights
- IIIC9. Automated Flagger Assistance Devices (AFADs)
- IIIC10. Project task force/committee
- IIIC11. Construction safety supervisors/inspectors
- IIIC12. Road safety audits
- IIIC13. TMP monitor/inspection team
- IIIC14. Team meetings
- IIIC15. Project on-site safety training
- IIIC16. Safety awards/incentives
- IIIC17. Windshield surveys

**D. Traffic/Incident Management and Enforcement Strategies**

- IIID1. ITS for traffic monitoring/management
- IIID2. Transportation management center (TMC)
- IIID3. Surveillance [Closed-Circuit Television (CCTV), loop detectors, lasers, probe vehicles]
- IIID4. Helicopter for aerial surveillance
- IIID5. Traffic screens
- IIID6. Call boxes
- IIID7. Mile-post markers
- IIID8. Tow/freeway service patrol
- IIID9. Total station units
- IIID10. Photogrammetry
- IIID11. Coordination with media
- IIID12. Local detour routes
- IIID13. Contract support for incident management
- IIID14. Incident/emergency management coordinator
- IIID15. Incident/emergency response plan
- IIID16. Dedicated (paid) police enforcement
- IIID17. Cooperative police enforcement
- IIID18. Automated enforcement
- IIID19. Increased penalties for work zone violations

## Sample Portions of Table B.1 TMP Strategy Matrix – Mobility/Safety Improvement and Considerations for Implementation

### I. Temporary Traffic Control (TTC) Strategies

Management Strategy	Mobility Improvement	Motorist Safety Improvement	Worker Safety Improvement	Triggers for Consideration	Potential Pros	Potential Challenges	Other Considerations
<b>A. Control Strategies</b>							
IA12. Pedestrian/bicycle access improvements	✓	✓		<ul style="list-style-type: none"> <li>▪ Long project duration</li> <li>▪ Significant pedestrian/bicyclist activities</li> <li>▪ Existing sidewalks traverse the work zone</li> <li>▪ A school route traverses the work zone</li> </ul>	Safer for pedestrians and bicyclists	Additional cost to build alternate paths for pedestrians/bicyclists	
<b>C. Project Coordination, Contracting and Innovative Construction Strategies</b>							
<b>IC1 Project coordination</b>							
IC1. Coordination with other projects	✓			May be beneficial to any project	<ul style="list-style-type: none"> <li>▪ Reduces motorist delay</li> <li>▪ Minimizes impacts to potentially affected businesses and communities</li> <li>▪ Reduces exposure time to road work</li> <li>▪ May increase efficiencies</li> </ul>	May be difficult to identify potential projects to coordinate with	Routine agency meetings may address coordination at the project level, corridor level, district region level, and at the State level

Source: Federal Highway Administration. *Developing and Implementing Transportation Management Plans for Work Zones*. June 2009. Available at: [http://www.ops.fhwa.dot.gov/wz/resources/publications/trans\\_mgmt\\_plans/app\\_b\\_t1.htm](http://www.ops.fhwa.dot.gov/wz/resources/publications/trans_mgmt_plans/app_b_t1.htm). Accessed July 13, 2009.

### Relevant Resources

Federal Highway Administration, Office of Operations, Work Zone Mobility and Safety Program, *Developing and Implementing Transportation Management Plans for Work Zones*, [http://ops.fhwa.dot.gov/wz/resources/publications/trans\\_mgmt\\_plans/index.htm](http://ops.fhwa.dot.gov/wz/resources/publications/trans_mgmt_plans/index.htm), and appendix B, [http://www.ops.fhwa.dot.gov/wz/resources/publications/trans\\_mgmt\\_plans/app\\_b\\_t1.htm](http://www.ops.fhwa.dot.gov/wz/resources/publications/trans_mgmt_plans/app_b_t1.htm).

## 6.3 Self-Assessment Checklist: Project-Level Opportunities

The following checklist may be used as a self-assessment to identify project-level opportunities for integrating operations and safety into multimodal planning. The user should consider the questions, whether or not the State DOT is undertaking the activity, and what can be done to improve integration.

Checklist: Project-Level Opportunities				
Question	Yes	No	If no, what can be added or improved?	Relevant Subsection
Are operations and safety components being incorporated into project planning and design?				6.1
Are transit operations and service considerations, and other multimodal aspects (e.g., bicycles, pedestrians) considered in project planning and design?				6.1
Are operations and safety components being incorporated into project construction mitigation?				6.2
Are project-level operations activities (e.g., demand management during construction) being considered as opportunities for broader planning initiatives to address operations and safety within corridors?				6.2

## Appendix A: Relevant Plans for Identifying Opportunities for Integration

- **Statewide Plans**
  - Statewide Long-Range Transportation Plan (SLRTP)
  - Strategic Business Plan
  - State Highway Safety Plan (SHSP)
  - Emergency Management Plan
  - Operations Plan
  - Incident Management Plan
  - Statewide Transportation Improvement Plan (STIP)
  - Intelligent Transportation System (ITS) Strategic Plan
  - Modal Plans:
    - Transit
    - Freight
    - Rail
    - Waterways
    - Nonmotorized Vehicles
    - Aviation
  
- **Regional Plans**
  - Regional Transportation Plan
  - Congestion Management Plan
  
- **Corridor Plans**
  - Re-Signalization Plan
  - Corridor System Management Plan
  - Corridor-Level Traffic Management Plan





## Appendix B: Agency Self-Assessment Checklist

Self-assessment checklists are located at the end of each section for users to answer questions regarding their agency's success toward integrating safety, operations, and planning. Each of the checklists have been compiled below to provide users with the option of completing the checklists before reading the document, and then turning to those sections where their agency may desire more information on integration opportunities.

### Creating an Environment for Integrating Operations, Safety, and Multimodal Planning

Checklist: Creating an Environment for Integration				Relevant Subsection
Question	Yes	No	If no, what can be added or improved?	
Does the agency currently have multidisciplinary teams involving staff from operations, safety, and planning?				2.1
Has the agency developed specific, measurable objectives to measure its success?				2.2
If so, are objectives for system operations (e.g., congestion, reliability) and safety used to support planning and investment decisions?				2.2
Has the agency developed performance measures related to operations and safety that can be measured using available data and used to support planning?				2.2
Does the agency have a completed strategic business plan?				2.2
If so, does the strategic business plan foster integration of operations, safety, and multimodal planning?				2.3
Is public transportation represented in a number of multidisciplinary agency efforts?				2.4
Are public transportation choices, and the efficient operation and safety of transit, identified as priorities in the State long range transportation plan?				2.4
Do operations and safety programs consider implications on multimodal options, including transit, bicycling, and walking?				2.4

### Statewide Level Opportunities

Checklist: Statewide Level Opportunities				Relevant Subsection
Question	Yes	No	If no, what can be added or improved?	
Are operations and safety staff involved in the development of the SLRTP?				3.1
Does the SLRTP include a vision and goal(s) that address operational and safety considerations?				3.1
Is there recognition of the importance of linkages between operations and safety considerations in the SLRTP?				3.1

Checklist: Statewide Level Opportunities				
Question	Yes	No	If no, what can be added or improved?	Relevant Subsection
Are there specific objectives in the SLRTP that relate to system operation and safety?				3.1
Have system-wide performance measures been developed in the SLRTP, including those focused on operations and safety?				3.2
Are performance measures for livability, multimodal choice, and other planning considerations utilized in operations and safety programs?				3.2
Are performance measures being tracked?				3.2
Are safety and/or operations data being utilized to monitor system performance?				3.3
Are operations and safety strategies, policies, and programs highlighted in the SLRTP?				3.4
Are the SHSP's goals, objectives, and priorities reflected in the SLRTP?				3.5
Has an effort been undertaken to develop statewide operations goals and priorities, such as development of a statewide operations or ITS plan?				3.6
Do other plans outside of the SLRTP (e.g., modal plans, freight plans, etc.) relate back to the overarching goals and objectives in the SLRTP? Do these plans include operations and safety considerations?				3.7
Are goals and objectives helping to inform projects that are programmed in the STIP?				3.8
Are fiscal constraints being considered in the development of the SLRTP and other plans?				3.8

## Regional Level Opportunities

Checklist: Regional Level Opportunities				
Question	Yes	No	If no, what can be added or improved?	Relevant Subsection
Are operations, safety, and planning staff working together to address regional challenges, such as incident management, work zone management, or emergency management?				4.1
Has a regional concept for transportation operations (RCTO) been developed?				4.1
Are operations and/or safety data being shared with MPOs, transit agencies, and other agencies responsible for regional planning?				4.2
Are State DOT planners, operations, and safety staff participating in the congestion management process?				4.2

Checklist: Regional Level Opportunities				
Question	Yes	No	If no, what can be added or improved?	Relevant Subsection
Are congestion and safety challenges in rural areas, tribal lands, and national parks being addressed through a cooperative approach involving State DOT operations and safety staff?				4.3
Is coordination with tribal governments, federal lands, transit agencies, and other agencies on planning and investment studies incorporating operations and safety considerations?				4.3

### Corridor and Sub-Area Level Opportunities

Checklist: Corridor and Sub-Area Level Opportunities				
Question	Yes	No	If no, what can be added or improved?	Relevant Subsection
Are operations and/or safety data being used in assessing corridor system performance?				5.1
Are reliability and other operations considerations (e.g., incident management, traveler information) as well as safety being considered within corridor studies?				5.2
Is analysis being conducted to assess the benefits of operations and safety strategies?				5.2
Are analysis tools being applied, such as simulation, to assess reliability and other operations considerations?				5.2
Are operations and safety strategies and multimodal options being included in corridor plans?				5.2
Do corridor system management and operations activities link back to planning efforts?				5.3

### Project Level Opportunities

Checklist: Project Level Opportunities				
Question	Yes	No	If no, what can be added or improved?	Relevant Subsection
Are operations and safety components being incorporated into project planning and design?				6.1
Are transit operations and service considerations, and other multimodal aspects (e.g., bicycles, pedestrians), considered in project planning and design?				6.1
Are operations and safety components being incorporated into project construction mitigation?				6.2
Are project-level operations activities (e.g., demand management during construction) being considered as opportunities for broader planning initiatives to address operations and safety within corridors?				6.2



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