

# Linking Planning and Operations

## Reference Links

- Guide to Incorporating Reliability Performance Measures into the Transportation Planning and Programming Processes, TRB(Direct to: <http://www.trb.org/Main/Blurbs/168855.aspx>)
- Planning for Operations Website, FHWA(Direct to: <http://www.ops.fhwa.dot.gov/plan4ops/index.htm>)
- Subcommittee on Transportation Systems Management and Operations, AASHTO(Direct to: <http://stsmo.transportation.org/pages/default.aspx>)
- Reliability Research in the Strategic Highway Research Program 2, TRB(Direct to: <http://www.trb.org/StrategicHighwayResearchProgram2SHRP2/SHRP2FocusAreas.aspx>)
- Publications List - Planning for Operations, FHWA(Direct to: <http://ops.fhwa.dot.gov/publications/publications.htm#pfo>)

## Overview

Increasing financial constraints and the public's growing demand for predictable travel have transportation agencies searching for ways to do more with less. Transportation systems management and operations (TSM&O) offers real-time strategies to address congestion as well as travel time reliability in the near term-often at a lower cost than capacity improvements. Use this application to identify when and how TSM&O can help address deficiencies and improve reliability.

Three areas of information support this integration:

1. Dealing with congestion is more than just adding pavement. See Congestion and Reliability to learn more.
2. The Decision Guide represents the key decisions in transportation that can be significantly improved through collaboration with partners and stakeholders. See The Decision Guide and Operations to understand when and how TSM&O can support the planning process.
3. Guidance documents and practical examples of success can help advance operations considerations in planning. See Planning for Operations for resources.

## Congestion and Reliability

Congestion and Reliability - Are they different or just two sides of the same coin?A "just in time" way of life demands reliable travel. The many causes of congestion include both recurring and temporary, unexpected (non-recurring) disruptions to normal routine that impact reliability.

To address congestion, transportation professionals increasingly look to TSM&O strategies for dealing with unpredictable as well as recurring causes. Congestion management planning offers many options to implement operational improvements. Use these ideas to get started:

- The Minnesota DOT Congestion Management Safety Plan identifies how "lower-cost/high-benefit projects" have been effective in the Metro District.
- Incorporating Reliability into Key Decision Points for the Congestion Management Process identifies specific points in the CMP where reliability can be considered and implemented.
- Learn more about TSM&O strategies that address recurring congestionand non-recurring congestion from FHWA.

## The Decision Guide and Operations

### Operations and the Decision Guide

TSM&O is typically associated with activities that manage the system in "real time". Considering operations during the development of transportation plans and projects can address congestion and reliability in the short-term and at a lower cost than adding pavement.

The transportation Decision Guide is a framework of key decisions required by law or regulation or which have become part of successful practice. These decisions require action by those empowered to make the final decisions about plan adoption,funding priorities or project implementation. Information is used at each of these key decisions to inform decision makers.

**To understand how TSM&O relates to decision making during the planning process, click on the key decisions highlighted below. Hover over individual key decisions for a snapshot of this relationship.** Key decisions that are grayed-out have no specific relationship to operations.

## Long Range Transportation Planning

- LRP-1 - Approve Scope of LRTP Process  
State intention to include TSM&O plans in the scope of the LRTP. Identify data, modes, and operational partners, roles, and responsibilities related to operations.
- LRP-2 - Approve Vision and Goals  
Incorporate goals and objectives for the long- and short-term TSM&O and performance of the transportation system.
- LRP-3 - Approve Evaluation Criteria, Methods and Measures  
Identify evaluation criteria and analytical methods for TSM&O strategies including those that incorporate mobility and other performance measures.
- LRP-4 - Approve Transportation Deficiencies  
Identify TSM&O, capacity, and other system performance deficiencies. Engage operational partners and other stakeholders to identify problems, deficiencies, and opportunities.
- LRP-5 - Approve Financial Assumptions  
Identify federal, state, local, or private revenue sources that could be available to support TSM&O improvements. Recommend dedicated funding to sustain adopted TSM&O improvements.
- LRP-6 - Approve Strategies  
Identify TSM&O strategies which can be used in scenario evaluation to address transportation deficiencies.
- LRP-7 - Approve Plan Scenarios  
Incorporate TSM&O strategies into scenarios and evaluate using available analytical techniques, including off-model analysis.
- LRP-8 - Adopt Preferred Plan Scenario  
Include the effectiveness of TSM&O strategies to meet transportation deficiencies in the selection of a preferred scenario.
- LRP-9 - Make Conformity Determination by MPO  
Include TSM&O strategy analysis and benefits in the air quality conformity process.
- LRP-10 - Adopt LRTP by MPO  
This key decision is not associated with application.
- LRP-11 - Make Conformity Determination  
This key decision is not associated with application.

## Programming

- PRO-1 - Approve Revenue Sources  
Identify public or private revenue sources that could be available to support improved system performance and reliability and critical day-to-day TSM&O. Make budget requests, as applicable.
- PRO-2 - Approve Methodology for Identifying Project Costs and Criteria for Allocating Revenue  
Ensure that the methodology used to identify project costs and allocate revenue includes equitable treatment of TSM&O programs and improvements and their management and operations lifecycle costs.
- PRO-3 - Approve Project List Drawn from Adopted Plan Scenario or Solution Set  
Ensure projects that include TSM&O strategies are identified, along with associated costs and revenue sources to implement.
- PRO-4 - Approve Project Prioritization  
Identify outcomes and other evaluation criteria (e.g., performance measures) to compare and rank projects and their impacts on system performance and reliability. Include criteria that reflect the benefits of TSM&O improvements.
- PRO-5 - Reach Consensus on Draft TIP  
Engage TSM&O partners for recommendations and input to decision makers.
- PRO-6 - Adopt TIP by MPO  
This key decision is not associated with application.
- PRO-7 - Approve TIP by Governor and Incorporate into Draft STIP  
This key decision is not associated with application.
- PRO-8 - Reach Consensus on Draft STIP  
For non-MPO areas, engage TSM&O partners for recommendations and input to decision makers.
- PRO-9 - Approve STIP with respect to Fiscal Constraint  
Ensure TSM&O commitments included in the adopted LRTP meet conformity and fiscal constraint.

## Corridor Planning

- COR-1 - Approve Scope of Corridor Planning Process  
Consider how the quality and reliability of transportation management and operations will be included in the corridor planning study. Identify data, analysis needs, modes, and operational partners that will be included.
- COR-2 - Approve Problem Statements and Opportunities  
Identify the TSM&O performance characteristics for the corridor and any TSM&O-related problems and opportunities.
- COR-3 - Approve Goals for the Corridor  
Determine the short and long-term transportation management and operational goals for the corridor and how they relate to identified problems and opportunities.
- COR-4 - Reach Consensus on Scope of Environmental Review and Analysis  
Reach consensus on TSM&O information that may be applicable to corridor projects in NEPA.
- COR-5 - Approve Evaluation Criteria, Methods and Measures  
Identify evaluation criteria, performance measures, and analytical methods appropriate to evaluate both mobility, transportation management and operations strategies on a level playing field with other solution options.
- COR-6 - Approve Range of Solution Sets  
Identify the TSM&O strategies that address corridor mobility goals.

- **COR-7 - Adopt Preferred Solution Set**  
Select a preferred solution set using input from a robust analysis of impacts of the potential solutions on reliability and mobility within the corridor.
- **COR-8 - Approve Evaluation Criteria, Methods and Measures for Prioritization of Projects**  
Identify and include mobility and TSM&O metrics to compare and rank projects.
- **COR-9 - Adopt Priorities for Implementation**  
Ensure that mobility and travel performance are embedded as part of ongoing project prioritization and selection process.

### **Environmental Review/NEPA Merged with Permitting**

- **ENV-1 - Reach Consensus on Scope of Environmental Review**  
Reach agreement about potential for using TSM&O strategies. Identify operations data, resources, and stakeholders to include in the environmental review process.
- **ENV-2 - Approve Notice of Intent**  
Develop brief descriptions that are broad enough to accommodate TSM&O components and possible alternatives for the NOI.
- **ENV-3 - Approve Purpose and Need/Reach Consensus on Project Purpose**  
Clearly articulate if and how TSM&O is a part of the project purpose and need.
- **ENV-4 - Reach Consensus on Study Area**  
Consider potential TSM&O-related alternatives and the needs of TSM&O partners in the identification of the initial study area.
- **ENV-5 - Approve Evaluation Criteria, Methods and Measures**  
Identify evaluation criteria that adequately measure the potential impacts and benefits of TSM&O strategies as well as related performance measures.
- **ENV-6 - Approve Full Range of Alternatives**  
Identify project alternatives that will support the inclusion of operations strategies and treatments consistent with the adopted purpose and need.
- **ENV-7 - Approve Alternatives to be Carried Forward**  
Carry forward alternatives that address system management, operations and performance.
- **ENV-8 - Approve Draft EIS with Conceptual Mitigation**  
Explain how alternatives address system management, operations and performance in the Draft EIS.
- **ENV-9 - Approve Resource Agency Public Notice**  
This key decision is not associated with application.
- **ENV-10 - Approve Preferred Alternative / LEDPA**  
Ensure the preferred alternative is consistent with management and operation assumptions and CMP (if applicable) incorporated in the long range transportation plan, the description of purpose and need, and input from TSM&O partners.
- **ENV-11 - Approve Final Jurisdictional Determination**  
This key decision is not associated with application.
- **ENV-12 - Reach Consensus on Avoidance and Minimization for the LEDPA**  
This key decision is not associated with application.
- **ENV-13 - Approve Final EIS**  
This key decision is not associated with application.
- **ENV-14 - Approve the Record of Decision**  
This key decision is not associated with application.
- **ENV-15 - Render Permit Decision and Approve Avoidance and Minimization**  
This key decision is not associated with application.

## **Planning for Operations**

Use the examples below to get started or to take your agency to the next level.

### **Regional Operations Coordination and Collaboration**

- **Regional Concept for Transportation Operations: The Blueprint for Action - A Primer**

A Regional Concept for Transportation Operations (RCTO) can help agencies collaboratively plan and implement management and operation strategies. An RCTO can be used by agencies to reach consensus on goals for the next 3 to 5 years and map out how they will get there. This primer describes in detail the purpose of an RCTO, how to develop one, and its relevance to regional planning.  
<http://www.ops.fhwa.dot.gov/publications/rctoprimer/index.htm>

- **The Regional Concept for Transportation Operations: A Practitioner's Guide**

This guide is a collection of lessons learned and observations from four different metropolitan regions as they developed Regional Concepts for Transportation Operations. It can be used by transportation practitioners and planners to provide strategic direction for implementing effective regional transportation systems management and operations (TSM&O). Successful examples from the four RCTO implementing regions show readers where challenges were overcome.  
The guide provides the methods that are deemed most effective in improving regional transportation system performance.  
<http://ops.fhwa.dot.gov/publications/fhwahop11032/index.htm>

- The Collaborative Advantage: Realizing the Tangible Benefits of Regional Transportation Operations Collaboration

This manual helps public agencies identify tangible benefits of collaborating with other agencies to improve transportation system operations. The benefits include access to funding and other resources, improvements in agency operations and productivity, and outcomes that help agencies achieve their mobility and safety goals. The manual also describes the six-step process that agencies can use to determine what benefits they could achieve through collaboration.  
[http://ops.fhwa.dot.gov/publications/benefits\\_guide/index.htm](http://ops.fhwa.dot.gov/publications/benefits_guide/index.htm)

- Regional Transportation Operations Collaboration and Coordination: A Primer for Working Together to Improve Transportation Safety, Reliability, and Security

It is important for all members of a region to work together and understand the importance of collaboration and coordination. This document is aimed at public safety officials and transportation professionals that are responsible for managing operations in cities, counties, and regions. The primer includes a self-assessment readers can use to determine how they are doing in terms of regional collaboration/coordination. Examples of well-run transportation TSM&O procedures from across the country are presented as case studies.  
[http://ntl.bts.gov/lib/jpodocs/repts\\_te/13686.html](http://ntl.bts.gov/lib/jpodocs/repts_te/13686.html)

## Planning for Operations Guidance

- Advancing Metropolitan Planning for Operations: An Objectives-Driven, Performance-Based Approach - A Guidebook

By incorporating TSM&O strategies into an existing or developing transportation planning process, metropolitan areas can maximize their systems' performance. This fulfills a Federal planning requirement, but also ensures that the metropolitan transportation plan is more adaptive to residents needs, and allows TSM&O strategies to be more easily incorporated into projects selected for the transportation improvement program (TIP).  
<http://www.ops.fhwa.dot.gov/publications/fhwahop10026/index.htm>

- Advancing Metropolitan Planning for Operations: The Building Blocks of a Model Transportation Plan - A Desk Reference

This resource enables transportation planners and practitioners to build plans that include operations objectives, performance measures, and strategies that will improve their region. It also explains that plans can reflect a community's values, while moving the region towards improved mobility and safety. It includes a variety of options for incorporating operations into plans, organized as a collection of operation objectives and performance measures.  
<http://www.ops.fhwa.dot.gov/publications/fhwahop10027/index.htm>

- Congestion Management Process: A Guidebook

This guidebook provides insight into the creation of an objectives-driven, performance-based CMP. It offers up a framework of eight recommended actions to include in the development of a CMP. The CMP helps to support multiple metropolitan transportation planning decisions, including issues such as livability, collaboration, and demand management.  
[http://www.fhwa.dot.gov/planning/congestion\\_management\\_process/cmp\\_guidebook/](http://www.fhwa.dot.gov/planning/congestion_management_process/cmp_guidebook/)

## Showcasing Visualization Tools in Congestion Management

Visualization practices are an important part of congestion management, and this publication has been created as a supplement to the CMP Guidebook. Visualization can include anything from maps, charts, and graphs to videos, photos, and computer simulations. The report includes information on what visualization techniques agencies are using and what type of data is needed for them, and a discussion about sources of data.  
[http://www.fhwa.dot.gov/planning/congestion\\_management\\_process/cmp\\_visualization\\_tools/](http://www.fhwa.dot.gov/planning/congestion_management_process/cmp_visualization_tools/)

- Getting More by Working Together - Opportunities for Linking Planning and Operations: A Reference Manual

This manual was created to help planners and agency managers understand the importance of working together and realize the values and benefits of doing so. Many positive opportunities arise when implementing management and operational strategies at the regional scale. This document identifies 10 such opportunities, such as data sharing, performance measures, and funding, to show the strong connection between planning and operations functions. It also includes a self-assessment for readers to gauge their current progress in linking planning and operations.  
[http://ops.fhwa.dot.gov/publications/lpo\\_ref\\_guide/index.htm](http://ops.fhwa.dot.gov/publications/lpo_ref_guide/index.htm)

- Incorporating Reliability Performance Measures into the Transportation Planning and Programming Processes

This TRB research project developed three different resources that address aspects of incorporating travel time reliability. The products of this research range from process improvement to analysis support. Each of these publications is detailed below.

## Guide

Agencies are now required to adopt a performance-based approach to planning and programming. This high-level reference document was developed to help planners, practitioners, and operations managers apply the concept of travel-time reliability to programs and projects across a metropolitan area. The purpose of the guide is to help agencies using reliability performance measurement to better understand and communicate it. It also identifies tools and methods needed to track reliability and presents emerging analysis tools that will help evaluate the progress and investments being made.  
<http://www.trb.org/Main/Blurbs/168855.aspx>

### Technical Reference

This technical reference supports the Guide to Incorporating Reliability Performance Measures into the Transportation Planning and Programming Processes. The reference discusses the choices involved in integrating reliability into planning and programming, and was created to guide technical staff in identifying performance measures that support the development of key planning products.  
<http://www.trb.org/Main/Blurbs/168856.aspx>

### Final Report

The report summarizes all the research done in the Incorporating Reliability Performance Measures project. It includes a summary of the literature review, a state-of-the-practice survey, and case studies that were piloted to verify concepts and methods evaluated as part of the project. The detailed appendix describes how the project links to PlanWorks.  
<http://www.trb.org/Main/Blurbs/168854.aspx>

- The Role of Transportation Systems Management & Operations in Supporting Livability and Sustainability: A Primer

TSM&O can play an important role in supporting livability and sustainability. This primer shows the connections between TSM&O and livability and sustainability objectives, and describes the best way to manage and capitalize on them. The primer provides an example of a transportation system with regional TSM&O strategies that have cohesively advanced livability and sustainability goals. Case studies guide practitioners on implementing these tactics in their own communities.  
<http://ops.fhwa.dot.gov/publications/fhwahop12004/index.htm>

- Applying a Regional ITS Architecture to Support Planning for Operations: A Primer

This primer gives planners and transportation practitioners a variety of options for applying the regional ITS architecture to enhance planning for operations. It specifically provides entry points for leveraging the regional ITS architecture into the planning process. The primer uses an objectives-driven, performance-based approach to planning for operations, which emphasizes operational objectives and performance measures. Techniques for making a regional ITS architecture relevant and more accessible in planning for operations are also included.  
<http://ops.fhwa.dot.gov/publications/fhwahop12001/index.htm>

- The Use of Operations Objectives and Performance Measures in Private and Public Organizations

This document provides insight and lessons learned from both private companies and public organizations that used a strategic approach to advance transportation planning for operations. The use of specific objectives and performance measures to accomplish operational performance was found to be commonplace among those meeting costs or even generating profit. Many useful practices were identified for consideration in transportation planning for operation.  
[http://ops.fhwa.dot.gov/publications/fhwahop10029/white\\_paper.htm](http://ops.fhwa.dot.gov/publications/fhwahop10029/white_paper.htm)

- Management & Operations in the Metropolitan Transportation Plan - A Guidebook for Creating an Objectives-Driven, Performance-Based Approach

This guidebook helps MPOs meet the federal requirements of SAFETEA-LU that call for TSM&O strategies to be incorporated into a metropolitan transportation plan. The document provides an overview of how to go about this integration and highlights effective practices for mixing infrastructure and operation strategies.  
<http://ops.fhwa.dot.gov/publications/moguidebook/index.htm>

- Integrating Demand Management into the Transportation Planning Process: A Desk Reference

This desk reference was created as an aid to integrating demand management into the transportation planning process. It addresses policy objectives and the scope of the planning effort. The desk reference includes a description of seven key policy objectives that could integrate demand management, explanations of how demand management could work into the four levels of transportation planning, and tools for evaluating the effectiveness of the demand management strategies being discussed.  
<http://ops.fhwa.dot.gov/publications/fhwahop12035/index.htm>

- Statewide Opportunities for Integrating Operations, Safety, and Multimodal Planning: A Reference Manual

This "how-to" manual is intended to help transportation professionals and practitioners integrate operations, safety, and multimodal planning. The document describes the available opportunities at different levels of decision making, whether for statewide, regional, or corridor projects. It also highlights the benefits of such approaches and recommends implementation actions. Real-life examples, a toolkit, and multiple self-

assessment checklists for each decision making level are included.  
<http://www.fhwa.dot.gov/planning/statewide/manual/index.cfm>

- **Creating an Effective Program to Advance Transportation System Management & Operations: Primer**

This reference, which is targeted at SM&O-related activity managers, provides guidance on the program, process, and organizational capabilities that are necessary for developing effective TSM&O strategies. It is intended to provide an understanding among these activity-level managers of the opportunities that exist for improving State and local TSM&O activities.  
<http://ops.fhwa.dot.gov/publications/fhwahop12003/index.htm>

## Examples in Practice

- **The How: Case Studies Advancing Planning for Operations**

Six different case studies from regions across the country represent some of the work that agencies are doing to apply elements of an objectives-driven, performance-based approach to planning for operations. These methods, guided by specific objectives and agreed-upon performance measures, help ensure that the best operations strategies are incorporated into transportation plans.  
<http://www.plan4operations.dot.gov/casestudies/benefits.htm>

- **Developing Decisionmaker Support for Transportation Systems Management and Operations at MetroPlan Orlando**

TSM&O has strong backing from MetroPlan Orlando's 19 voting board members, because they have worked hard over several years to gain support for further TSM&O strategies in the region. A successful 2003 traffic incident management campaign encouraged the MPO board's efforts. With this early TSM&O accomplishment, the MPO has dedicated funding annually, and even created an M&O subcommittee.  
<http://ops.fhwa.dot.gov/publications/fhwahop10056/index.htm>

- **Outcomes-Based, Performance-Driven Planning at Metro Portland**

Metro, the metropolitan planning organization for the Portland, Oregon region, took a new approach for its 2035 Regional Transportation Plan, focusing on desired outcomes and measurable performance. The region went forward with an outcomes-based framework that included policy-level performance targets that will guide investments and demonstrate measurable results. Metro also established a performance monitoring program that can assess system performance periodically to help make more educated implementation decisions.  
<http://ops.fhwa.dot.gov/publications/fhwahop10055/index.htm>

- **The Use of an Objectives-Driven, Performance-Based Approach at the Champaign County Regional Planning Commission**

The Champaign-Urbana Urbanized Area Transportation Study (CUUATS) developed its own objectives-driven, performance-based approach to metropolitan transportation planning in their recent plan, Choices 2035. CUUATS and its partners were able to directly tie TSM&O into several of their 12 regional goals, identifying specific objectives to help support each of them. All objectives and goals have measures to track progress and effectiveness. Positive results of this new approach have included increased public engagement, more accountability, and a safer, transit-oriented community.  
<http://ops.fhwa.dot.gov/publications/fhwahop10054/index.htm>

- **Regional Concept for Transportation Operations Fosters Planning for Operations in the Tucson Metropolitan Area**

An FHWA initiative to advance regional collaboration for operations inspired the Tucson region to embark on the development of a RCTO; allowing transportation practitioners to strategically plan for improving operations in their region. Participants identified specific objectives and performance measurements they wanted included in arterial management, traveler information, and work zone management. These objectives guided the selection of strategies and approaches for implementation.  
<http://ops.fhwa.dot.gov/publications/fhwahop09048/index.htm>

- **Metropolitan Transportation Commission San Francisco Bay Area**

The Metropolitan Transportation Commission chose to use an objectives-driven, performance-based approach for transportation planning in the Bay Area. This approach highlights the most important transportation investments and those deemed highest priority. Regional performance is more valued than individual project-level performance, and broad targets have been set by the agency. Objectives also help provide a quantitative assessment of a project's costs and benefits using project-level analysis.  
<http://ops.fhwa.dot.gov/publications/fhwahop09047/index.htm>

- **The Denver Region Traffic Signal System Improvement Program**

The Traffic Signal System Improvement Program in the Denver region is a collection of TSM&O strategies to help coordinate efficient traffic signals. The Denver Regional Council of Governments works through a collaborative planning process to identify critical needs throughout regionally significant arterials. The program has seen improved operations of more than a thousand traffic signals, which has led to reduced travel time for commuters, less fuel consumption, and lower vehicle emissions.  
<http://ops.fhwa.dot.gov/publications/fhwahop09046/index.htm>

- Wilmington Area Planning Council New Castle County, Delaware and Cecil County, Maryland

For its metropolitan transportation plan, the Wilmington Area Planning Council took an objectives-driven, performance-based approach, even integrating a congestion management process into the plan. Because the agency has a close working relationship with the region's public transportation provider, transit has become a true partner in the regional planning process. This allows transit data to be used as a performance measure for congestion and helps to provide a toolbox of solutions that include better transit options. Crash data has also been incorporated into the congested corridor identification process, and there are plans to further enhance partnerships with regional leaders and improve the assessment of costs and benefits of transportation investments.  
<http://ops.fhwa.dot.gov/publications/fhwahop09045/index.htm>

- Capital District Transportation Committee Albany, New York

This case study describes how the Capital District Transportation Committee linked their CMP with the metropolitan transportation plan. Issues such as land use planning, development patterns, and general quality of life are now reflected in planning decisions, and the plan will focus on transportation investments such as urban reinvestment and context-sensitive design. Performance measurement will help to assess congestion mitigation within a range of other measures. Linking the CMP and the planning process resulted in a broader regional scope, creating goals that generate greater public interest.  
<http://ops.fhwa.dot.gov/publications/fhwahop09043/index.htm>

- Delaware Valley Regional Planning Commission Philadelphia Metropolitan Region

Managing traffic congestion and monitoring system performance is a systematic process for the Delaware Valley Regional Planning Commission. Aided by an advisory team of practitioners, the agency determines the congested roads of the region, and then develops appropriate multimodal strategies to help mitigate the issues. Performance indicators are set to help the agency track its progress in hitting long-range goals. In the future, the agency hopes to increase its focus on systems TSM&O to measure reliability.  
<http://ops.fhwa.dot.gov/publications/fhwahop09044/index.htm>

## Tools and Analysis

- Designing for Transportation Management and Operations: A Primer

This primer is focused on the collaborative considerations needed when incorporating TSM&O into transportation project design and development. The term "designing for operations" involves the development as well as the application of design policies, procedures, and strategies that support TSM&O. This process encompasses a broad range of transportation practitioners including ITS staff, transit professionals, and traffic incident management employees, among others.  
<http://ops.fhwa.dot.gov/publications/fhwahop13013/index.htm>

- FHWA Operations Benefit/Cost Analysis Desk Reference

The FHWA Operations Benefit/Cost Analysis Desk Reference provides transportation professionals with guidance on how to most efficiently estimate the benefits and costs of operational strategies. The guidance includes basic background information on benefit/cost analysis for those who are unfamiliar with the concepts and terminology of the subject. More advanced analytical concepts are also included to support the more complex analysis needed for measuring TSM&O factors such as travel time reliability, traffic surveillance, and communications.  
<http://ops.fhwa.dot.gov/publications/fhwahop13006/index.htm>

- Applying Analysis Tools in Planning for Operations

This brochure and collection of case studies stresses the importance of using analysis tools to strengthen the links between planning and operations. "Tools" here refers to basic analysis methods and procedures, and not to physical software or applications. The guidance in these case studies is intended to help planners better use existing transportation planning and operations analysis tools and methods. By being more systematic with these methods, they can analyze, evaluate, and report the benefits of needed investments in transportation operations.  
<http://www.plan4operations.dot.gov/casestudies/analysis.htm>

- FHWA Operations Benefit/Cost Analysis Desk Reference: Conducting Benefit/Cost Analysis of Strategies Impacting Non-Typical Traffic Conditions

This reference was created to provide practitioners with analytical methods that can be used to assess impacts and benefits of various operations strategies for reducing traffic congestion caused by atypical conditions. Atypical circumstances include incidents, high demand from special events, weather, and other unusual causes. A different approach is needed for analyzing the benefit/cost estimation of operations strategies related to atypical conditions.  
<http://ops.fhwa.dot.gov/publications/fhwahop13005/index.htm>