

Advancing Metropolitan Planning for Operations

**An Objectives-Driven,
Performance-Based Approach**

A Guidebook



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

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16. Abstract This guidebook presents an approach for integrating management and operations (M&O) strategies into the metropolitan transportation planning process that is designed to maximize the performance of the existing and planned transportation system. This approach is recommended as a means to meet Federal transportation planning requirements for promoting efficient system management and operations and implementing a congestion management process (CMP). The approach is driven by operations objectives for the regional transportation system and performance measures for achieving those objectives. The MTP resulting from this approach contains specific, measurable operations objectives, performance measures, and M&O strategies that directly influence the projects selected for the transportation improvement program (TIP). This approach not only helps fulfill Federal planning requirements, but also results in an MTP that is a better able to meet customer needs, creating a more optimal mix of transportation investments					
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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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ACRONYMS

CMAQ	Congestion Mitigation and Air Quality
CMP	Congestion Management Process
DOT	Department of Transportation
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
ITS	Intelligent Transportation System
M&O	Management and Operations
MPO	Metropolitan Planning Organization
MTP	Metropolitan Transportation Plan
NEPA	National Environmental Policy Act
RCTO	Regional Concept for Transportation Operations
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SMART	Specific, Measurable, Agreed, Realistic, Time-Bound
TIM	Traffic Incident Management
TIP	Transportation Improvement Program
TMA	Transportation Management Area
TSM&O	Transportation Systems Management and Operations

EXECUTIVE SUMMARY

The pressures of a rapidly changing world require that we optimize the use of our existing and planned transportation infrastructure. Demand for travel has increased dramatically over the past 20 years, resulting in congestion that steals approximately 6 billion hours of time away from Americans each year.¹ Businesses are constantly challenged by the need to move freight quickly on congested roads and rails, which results in increases in the cost of doing business in the United States. Effective transportation solutions are needed to remain competitive in a global economy, address climate change, and meet transportation system user expectations. The public is increasingly calling for greater Government transparency, travel options, and information to make travel decisions.

Addressing these needs requires a new way of doing business. This guidebook presents an approach for integrating management and operations (M&O) strategies into the metropolitan transportation planning process that is designed to maximize the performance of the existing and planned transportation system. M&O strategies include a broad range of activities, such as traveler information dissemination, traffic signal coordination, incident management, and transit systems management. By planning for and investing in strategies to manage and operate the existing infrastructure, regions can use what they have more efficiently and improve mobility for the public during both daily operations and emergencies. This approach is recommended as a means to meet Federal transportation planning requirements for promoting “efficient system management and operations” and implementing a congestion management process (CMP), which is required in Transportation Management Areas (TMA).

The approach is driven by specific operations objectives for the regional transportation system and performance measures for achieving those objectives. These operations objectives and performance measures are developed for and contained in the metropolitan transportation plan (MTP). Operations objectives provide specific, measurable, agreed-upon statements of system performance that can be tracked on the regional level and will inform investment decisions.

The objectives may relate to issues such as recurring and non-recurring congestion, access to traveler information, emergency response, incident management, and transit operations, among others. A plan developed using an objectives-driven, performance-based approach for operations provides a direct connection between operations objectives and project selection. The CMP, guided by specific objectives and integrated into the planning process, is an example of this systematic approach. In some regions, the objectives-driven, performance-based approach for integrating operations into the plan may be performed within the CMP.

As illustrated in Figure 1, an objectives-driven, performance-based approach to planning for operations within a metropolitan area includes the following activities, which are performed collaboratively among planners, operators, and other stakeholders:

- Establish one or more goals within the MTP that focus on the efficient management and operation of the transportation system.
- Develop regional operations objectives for the MTP – specific, measurable statements of performance – that will lead to accomplishing the goal or goals.
- Use a systematic process to develop performance measures, analyze transportation performance issues, and recommend M&O strategies.
- Select M&O strategies within fiscal constraints to meet operations objectives for inclusion in the metropolitan transportation plan (MTP) and transportation improvement program (TIP).
- Implement M&O strategies including program investments, collaborative activities, and projects.
- Monitor and evaluate the effectiveness of implemented strategies and track progress toward meeting regional operations objectives.

¹ U.S. Department of Transportation, FHWA, “Focus on Congestion Relief: Traffic Congestion Factoids.” Available at: <http://www.fhwa.dot.gov/congestion/factoids.htm>, last accessed July 16, 2009.

This approach is iterative, with monitoring and evaluation used to refine and adjust operations objectives over time. Coordination and collaboration between planners and operators is a critical component of the approach, which supports the development of agreed-upon regional operations objectives, identification of strategies, and monitoring and evaluation of system performance. The commitment of operators in the region to support the achievement of the operations objectives is vital. The operations objectives not only reside in the metropolitan transportation plan, but also must be incorporated into the priorities of the operating agencies in the region. Decisionmakers within operating agencies in the region must be involved in the development of the operations objectives.

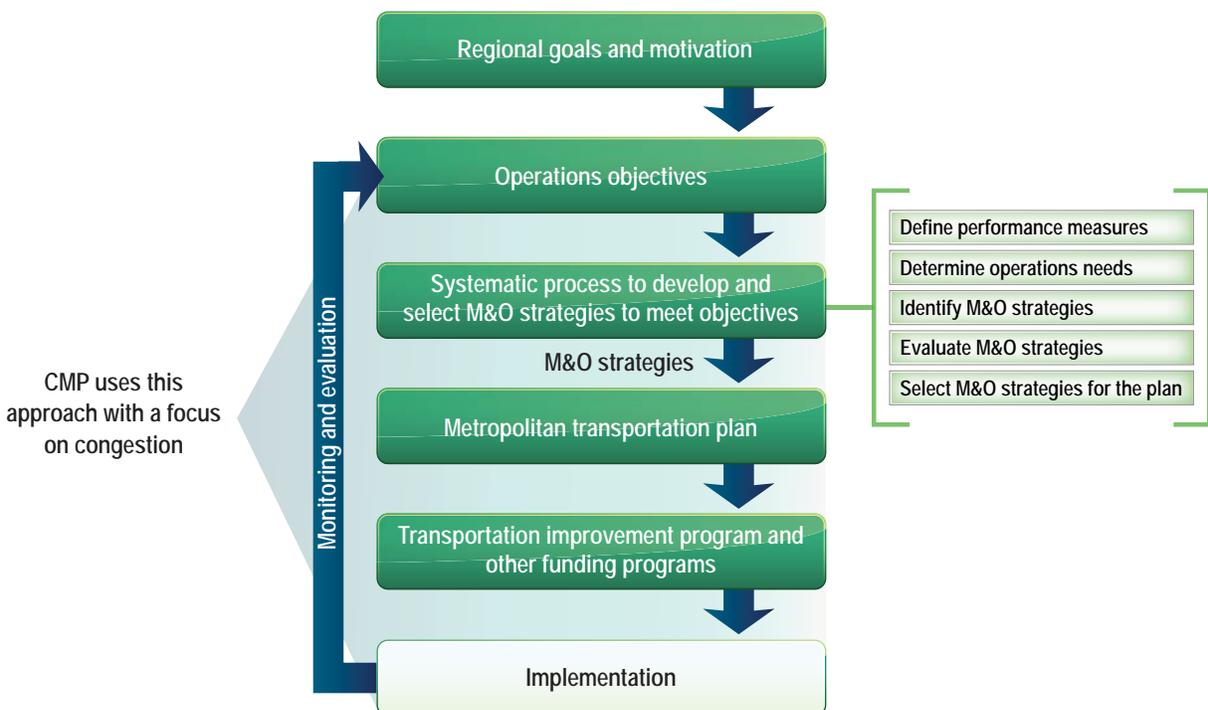
The benefits of this objectives-driven, performance-based approach to planning for operations include:

- A metropolitan transportation plan that illustrates the inclusion of specific, measurable, and agreed-upon operations objectives and shows the ties of these objectives to resource allocations in the document.

- A closer tie between specific, desired outcomes and resource allocation.
- Increased accountability and communication with the public and stakeholders through performance measurement.
- Engagement of the operations community, as well as law enforcement, freight, and the private sector, in setting objectives and measuring performance.
- A focus on both short-range and long-range needs related to the operation of the transportation system in the MTP.

The MTP resulting from this approach contains specific, measurable operations objectives, performance measures, and M&O strategies that directly influence the projects selected for the transportation improvement program (TIP). This approach not only helps fulfill Federal planning requirements, but also results in an MTP that is a better able to meet customer needs, creating a more optimal mix of transportation investments.

Figure 1. An Objectives-Driven, Performance-Based Approach to Planning for Operations



CMP uses this approach with a focus on congestion

1.0 INTRODUCTION

1.1 Motivation for Advancing Operations in Metropolitan Transportation Planning

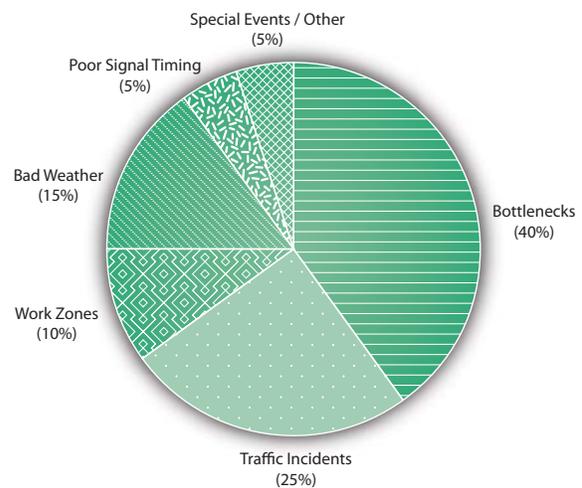
The pressures of a rapidly changing world require that we optimize the use of our existing and planned transportation infrastructure. Traffic congestion continues to challenge urban areas of all sizes across the country, taking approximately 6 billion hours of time away from Americans each year.² Freight is tied up on the roads and rails, increasing the cost of doing business in the United States. The call to address climate change is becoming more urgent, and effective multimodal solutions are needed to remain competitive in a global economy. With increased communications technologies, travelers expect to have more choices for travel and better information to use to make those choices. Additionally, the public is demanding increased Government accountability and transparency.

The public expects that traffic signals be coordinated, and technology is being used effectively to optimize system performance across geographic and jurisdictional boundaries. The public also demands increased reliability from transit services and accurate information to make choices in travel modes, routes, and times. With homeland security concerns as well as natural disasters, efficient emergency response and evacuations are critical, and rely upon effective coordination and communication between transportation agencies and law enforcement. It is estimated that more than half of congestion experienced by travelers is caused by non-recurring events, such as weather conditions (e.g., snow, ice, rain); work zones; special events; and major incidents and emergencies that are not typically taken into account in the traditional metropolitan transportation planning process (see Figure 2).³ All of these factors are putting more emphasis on operations strategies that optimize transportation system performance and provide near-term, cost-effective solutions to get the most out of our transportation system.

Traditionally, the metropolitan transportation planning process has sought to address the performance of our transportation system by primarily identifying long-range project needs rather than addressing the short- to medium-range issues associated with transportation system operations. Although management and operations (M&O) strategies are increasingly being recognized as important by transportation planners and operators today, in most regions the metropolitan transportation plan (MTP) still tends to be largely “project-focused,” and it is often difficult to clearly identify M&O strategies in the plan. Moreover, while the MTP typically includes a range of goals, there is limited development of measurable regional operations objectives and tracking of actual system performance against those objectives.

Addressing these needs and others requires a new way of doing business – a strategic and informed approach to planning for operations.

Figure 2. Sources of Congestion



² U.S. Department of Transportation, FHWA, “Focus on Congestion Relief: Traffic Congestion Factoids.” Available at: <http://www.fhwa.dot.gov/congestion/factoids.htm>, last accessed July 16, 2009.

³ The graph shown in Figure 2 is taken from the recent FHWA publication, “Traffic Congestion and Reliability: Linking Solutions to Problems,” and provides rough approximations based on many past and ongoing congestion research studies. This graph roughly shows the contribution of each factor to congestion.

This guidebook provides the foundation for integrating operations in the metropolitan transportation planning process using an objectives-driven, performance-based approach (also referred to as “the approach”). It is designed to assist metropolitan planning organizations (MPOs) in meeting Federal requirements under the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) calling both for M&O strategies to be incorporated into the MTP and for larger MPOs to implement a congestion management process (CMP). The guidebook highlights effective practices in planning for operations that result in an MTP with a more optimal mix of infrastructure and operational strategies.

This guidebook is intended for those professionals involved in the metropolitan transportation planning process at MPOs, State Departments of Transportation (DOT), transit agencies, or other operating agencies across the country. The recommended approach applies to all stakeholders; it recognizes their diverse roles and responsibilities, and appreciates their commonly held goal: to improve the performance of our transportation system.

1.2 What is Planning for Operations?

“Planning for operations” is a joint effort between planners and operators to support improved regional transportation system management and operations. This term encompasses a variety of activities that lead to improved transportation system operations, including the consideration of M&O strategies in the transportation planning process. Planning for operations also includes collaboration among transportation system operators, transit agencies, highway agencies, toll authorities, local governments, and others to facilitate improved transportation system operations and to ensure that transportation services are delivered in as safe, reliable, and secure a manner as possible. Oftentimes, this collaboration is carried out in the context of a regional planning agency and is connected to the planning process. In this guidebook, planning for operations will focus on those activities performed in the context of the metropolitan transportation planning process to advance regional operations in the MTP.

Planning for operations in the metropolitan trans-

portation planning process means developing operations objectives to direct the consideration of operational performance during the planning process and incorporating operations solutions into investment decisions that support the operations objectives. This approach ensures that operations needs are addressed in regional planning and investment decisions.

Operations managers are engaged in the planning process so that system performance concerns or challenges and potential operations strategies inform and influence the development of the metropolitan transportation plan. Operator involvement further ensures that operations informs and influences the planning process so that operations considerations are reflected in regional transportation plans. This results in a mix of operations and capital projects that optimizes transportation system performance.

While certain activities associated with planning for operations are already occurring in many metropolitan areas throughout the country, the challenges discussed above are motivating increased attention to incorporating M&O strategies more effectively into metropolitan transportation plans.

Management & Operations Strategies

An effective transportation system requires not only a highway and transit infrastructure for the traveling public and the movement of freight, it also requires the efficient and coordinated operation of the regional transportation network to improve system efficiency, reliability, and safety.

M&O strategies focus on optimizing the performance of the multimodal transportation system and include a broad range of activities, such as:

- Traffic incident management.
- Traveler information services.
- Roadway weather information.
- Freeway management.
- Automatic vehicle location.
- Traffic signal coordination.
- Work zone management.
- Electronic payment/toll collection.

- Transit priority/integration.
- Emergency response and homeland security.
- Freight management.
- Transportation demand management.
- Transit fleet management and dispatching.

M&O strategies are part of an integrated approach to optimizing the performance of existing and planned infrastructure through the implementation of multimodal, intermodal, and often cross-jurisdictional systems, services, and projects (often called regional transportation systems management and operations, or RTSM&O).⁴ In the MTP, M&O strategies lead to either operations projects or programs or are combined with other projects such as capacity additions. It is important to note that M&O does not encompass traditional maintenance activities, such as landscape maintenance, pothole repair, or road resurfacing. Although M&O strategies may be implemented on a regional, area-wide, or project-specific basis, those included in a transportation plan should typically be those that have importance on a regional level.

Congestion Management Process

The congestion management process (CMP)⁵ is a systematic approach applied in a metropolitan region to identify congestion and its causes, propose mitigation strategies, and evaluate the effectiveness of implemented strategies.⁶ The CMP then recommends projects and strategies for the plan and transportation improvement program (TIP). In many metropolitan areas, the CMP is one of the primary avenues for planning for operations. In the CMP, system performance issues are systematically examined and management and operations strategies are often included in the set of solutions recommended to address congestion. The CMP, guided by specific objectives and integrated into the planning process, is an example of this systematic approach. In some regions, the objectives-driven, performance-based approach for integrating operations into the plan may be performed within the CMP.

A CMP is required in Transportation Management Areas (TMA), defined as urban areas with a population over 200,000. The congestion management process should not be considered as a stand-alone system, but as an integral part of the metropolitan transportation planning process. At the core, a CMP should include a data collection and monitoring system, identification of strategies for addressing congestion, performance measures or criteria for identifying when action is needed, and a system for prioritizing which congestion management strategies would be most effective. In air quality non-attainment areas, the CMP takes on even greater importance since Federal guidelines prohibit projects that increase capacity for single occupant vehicles unless the project results from a CMP.⁷

Although a CMP is only required for TMAs, all MPOs can benefit from using a systematic process to address congestion issues. Moreover, while the CMP focuses on congestion, the data collected as part of the CMP also can be used to help support other system management and operations consideration, such as safety, accessibility, and connectivity.

1.3 Federal Requirements

Planning for operations, in addition to having many congestion mitigation and system efficiency benefits, is required under Federal law.

Integrating Management & Operations Strategies

SAFETEA-LU contains the following requirements for all MPOs, regardless of size:

- **Promote Efficient System Management and Operations:** Section 6001(a) of SAFETEA-LU amends United States Code Title 23, Section 134(h) to require consideration of M&O in the metropolitan transportation planning process – “Promote efficient system management and operation” is specifically identified as one of eight planning factors.

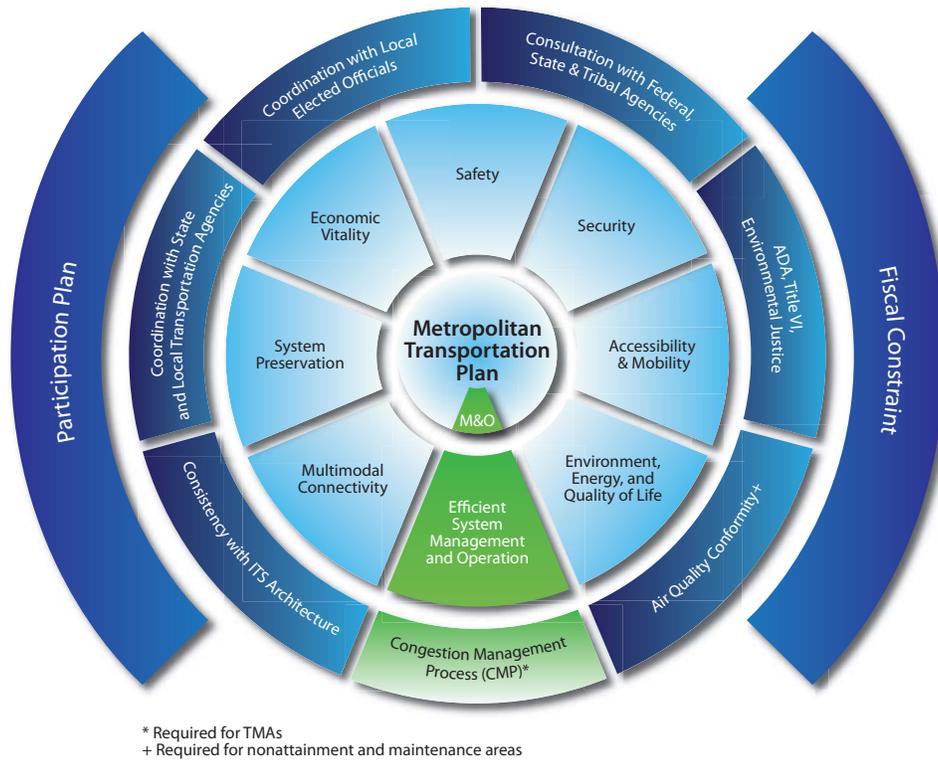
⁴ Transportation Research Board, *Glossary of Regional Transportation Systems Management and Operations Terms*, Transportation Research Circular, Number E-C133, April 2009. Available at: <http://onlinepubs.trb.org/onlinepubs/circulars/ec133.pdf>, last accessed December 6, 2009.

⁵ The CMP evolved from what was formerly called a Congestion Management System (CMS).

⁶ For a more detailed discussion of the components of the congestion management process, see Appendix B.

⁷ Safety improvements and the elimination of bottlenecks are exceptions to this restriction.

Figure 3. M&O and CMP in the Context of Metropolitan Transportation Planning Requirements



- Include Management and Operations Strategies:** Section 6001(a) of SAFETEA-LU amends United States Code Title 23, Section 134(i) to state that the MTP shall include “operational and management strategies to improve the performance of existing transportation facilities to relieve vehicular congestion and maximize the safety and mobility of people and goods.”

For MPOs of areas with populations greater than 200,000, SAFETEA-LU contains this requirement:

- Congestion Management Process:** Section 6001(a) of SAFETEA-LU includes an amendment to Title 23, Section 134(k), of the United States Code that states: “Within a metropolitan planning area serving a transportation management area, the transportation planning process under this section shall address congestion management through a process that provides for effective management and operation, based on a cooperatively developed and implemented metropolitan-wide strategy, of new and existing transportation facilities eligible for funding under this title and chapter 53 of title 49 through the use of travel

demand reduction and operational management strategies.”

Planning for Operations within the Context of Other Metropolitan Planning Requirements

While this guidebook focuses on planning for operations (including requirements to incorporate M&O strategies and the CMP in metropolitan transportation planning, where applicable), it is important to recognize that MPOs face a wide range of transportation planning requirements, which may place competing demands on priorities for inclusion in the MTP.

Figure 3 highlights the operations portions of the planning process that are the focus of this guidebook in the context of the many planning requirements that MPOs face in developing the MTP. The figure illustrates the eight planning factors that must be considered in developing the MTP, including the M&O planning factor. Surrounding these factors are other planning requirements, including the requirement that TMAs develop a CMP. Highlighted within the center circle is the requirement that the MTP must include M&O strategies.

The M&O planning factor should not be viewed in isolation. In fact, improving transportation system M&O can support the other planning factors. Similarly, while the CMP focuses on congestion, the analysis of congestion problems and solutions also can help support multiple goals, including economic vitality, safety, and connectivity. The CMP can also help to identify M&O strategies.

In support of other planning factors, M&O strategies can:

- Support economic vitality by improving system reliability, which is valued by the freight and business communities.
- Increase safety by focusing attention on operational strategies, such as driver education, speed enforcement, and technologies to improve pedestrian safety.
- Increase security by improving communication and coordination between transportation agencies and law enforcement.
- Increase accessibility and mobility by implementing strategies that reduce recurrent and non-recurrent congestion, and improve the efficiency of operations, such as transit bus priority, signal timing, and pricing.
- Enhance the environment, energy conservation, quality of life, and consistency with planned growth by implementing programs to reduce travel demand, providing traveler information to help drivers avoid or reduce time stuck in traffic delay, and avoiding the need to develop new transportation infrastructure with negative impacts to the environment and communities.
- Enhance integration and connectivity by implementing strategies to allow seamless travel between transit service providers and modes.
- Emphasize preservation of the existing transportation system by focusing resources toward optimizing existing capacity rather than building new capacity.

1.4 Creating an Objectives-Driven, Performance-Based Approach to Planning for Operations

The guidebook describes an approach that is designed to help MPOs and other stakeholders incorporate M&O in metropolitan transportation planning through use of regional operations objectives. The guidebook not only helps fulfill SAFETEA-LU requirements, but also results in an MTP that is a better able to meet customer needs through an optimal mix of transportation investments. The approach is consistent with operational performance management strategies used in the private sector as discussed in section 2.1. The CMP is one example of applying this approach to manage congestion.

As described here, the approach to planning for operations includes the following elements:

- Developing one or more goals within the MTP that focus on the efficient management and operation of the transportation system.
- Developing regional operations objectives for the MTP – specific, measurable statements of performance that will lead to accomplishing the goal or goals.
- Implementing a systematic approach to developing performance measures, analyzing transportation performance issues, and recommending M&O strategies.
- Selecting M&O strategies (within fiscal constraints and to meet operations objectives) for inclusion in the MTP and transportation improvement program (TIP).
- Implementing M&O strategies, which may include investments and collaborative activities.
- Monitoring and evaluating the effectiveness of implemented strategies and tracking progress toward meeting regional operations objectives.

The approach is iterative, with monitoring and evaluation used to refine and adjust operations objectives over time. Regional coordination and collaboration among partners and stakeholders is important throughout this process. The commitment of operators in the region to

support the achievement of the operations objectives is vital. The operations objectives not only reside in the MTP, but also must be incorporated into the priorities of the operating agencies in the region. Decisionmakers within operating agencies in the region must be involved in the development of the operations objectives.

1.5 Guidebook Organization

This guidebook describes the major elements of the objectives-driven, performance-based approach, organized in the sections listed in Table 1.

In addition, this guidebook includes four appendices that provide additional technical information on SAFETEA-LU, the CMP, and the objectives-driven, performance-based approach:

- **Appendix A** provides the Federal requirements under SAFETEA-LU regarding M&O and the CMP.
- **Appendix B** provides more detail on the components of the congestion management process, including developing a CMP, developing objectives for the CMP, and finally, applying the CMP.
- **Appendix C** describes four related emerging applications of the objectives-driven, performance-based approach that affects MPOs and State DOTs – **Linking Planning and NEPA (National Environmental Policy Act), freight planning, safety planning, and land use integration.**
- **Appendix D** describes the details and potential lessons learned from the use of operations objectives and performance measures in financially self-sustaining public and private organizations that focus on the delivery of services – **Operations Objectives and Performance Measures in Private and Public Organizations.**

Table 1: Guidebook Organization by Section and Description

Section	Description
Section 2: An Objectives-Driven, Performance-Based Approach to Planning for Operations	Provides an introduction to the objectives-driven, performance-based approach, including the rationale for its use and its relationship to the CMP.
Section 3: Developing Operations Goals and Objectives	Describes the first steps of developing goals and operations objectives, including characteristics and examples of operations objectives.
Section 4: Developing Performance Measures, Assessing Needs, and Selecting Strategies	Describes a systematic process of developing performance measures, assessing needs, and identifying and selecting strategies. Also includes examples of M&O and congestion management strategies, including approaches for analyzing their effectiveness.
Section 5: Resulting Plans, Programs, and Projects	Discusses outcomes of the approach to planning for operations in metropolitan areas in terms of what the MTP looks like and additional benefits MPOs might achieve from following this approach.
Section 6: Ongoing Monitoring and Evaluation	Addresses the critical but sometimes overlooked aspect of monitoring and evaluating implemented strategies and overall progress in meeting transportation system performance objectives.
Section 7: Moving Forward Through Regional Coordination and Collaboration	Provides information on engaging operations stakeholders in transportation planning and provides examples of ways to collaborate effectively to implement the objectives-driven, performance-based approach.
Section 8: Getting Started	Provides steps for getting started with the approach and a self-assessment designed to help MPOs assess to what extent they are addressing M&O and integrating the CMP in the MTP using the approach.

2.0 AN OBJECTIVES-DRIVEN, PERFORMANCE-BASED APPROACH TO PLANNING FOR OPERATIONS

2.1 Rationale for a New Approach

Benefits of a New Approach

Implementing a planning process with strong M&O components can best be accomplished by a new approach to transportation planning for operations, one that is objectives-driven rather than project-driven. An objectives-driven, performance-based approach focuses on both short-term and long-term system performance, using established system performance measures rather than simply focusing on implementation of projects as a measure of success.

The maxim that “what gets measured gets managed” recognizes that performance measurement can focus the attention of decisionmakers, practitioners, and the public on important characteristics of the transportation system. Similarly, using the approach in the MTP will place increased attention on the operational performance of the transportation system.

By including operations objectives that address system performance issues, such as recurring and non-recurring congestion, emergency response times, connectivity among modes, and access to traveler information, the MTP will yield programs and strategies that more effectively address these concerns. In addition to addressing long-range system capacity needs, the MTP will encourage operators to play a more important role in transportation investment planning and address both short-range and long-range needs.

The process of applying regional operations objectives in the MTP will lead to broader outcomes that improve transportation planning and strengthen the linkages between planning and operations. Specifically, the benefits of this process include:

- **A more objective approach to addressing operations in the transportation planning process.** By using the approach in the MTP, resource and investment decisions can be made with a clearer focus on outcomes of the plan. This will allow a better screening of strategies using objective criteria. While political considerations, public support, and tradeoffs between different goals will continue to play an important role in the process, having a clear set of agreed-upon objectives in the MTP will allow comparisons of alternative strategies and scenarios using specific metrics.
- **Focused transportation investment prioritization.** Use of operations objectives and performance measures in the MTP will help in prioritizing investments on a regional basis. With regional operations objectives, there are established metrics for determining which investments are most important and cost-effective in meeting regional goals. For instance, regional operations objectives naturally lead to the development of performance measures, which can be utilized as part of the CMP to prioritize locations with the most significant recurring and non-recurring congestion problems.
- **Improved resource allocation.** Transportation investment decisionmaking will become more comprehensive, incorporating system operations for an optimal mix of operations and capital projects and programs. In addition to “stand alone” operations projects, M&O strategies can be built into transportation system preservation, capacity expansion, and safety projects to help maintain existing and future planned capacity and safety.

- **Increased accountability and measurement of performance.** Success in achieving regional operations objectives can be tracked over time. Tracking performance can help transportation agencies demonstrate to the public the benefits of their programs and investments and can feed into future updates to the MTP if it is determined that objectives need to be reassessed.
- **Engaging the operations community in a substantive way.** Integrating M&O into the MTP process has benefits for transportation planners and operators as well as the traveling public. By working toward optimizing the transportation system with M&O strategies, planners are better able to demonstrate to the public and elected officials that progress is being made on reducing congestion in the short-term with lower cost techniques. Similarly, managers of day-to-day system operations are able to make their limited staff time and other resources go farther by collaborating with planners and other operators to address operations from a regional perspective. Transportation operations improvements made in one jurisdiction are reinforced by coordinated improvements in neighboring areas, enabling travelers to move seamlessly across the region without encountering inconsistent traveler information, toll collection technologies, or traffic signal timing.

By working together to address transportation issues of regional significance with M&O strategies, planners and operators are able to have a greater impact on the performance of the transportation system in the region than they would by working alone. The MTP and TIP will result in a more optimal mix of transportation investments among system preservation, M&O, safety projects, and system expansion strategies, and will more effectively integrate M&O strategies into all types of investments. The ultimate benefit of the approach is the improvement in regional transportation system performance that is realized when jurisdictions and agencies work together toward commonly held operations objectives.

Benefits of the Approach to Operators

The use of an objectives-driven, performance-based approach for integrating operations into the MTP has multiple benefits for operating agencies that participate in the approach. The approach is intended to be conducted as a collaborative effort between planners at the MPO and operators in the region. Through the use of the approach, operators have an established, formal mechanism for elevating their needs and interests in the development of the operations objectives. By working to incorporate operations into the plan, operations needs and the benefits of M&O strategies receive more attention and perhaps more funding on a regional level. This approach also helps to create greater awareness among operating agencies of data or other technical resources available from the MPO.

The approach helps to advance and strengthen the collaboration among operators, and in turn, the collaboration brings tangible benefits to the participating agencies working toward the operations objectives. Collaborating agencies can benefit through acquiring and applying resources more efficiently: sharing critical skills, negotiating favorable terms in joint purchasing decisions, sharing facilities, developing standards for materials and supplies that allow resource sharing, etc. They can also establish common procedures and practices and share information so that they perform key functions more effectively and in ways that are seamless from the perspective of system users. Through collaboration, agencies can reduce duplication in service or combine project needs and submit a joint application for funding.

Support for the Approach in Private and Public Organizations

An objectives-driven, performance-based approach for improving operations is well-supported in practice in self-sustaining private and public organizations that are responsible for generating sufficient revenue to meet cost and/or produce profit through delivery of services in a competitive or service-driven context. For example, package delivery companies such as FedEx collect data, monitor key

performance measures, and make adjustments on a daily basis. This focus on performance targets and measures has contributed to increased service quality and customer satisfaction.

In an effort to spur progress toward their ultimate target of 100 percent customer satisfaction, FedEx developed a 12-component index, known as the Service Quality Indicator (SQI). Each item in the SQI is weighted to reflect how significantly it affects overall customer satisfaction. Management meets daily to discuss the previous day's performance, and weekly, monthly, and annual trends are tracked. Since being put in place in the late 1980s, the SQI enabled FedEx to increase its on-time delivery performance from 95 percent to 99.7 percent in 2003 without significantly increasing costs.⁸

Austin Energy, a community-owned electric utility located in Austin, Texas also makes extensive use of objectives and performance measures to monitor and improve its power production and delivery to approximately 400,000 customers.⁹ Austin Energy has adopted three overarching strategies to maintain a successful organization: a risk management strategy, an excellent customer service strategy, and an energy resource strategy. In support of these strategies, Austin Energy developed five strategic objectives. Each objective is tracked using one of more performance measures and associated performance targets. Austin Energy measures system reliability with six reliability performance measures that focus on the duration and frequency of power outages, transmission faults or sags, and the availability of power.¹⁰

The Electric Service Delivery business area of Austin Energy developed a set of key performance indicators aligned with the organization-wide objectives. The performance indicators are divided into three tiers: strategic, operational, and support. The strategic, operational, and support key performance indicators are used by executives, managers, and supervisors of day-to-day operations respectively

to manage and improve quality. The first-tier performance measures are reported regularly to the community as part of the overall organization's performance measures through the Austin Energy website, bulletin boards, and newsletter. The Austin Energy Electric Service Delivery business area management meets every 6 months to evaluate the effectiveness of the quality management system. Several benefits have been realized by the Electric Service Delivery area because of its quality improvement effort including improvements in: communications and collaboration between operational work groups, the documentation of issues as they occur, identification of root causes, and action plans developed and carried out to address these issues.

Similarly, the Illinois Tollway has worked to measure, monitor, and improve its performance.¹¹ The Tollway focuses its efforts on four key operations areas: overall traffic operations, toll collection, incident response, and construction work zone management. It operates 286 miles of highway and serves approximately 1.4 million customers a day. Since the early 2000s, the Tollway's management has focused on measuring how the system is operating and performing (e.g., where it is experiencing backups, where it typically has slow downs, and what the travel times are). Performance measures include traffic volume, speed, travel time, and length of backup. Key performance measures for incident response include detection, response, and clearance times. The Tollway also audits and monitors tow activity to manage the towers' operations closely. The Tollway's management produces quarterly reports for the Governor's office regarding non-recurrent congestion. These reports provide timely, measurable results regarding overall improvements based on the performance measures in place.

Additional details and potential lessons from the use of operations objectives and performance measures in financially self-sustaining public and private organizations can be found in Appendix D.

⁸ Morris, D.D. and R.J. Baker, "Measuring what matters: [want to know how successful your firm is? Take the customer's point of view]," August 2003. Available at: http://findarticles.com/p/articles/mi_m0lCC/is_2_72/ai_107755417, last accessed July 9, 2009.

⁹ Telephone Interview with Mercedes Sanchez, Austin Energy. December 3, 2009.

¹⁰ Austin Energy, *Strategic Plan Update, 2008*. Available at: http://www.austinenenergy.com/About%20Us/Newsroom/Strategic%20Plan/strategicPlanningUpdate_2008.pdf, last accessed December 31, 2009.

¹¹ Telephone Interview with John L. Benda, General Manager of Maintenance & Traffic, Illinois Tollway. March 2009.

2.2 The Approach

Overview of the New Approach

An objectives-driven, performance-based approach to planning for operations involves the development of operations objectives for a region, which inform the way in which transportation investments are determined as part of the MTP, as shown in Figure 4. This approach can be used to address a full range of operations issues, such as traffic congestion, transit operations, emergency response, and integration of transportation services, among others. In areas subject to the Federal requirement, the CMP encompasses this approach with a focus on congestion.

The development of a **regional vision and goals** arises from a thoughtful and deliberate regional process that takes into account the eight planning factors. The regional vision and goals are the agreed-upon statements of the overall aims of the regional transportation plan and define the desired end-state.

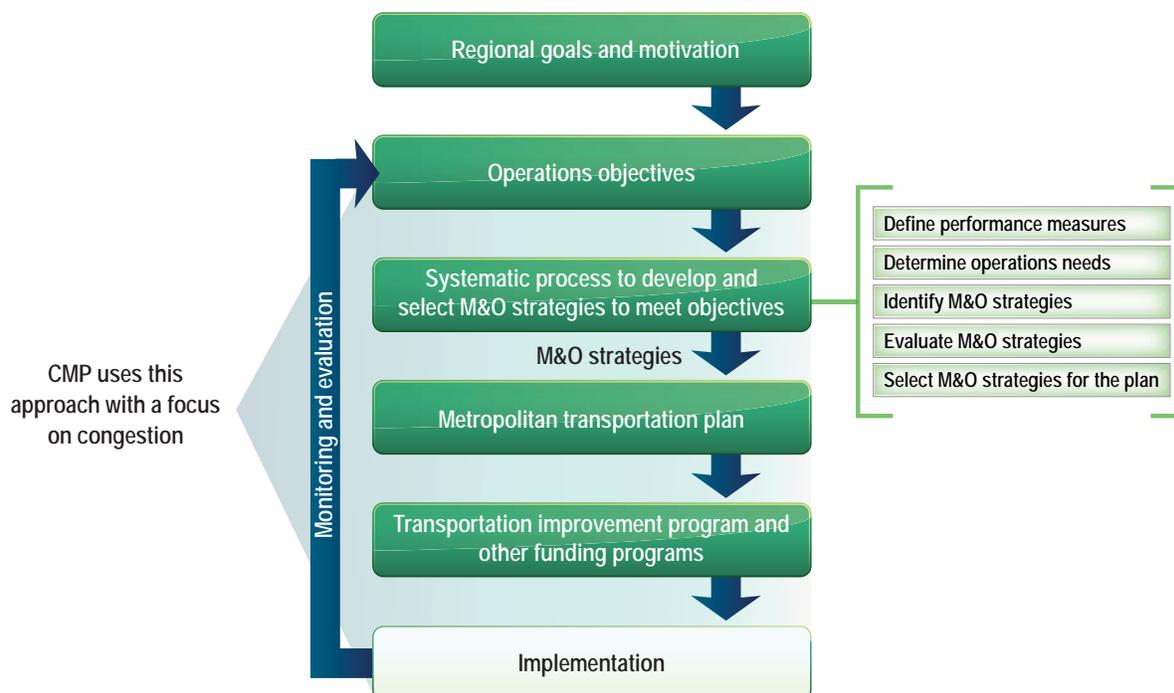
Operations objectives in the MTP flow directly from the goals. These objectives are measurable and define desired outcomes that help to achieve the goals. Operations objectives are defined for a region rather than a single jurisdiction and often include

multiple modes. They are developed through coordination and collaboration with operating agencies and play a central role in the planning process. In the congestion management process, objectives specific to congestion management would be developed.

The operations objectives lead to a **systematic process to develop and select M&O strategies to meet objectives**. In this process, performance measures are defined that will be used to assess current operational performance needs, progress toward the operations objectives, and the effectiveness of M&O strategies.

Identifying the operational performance issues in the region that must be addressed to reach the region's objectives is a crucial element in planning for operations improvements. This involves examining current system performance and operations practices to answer the question of what needs to change to reach the objectives. This step typically requires collecting data and determining the cause and extent of system performance issues. During this process, operations objectives and associated performance measures may be tailored to regional needs, availability of data, opportunities for coordination and collaboration, and existing performance measures used by agencies in the region.

Figure 4. An Objectives-Driven, Performance-Based Approach to Planning for Operations



Next, M&O strategies are identified to meet regional operations objectives. This is best accomplished through collaboration between planners and operators. Planners may often be able to supply data on where current and future mobility issues will arise, and operators can give input on the operations strategies that they think would be best to implement. M&O strategies involve a variety of activities including expanding current operations services such as freeway service patrols, adopting a best practice from another region, developing mutual aid agreements, or implementing a new system such as a common video-sharing system between traffic management centers (TMC).

Once M&O strategies are identified and proposed, the next step is typically to evaluate the effectiveness of these strategies in addressing the regional need. There are several analysis tools available for use in evaluating the effectiveness of operational improvements. M&O strategies are then selected within fiscal constraints for inclusion in the MTP.

In the context of the CMP, the systematic process described above is focused on objectives for managing congestion rather than a broader set of operations objectives. Additionally, the systematic process as performed in the CMP leads to the consideration of M&O strategies as well as other types of strategies, such as growth management or increasing system capacity, that address congestion. The CMP includes establishment of a coordinated program for data collection and system performance monitoring, identification and evaluation of the expected benefits of appropriate congestion management strategies, and development of an implementation schedule and possible funding sources for each strategy.

The result of this approach is an **MTP** with a 20+ year outlook that includes operations objectives, performance measures, and a mix of M&O strategies and capital investments. Additionally, the TIP with a near-term focus includes specific M&O programs and projects arising from the plan. Planned and programmed investments are then implemented.

Key Role of Transit and Other Operating Agencies in Advancing the Approach at the MPO:

- Contribute to decisions at the MPO and State level regarding investment priorities, land use, and economic development.
- Participate in developing regional operations objectives.
- Provide operations data to planning partners.
- Recommend transit-based strategies for improving regional transportation system performance.
- Implement performance-based objectives in planning processes.
- Collaborate with other transportation operators in regional operations efforts.

Monitoring and evaluation of the transportation system then feeds back into the update of the regional vision, goals, and objectives in the next cycle of developing the MTP. The CMP includes methods to monitor and evaluate the performance of the multimodal transportation system and a process for periodic assessment of the effectiveness of implemented strategies.

2.3 Relationship to the Congestion Management Process

As described in the section above, the CMP is intended to be directly integrated into the metropolitan transportation planning process and is an example of the objectives-driven, performance-based approach to planning for operations with a focus on congestion. Although M&O strategies address a wide range of issues, many aspects of operations relate directly to congestion and are identified as part of the CMP.

The Final Rule on Statewide and Metropolitan Transportation Planning (23 CFR Part 450, Sec 320) clearly makes the connection between M&O strategies and the CMP, stating (underlining added for emphasis):

“(a) The transportation planning process in a TMA shall address congestion management through a process that provides for safe and effective integrated management and operation of the multimodal transportation system, based on a cooperatively developed and implemented metropolitan-wide strategy, of new and existing transportation facilities eligible for funding under title 23 U.S.C. and title 49 U.S.C. Chapter 53 through the use of travel demand reduction and operational management strategies.”

“(b) The development of a congestion management process should result in multimodal system performance measures and strategies that can be reflected in the metropolitan transportation plan and the TIP. The level of system performance deemed acceptable by State and local transportation officials may vary by type of transportation facility, geographic location (metropolitan area or subarea), and/or time of day. In addition, consideration should be given to strategies that manage demand, reduce single occupant vehicle (SOV) travel, and improve transportation system management and operations. Where the addition of general purpose lanes is determined to be an appropriate congestion management strategy, explicit consideration is to be given to the incorporation of appropriate features into the SOV project to facilitate future demand management strategies and operational improvements that will maintain the functional integrity and safety of those lanes.”

“(c) The congestion management process shall be developed, established, and implemented as part of the metropolitan transportation planning process that includes coordination with transportation system management and operations activities.”¹²

Although not all MPOs are required to implement a CMP, the CMP is associated with each step in the approach described above. Specific CMP requirements include:¹³

- Definition of objectives for congestion management.
- Definition of appropriate performance measures to assess the extent of congestion and support the evaluation of the effectiveness of congestion reduction and mobility enhancement strategies.
- Methods to monitor and evaluate the performance of the multimodal transportation system, including a coordinated program for data collection and system performance monitoring to define the extent and duration of congestion and contribute to identifying the causes of congestion.
- Identification and evaluation of the anticipated performance and expected benefits of appropriate congestion management strategies that will contribute to the more effective use and improved safety of existing and future transportation systems based on the established performance measures.
- Identification of an implementation schedule, implementation responsibilities, and possible funding sources for each strategy (or combination of strategies) proposed for implementation.
- Implementation of a process for periodic assessment of the effectiveness of implemented strategies in terms of the area’s established performance measures.

¹² Federal Register: February 14, 2007 (Volume 72, Number 30), “Statewide Transportation Planning; Metropolitan Transportation Planning; Final Rule.” Available at: <http://edocket.access.gpo.gov/2007/07-493.htm>, last accessed December 6, 2009.

¹³ Adapted from the “Statewide Transportation Planning; Metropolitan Transportation Planning; Final Rule” (23 CFR Part 450, Sec 320). See Appendix A for complete language.

3.0 DEVELOPING OPERATIONS GOALS & OBJECTIVES

3.1 Develop Operations Goals

An important first step to integrating M&O in the MTP is to establish goals that focus on the efficient management and operation of the transportation system. A goal is a broad statement that describes a desired end state. In the metropolitan transportation planning process, goals stem from the values inherent in the region’s vision.

The MTP may identify an overarching M&O goal. For example:

- “Multi-modal transportation infrastructure and services are well-managed and optimized to improve travel conditions and operations, and maximize the multi-modal capacity and operating performance of existing and future transportation infrastructure and services.”
— Final Draft, *2035 Regional Transportation Plan*, Metro Regional Government (Portland, Oregon).

Alternatively, the MTP may identify a set of M&O goals that are broad, but address different aspects of transportation systems management and operations, such as transportation system reliability, efficiency, quality of service, and travel options. Examples include:

- “The urbanized area transportation system will become more time and cost efficient during the 20 year planning horizon.” – *Long-Range Transportation Plan 2025*, Champaign County Regional Planning Commission.
- “Efficient Freight Travel” – *Transportation 2035: Change in Motion*, Metropolitan Transportation Commission (San Francisco Bay Area).
- “Provide options for safe access and expanded mobility choices in a cost-effective manner in the region.” – *Communities in Motion 2030 Plan*, Community Planning Association of Southwest Idaho (COMPASS).



- “Reduce congestion by making the transportation infrastructure more efficient, instituting transportation demand management strategies and providing alternatives to the single-occupant vehicle.” – *Destination 2030 – The Long Range Plan for the Delaware Valley*, Delaware Valley Regional Planning Commission.
- “Improve the reliability and safety of the transportation system.” – *2030 San Diego Regional Transportation Plan: Pathways for the Future*, San Diego Association of Governments.

The MTP also may identify a wide range of other goals relating to issues such as improving transportation safety, security, and environment. These goals also may lead to the development of M&O strategies.

3.2 Develop Operations Objectives

Operations objectives are critical components of creating an objectives-driven, performance-based approach to integrating M&O in the MTP. They are contained in the MTP and guide the discussion about operations in the region. Whereas goals relate to the “big picture” or desired end-result, operations objectives are specific and measurable. Unlike goals, progress toward an operations objective and its achievement can be evaluated with performance measures.

In the context of the MTP, operations objectives typically come from the goals defined during the trans-

portation planning process and are regional in nature. They describe what needs to occur to accomplish a regional goal. The operations objectives state what a region plans to achieve concerning the operational performance of the transportation system and help to determine what strategies and investments to include in the MTP. Operations objectives typically place a focus on issues of congestion, reliability, safety and security, incident management, and work zone management, among other issues.

While operations objectives typically stem from goals in the metropolitan transportation planning process, operations objectives also may be formed in response to motivations that are identified outside of the transportation planning process. For example, a natural or man-made disaster, a significant weather event, or a major incident may create public attention that causes elected officials to focus on incident management or emergency response. A major sporting event or a large public works project could focus attention on special events and work zone management. These motivations might lead to the development of operations objectives that can be included in the MTP.

In areas subject to CMP requirements, the MPO should develop operations objectives that address congestion.¹⁴ Like other operations objectives, congestion mitigation objectives also are incorporated into the MTP and serve as the basis for the congestion management process.

SMART Characteristics of Operations Objectives

Operations objectives are specific, measurable statements developed in collaboration with a broad range of regional partners. They are regional or multi-jurisdictional in nature. Operations objectives generally lead directly to a measure of performance that can be used to assess whether or not the objective has subsequently been achieved.

An operations objective should have “SMART” characteristics as defined here:

- **Specific** – The objective provides sufficient specificity to guide formulation of viable approaches to achieving the objective without dictating the approach.

Is your objective SMART?

- Specific** – is the desired outcome clearly written?
- Measurable** – can it be measured quantitatively and evaluated?
- Agreed** – was there consensus among partners?
- Realistic** – can it reasonably be accomplished?
- Time-Bound** – did you set a timeframe to complete performance?

- **Measurable** – The objective facilitates quantitative evaluation, saying how many or how much should be accomplished. Tracking progress against the objective enables an assessment of effectiveness of actions.
- **Agreed** – Planners, operators, and relevant planning participants come to a consensus on a common objective. This is most effective when the planning process involves a wide range of stakeholders to facilitate regional collaboration and coordination.
- **Realistic** – The objective can reasonably be accomplished within the limitations of resources and other demands. The objective may require substantial coordination, collaboration, and investment to achieve. Factors such as land use may also have an impact on the feasibility of the objective and should be taken into account. Because how realistic the objective is cannot be fully evaluated until after strategies and approaches are defined, the objective may need to be adjusted to be achievable.
- **Time-Bound** – The objective identifies a timeframe within which it will be achieved (e.g., “by 2012”).

Specifically, an operations objective identifies targets regarding a particular aspect of regional transportation system performance, such as traffic congestion, reliability, emergency response time, or incident response. By developing SMART operations objectives, system performance can be examined and monitored over time.

¹⁴ Metropolitan Transportation Planning Regulations (23 CFR Part 450.320 c) specify that the “congestion management process shall include...congestion management objectives and appropriate performance measures.”

Examples of Operations Objectives

Operations objectives are developed in the context of recognizing existing conditions and what is realistically possible for the region to achieve; therefore, the specifics of operations objectives will vary widely across MPOs of different sizes and characteristics.

There is likely to be a wide range of operations objectives to address a goal or specific operational issues. This may be because of the different measures of performance available in that operations area. There also may be a wide range of objectives for any given goal because each region will have its own set of performance issues that must be addressed to reach its operations goal. In developing operations objectives that bring a region closer to its goal, planners and operators must examine what needs to be improved. For instance, a goal of “improved transportation system reliability” could lead to many possible operations objectives depending on what will contribute to a reliable system for that region:

- By 2020, reduce the variability in travel time on freeways and major arteries in the region such that 95 percent of trips (19 out of 20) have travel times no more than 1.5 times the average travel time for a specific time of day.
- By 2015, reduce the clearance time of traffic incidents on freeways and major arteries in the region from a current average of X minutes to an average of Y minutes.
- Throughout the timeframe of the plan, maintain an average time of no more than Z hours to clear all emergency snow routes and priority arterials.
- By 2015, decrease average annual traveler delay associated with road closures, major incidents, and weather-related conditions on interstate highways by 20 percent from 2000 levels.
- By 2015, at least 90 percent of transit buses will arrive within no more than 5 minutes of scheduled time.
- By 2015, access to real-time information on bus arrival times will be provided for all bus routes of all major transit providers within the region.

Alternatively the goal to “improve transportation system performance through effective management

Achieving Multiple Planning Goals:

Just as operations objectives help meet M&O goals, a similar approach could be used throughout the MTP for other goals, such as community goals, environmental goals, or safety goals. In this way, the entire plan becomes objectives-driven. For example: the goal, “Provide a safe transportation system,” could be supported by the following objectives:

- Reduce the number of fatalities on the highway system to X per 100,000 vehicle miles by 2025.
- Reduce the number of accidents in the transit system to Y per 1000 riders by 2025.
- Reduce the number of pedestrian fatalities to no more than Z per year by 2025.

of travel demand” could lead to one or more operations objectives focused on managing the demand for travel, such as:

- Reduce vehicle miles traveled per capita by X percent by 2015.
- Increase the percentage of major employers actively participating in transportation demand management programs by X percent within 5 years.
- Increase transit mode share by X percent by 2020.
- Increase the share of roadways with bicycle lanes to X by 2015.

In developing operations objectives, it is important to recognize – and to communicate to elected officials and the public – that conditions may be significantly worse without the implementation of new strategies or programs, particularly in regions where population is growing rapidly. Consequently, it may not be realistic to improve some aspects of system performance (e.g., reduce traveler delay) from existing levels. Even if a plan results in significant improvements over projected “baseline” conditions, it still may not show significant improvement over current conditions. In these cases, an objective might be to hold average traveler delay to no greater than 2007 levels by 2020, to improve the availability and accuracy of traveler information to a certain level so that travelers can make more informed travel choices, to optimize signal timing on major congested corridors, or another measure that is achievable and helps to achieve overall goals.

Table 2 illustrates the connection between operations issues or challenges in a region and the operations objectives developed in response to the issues. The table also includes performance measures that can be used to track progress toward the operations objectives.

3.3 Operations Objectives Are Scalable

While the concept of developing operations objectives is simple, its execution is often hampered by limitations in the data needed for performance measures and difficulty in agreeing upon the appropriate target or timeframe for achievement. Developing operations objectives requires data on baseline conditions and often requires information on historical conditions and forecasts of future conditions. Similarly, objectives within the CMP should be informed by available information on existing congestion levels, an assessment of the causes of congestion, and information on forecasted future congestion levels.

The costs and extent of data collection and analysis needed to develop operations objectives will depend on many factors, including the size of the metropolitan area, the staffing and data available to the MPO, the extent of traffic congestion, and the degree to which regional goals focus on improving the operation of the transportation system. In particular, small MPOs often are somewhat constrained in their access to system performance data and limited staff resources. Large MPOs may have more extensive data collection resources, but they often are challenged by the wide range of transportation system operators, jurisdictions, and stakeholders involved. These challenges can make it difficult to develop consensus on an appropriate system-level performance objective.

Fortunately, the concept of operations objectives is a scalable one. As a region's use of the approach grows over time, specific objectives can be added, revisited, and refined. Initially, planners and operators should identify which objectives to include in the plan based on regional goals, select those that can be implemented in the near-term, and build on initial efforts by refining and expanding the range of objectives used over time.

Table 2: Operations Objectives Motivated by Significant Issues in the Region

Operations Issue in Region	Operations Objective	Performance Measure
Heavy reliance on trips made by single-occupancy vehicles in the region contributing to congestion and air quality issues.	Increase non SOV mode share for all trips by X percent within the next Y years.	Share of trips by each mode of travel.
Significant levels of delay at border crossings negatively impacting businesses in the region and freight carriers.	Decrease average crossing times at international borders by X minutes for each border crossing in region over Y years.	Average border crossing time for freight at international borders per year.
Snow, ice, and wind storms frequently cause severe delays, stranded vehicles, and traffic accidents.	Reduce time to alert travelers of weather impacts on travel using [variable message signs, 511, Road Weather Information Systems, public information broadcasts etc.] by X (time period or percent) in Y years.	Time between the beginning of weather event and posting of traveler information on (select from among variable message signs, 511, Road Weather Information Systems, public information broadcasts, etc.).
Incidents on the roads and rails cause significant travel delays that have the potential to be reduced through improvements in incident management.	Reduce mean incident clearance time per incident by X percent in Y years. (Defined as the time between awareness of an incident and the time the last responder has left the scene.)	Mean incident clearance time per incident.
Traffic signal timing in the region is performed sporadically and there is delay on arterials due to poorly timed signals.	Retime X percent of traffic signals every Y years.	Percent of traffic signals retimed every Y years.

Use Outcome- and Activity-Based Objectives

Given that the fundamental purpose of M&O improvements is to improve transportation system performance, operations objectives are preferably described in terms of those system performance outcomes as experienced by users. Objectives focused on outcomes to the user include travel times, travel time reliability, and access to traveler information. The public cares about these measures, and in many regions, data may be available to develop specific outcome-based operations objectives.

In cases where developing outcome-based objectives is difficult, agencies may develop operations objectives that are activity-based and support desired system performance outcomes. For example, it may not be possible for a region to develop a specific objective related to incident-based delay experienced by travelers if data is unavailable for this type of delay. However, the region may be able to develop an objective that relates to incident response time, which may be more easily established and measured.

Other examples of activity-based objectives include the percentage of traffic signals re-timed, the number of variable message signs deployed, and the share of bus stops with real-time transit information. Although these objectives are not as ideal as outcome-based objectives for inclusion in the MTP since they tend to focus on specific strategies or approaches, they may serve as interim objectives until more outcome-based objectives can be established and measured. Working together to develop the objectives themselves may help to elevate M&O discussions among planners and operators and lead to initiatives to collect additional data.

Start with a Limited Number of Objectives

It is recommended for agencies to start simple when developing operations objectives. Agencies should build on the existing data they have and the conditions with which they are familiar. Rather than developing dozens of operations objectives, a region could start with a limited number of objectives and performance measures for which data already exists and build on the objectives over time as data become more available or performance trends become clearer.

Add Targets over Time

Even when stakeholders agree on the performance measure(s) and have access to data for tracking performance, it may be difficult for agencies to agree on an appropriate target to reach within a specific timeframe. In these cases, it is recommended to start with an operations objective that does not include a specific time-bound target, and add a target in the future after additional performance tracking has occurred.

An initial operations objective might be worded simply, showing the direction of effects that are desired. For example, simple objectives might be to “reduce clearance time for incidents” or “improve transit on-time performance.” These objectives lead to performance measures that can be tracked over time and reported. In the future, after additional data are collected, it may be possible to revisit these objectives to develop more specific, time-bound targets. For example, “reduce average incident clearance time to X by 2015,” or “improve transit on-time performance to Y by 2020.”

4.0 DEVELOPING PERFORMANCE MEASURES, ASSESSING NEEDS, AND SELECTING STRATEGIES

4.1 Operations Objectives Lead to Performance Measures

Developing operations objectives is a precursor to the systematic process to identify and select strategies to include in the MTP and corresponding TIP. Developing operations objectives leads to establishing performance measures that can be used to assess and track regional system performance. By establishing specific and measurable performance outcomes, operations objectives also can lead to the development of performance measures that are used at a lower level, for instance, to analyze performance of corridors, road segments, intersections, or transit routes. Collecting and analyzing data on performance, and forecasting future conditions, can then be used to identify and pinpoint areas of deficiencies, which in turn can help to determine the most appropriate strategies to achieve the operations objectives. An example of how operations objectives are applied throughout the planning process is illustrated in Table 3 on the following page.

For TMAs, the CMP uses this systematic process in developing performance measures, collecting data, identifying and analyzing congestion problems and deficiencies, and developing strategies and projects. This is followed by monitoring and evaluation that cycles back to refining and re-examining congestion objectives. Even in metropolitan areas that are not required to implement a CMP, this systematic process is valuable as operations objectives related to congestion are considered in the decisionmaking process.

4.2 Develop Performance Measures

Performance measures are indicators of how well the transportation system is performing and are inextricably tied to operations objectives. A range of performance measures may come from developing operations objectives. The performance measures selected should provide adequate information to planners, operators, and decisionmakers on progress toward achieving their operations objectives.



However, this is an iterative process as operations objectives may be refined once performance measures are developed and baseline data has been collected.

Performance measures should be developed based on the individual needs and resources of each agency. For example, transit agencies typically use a number of measures that are of interest to their customers, such as on-time performance, average passenger load, and total ridership. An MPO uses measures of mobility such as facility level-of-service, travel time, and travel delay. These performance measures help planners focus on the day-to-day experience for their users. This provides important balance in settings where planners have focused exclusively on long-term development of the network. With greater focus on the day-to-day characteristics of the system, planners appreciate the issues faced by system operators. The result is that mid- and long-term planning now reflect greater consideration of operations and the associated investment needs.

Examples of Performance Measures

Performance measures may be used either at a system-wide scale or at a corridor or transportation facility level in order to determine where deficiencies exist and to prioritize strategies and funding to the most critical problems. For instance, by identifying locations with the greatest recurrent and non-recurrent traffic congestion using performance measures

Table 3: Example of Operations Objectives Applied in the Planning Process

Planning Process Stage	Examples			
<p>Goal(s): Broadly describe what the region wants to accomplish, focused on outcomes.</p>	Improved transportation system reliability and reduced unexpected traveler delay.			
<p>Operations Objectives: Specific, measurable statements relating to the attainment of goals.</p>	Reduce incident-based delay so that by 2015, travelers experience no more than X hours of delay per year.	Reduce traveler delay associated with work zones, weather conditions, and special events so that average buffer time is reduced by X minutes over the next Y years.	Increase awareness of traveler information by X percent to businesses and the public by 2016.	Improve transit system reliability so that by 2020, at least X percent of buses are on schedule.
<p>Performance Measures: Metric used on a regional basis to track system-wide performance (used in developing a regional objective), or at a corridor, roadway, or intersection level to identify specific deficiencies within the system to address.</p>	Person hours of delay due to incidents.	Total vehicle hours of delay associated with work zones, weather conditions, and special events. Buffer time (additional time to ensure travelers arrive at destination by intended time 95 percent of the time).	Public awareness of traveler information (through surveys).	Percentage of buses more than 5 minutes off schedule.
<p>Strategies: Approaches to achieve objectives. Includes system preservation, safety projects, management and operations, capacity expansion.</p>	Traffic cameras and detection systems to identify incidents more quickly. Roving incident response teams.	Work zone information campaign. Variable message signs (VMS) to alert about alternative routes.	Traveler alert system. 511 Traveler Information System. Electronic real-time “next bus” information at bus stops.	Increased rail inspections and maintenance. GPS systems to track transit buses.
<p>Projects/ Implementation: Initiatives identified to carry out strategies.</p>	Install traffic cameras on Route X (2009). Install variable message signs on Route X (2013). Implement incident clearance teams on route X (2012).	Implement regional electronic notification system (2015). Install VMS along key corridors (2013).	Design and implement regional 511 system (2015). Install “next bus” signage at selected bus stops (2011).	Install GPS locator system for bus system (2016). Install “Next Train” signage (2011). Provide integrated train departure/ arrival schedule for connecting buses.

in the CMP, an MPO can help to target funding toward facilities with the greatest congestion problems and the greatest opportunities to reach operations objectives for congestion management.

Examples of M&O performance measures include:¹⁵

- **Travel Time:** Travel time measures focus on the time needed to travel along a selected portion of the transportation system, and can be applied for specific roadways, corridors, transit lines, or at a regional level. Common travel time metrics include:
 - Average travel time, which can be measured based on travel time surveys.
 - Average travel speeds, which can be calculated based on travel time divided by segment length or measured based on real-time information collection.
 - Travel time index: the ratio of peak to non-peak travel time, which provides a measure of congestion.
- **Congestion Extent:** Congestion measures can address both the spatial and temporal extent (duration). Depending on how these measures are defined and data are collected, these measures may focus on recurring congestion or address both recurring and non-recurring congestion. Examples include:

New Jersey Transportation Planning Authority:

The NJTPA selected a reliability index that compares non-recurring delay to total delay. NJTPA uses a special post-processing module to its travel demand model to help produce this measurement.

See:

<http://www.njtpa.org/>.

Massachusetts Bay Transportation Authority:

The MBTA measures peak-period passenger crowding and on-time performance by transit line. Using data collected on the regional transit system, the Boston MPO reports number of passengers per seat on transit lines in the peak period as well as the percentage of trips operating within 5 minutes of scheduled times.

See:

<http://www.ctps.org/bostonmpo/index.html>.

- Lane miles of congested conditions (defined based on volume to capacity (V/C) ratio, level of service (LOS) measures, or travel time index).
 - Number of intersections experiencing congestion (based on LOS).
 - Percent of roadways congested by type or roadway (e.g., freeway, arterial, collector).
 - Average hours of congestion per day.
 - Share of peak period transit services experiencing overcrowding.
- **Delay:** Delay measures take into account the amount of time that it takes to travel in excess of travel under unconstrained (ideal or free-flow) operating conditions, and the number of vehicles affected. These measures provide an indication of how problematic traffic congestion is, and can address both recurring and non-recurring congestion-related delay. Examples of delay measures include:
 - Vehicle-hours of recurring delay associated with population and employment growth.
 - Vehicle-hours of nonrecurring delay associated with incidents, work zones, weather conditions, special events, etc.
- **Incident Occurrence/Duration:** Incident duration is a measure of the time elapsed from the notification of an incident until the incident has been removed or response vehicles have left the incident scene. This measure can be used to assess the performance of service patrols and incident management systems. Incident occurrence also can be used to assess the performance and reliability of transit services. Example measures include:
 - Median minutes from time of incident until incident has been removed from scene.
 - Number of transit bus breakdowns.
 - Average number of transit rail system delays in excess of X minutes.

¹⁵ National Transportation Operations Coalition, *Performance Measurement Initiative – Final Report*, July 2005. Available at: http://www.ntoctalks.com/ntoc/ntoc_final_report.pdf, last accessed December 6, 2009.

- **Travel Time Reliability:**¹⁶ Travel time reliability measures take into account the variation in travel times that occur on roadways and across the system. Examples of measures include:
 - Buffer time, which describes the additional time that must be added to a trip to ensure that travelers will arrive at their destination at, or before, the intended time 95 percent of the time.
 - Buffer time index, which represents the percent of time that should be budgeted on top of average travel time to arrive on time 95 percent of the time (e.g., a buffer index of 40 percent means that for a trip that usually takes 20 minutes, a traveler should budget an additional 8 minutes to ensure on-time arrival most of the time).
 - Percentage of travel when travel time is X percent (e.g., 20 percent) greater than average travel time.
 - Planning time index, defined as the 95th percentile travel time index.
 - 90th or 95th percentile travel times for specific travel routes or trips, which indicates how bad delay will be on the heaviest travel days.
 - Percentage of weekdays each month that average travel speed of designated facilities fall more than X MPH below posted speed limit during peak periods.
- **Travel Demand Management (TDM):**¹⁷ Travel demand management measures examine demand on the system as well as the impact of strategies to manage that demand. Measures of travel demand and the impact of TDM programs include:
 - Awareness – Portion of potential program participants aware of a TDM program.
 - Utilization – Number or percentage of individuals using a TDM service or alternate mode.
 - Mode split – Proportion of total person trips that uses each mode of transportation.
 - Vehicle Trips or Peak Period Vehicle Trips – The total number of private vehicles arriving at a destination.
- **Person Throughput:** Examines the number of people that are moved on a roadway or transit system. Efforts to improve this measure can be reflected in efforts to improve the flow of traffic, increase high occupancy vehicle movement, or increase transit seat occupancy on transit. Example measures include:
 - Peak hour persons moved per lane.
 - Peak hour persons moved on transit services.
- **Customer Satisfaction:** Examines public perceptions about the quality of the travel experience, including the efficiency of system M&O. Customer satisfaction is typically measured through surveys and may include measures such as:
 - Percent of the population reporting being satisfied or highly satisfied with travel conditions.
 - Percent of the population reporting being satisfied or highly satisfied with access to traveler information.
 - Percent of the population reporting being satisfied or highly satisfied with the reliability of transit services.
- **Availability of or Awareness of Information:** These measures focus on public knowledge of travel alternatives or traveler information.

¹⁶ Federal Highway Administration, Office of Operations, "Travel Time Reliability Measures – Operations Performance Measurement." Available at: http://ops.fhwa.dot.gov/perf_measurement/reliability_measures/index.htm, last accessed December 6, 2009.

¹⁷ Victoria Transport Policy Institute, *TDM Encyclopedia*, Performance Evaluation Practical Indicators For Evaluating Progress Toward Planning Objectives at <http://www.vtpi.org/tdm/tdm131.htm> and Eric Schreffler (2000), "State of the Practice: Mobility Management Monitoring and Evaluation in the United States, MOST: Mobility Management Strategies for the Next Decades"; Work Package 3, D3 Report, Appendix C.

Defining and Measuring Congestion in the CMP

In areas that implement a CMP, the CMP must define the appropriate performance measures for congestion. How congestion is defined may differ across regions and may relate back to regional visions and goals articulated in the MTP, based on public input.

Many CMPs have relied on volume-to-capacity (V/C) ratios as the measure of congestion. This simple measure is relatively easy to define and to collect data and model future performance. However, some transportation agencies are beginning to use more customer-oriented measures, such as travel time measures, which are easier to understand and communicate to the public. Based on congestion problems in a region, a wide range of measures of congestion may be used, addressing:

- Scope (total delay time experienced by travelers).
- Extent (amount of lane miles experience congestion).
- Duration (hours of congestion per day).
- Intensity (level of service) of congestion.
- Sources of congestion (recurring and non-recurring) and other considerations.

Moreover, if a region's goals and objectives look to improve accessibility and personal mobility, then measuring congestion based solely on vehicle counts may not be the most effective choice for that region. Instead, a region may wish to include other measures that relate to alternatives to driving alone and transportation options in their CMP. These alternatives may include such elements as average vehicle occupancies, person-throughput, or transit mode share. Some regions measure travel conditions for transit, biking, and walking, including whether those modes are available, how much the modes are used, and how the modes perform regarding the traveler experience within their CMP.

Recognizing that the public often finds unexpected delay most aggravating, some MPOs are incorporating performance measures relating to system

Maricopa Performance Measure Framework and CMP Update:

The Maricopa Association of Governments (MAG) recently launched a study to develop a performance measurement framework and a congestion management process update for evaluating future planning and programming activities.

The three-phase study is being conducted in conjunction with a technical advisory group formed from MAG's member agencies, Arizona DOT, and local FHWA representatives. The idea for developing a common process to assess and evaluate projects was based on integrating the regional transportation plan and congestion management goals and objectives.

Following the development of the performance measurement framework and monitoring program, the study will move into its third phase of determining how CMP strategies should be developed based on congestion mitigation outcome measures and effective congestion management techniques.

See:

<http://www.mag.maricopa.gov/division.cms?item=64>.

reliability, incidents, and non-recurrent delay into their CMPs. In selecting congestion performance measures and other operations-related performance measures, agencies should consider the following:

- Ability of the set of measures to track performance for the region overall, the corridors, and for individual transportation facilities.
- Ability of the agency to collect data to track the measure.
- Ability of the measure to relate the data to traveler perceptions in an easily understood way.
- Incorporation of safety-related measures given the role of traffic incidents in non-recurring congestion.
- Opportunities for addressing different aspects of congestion that are important to users of the transportation system, such as non-recurring traffic congestion, impacts of congestion on freight movement, and the availability of alternatives to avoid traffic congestion (e.g., transit, bicycle, and pedestrian options).

4.3 Use Performance Measures to Determine Operational Needs

Identifying Specific Deficiencies and Needs

Operations objectives may lead to the development of not only regional performance measures, but also local performance measures, which may be used for specific local geographic areas or facilities to assess system performance. For instance, in the CMP, a region must define what it means to have unacceptable congestion. Different thresholds can be used to define unacceptable congestion based on location, facility type, and time period, recognizing that the public may find different levels of congestion acceptable for different circumstances.

For example, slower speeds are often expected in a central business district than in a more suburban or rural area. Differentiating between location types recognizes that eradicating congestion may not be the sole community goal in all areas. Higher levels of traffic congestion may be acceptable in downtown areas where there is available transit service and quality pedestrian environments. Operations objectives targeting this congestion would, therefore, be different from objectives addressing congestion in the suburban and rural areas. Once performance measures are established for different types of roadways, these measures can be used at a local scale to identify the areas with the greatest congestion problems and target strategies and investments for these areas to maximize the investment's value.

For instance, as part of its CMP, the Capital Area Metropolitan Planning Organization (CAMPO) in Austin, Texas, utilizes travel-speed-related measures to identify congested locations. For roadway segments, CAMPO has defined minimum threshold acceptable speeds, based on the type of road and the type of area through which that road travels, with lower speeds more acceptable in a central business district location than in a rural area.

The East-West Gateway Coordinating Council (EWGC) in St. Louis, Missouri, used aerial photography with multiple photographs taken during 3-hour a.m. and p.m. peak periods, producing traffic volume and density numbers for several time points at the

Using Data to Prioritize Congestion Relief:

The Capital District Transportation Commission (CDTC) uses operations performance data collected by New York State DOT (NYSDOT) to feed its congestion management process. Analyzing NYSDOT's operations performance data led CDTC to prioritize certain corridors for incident-related delay in its CMP. CDTC analyzed data for two major corridors in the region, Interstates 87 and 90. The agency found that recurring delay was not as severe as its regional demand model suggested, but incident-related delay was worse. Since previous public input suggested that travelers have less tolerance for incident-related delay compared to recurring delay, CDTC used the operations data it received from the State to prioritize managing incident-related delay in its CMP. CDTC also incorporated a measure of reliability into its CMP called the "Planning Time Index."

See:

<http://www.cdcmpo.org/>.

same location. This information allowed EWGC to track the duration of congestion along congested links, distinguishing links with prolonged congestion from those that are congested over short portions of the peak periods.¹⁸

A number of regions have developed systems to provide the public with real-time information on the condition of the transportation system (e.g., location and severity of delays, location and status of accidents, status of the transit network, weather-related traffic problems, and disruptions from special events). Much of this information can be evaluated to identify trends and current variation in system performance and to assess performance on specific sub-elements of the system. Agencies can examine ongoing system monitoring efforts as a starting place for a performance measurement program.

Determine Data Needs

Data is a prerequisite for the use of performance measures. MPOs often struggle between the desire to measure regional performance, data limitations, and cost considerations that place constraints on the extent to which performance measures can be used.

¹⁸ For more information, see East-West Gateway Council of Governments, "Transportation." Available at: <http://www.ewgateway.org/trans/transportation.htm>, last accessed December 6, 2009.

At the same time, a wealth of data is currently being collected in most regions by transportation system operators who run systems that keep track of real-time travel information. Intelligent Transportation Systems (ITS) components, in particular, such as toll tag readers and transponders, video detector systems, and traffic management systems used to provide travelers with real-time travel information, can be used to measure performance of the transportation system on an ongoing basis.

Examples of potential sources of data include:

- **ITS Data on Speeds/Reliability:** Operators of ITS equipment and traffic management centers (TMCs) rely on continuous collection of vehicle speed and volume data to make their systems work. These large and continuous data sets can provide a much more detailed picture of travel conditions than sampling procedures such as annual counts, if the time and effort are taken to archive them for congestion planning purposes.
- **Transit Operations Data:** Transit agencies may collect data on bus travel times, speeds, ridership, passenger loadings, and other factors.
- **GPS Technologies:** Data on travel times are collected in the field using global positioning system technology. Field surveyors drive “probe” vehicles to match traffic flow, recording digitally the time required for each segment of their travel time runs.
- **Other Electronic Data:** Examples include E-ZPass, Smart Cards, and other automated toll or transit fare collection services. In addition, cell phone location technologies are available. These technologies use cell phone data collected by phone companies along highway corridors to calculate travel speeds.

Central New Jersey Route 1 BRT:

With traffic volumes in the New Jersey corridor estimated to increase by 55 percent by 2020 and the lack of transit service availability, several 2006 BRT studies conducted by the New Jersey Transit Corporation (NJ TRANSIT), the Delaware Valley Regional Planning Commission, North Jersey Transportation Planning Authority, and the New Jersey DOT, estimated that a bus rapid transit (BRT) system in the corridor could reduce weekday auto person trips by 11,000 to 12,000. The BRT system would transport 31,200 person trips per weekday, and include several park and rides. The transit share of work trips would more than double present transit use, from 2 - 4 percent to 5 - 9 percent in the core study area. Potential BRT routes would be designed on an exclusive guideway, where possible, to create fast, direct travel from station to station, unhampered by traffic conditions on local roads. To establish this quick and reliable service, an alignment was created to directly connect to major activity centers and only allow access to BRT and supporting feeder route buses at transfer points. This would also separate the buses from auto congestion on U.S. Route 1. The BRT will be a shared right-of-way that numerous different bus routes will use coming from various feeder locations. Instead of one line going from one point to the next, which requires people to walk and use park & ride systems, the BRT will have more flexibility over the long term: different bus routes will provide service for various counties along U.S. Route 1 and travel to many key job center destinations without the need for riders to change buses.

See:

<http://www.dvrpc.org/LongRangePlan/CentralJerseyForum/brt.htm>.

4.4 Identify and Evaluate Strategies

Identifying Strategies

Identifying strategies to achieve operations objectives is best accomplished when transportation planners and system operators collaborate. Planners have access to data on current and future mobility concerns. Operators know best practices to implement based on their experience. When these two groups collaborate and share information, agencies are able to identify the most promising strategies to improve regional system performance.

M&O strategies may be implemented as individual programs or projects, such as a regional incident management system, traveler information system, or transit smart card system. These strategies also can be implemented as part of transportation preservation projects, safety projects, or capacity improvements. For instance, as part of any new highway expansion, it may be useful to consider the role of transportation pricing, high-occupancy vehicle (HOV) lanes, flexible design to accommodate concurrent flows of traffic, or demand management programs during the construction period.

Bringing operations stakeholders to the table with a focus on M&O in the planning process can help to identify strategies that are already being implemented or considered by operating agencies but which may have never before appeared in the MTP.

Congestion management strategies include many M&O strategies, and also may include land use strategies or infrastructure development, where needed. Examples of congestion management strategies that might be included in a CMP are identified here:

- **Operating Existing Capacity More Efficiently:** Getting more out of what we have through improvements to system operations:
 - Metering traffic onto freeways.
 - Optimizing the timing of traffic signals.
 - Improving incident response.
 - Realigning transit service schedules.
 - Improving management of work zones.

Example of an M&O Strategy - Boston Silver Line BRT:

The Massachusetts Bay Transportation Authority (MBTA) designed the 7-mile Silver Line as a Bus Rapid Transit (BRT) service to provide high frequency and high quality service from Dudley Square and lower Roxbury through the South End, Chinatown, downtown, and on to the South Boston Waterfront and continuing service to Logan International Airport.

The Silver Line is intended to increase mobility and support economic development in Boston's neighborhoods. This new line will greatly improve the existing transportation network in the downtown core by providing mobility improvements throughout the system through improving connections to the Red, Orange, and Green subway lines, and providing improved access to the commuter rail system, as well as the intercity Amtrak and intercity bus terminals. The Silver Line also will address existing congestion on both the transit system as well as the roadway network. Several attributes and ITS applications utilized by the Silver Line are fundamental to producing many BRT benefits, significantly improving the system. Silver Line's traffic signal priority technologies improve schedule adherence, reliability, and speed to extend or advance green light times or allow left turn swaps to allow buses that are behind schedule to get back on schedule. Designated (reserved) arterial lanes reduce travel time and improve reliability since a traffic lane within an arterial roadway is set aside for the operation of BRT vehicles. The automated scheduling dispatch system utilizes real-time vehicle data to manage all BRT vehicles in the system and ensure a high level of service for passengers.

See:

http://www.mbta.com/about_the_mbta/t_projects/.

- Identifying weather and road surface problems and rapidly targeting responses.
- Installing a transit signal priority system.
- Implementing access management.
- **Demand Management:** Encouraging changes in travel mode, time, location, or route:
 - Programs that encourage transit use, ride-sharing, bicycling, and walking.
 - Parking management.
 - Employer-based programs.

- Telecommuting programs.
- Congestion pricing.
- Providing real-time information on transit schedules and arrivals.
- **Land Use Strategies:** Strategies designed to alter development patterns and design:
 - Transit-oriented development.
 - Clustering development.
 - Urban design.
- **Infrastructure Development:** New highway, transit, or bicycle/pedestrian capacity:
 - Adding capacity to the transit system (buses, urban rail, or commuter rail).
 - Adding travel lanes on major freeways and streets.
 - Removing bottlenecks.
 - Installing overpasses or underpasses at congested locations.

A Toolbox of Solutions

Some regions have developed a “toolbox” of congestion management strategies as part of their CMPs to provide guidance for agencies that are essential partners to MPOs in managing congestion. A toolbox offers MPOs an opportunity to communicate a framework for responding to congestion. For instance, MPOs can suggest that roadway capacity projects be considered only after other strategies, such as demand management or operations, have been exhausted. A toolbox also serves as a guide to inform implementing agencies about issues that may arise in implementing the strategies, such as when strategies require supporting efforts, such as local land use planning, to work most effectively.

Performance measures can be used to help identify, develop, and assess strategies that are best geared toward achieving results. Utilizing operations objectives and related performance measures focused on issues such as reliability, travel delay, and other operating issues often leads to the development of M&O strategies. Use of measurable objectives for a wide range of goals, addressing safety, security, the environment, etc., also can lead to greater attention to M&O strategies since

Congestion Management Toolbox: Helping Evaluate Strategies:

The Southwestern Pennsylvania Commission (SPC) uses a congestion management toolbox that includes 25 different strategies for addressing congestion, all organized around the four major categories of demand management, modal option, operational improvements, and capacity. Each of the 25 strategies is evaluated for suitability and potential benefit with each of the region’s CMP corridors.

To provide input on strategy evaluations, SPC developed an Internet-based tool. The tool is linked to a database that compiles the input and allows SPC to create a series of matrices for each corridor. These matrices help to identify where the consensus lies on various strategies in that corridor and can help prioritize strategies for each corridor. The prioritization of congestion management strategies can then be used to inform decisionmaking for the long-range plan and the TIP programming process.

See:

http://www.spcregion.org/trans_cong_shtml.

the planning process focuses on performance rather than looking narrowly at categories of projects, such as highways, transit, and bicycle and pedestrian projects.

Data on system performance can highlight the value of investments in programs that minimize incident-related delays, provide information on real-time travel conditions, and improve emergency response times by showing how such investments can improve transportation system reliability and reduce travel times for customers.

Analyzing Strategies for Prioritization

After a region has identified potential M&O strategies for achieving its operations objectives, the region moves forward with the task of evaluating and prioritizing the strategies that will be selected for funding and implementation. In the objectives-driven, performance-based approach for planning for operations, the prioritization of M&O strategies is founded on the predicted ability to help the region achieve its operations objectives. While this element of the approach is challenging for many regions, it is important for making informed decisions on applying resources to achieve operations objectives.

The ability of MPOs to quantify the performance benefits of M&O strategies is limited by access to quality data and the effort required to use analysis tools appropriate for this task. Analysis tools that can be effectively used for planning for operations is a current area of research and development. However, there are a number of existing tools and methods available to predict the effects of operational strategies on system performance. Partnering with other agencies in the use of analysis tools for evaluating the impacts of M&O strategies can be critical for success and should be considered as a way to overcome the challenges associated with analysis.

The prioritization of M&O strategies for funding and implementation will typically not occur in isolation, but instead within the context of goals and objectives outside of operations. Goals and objectives for safety, environment, system preservation, livability, and others are likely to be included in an MTP. M&O strategies may be evaluated and prioritized for their impact on these other areas as well as their contribution to operations objectives. In some regions, M&O strategies or projects may compete directly with other projects for funding whereas in other regions there is a dedicated pool of funding for operations projects so that operations projects may compete with each other but not with other types of projects such as capacity or preservation improvements.

The following is a brief description of analysis tools that can be used for predicting the impacts of M&O strategies:¹⁹

- **Sketch planning tools**, such as the ITS Deployment Analysis System (IDAS), Screening for ITS (SCRITS), and Surface Transportation Efficiency Analysis Model (STEAM). These tools generally provide order-of-magnitude estimates of travel demand and traffic operations in response to transportation improvements. They can be low cost and require less data than other tools, but are limited in scope and presentation. The IDAS software works with the output of traditional transporta-

tion planning models and enables planners to evaluate both the relative costs and benefits of ITS investments.²⁰ SCRITS is similar in that it is intended to allow practitioners to obtain an initial indication of the possible benefits of various ITS applications. It involves a more simplified spreadsheet analysis to expedite a benefit-cost analysis.²¹ STEAM enables users to assess the net safety and mobility benefits of transportation investments as well as policy alternatives in multimodal urban regions and corridors.

- **Simulation tools**, which include microscopic, mesoscopic, and macroscopic applications. Simulation tools are used by agencies to analyze the impact of operations strategies as well as to conduct environmental impact studies, needs assessments, and alternatives analysis. Tools within this group can provide detailed results, an analysis of incidents and real-time diversion patterns, and useful visualizations of impacts for presentations. While the tools have several advantages, they can be costly to use because of data requirements and necessary computing capability.²²
 - **Macroscopic simulation models** are based on the deterministic relationships of the flow, speed, and density of the traffic stream. The simulation in a macroscopic model takes place on a section-by-section basis rather than by tracking individual vehicles. They are limited because of the lack of detail they can provide and they do not account for trip generation, trip distribution, or mode choice in their simulations.
 - **Mesoscopic simulation models** provide a combination of macroscopic and microscopic simulation model attributes. They use individual vehicles as the traffic flow units but predict travel on an aggregate level and do not factor in the dynamic relationships of speed and volume. They can be used for short-range operations

¹⁹ U.S. Department of Transportation, FHWA, "Applying Analysis Tools in Planning for Operations," FHWA-HOP-10-001 (Washington, DC: 2009). Available at: <http://www.ops.fhwa.dot.gov/publications/fhwahop10001/index.htm>, last accessed February 4, 2010.

²⁰ For more information, see the IDAS information page at: <http://idas.camsys.com/>.

²¹ For more information, see the Federal Highway Administration's "STEAM: Screening for ITS" page at: <http://www.fhwa.dot.gov/steam/scrirts.htm>.

²² Federal Highway Administration, Office of Operations, "Traffic Analysis Tools, Types of Traffic Analysis Tools." http://ops.fhwa.dot.gov/trafficanalysisitools/type_tools.htm, last accessed February 9, 2010.

planning including traveler information strategies. DYNASMART-P, DynaMIT-P, TransModeler, and TRANSIMS are examples of mesoscopic simulation models.

- **Microscopic simulation models** include CORSIM/TSIS, Paramics, AIMSUN, and VISSIM. They model traffic flow at the level of individual vehicles based on car-following and lane-changing theories. These models can produce results beyond other types of tools but require significant computing time and storage, and may be difficult to calibrate. They can be effective, though, in evaluating areas of significant congestion and impacts of proposed transportation improvements at the system level.

Microscopic models, like CORSIM, have been used for operations planning by Wisconsin DOT, Indiana DOT (INDOT), New York State DOT Region 11, New Jersey DOT, Miami-Dade County, Florida DOT, and California DOT (Caltrans). CORSIM, a comprehensive microscopic traffic simulation tool, is applicable to surface streets,

freeways, and integrated networks with a complete selection of control devices (i.e., stop/yield sign, traffic signals, and ramp metering). CORSIM simulates traffic and traffic control systems using commonly accepted vehicle and driver behavior models. INDOT uses PARAMICS to evaluate and address future operational needs, which is being applied to determine future growth and design needs for I-465, I-70, and I-69 within Marion County. The City of El Paso and the University of Texas-El Paso have combined DYNASMART-P and CORSIM to evaluate downtown traffic and the environmental impacts of one-way and two-way traffic flow reconfigurations.

- **Use of archived data**, which allows performance measurement before and after implementation of operations-oriented projects. This data can be also used to calibrate and supply inputs to models. Archived data is often collected by State and local DOTs through roadway detection devices and transit agencies via on-board systems.

5.0 RESULTING PLANS, PROGRAMS, AND PROJECTS

5.1 The Resulting Metropolitan Transportation Plan and TIP

A plan resulting from the objectives-driven, performance-based approach for operations should include the following (See Figure 5):

- Goals and measurable objectives that advance operational performance outcomes of the regional transportation system.
- Performance measures that allow the region to track progress toward achieving its objectives.
- Clearly defined M&O strategies backed by specific performance measures that allow for evaluation.

MTPs should discuss M&O strategies that are funded by State, regional, and local transportation agencies, even without Federal funding involved. Since many M&O strategies (e.g., incident clearance, emergency response) are planned and executed by these types of agencies, this discussion would provide a more holistic picture of the M&O strategies being employed within a region, which will provide a clearer picture of the entire transportation system and its performance.

These strategies should then move forward to programming and implementation in collaboration with operating agencies. Many of the M&O strategies will flow from the MTP to be programmed in the TIP.

M&O projects may be eligible for several funding sources: State funds, local funds, STP, Congestion Mitigation and Air Quality (CMAQ), and others. Examples of more innovative funding sources for M&O strategies across the U.S. include:

- **Development Fees:** New developments pay pro rata share of the costs of transportation improvements necessitated by the impact of the development in Montgomery County, Maryland.



- **Private Traffic Reporting Company:** A Tucson, Arizona traffic control center receives personnel services and advertising time in exchange for traffic information.
- **Turnpike Tolls:** A New Jersey Turnpike Authority's Traffic Operations Center is funded through tolls.²³

The MTP is a product of coordination among local jurisdictions, stakeholder agencies, and the public. The resulting plan can take on one of many different formats and organizations while still adhering to Federal requirements, but correspondingly, applying an objectives-driven, performance-based approach to integrate operations in the MTP can result in an MTP being structured in a variety of ways. A couple of alternatives to consider include the following:

- A section focused specifically on M&O. This section of the plan would identify M&O goals, include specific, measurable, regional operations objectives, and describe how M&O strategies achieve stated objectives. This section might describe existing system performance, project system performance in absence of the plan, and expected performance with the inclusion of all planned M&O projects and strategies.

²³ Information on funding for operations can be found in *Show Me the Money: A Decision-Maker's Funding Compendium for Transportation Systems Management and Operations*, U.S. Department of Transportation and the National Transportation Operations Coalition, FHWA-HOP-06-003, December 2005. Available at: http://www.narc.org/uploads/File/Transportation/Library/Trans_Funding_PTI_FHWA_2006.pdf, last accessed December 6, 2009.

Homeland Security Funding Supports M&O in Baltimore Region:

Transportation management and operations is an integral part of many regional goal areas such as homeland security, environment, safety, and livability. In the Baltimore, Maryland region, the MPO – the Baltimore Regional Transportation Board (BRTB) – has worked to advance emergency preparedness and related transportation operations activities. Since September 11, 2001, the BRTB’s committees have expanded their collaboration with emergency responders to all hazards including acts of terrorism. One of the BRTB’s committees, the Transportation & Public Works (T&PW) Subcommittee, also reports to the Urban Area Homeland Security Work Group (UAWG). The UAWG, which is a stand-alone regional committee, allocates the U.S. Department of Homeland Security’s Urban Area Security Initiative (UASI) funds to the region.

The T&PW Subcommittee requested and received UASI funds from the UAWG for several projects that support planning for transportation management and operations during emergencies. One project involves the development of an evacuation model that will provide emergency responders with recommended evacuation zones and routes given the location of the incident, recommended signal timing and turning movement restrictions, and estimated evacuation clearance times. While designed for emergencies, this model can also be used to support transportation management during other types of events. UASI funds have also been used to develop a decision-support tool for identifying routes that would be most appropriate for contra-flow operations and would warrant further study and analysis. Also, the T&PW Subcommittee used UASI funds as well as transportation funds to conduct a transportation-focused evacuation tabletop exercise in the spring of 2010.

See:
<http://www.baltometro.org/>.

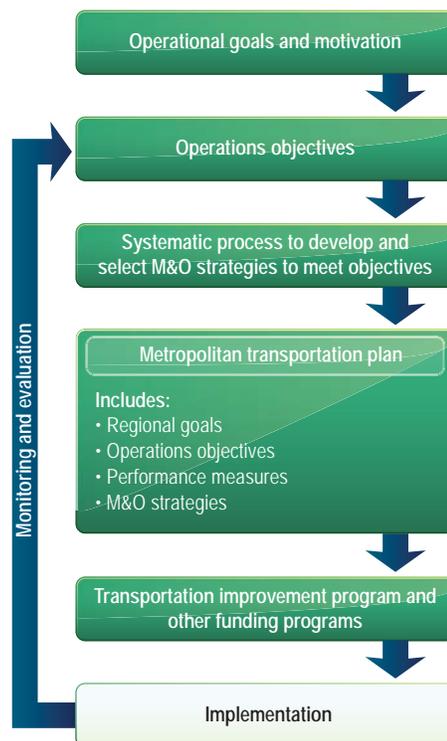
Pima Association of Governments’ Use of Operations Objectives Led to M&O Projects in the TIP:

The Pima Association of Governments (PAG) led a group of operations participants in identifying specific objectives and performance measures for arterial management, traveler information, and work zone management to develop a regional concept for transportation operations. These objectives guided Tucson’s selection of management and operations strategies and the approaches for implementation. The regional concept for transportation operations (RCTO) group identified specific operations projects and programs such as a regional

traffic signal program to be included in the PAG TIP and funded through a half-cent transportation sales tax, which passed in 2006.

See:
<http://www.pagnet.org/Programs/TransportationPlanning/PlansandPrograms/RegionalSafetyandOperations/tabid/170/Default.aspx>.

Figure 5: A Metropolitan Transportation Plan Resulting from the Approach Includes Goals, Operations Objectives, Performance Measures, and M&O Strategies



- Alternately, a resulting MTP could include discussion of M&O strategies within the context of different goals and strategies identified within the MTP. For example, a goal aimed at improving highway safety might utilize a regional operations objective related to reducing the number of fatalities on the highway system, and include M&O strategies such as emergency response teams, enhanced signalization, etc. A goal aimed at improving mobility and access across the region might include a regional operations objective related to reducing the level of traveler delay, and include M&O strategies such as peak-period use of shoulder lanes, congestion pricing, and variable message signs.

Examples of Plans Incorporating Elements of the Approach

The *Regional Transportation Plan (the Plan)* developed by the Regional Transportation Commission of Washoe County is organized by mode of travel and contains goals, measurable objectives, performance measures, and transportation improvement strategies across several plan areas including congestion, condition, safety, and air quality.²⁴ There are six overall goals that guide the Plan's implementation. The goal with the strongest element of operations is "Manage the transportation system to provide an optimum level of mobility for the greatest number of persons while insuring mobility for the transportation disadvantaged." The goals, objectives, policies and performance measures also are discussed with each mode, while M&O strategies are discussed primarily in the chapter titled "Transportation Management/Intelligent Transportation Systems Element."

Examples of operations objectives included in the Plan are:

- Average per capita daily travel time will not increase above 2000 levels more than 20 percent by 2008; 30 percent by 2018; and 40 percent by 2030 and beyond.
- Within Bus Rapid Transit (BRT) corridors, the BRT mode share will be 20 percent by 2020 and 30 percent by 2040 and beyond.
- All signalized intersection will be within policy level of service by the year 2012 and maintained at that policy level of service thereafter.

M&O strategies highlighted in the plan include a collaborative transportation management center, ramp metering, traffic signal coordination, and real-time bus information. The FY 2009-2013 Regional Transportation Improvement Program for the Regional Transportation Commission of Washoe County contains approximately \$35.7 million for transportation systems management and transpor-

tation demand management projects including a freeway service patrol, a traffic management center, a trip reduction program, ongoing signal coordination improvements, and pedestrian and bicycle improvements.²⁵

The Plan notes that during the RTP update process, the progress toward the objectives will be reviewed and objectives and activities will be updated as necessary.

The Denver Regional Council of Governments' 2035 Metro Vision Regional Transportation Plan has several focus areas, such as freight, security, and safety, including one that is dedicated to system management and operational improvements.²⁶ The overall objective of this focal area is "to provide more reliable travel times and reduce the amount of delay faced by drivers, passengers, and trucks on the roadway and transit system." Strategies identified in the plan include providing queue jump lanes for transit, disseminating real-time information to travelers on travel time/speeds on VMS and websites, and coordinating traffic signal timing plans across jurisdictions. More importantly, "management, operational, and air quality improvements" is a major system category with designated funds in DRCOG's plan.

5.2 Benefits of the Resulting Plan and TIP

The regional transportation system may not only see direct benefits through improved system performance, but broader benefits may be realized through a transportation planning process that is objectives-driven and performance-based. Specifically, MPOs and operating agencies may expect benefits such as:

- Clearer links between the MTP and the TIP, which often includes short-term projects focused on operations. An MTP may identify funding sources that can be set aside for projects that will be selected in more short-range planning analyses to address congestion and reliability issues.

²⁴ Regional Transportation Commission of Washoe County, 2040 *Regional Transportation Plan*. Available at: <http://www.rtcwashoe.com/planning-Z>, last accessed March 1, 2010.

²⁵ Regional Transportation Commission of Washoe County, *FY 2009-2013 Regional Transportation Improvement Program*, Available at: <http://www.rtcwashoe.com/planning-34>, last accessed March 1, 2010

²⁶ Denver Regional Council of Governments, 2035 *Metro Vision Regional Transportation Plan*. Available at: [http://www.drcog.org/index.cfm?page=regionaltransportationplan\(rtp\)](http://www.drcog.org/index.cfm?page=regionaltransportationplan(rtp)), last accessed December 6, 2009.

- Stronger links between transportation planning and the NEPA process. An objectives-driven, performance-based planning process offers potential to strengthen the process of developing and reviewing transportation projects. Specifically:
 - By clearly articulating regional goals and objectives, this can help to ensure that infrastructure projects in the MTP have a clearly identified purpose and need.
 - Since the approach places increased attention on M&O strategies, it will inherently involve stronger consideration of transportation system management alternatives to projects.
 - By considering M&O strategies in connection with infrastructure projects, this may help to shape project decisions as the

project moves from planning through project development and design. For instance, as part of any new highway expansion, M&O strategies such as the deployment of enabling technologies (i.e., ITS), transportation pricing, development of high-occupancy vehicle lanes, or flexible design to accommodate concurrent flows of traffic can be put forward and incorporated into the proposed project alternatives.

- Improved ability to meet customer needs in the short-run and long-run, rather than just focusing on long-term needs.
- Improved ability to meet a range of regional goals, as M&O strategies help to address safety, security, mobility, recurring and non-recurring congestion, and other issues.

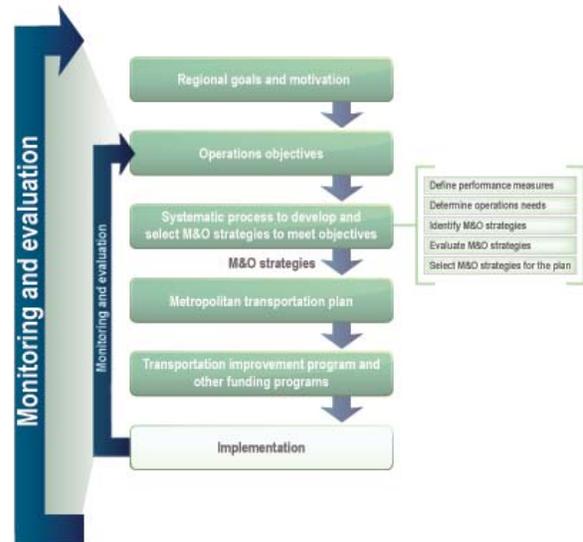
6.0 ONGOING MONITORING AND EVALUATION

6.1 The Role of Monitoring and Evaluation in the Approach

Monitoring and evaluating performance is an important step, but it is sometimes overlooked in the objectives-driven, performance-based approach to planning for operations. The value of developing operations objectives and performance measures would not be fully realized without an assessment of progress in meeting the objectives. The CMP requires a coordinated program for data collection and system performance monitoring to define the extent and duration of congestion; to help determine the causes of congestion; and to evaluate the effectiveness of implemented actions.

Monitoring and evaluation helps to inform better decisionmaking by transportation planners and operators. These efforts help transportation professionals:

- Better understand the effectiveness of transportation strategies and investments so transportation planners and operators can work together to devise more effective investment strategies to meet regional objectives.
- Fine-tune the operation of projects already implemented and the implementation of ongoing operations programs.
- Provide assistance in calibrating and refining planning tools and models, such as regional travel demand models, so that relationships and traveler responses are properly reflected.
- Spur greater collaboration between planners and operations managers in collecting and monitoring data, which can yield benefits in terms of both developing and refining operations objectives and performance measures as well as in identifying successful strategies.



Tracking Progress – Regional Indicators:

The Delaware Valley Regional Planning Commission (DVRPC) uses a systematic framework to monitor the Philadelphia metropolitan area's progress in meeting its MTP goals.

Tracking Progress is an ongoing, outcome-based effort to align planning and implementation activities and is intended to guide the region's investment strategy. The effort collects and compiles meaningful time series data that helps regional decisionmaking.

The resulting products feed back into future long-range plan updates and subsequent performance measures to provide a valuable interface between the region's investment pattern and evaluative process.

See:

<http://www.dvrpc.org/LongRangePlan/RegionallIndicators/>.

Lincoln, Nebraska Signal Timing:

The City of Lincoln, Nebraska, provides staff support to the Lincoln MPO. As part of its congestion management efforts, the city conducted travel time runs through designated corridors before and after a set of signal timing modifications were implemented as a congestion strategy. Studies were conducted on 8 corridors and at 46 signalized intersections.

See:

<http://lincoln.ne.gov/city/pworks/engine/traffic/signal/index.htm>.

Denver Region's Transit Signal Improvement Program:

The Denver Regional Council of Governments works with over 30 local jurisdictions on the Traffic Signal System Improvement Program (TSSIP), a combination of M&O strategies designed to time and coordinate traffic signals in the Denver region. The program is updated regularly through a collaborative planning process involving representatives from the region's operating agencies. Each agency identifies critical needs yet understands that the focus of the program is improving signals at regionally significant arterials. The TSSIP serves as a key component of the MPO's congestion mitigation program. Funding is programmed for TSSIP through the TIP. The program has already improved operations at more than 1,000 traffic signals in the region – reducing travel times, fuel consumption, and vehicle emissions.

See:

<http://www.drcog.org/index.cfm?page=TrafficSignalProgram>.

NCTCOG Thoroughfare Assessment Program:

The Thoroughfare Assessment Program (TAP) is a multi-phased program being implemented by the North Central Texas Council of Governments. The purpose is to maximize the capacity of the existing system and improve air quality through advancing traffic operations via signal retiming and implementation of low-cost operational improvements along selected corridors. An extensive data collection and system analysis process occurs for selected thoroughfares by means of assessing operational characteristics; estimating air quality benefits; and using performance measures such as travel time, delay, speed, and number of stops in order to develop and implement improvements.

See:

<http://www.nctcog.org/trans/tsm/index.asp>.

Monitoring and evaluating information also improves the effectiveness of communications with decisionmakers, stakeholders, and the public, enabling them to:

- Understand the current status of transportation system performance more clearly, not just based on anecdotal information but based on valid data.
- More accurately assess what progress has been made in meeting operations objectives in order to see where performance has been improved and where progress still needs to be made.
- Understand the connections between transportation investments and policies and regional transportation system performance, including greater appreciation for the benefits of operational strategies.

6.2 Aspects of Monitoring and Evaluation

Monitoring and evaluating involves three related elements:

1. Evaluating the effectiveness of implemented strategies.
2. Tracking regional system performance.
3. Assessing and refining operations objectives.

Evaluating the Effectiveness of Implemented Strategies

Measuring the performance of implemented strategies:

1. Provides documentation of effectiveness, so that transportation agencies can communicate to the public and decisionmakers about the benefits of their investments. This documentation is particularly important for operations strategies, since the strategies themselves (e.g., traffic signal retiming, transit signal priority, etc.) are often less tangible than infrastructure solutions, such as new roads and transit lines.

Wilmington Area Planning Council:

WILMAPCO, the metropolitan planning organization for New Castle County, Delaware and Cecil Council, Maryland, recently incorporated crash statistics (e.g., rates, frequency) into its identification of congested corridors. Recognizing that traffic congestion poses a continuing problem for the region, WILMAPCO has developed a regional approach to review the location of areas with highest crash frequencies. As crash data has become more reliable over the years, the agency expects to include it in its next summary publication of its congestion management process. In addition, with reliable historical crash data now available, WILMAPCO has the ability to begin tracking the crash trends in the region.

See: <http://www.wilmapco.org>.

2. Supports more effective decisionmaking by helping transportation agencies to determine which strategies and investments are most effective in helping to attain operations objectives.
3. Demonstrates whether operational or policy adjustments are needed to make the current strategies work better, and provides information about how various strategies work to inform future approaches within the region.

Monitoring strategy effectiveness is one of the required elements of the CMP. Federal regulation indicates that the CMP should include “a process for periodic assessment of the efficiency and effectiveness of implemented strategies, in terms of the area’s established performance measures.”²⁷ This type of evaluation should be conducted for other types of operational improvements outside of the CMP as well.

Measuring results typically requires a plan to collect pre-implementation and post-implementation data. Given the incremental changes in travel associated with many operational strategies, it will be important to select appropriate data, timeframes, and collection procedures to help isolate the changes in system performance that are associated with the strategy implementation.

Monitoring strategy effectiveness can be the most challenging part of the approach. For instance, traffic congestion is the result of multiple factors, including available transportation capacity and the demand for travel, which interplay in complex ways. It can be difficult to identify the effects of a particular strategy from other factors that might influence congestion. As a result, there possibly is less accumulated experience with monitoring strategy effectiveness than other CMP elements. Although many regions now systematically report on congested conditions and performance, fewer focus monitoring efforts on specific CMP strategies to determine whether they have had the predicted or desired effect.

Monitoring approaches can include the following:

- **Conduct program evaluation studies.** For instance, fund a study to evaluate the effectiveness of a regional transportation demand management program.
- **Build data collection into the implementation of specific projects.** For instance, conduct a study of a sample of intersections prior to and after implementing traffic signal improvements, or utilize transit ridership data collected through fare collection to determine the implications of adjusting bus schedules and providing real-time transit information signs along specific routes.
- **Develop guidelines or incentives for local governments that receive funding to conduct evaluation studies.** Although an MPO may not be able to fund studies of individual projects, it can provide guidelines or incentives for cities, counties, and other entities that receive funding to build evaluation into their program efforts. For instance, priority can be given to funding projects that have a data collection element.

Although collecting data to assess individual projects and programs may seem like a daunting challenge, particularly given small project budgets, the costs of data collection do not need to be high.

²⁷ See the Metropolitan Transportation Planning Regulations, 23 CFR 450.320(c).

Tracking Regional System Performance

Collecting data on actual transportation system performance helps to demonstrate the region's status and can show trends identifying whether indicators are moving in the right direction. Performance measures in the MTP can be used by the MPO to report regularly on the performance of the metropolitan transportation system, for instance, as part of a periodic (e.g., monthly, quarterly, biannual) performance report. Periodic performance reports provide an excellent mechanism to make M&O more relevant to the everyday experiences of the public. A number of MPOs, transit operators, and State DOTs use performance reports to open up dialogue with decisionmakers and keep them informed about trends in system performance.

Such reports inform transportation planning in a number of ways to:

- Provide a realistic view of system performance improvements achievable through management and operations investments.
- Provide operations managers with guideposts and goals that provide some measure of how operations programs are contributing to the long-term goals of the system.
- Support policy that is realistic about system constraints and that supports the role of management and operations in maintaining acceptable transportation performance.

Agencies that report performance measures in a periodic performance report encourage a sustained communications link between planning and operations staffs. There are many cases where a particular activity or project requires temporary coordination or exchange between planners and operators, but sustaining such communication is critical for changing the everyday perspective of these departments to routinely consider operations tools within the planning process. Routine, sustained performance reporting is, therefore, particularly valuable.

Assessing and Refining Operations Objectives

A feedback segment is part of the cycle of developing operations objectives, implementing strategies,

GPS Technologies to Assess Reliability:

The Capital Region Council of Governments (CRCOG) of the Hartford, Connecticut, metro area used a \$12,000 Technology and Innovation Funding grant from FHWA to purchase GPS equipment to monitor travel times and speeds during peak hours on arterial roads. CRCOG utilized its own staff to collect data with the GPS units as part of their normal commute routines along several key arterial corridors. Some staff deviated from their normal routes in order to conduct the travel time study.

See:

<http://www.crcog.org/>.

Aerial Photos:

Every 3 years, the Dallas-Forth Worth, Texas MPO conducts a series of aerial photo surveys to assess both system-wide and site-specific freeway system performance. This information helps identify potential locations for freeway bottleneck improvements as well as major corridor needs. The resulting data also enables decisionmakers to compare long-term congestion trends and to evaluate the benefits of the transportation improvement strategies being implemented over the coming years.

Data is obtained once an hour for 4 days during peak morning and evening periods of commuter travel. The aerial surveys show heavy truck traffic corridors and locations of peak period traffic bottlenecks. Vehicle type breakdown, vehicle counts, and the corresponding level of service (LOS) estimates are then derived from the data. The LOS ratings are presented in graphical format by highway segment, direction, and time slice.

See:

<http://www.nctcog.org/trans/cmp/aerial/index.asp>.

and evaluating results. Collecting data on system performance can be used to compare the status against specific targets that have been identified in operations objectives. This information in turn can be used to help assess the feasibility of meeting objectives within the stated timeframe and may be used to refine or develop new operations objectives over time. For instance, if trends show difficulty in meeting an objective, it may be necessary to refine the objective or consider alternative strategies to meet the objective.

6.3 Collecting Data for Evaluation Studies

Data is a necessary component of monitoring and evaluation. The costs and time associated with collecting data are often considered challenges, given limited budgets for implementation, let alone post-evaluation studies. However, there is a wide range of ways to collect data, which vary substantially in terms of resource requirements. In many instances,

operations data may be available for use in this process. Table 4 provides some examples of data collection methods for evaluating various types of transportation strategies.

At a regional level, transportation system performance data can be collected from a range of different methods, several of which were noted earlier in section 4.3.

Table 4: Data Collection Methods for Evaluating Transportation Strategies

Strategies Being Evaluated	Performance Measures	Data Collection Methods
Incident Management	<ul style="list-style-type: none"> • Average incident duration • Occurrence of secondary accidents • Incidence response time 	<ul style="list-style-type: none"> • Log of incident duration (from dispatcher records) • Measurement of speeds from surveillance system
Traffic Management	<ul style="list-style-type: none"> • Average speeds • Intersection delay 	<ul style="list-style-type: none"> • Traffic volume counts • Moving car runs • Measurement of speeds from surveillance system
Traveler Information	<ul style="list-style-type: none"> • Door-to-door trip time • Transit ridership • Mode share • On-time arrivals 	<ul style="list-style-type: none"> • Trip logs (by regular commuters), for roads and/or transit • Traffic counts • Transit ridership counts • Mode shift survey
Transit Operations	<ul style="list-style-type: none"> • Transit travel times • Transit ridership • Peak load factor • Schedule reliability • Transfer time/station delay or waiting time • Transit travel time • Roadway impacts (e.g., vehicle delay, speeds) • Mode share 	<ul style="list-style-type: none"> • Mean incident clearance time per incident
Travel Demand Management	<ul style="list-style-type: none"> • Mode share • VMT reduced 	<ul style="list-style-type: none"> • Mode share survey • Traffic counts

Source: Table adapted from East-West Gateway Coordinating Council, *St. Louis Region CMS Congestion Mitigation Handbook*, available at: <http://www.ewgateway.org/pdf/library/trans/cmshandbook.pdf>.

7.0 MOVING FORWARD THROUGH REGIONAL COORDINATION AND COLLABORATION

7.1 The Role of Regional Coordination and Collaboration in the Approach

Implementing an objectives-driven, performance-based approach to planning for operations in the MTP requires regional collaboration among transportation planners and operators as well as non-transportation entities (e.g., public safety officials, major employers, chambers of commerce, convention and visitors' bureaus, and special interest groups) that routinely affect or depend upon transportation. The inclusion of such a diverse set of participants ensures that a regional perspective on transportation system performance informs the planning process.²⁸

Coordination and collaboration among planners and operators is necessary across all steps in the approach, and is particularly important in defining regional operations objectives. Inclusion of both operators and planners in the MTP development process is vital to ensure that the objectives set forth in the plan are realistic and achievable. Coordination also will be important for identifying operations strategies, monitoring system performance, and evaluating the effectiveness of implemented strategies.

The MPO can play a crucial role in bringing stakeholders together in a regional forum where all agencies benefit by working together. For example, the Puget Sound Regional Council (PSRC) in conjunction with the Washington State Department of Transportation recently formed an Interagency Data Group among PSRC member agencies to broaden the region's ability to research and collect multimodal data on the transportation system. According to a PSRC program director, there is an understanding among the members that they can benefit from knowing what data others are collecting and comparing research needs and planned research across the agencies.

7.2 Who is Involved?

A first step in the process of integrating M&O in the MTP is to involve key regional transportation system operators in the metropolitan transportation planning process. This is often quite challenging, since it requires operators and planners to make a fundamental cultural shift to integrate the near-term considerations that are the focus of transportation system operators with the long-range considerations that are the focus of transportation planners. In most regions, operation of the transportation system is the responsibility of individual operating agencies (e.g., local departments of public works, transit agencies, and State departments of transportation), exacerbating the challenge of viewing the transportation system from a regional perspective. An objectives-driven, performance-based planning process will result in operators broadening their traditional perspective to one in which individual facilities are viewed as interconnected pieces of a regional system. Neighboring jurisdictions and agencies will work together as partners in providing transportation services to customers.

While the MPO serves a coordinating function in developing the MTP, the process of developing operations objectives requires involvement of a full range of agencies engaged in the operation of the transportation system. This includes:

- State DOTs.
- Local jurisdictions.
- Transit agencies.
- Bridge and toll facilities.
- Port authorities.

²⁸ For a more detailed discussion of collaboration and coordination, see *Regional Transportation Operations Collaboration and Coordination – A Primer for Working Together to Improve Transportation Safety, Reliability, and Security*, U.S. Department of Transportation, Federal Highway Administration, Publication Number FHWA-OP-03-008. Available at: http://www.itsdocs.fhwa.dot.gov/JPODOCS/REPTS_TE/13686.html, last accessed December 6, 2009.

Moreover, there is a need to reach out to broader customer stakeholders, including the freight and business communities and agencies responsible for emergency management, such as:

- Police and fire officials.
- Emergency medical service (EMS) officials.
- Emergency managers.
- Public works officials.
- The tourism industry.
- Elected leaders.
- Freight shippers.
- Business organizations, such as chambers of commerce.

7.3 How to Engage Participants

Engaging stakeholders to think about M&O is a critical factor in developing regional operations objectives, and in the ultimate success of incorporating M&O strategies in the MTP. This requires piquing the interest of operations agencies currently involved in the MTP process, and engaging new stakeholders in a new manner – one that addresses M&O as well as capital projects.

Engage Existing Operations Agencies in Thinking about M&O

Operating agencies are typically already at the MPO table and involved in the transportation planning process. However, it is important to engage day to day operating agency managers from a systems operations perspective and not simply as advocates for capital projects. As they participate, operators should identify existing operational programs and strategies that they are using and others that should be considered across agency lines and jurisdictional boundaries. Currently, many operating agencies are implementing M&O strategies; the MTP should identify regionally significant activities, which may already be occurring, as well as help to identify additional areas for coordination across jurisdictions and agencies.

Engage New Stakeholders in the Planning Process

New stakeholders also need to be engaged in the MTP process. One way to achieve greater stakeholder par-

Spokane Regional Transportation Council Model Users Group:

The Spokane Regional Transportation Council (SRTC) is working to improve its collaboration with western Washington local jurisdictions and Washington State DOT. As a means to bolster collaboration, SRTC created the Transportation Model Users Group, which helps make future transportation decisions and investments.

The users group has championed various projects, including the SRTC Transportation Management Center, an interactive website that provides real-time updates on traffic conditions in the area and live camera photos of heavily traveled routes and intersections.

See:

<http://www.srtc.org/>.

Puget Sound Freight Roundtable:

In 1993 the Puget Sound Regional Council (PSRC), the MPO for the Seattle-Tacoma metropolitan area, with the assistance of the Economic Development Council, gathered public and private freight sector representatives to form the Puget Sound Freight Roundtable. The Roundtable was created in an effort to better involve the freight industry in the planning process. The first task of the Roundtable was to provide input on freight issues to the update of the metropolitan transportation plan. Since then, the Roundtable has influenced the transportation planning process by advising PSRC on freight needs and the potential impact of proposed projects on freight mobility. It educates policy-makers and the public on freight issues, and it helps to develop performance measures, data collection systems, and analysis techniques necessary to study freight movement.

See:

<http://www.psrc.org/transportation/freight>.

ticipation is to focus discussions on specific operations concerns, which makes it clear to operations practitioners and policy makers when the forum is within their area of expertise. For example, someone who manages first responders is more likely to attend a committee meeting on regional incident management than a meeting dealing with the broad topic of regional M&O coordination. A focused forum also will likely benefit from participants who have a grasp of both the technical and the institutional challenges associated with regional coordination for that specific topic.

Freight transportation planning is an area where focused forums have been successful. Engaging shippers, freight carriers, and freight terminal operators in the regional planning discussion has been challenging, in part because the long timeframe for planning is foreign to most private sector entities. Freight companies also may be mistrustful of Government planners and concerned about divulging proprietary business information. Some regions have successfully developed forums or task forces specifically to address regional freight operations planning. Such committees have succeeded at bringing freight needs and perspectives to the planning process, helping to promote a regional perspective on operations challenges.

Develop MPO Committees Focused On Operations Issues

An increasing number of MPOs support interagency committees that deal directly and regularly with regional systems management and operations. In hosting such committees, the MPO facilitates a vital forum where inter-jurisdictional coordination, funding strategies, and data sharing can be addressed. In addition, the MPO can use the committee's diverse operations expertise to inform M&O issues in the regional planning process, to identify ITS systems and data needed to support operations, and to influence the MPO's annual work program. The forum will allow operations managers to increase their awareness of broader regional trends, needs, and strategies, and can be a key mechanism for developing regional operations objectives for inclusion in the MTP.

The Genesee Transportation Council in Rochester, New York currently convenes a regional transportation management committee that includes departments of transportation, the transit authority, law enforcement agencies, and local elected officials. The group meets every two months. According to the Genesee Transportation Council Executive Director, the committee is "invaluable in continuing the dialogue on M&O and constantly informing the metropolitan planning process."

Developing an effective structure for these MPO committees can be challenging. One reason is that regional management and operations planning must often deal

National Capital Region's Management, Operations, and ITS Task Forces:

The National Capital Region Transportation Planning Board (TPB) initiated the Washington Region ITS Task Force in 1997. After the region received Federal earmark funding for ITS, the task force attracted interest from a number of agencies in the region. These agencies collaborated to develop CapWIN, a wireless integrated mobile communications network that supports coordination between public safety and transportation agencies. Later that year, the TBP divided the Task Force into a technical task force and a policy task force. This facilitated the direct involvement of policy-level officials in ITS activities while maintaining the capacity to address technical details associated with ITS integration and coordination. In 2001, the TBP changed the name of the two task forces to the Management, Operations and Intelligent Transportation Systems (MOITS) Policy Task Force and the MOITS Technical Task Forces to reflect a broader focus on management and operations from a regional perspective.

See:

<http://www.mwcog.org/transportation/committee>.

with narrow technical issues. For example, one committee might address topics such as how to provide back-up power at signals, use of various signalization software programs, and measures of effectiveness for signals. These types of regional forums may be invaluable as an information exchange for operations practitioners, but less useful as a forum for addressing broader coordination issues.

As a result, some MPOs have created separate subcommittees for technical and policy issues. A technical subcommittee may focus on the details of equipment coordination, while the policy committee may address regional funding strategies and prioritization of regional operations initiatives. Periodic meetings of the full committee allow exchange between technical and policy staff. MPOs should take advantage of the existing ITS architecture committees that are experienced in bringing diverse stakeholders to the planning process.

As noted above, it also may be beneficial to develop specific forums around aspects of operations, such as freight management, emergency management, and incident management.

7.4 Tools to Advance the Approach

To sustain the successful integration of objectives-driven, performance-based M&O in the planning process, MPOs need to institutionalize the process of engaging operating agencies and stakeholders in developing operations objectives.

Planners and operators interested in adopting this approach to planning for operations can leverage an organizational framework for regional transportation operations collaboration and coordination.²⁹ This framework identifies five elements of collaboration that participants can focus on improving as they move forward in making planning for operations a sustained and productive endeavor. By advancing each element, planners and operators can help institutionalize the concept of “working together” among transportation agencies, public safety officials, and other public and private sector interests within a metropolitan region to guide the objectives-driven, performance-based approach within the metropolitan transportation planning process. The five elements of collaboration include:

- **Structure:** The *structure* consists of the relationships and the setting that enable regional collaboration and coordination. It functions as the “table” where planners and operators meet to develop operations objectives and identify data sources and M&O strategies for inclusion in the MTP.
- **Processes:** *Processes* are the formal and informal activities carried out to accomplish planning for operations. This includes how ideas are generated, decisions are made, and programs and projects are implemented.
- **Products:** The *products* of collaboration and coordination are the results of processes. In the context of the objectives-driven, performance-based approach, the products include the objectives, performance measures, and M&O strategies incorporated into the MTP. Additional products may be a regional concept for transportation operations, a regional ITS architecture, operations data, and operating plans and procedures.

Hampton Roads ITS Architecture Leads to Inclusion of ITS and M&O in Regional Long-Range Plan:

One of the lasting benefits to developing a regional ITS architecture in 1995 for the Hampton Roads, Virginia region was the formation of an ITS committee hosted by the MPO. The collaboration started off with a simple meeting where several area traffic engineers got together and exchanged contact information so that they could communicate in the event of an accident or special event. This led to regular meetings where operators and planning staff got together to discuss technical and institutional issues, their individual needs, and how to work together better. They envisioned compatible technologies throughout the region that would allow for inter-jurisdictional cooperation.

During the 2003 update of the ITS plan and architecture, the Hampton Roads ITS champions saw the opportunity to include ITS projects in the long-range plan, which was in the process of being updated. ITS and management and operations strategies and projects were presented to the MPO’s technical committee and approved for inclusion with funding in the Hampton Roads 2026 Regional Long-Range Plan.

See:
<http://www.hrtpo.org/>.

- **Resources:** *Resources* govern what is available within the region for sustaining and implementing regional operations on an ongoing basis, not just for the completion of specific projects. Resources include funding for M&O strategies as well as the staff, data, and technology necessary for tracking operations performance toward objectives.
- **Performance:** The *performance* element comprises how performance will be measured, and individual and collective responsibilities for monitoring and improving regional transportation system performance.

Build on the Regional ITS Architecture

Regional ITS architectures and associated ITS committees can be significant resources for advancing the incorporation of operations into the metropolitan transportation planning process. A regional ITS architecture creates a picture of ITS deployment and use in

²⁹ U.S. Department of Transportation, FHWA, *Regional Transportation Operations Collaboration and Coordination: A Primer for Working Together to Improve Transportation Safety, Reliability, and Security*, FHWA-OP-03-008 (Washington, DC, 2003). Available at: http://www.itdocs.fhwa.dot.gov/JPODOCS/REPTS_TE/13686.html, last accessed December 6, 2009.

a region as envisioned by a broad base of stakeholders. SAFETEA-LU requires that ITS projects funded through the Federal Highway Trust Fund conform to the National ITS Architecture and applicable standards. An ITS architecture defines existing or desired sensor, computer, electronics, and communications technologies, the interconnections and information exchanges between these systems, stakeholder agreements, and standards. In addition, the architecture describes the regional needs, ITS services that can address these needs, and the envisioned operational roles of agencies responsible for these systems.

A large number of regions in the United States already have developed architectures and established collaborative relationships between operating agencies and MPOs based on ITS deployment. These relationships can serve as the foundation for operator involvement in the transportation planning process. A region's ITS architecture may advance the integration of operations into the MTP through information on data sources, operations objectives, operational needs and system deficiencies, and M&O strategies.

The objectives-driven, performance-based approach for incorporating operations into the MTP requires **data** on the operational performance of the transportation system. The architecture may be a rich source of information on what operations data may already be collected, what data collection is being planned for the near future, and which agencies have access to the data.

As planners and operators work together to define **operations objectives and M&O strategies** to meet those objectives, they should consult their regional ITS architecture's list of needs and services. In the development of the architecture, the stakeholders must identify the problems with the regional transportation system and the associated needs of the operators and transportation users. This may include operational problems that need to be addressed, such as "improve management of road closures," "alleviate congestion in central business district," or "improve electronic fare coordination between agencies." The needs and services included in the ITS architecture can give regions a valuable jumpstart in developing operations objectives and identifying M&O strategies.³⁰

Regional Concept for Transportation Operations

A regional concept for transportation operations (RCTO) is a management tool to assist in planning and implementing management and operations strategies in a collaborative and sustained manner.³¹ Through the development of the RCTO, transportation operators, planners, public safety agencies, and other stakeholders use an objectives-driven, performance-based approach to plan for regional transportation operations. An RCTO is a tool of particular significance for integrating operations into the metropolitan planning process.

An RCTO is developed and implemented by a group of transportation operators, planners, public safety agencies, or other stakeholders who want to improve regional transportation system performance by working together. The group often works within the context of an MPO working group or subcommittee.

One of the first steps in developing an RCTO is identifying one or more operations objectives of regional scope. The objectives may focus on a single operations area such as traveler information or traffic incident management, or they may cover multiple operations areas or performance outcomes. Operations objectives in an RCTO are similar in form and content to the regional operations objectives in the MTP. The operations objectives in an RCTO may help to further refine the operations objectives already in the MTP, or the RCTO's **operations objectives** may be incorporated into the MTP and used to incorporate operations into the overall metropolitan transportation planning process.

Planners and operators working to incorporate operations into the metropolitan transportation planning process may use the RCTO as a tool to translate that regional operations objective into a specific and actionable strategy for achieving the objective. The RCTO can help planners and operators develop **management and operations strategies** that can be included in the MTP.

Through developing an RCTO, the collaborative group of planners and operators establish roles,

³⁰ For more information see: U.S. Department of Transportation, FHWA, *Regional ITS Architecture Guidance Developing, Using, and Maintaining an ITS Architecture for your Region*, FHWA-HOP-06-112 (Washington, DC, 2006). Available at: <http://www.ops.fhwa.dot.gov/publications/regitsarchguide/index.htm>, last accessed December 6, 2009.

³¹ For more information see: U.S. Department of Transportation, FHWA, *Regional Concept for Transportation Operations: The Blueprint for Action - A Primer*, FHWA-HOP-07-122 (Washington, DC, 2007). Available at: <http://www.ops.fhwa.dot.gov/publications/rctoprimer/index.htm>, last accessed December 6, 2009.

responsibilities, and resources needed to achieve the operations objectives. In this way, the RCTO can serve as an important tool for **implementing** M&O strategies at a regional level.

7.5 Engage Elected Officials and the Public

Elected officials and the general public play a key role in the approach to planning for operations. The process of integrating M&O strategies into the metropolitan transportation planning process often calls for strong regional leadership. Often this comes from MPO leadership that recognizes the practicality of solutions in the near-term that may be achieved with operational solutions. This may be as simple as the mayor of the central city responding to his constituents' demands for greater travel time reliability along major routes. Leadership may come from the manager of the regional transit system recognizing the utility of a "smart card" that may be used for all transit systems in the region, or it may arise from the State DOT's need for improving the management of work zones. These concepts may arise in the context of the MPO planning process or they may surface in the arena of transportation operating agency coordination.

No matter how an issue arises, in most cases it takes a "champion" to push it and support it through the planning process (both internally to an operating agency and in the regional transportation planning process). It usually helps if the concept is pursued both at the technical level and the policy level. This can be facilitated by an MPO having a policy committee that champions operational strategies and a technical committee that develops the "nuts and bolts" of a concept. Elected officials also can play a key role in placing an emphasis in the MTP on the operational performance of the transportation system.

There are more than 100,000 State and local elected officials in the United States, ranging from governors to village selectmen. Beyond this number, there are tens of thousands of other individuals working in concert with elected officials at the following various levels

- **State Level:** Elected officials include governors and State legislators. Appointed officials typically include secretaries of transportation, commissioners, and often some form of State transportation board.
- **Local Level:** City councils and mayors (or whatever the chief local elected official may be called), who range from "strong" mayors in major cities where these elected individuals are the chief executive officers to "weak" mayors in smaller cities and towns that operate on a "council-manager" form of governance. In these cases, the city or town manager is usually the CEO. Additionally, there will be a council of some sort. Appointed officials typically include a director of transportation or public works.

Communicating the benefits of M&O strategies to elected officials is important since these strategies are often less tangible than infrastructure projects. Factors to consider when reaching out to elected/appointed officials include:³²

- Merits/content of a recommendation. Is it germane and relevant to the interests of the official?
- Framing of the issue. Is it framed in a manner that is relevant to elected official and his/her role?
- Timing of proposal. Do you allow enough time for reflection and consultation with others?
- Form of message. Is the form concise and easily absorbed?
- Deliverer of the message. Is the message presented by peers or others in whom the elected/appointed official has confidence?

Engaging the public in planning for operations and garnering public support for operations are important components of advancing regional operations and achieving operations objectives. Ultimately, M&O strategies are implemented to provide value to the public. Public support for operations objectives should be thoroughly considered when selecting

³² Federal Highway Administration, Office of Planning, Environment and Realty and the Office of Operations, "Understanding the Communications and Information Needs of Elected Officials for Transportation Planning and Operations," January 5, 2005. Prepared by John Mason. Available at: <http://www.planning.dot.gov/Documents/PublicInvolvement/understandComm.htm>, last accessed December 6, 2009.

objectives. The public can determine funding for operations by voting on local tax laws and influencing the selection and decisions of elected officials. To garner the public's support for operations, planners and operators need to help them understand the value of M&O strategies and the benefits they receive for their tax dollars.

Unlike road construction projects, operations projects and programs can be difficult for the public to see. Planners and operators have to rely on other ways to get the public's attention. Tracking and reporting on operations-related performance measures is one of the most common ways to gain public interest in transportation system performance. It can

also be used, as in the case of the Washington State Department of Transportation,³³ to create transparency and gain public trust. Advertising the success of M&O strategies and their measurable benefits to the public is another effective strategy in gaining public support.³⁴ Additionally, operators and planners can use branding techniques for M&O programs such as traveler information or freeway/arterial service patrols so that the public can easily recognize operation efforts. Finally, planners and operators can gather support for operations by relating operations to the things that the public cares about, such as spending more time with family in their communications with the public.

³³ Washington State Department of Transportation, "WSDOT Accountability and Performance Information," 2009. Available at: <http://www.wsdot.wa.gov/Accountability>, last accessed December 6, 2009.

³⁴ See "Metropolitan Mobility the Smart Way" from Metro in Portland, Oregon for an example. Available at: <http://library.oregonmetro.gov/files/metromobilityreport.pdf>, last accessed December 6, 2009.

8.0 GETTING STARTED

8.1 Steps to Getting Started: Planning for Operations Using the Approach

1. Making the case to MPO decisionmakers:

- a. Identify the key regional challenges (e.g., congestion).
- b. Identify the constraints (e.g., funding, environmental) on traditional capital investment.
- c. Gain policy agreement on pursuing M&O options for MTP and TIP.

2. Developing internal MPO leadership and advocacy for M&O:

- a. Design a structure appropriate to your MPO that establishes advocacy within the decisionmaking process (e.g., an M&O policy committee and/or an M&O technical committee).
- b. Ensure the full range of necessary stakeholders are at the table and invested in the effort.
- c. Develop a mechanism to allow for continual participation in the iterative process, which can help institutionalize the consideration of M&O.

3. Gaining regional participation in integrating M&O into planning:

- a. Coordinate with transportation operators in the region to develop an M&O subcommittee or group that will build consensus on the direction for operations in the region.
- b. Identify what data is currently being collected in the region. Utilize participating agencies to obtain operations data to support development of operations objectives and performance measures.

4. Developing operations goals and operations objectives for the MTP:

- a. Engage key operations participants in the region in developing the regional operations goals and operations objectives during the MTP update process, including State DOT, local DOT, transit, public safety, etc.
- b. Develop one or more goals that focus on the desired operational performance of the transportation system.
- c. Based on operations goals, begin to develop operations objectives that accurately reflect what the region would like to achieve and believes can be achieved within a certain timeframe. These operations objectives may start out as vague and then get “SMART” as part of an iterative process to define the operations objectives more specifically. Throughout this process, it is vital that the agencies necessary for achieving the objectives be committed to the resulting objectives.
 - a. Initially focus on what to improve, such as delay, clearance time, etc.
 - b. Select the area and time of focus, such as regionally significant arterials during peak hours.
 - c. Identify what data is currently being collected in the region and may be available for tracking the objectives. Based on this information, make the operations objectives more specific and link them to performance measures.
 - d. As fiscal constraints are applied during the development of the MTP, revisit the operations objectives to ensure feasibility.
 - e. Collect baseline data for performance measures. Performance targets can be introduced into the operations objectives or adjusted with an understanding of baseline performance.

5. Incorporating M&O strategies into the planning and programming processes:

- a. Identify strategies for achieving operations objectives and include them in the MTP.
- b. Be sure to include discussion of M&O strategies that are funded by State, regional and local transportation agencies, even without use of Federal funding, in the MTP.
- c. Develop a method to allocate funding to M&O projects. This may be done by competing M&O projects against all other types of projects, or the M&O projects may compete against each other for funding allocated through a line item reserved for M&O projects.

8.2 Self-Assessment

Agencies are at different levels of development in implementing an objectives-driven, performance-based approach. As the approach is scalable and can accommodate different levels of development, agencies should first begin by determining their own progress. The purpose of this section is to provide a tool for agencies to assess the extent to which they have integrated the approach to planning for operations at their organization. The assessment tool presented in Table 5 should be regarded as a starting point for integration of the approach and assessing the degree to which the operations goals and objectives have been integrated. It is not a comprehensive tool covering all aspects of transportation planning, but will help clarify certain areas and identify opportunities for future improvement.

Table 5: Assessment Tool to Measure Integration of an Objectives-Driven, Performance-Based Approach

	No Action to Date	Beginning to Make Progress	Partially Achieved	Mostly Achieved	Fully Achieved
Operations Goals and Objectives					
Does our MTP have one or more goals that focus on the improved performance of our regional transportation system?					
Does our MTP contain operations objectives that define desired system performance outcomes?					
Are our operations objectives specific and measurable?					
Have our operations goals and objectives been agreed upon by all our transportation system partners and stakeholders?					
Is it realistic that we will achieve our stated operations objectives?					
Do our operations objectives contain a timeframe for achievement?					
Do our operations objectives include multimodal considerations?					
Have we identified opportunities to build on our objectives as data becomes more available and performance trends become clear?					
Performance Measures					
Have we established performance measures that can be used to assess attainment of our operations objectives?					
Have we assessed our transportation system's performance according to our operation objectives to see where improvements are needed?					
Have we identified where we need additional data to support our performance measures and potential sources of that data?					
Management and Operations Strategies					
Have we identified M&O strategies to meet our operations objectives?					
Have we engaged both planners and operators to identify our M&O strategies?					
Have we formed a committee or other mechanism to identify/prioritize our strategies?					
Have we put together an inventory of current M&O strategies in effect within our region, including those not traditionally incorporated into the MTP planning process?					
Have we clearly articulated how we prioritize our M&O strategies?					

	No Action to Date	Beginning to Make Progress	Partially Achieved	Mostly Achieved	Fully Achieved
Management and Operations Strategies, continued					
Does our MTP clearly identify M&O strategies in a manner that lets decisionmakers clearly see the level of investment?					
Are investment decisions included within our MTP based on the best combination of capital investments and operations strategies (performance-based planning)?					
Monitoring and Evaluation					
Are we monitoring and evaluating our system performance on a regular basis?					
Do we have a plan in place to re-evaluate our operations objectives and performance measures?					
Have we regularly communicated our evaluation to our stakeholders?					
Regional Collaboration and Commitment					
Have we worked collaboratively with the leadership from the operating agencies in our region?					
Have we engaged our non-traditional stakeholders (e.g., emergency responders, freight operators, business community) as well as our traditional transportation planning partners?					
Have we leveraged our regional ITS architecture and/or ITS committees in our planning for operations?					
Have we utilized a regional concept for transportation operations?					

APPENDIX A. SAFETEA-LU REQUIREMENTS

1.0 Management & Operations in the Planning Process

On August 10, 2005, the Safe, Accountable, Flexible, and Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) was signed into law and became the most recent reauthorization of the Nation's surface transportation program. Along with identifying Federal funding for a range of transportation programs and other transportation-related regulations, SAFETEA-LU updated requirements for metropolitan transportation planning. A final planning rule (23 CFR Part 450) was issued on February 14, 2007. Beginning July 1, 2007, all newly adopted metropolitan transportation plans must comply with Federal regulations identified in SAFETEA-LU and the associated planning rule.

According to the planning rule, "Promote efficient system management and operation" is one of the eight planning factors that must be addressed in metropolitan transportation plans. Below is an excerpt from the Statewide Transportation Planning; Metropolitan Transportation Planning; Final Rule, February 14, 2007, Federal Register (**bold added to highlight points related to operations**):

§ 450.306 Scope of the metropolitan transportation planning process.

(a) The metropolitan transportation planning process shall be continuous, cooperative, and comprehensive, and provide for consideration and implementation of projects, strategies, and services that will address the following factors:

- (1) Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency;
- (2) Increase the safety of the transportation system for motorized and non-motorized users;
- (3) Increase the security of the transportation system for motorized and non-motorized users;
- (4) Increase accessibility and mobility of people and freight;

(5) Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and State and local planned growth and economic development patterns;

(6) Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight;

(7) Promote efficient system management and operation; and

(8) Emphasize the preservation of the existing transportation system.

(b) Consideration of the planning factors in paragraph (a) of this section shall be reflected, as appropriate, in the metropolitan transportation planning process. The degree of consideration and analysis of the factors should be based on the scale and complexity of many issues, including transportation system development, land use, employment, economic development, human and natural environment, and housing and community development.

The Final Rule also strengthens expectations for including management and operations strategies in the transportation planning process. The Rule states that metropolitan transportation plans shall include both long-range and short-range strategies/actions, including operational and management strategies that improve the performance of existing transportation facilities to relieve congestion and maximize the safety and mobility of people and goods.

Selected excerpts are presented below (**bold added to highlight points related to operations**):

§ 450.322 Development and content of the metropolitan transportation plan.

(a) The metropolitan transportation planning process shall include the development of a transportation plan addressing no less than a 20-year planning horizon as of the effective date. In nonattainment and maintenance areas, the effective date of the

transportation plan shall be the date of a conformity determination issued by the FHWA and the FTA. In attainment areas, the effective date of the transportation plan shall be its date of adoption by the MPO.

(b) The transportation plan shall include both **long-range and short-range strategies/actions** that lead to the development of an integrated multimodal transportation system to facilitate the safe and efficient movement of people and goods in addressing current and future transportation demand.

...

(f) **The metropolitan transportation plan shall, at a minimum, include:**

(1) The projected transportation demand of persons and goods in the metropolitan planning area over the period of the transportation plan;

(2) Existing and proposed transportation facilities (including major roadways, transit, multimodal and intermodal facilities, pedestrian walkways and bicycle facilities, and intermodal connectors) that should function as an integrated metropolitan transportation system, giving emphasis to those facilities that serve important national and regional transportation functions over the period of the transportation plan. In addition, the locally preferred alternative selected from an Alternatives Analysis under the FTA's Capital Investment Grant program (49 U.S.C. 5309 and 49 CFR part 611) needs to be adopted as part of the metropolitan transportation plan as a condition for funding under 49 U.S.C. 5309;

(3) **Operational and management strategies to improve the performance of existing transportation facilities to relieve vehicular congestion and maximize the safety and mobility of people and goods;**

(4) Consideration of the results of the congestion management process in [Transportation Management Areas] TMAs that meet the requirements of this subpart, including the identification of [single-occupancy vehicle] SOV projects that result from a congestion management process in TMAs that are nonattainment for ozone or carbon monoxide;

2.0 Transportation Systems Management and Operations

The SAFETEA-LU Technical Corrections Act of 2008 amended Section 101(a) of Title 23 U.S.C. to include a definition of transportation systems management and operations (TSM&O). TSM&O is also referred to as "management and operations" or "M&O."

Below is an excerpt from the SAFETEA-LU Technical Corrections Act of 2008:

(h) Transportation Systems Management and Operations Defined- Section 101(a) of title 23, United States Code, is amended by adding at the end the following:

(39) TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS-

(A) IN GENERAL- The term 'transportation systems management and operations' means an integrated program to optimize the performance of existing infrastructure through the implementation of multimodal and intermodal, cross-jurisdictional systems, services, and projects designed to preserve capacity and improve security, safety, and reliability of the transportation system.

(B) INCLUSIONS- The term 'transportation systems management and operations' includes--

(i) regional operations collaboration and coordination activities between transportation and public safety agencies; and

(ii) improvements to the transportation system, such as traffic detection and surveillance, arterial management, freeway management, demand management, work zone management, emergency management, electronic toll collection, automated enforcement, traffic incident management, roadway weather management, traveler information services, commercial vehicle operations, traffic control, freight management, and coordination of highway, rail, transit, bicycle, and pedestrian operations.

3.0 Congestion Management Process

SAFETEA-LU also made a significant change regarding congestion management. Title III Section 3005 and Title VI Section 6001 updated the requirement for addressing congestion in Transportation Management Areas, mandating the incorporation of a “congestion management process” (CMP) within the metropolitan planning process.

The law requires a CMP in TMAs – urban areas with a population greater than 200,000 – as opposed to a congestion management system (CMS). The change in name (and acronym) is intended to be a substantive change in perspective and practice intended to encourage targeted areas to address congestion management through a process that provides for effective M&O and an enhanced linkage to both the planning process and the environmental review process that is based on cooperatively developed travel demand reduction and operational management strategies and capacity increases. This new focus retains the traditional role of the MPO in long-range transportation planning, but empowers the MPO and its partners in planning for the ongoing operations and management of the transportation system.

Below is language from the Statewide Transportation Planning; Metropolitan Transportation Planning; Final Rule, February 14, 2007, Federal Register (**bold added to highlight points**):

Sec. 450.320 Congestion management process in transportation management areas.

(a) The transportation planning process in a TMA shall **address congestion management through a process that provides for safe and effective integrated management and operation of the multimodal transportation system**, based on a cooperatively developed and implemented metropolitan-wide strategy, of new and existing transportation facilities eligible for funding under title 23 U.S.C. and title 49 U.S.C. Chapter 53 **through the use of travel demand reduction and operational management strategies.**

(b) The development of a congestion management process **should result in multimodal system**

performance measures and strategies that can be reflected in the metropolitan transportation plan and the TIP. The level of system performance deemed acceptable by State and local transportation officials may vary by type of transportation facility, geographic location (metropolitan area or subarea), and/or time of day. In addition, **consideration should be given to strategies that manage demand, reduce single occupant vehicle (SOV) travel, and improve transportation system management and operations.** Where the addition of general purpose lanes is determined to be an appropriate congestion management strategy, explicit **consideration is to be given to the incorporation of appropriate features into the SOV project to facilitate future demand management strategies and operational improvements** that will maintain the functional integrity and safety of those lanes.

(c) The congestion management process shall be developed, established, and implemented as part of the metropolitan transportation planning process that includes **coordination with transportation system management and operations activities.** The congestion management process shall include:

(1) **Methods to monitor and evaluate the performance of the multimodal transportation system**, identify the causes of recurring and non-recurring congestion, identify and evaluate alternative strategies, provide information supporting the implementation of actions, and evaluate the effectiveness of implemented actions;

(2) Definition of **congestion management objectives and appropriate performance measures** to assess the extent of congestion and support the evaluation of the effectiveness of congestion reduction and mobility enhancement strategies for the movement of people and goods. Since levels of acceptable system performance may vary among local communities, **performance measures should be tailored to the specific needs of the area and established cooperatively by the State(s), affected MPO(s), and local officials in consultation with the operators of major modes of transportation in the coverage area;**

(3) Establishment of a coordinated program for **data collection and system performance monitoring** to define the extent and duration of congestion, to contribute in determining the causes of congestion, and evaluate the efficiency and effectiveness of implemented actions. To the extent possible, this data collection program should be coordinated with existing data sources (including archived operational/ITS data) and **coordinated with operations managers** in the metropolitan area;

(4) Identification and **evaluation of the anticipated performance and expected benefits of appropriate congestion management strategies** that will contribute to the more effective use and improved safety of existing and future transportation systems based on the established performance measures. The following categories of strategies, or combinations of strategies, are some examples of what should be appropriately considered for each area:

(i) Demand management measures, including growth management and congestion pricing;

(ii) Traffic operational improvements;

(iii) Public transportation improvements;

(iv) ITS technologies as related to the regional ITS architecture; and

(v) Where necessary, additional system capacity;

(5) Identification of an implementation schedule, implementation responsibilities, and possible funding sources for each strategy (or combination of strategies) proposed for implementation; and

(6) Implementation of a process for periodic **assessment of the effectiveness of implemented strategies, in terms of the area's established performance measures**. The results of this evaluation shall be provided to decisionmakers and the public to provide guidance on selection of effective strategies for future implementation.

(d) In a TMA designated as nonattainment area for ozone or carbon monoxide pursuant to the Clean Air Act, Federal funds may not be programmed for any project that will result in a significant increase in the carrying capacity for SOVs (i.e., a new general purpose highway on a new location or adding general purpose lanes, with the exception of safety improvements or the elimination of bottlenecks), unless the project is addressed through a congestion management process meeting the requirements of this section.

(e) **In TMAs designated as nonattainment for ozone or carbon monoxide, the congestion management process shall provide an appropriate analysis of reasonable (including multimodal) travel demand reduction and operational management strategies for the corridor in which a project that will result in a significant increase in capacity for SOVs (as described in paragraph (d) of this section) is proposed** to be advanced with Federal funds. If the analysis demonstrates that travel demand reduction and operational management strategies cannot fully satisfy the need for additional capacity in the corridor and additional SOV capacity is warranted, then the congestion management process shall identify all reasonable strategies to manage the SOV facility safely and effectively (or to facilitate its management in the future). Other travel demand reduction and operational management strategies appropriate for the corridor, but not appropriate for incorporation into the SOV facility itself, shall also be identified through the congestion management process. All identified reasonable travel demand reduction and operational management strategies shall be incorporated into the SOV project or committed to by the State and MPO for implementation.

(f) State laws, rules, or regulations pertaining to congestion management systems or programs may constitute the congestion management process, if the FHWA and the FTA find that the State laws, rules, or regulations are consistent with, and fulfill the intent of, the purposes of 23 U.S.C. 134 and 49 U.S.C. 5303.

APPENDIX B. COMPONENTS OF THE CMP

1.0 Developing a CMP: The “8 Steps”

The congestion management process (CMP) uses the objectives-driven, performance-based approach described in this guidebook to focus on managing congestion. The CMP looks at M&O and other strategies for managing congestion, focusing on developing objectives that drive performance-based planning for responding to congestion. The CMP is based upon objectives articulated in the metropolitan transportation plan (MTP). The CMP incorporates specific, measurable, agreed-upon, realistic, and time-bound objectives that reflect regional goals. And, as an integral part of the planning process, the CMP feeds projects and strategies directly into the MTP and transportation improvement program (TIP). Developing a CMP typically follows an eight-step process. Figure 6 illustrates the entire framework for the CMP process.

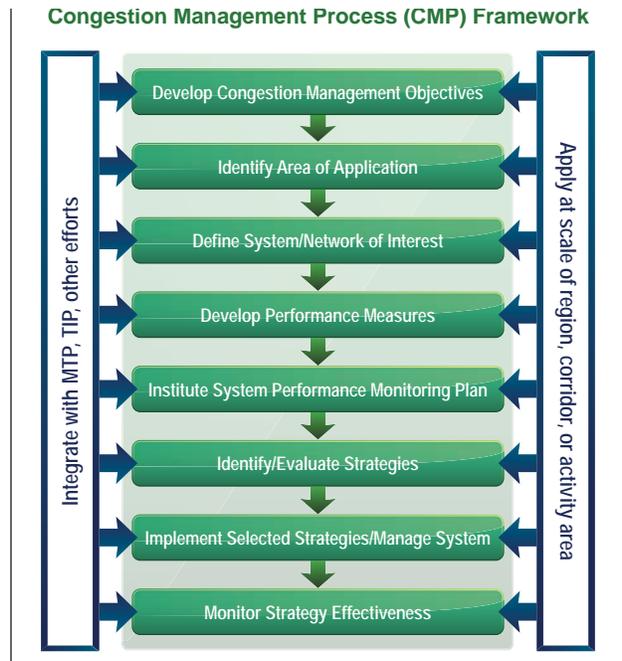
Step 1 – Develop Congestion Management Objectives

The first step in developing a CMP is to identify objectives that focus on congestion management. These objectives typically are derived from the vision and goals articulated in the MTP. These objectives include SMART criteria, as within the objectives-driven, performance-based approach, and are defined in terms that enable stakeholders to focus on specific aspects of congestion. For example, objectives for commute trips may be different from objectives for other travel purposes. Alternatively, objectives may be established only for peak period travel as opposed to off-peak period. Objectives may also be developed for freight movement, and may be focused on activity areas or corridors where the movement of goods is particularly important, such as a port, terminal, or freight corridor.

Step 2 – Identify the Area of Application

The CMP should be applied to a specific geographic area and network of surface transportation facilities. Often an area of application may align with the same geographic area as for the regional ITS architecture. This alignment would allow system inventories and network descriptions to link together. The area of

Figure 6: The 8-Step Framework for the CMP



The congestion management process (CMP) is required as an integral part of the metropolitan planning process in transportation management areas (TMAs) – urbanized areas with a population over 200,000 people – or any area where designation as a TMA has been requested. Although the CMP is not required in non-TMAs, the CMP represents an objectives-driven, performance-based approach to managing congestion; therefore, the CMP should be considered in all metropolitan areas facing current and future congestion challenges.

application must encompass at least the transportation management area (TMA) boundary, though it may be advantageous to include the entire metropolitan area boundary (TMA boundary plus the area that will become urbanized within the next 20 years). In non-TMAs, the area of application is most likely the MPO planning area boundary. In some areas, where significant facilities or activity centers border the limits of a given metropolitan area, it may be appropriate to expand the CMP boundaries to include a broader analysis area.

Step 3 – Define the System/Network of Interest

Whatever the area of application used, the CMP should define the system characteristics and transportation network under consideration. The CMP should be multi-modal, so the network should include both highway and transit facilities. Freight and/or rail transportation assets may also be included as conditions warrant. The CMP could consider particular corridors or activity centers, in addition to encompassing an entire metropolitan area. Finally, the CMP may also comprise a combination of regional, corridor, and activity area definitions, with each component serving different, specific purposes.

Step 4 – Develop Performance Measures

As with the objectives-driven, performance-based approach, performance measures created for the CMP should be derived from the goals and objectives established during the MTP process. Performance measures should reflect the impact of congestion on travelers and on economic activity, such as the number of highway accidents or lost time due to congestion. Measures developed should be flexible in their application and may change over time. Measures should include multimodal consideration. For example, measures related to highway congestion should be accompanied by those for transit, goods movement, and non-motorized modes. Finally, ideal performance measures will allow system performance to be tracked over time.

Step 5 – Institute System Performance Monitoring Plan

For a CMP to be truly effective, it requires a coordinated program of data collection and system performance monitoring to assess the extent of congestion and to see whether remedial steps are working. Data collection needs are based on the performance measures selected. The data should be relevant to the area, readily available, timely, reliable, consistent, and susceptible to forecasting. Common sources of data include traditional methods such as travel surveys and screen line counts, traffic counts, ITS traffic detection devices, aerial surveys, and speed surveys.

Step 6 – Identify/Evaluate Strategies

As the CMP is performance-based, strategies that manage congestion should be identified and evaluated for their performance. A full range of potential strategies should be considered, including M&O strategies

(including travel demand management), land use strategies, and infrastructure improvements. An evaluation would rely upon the performance measures selected and assess whether associated objectives were realized.

Step 7 – Implement Selected Strategies/Manage the System

This step involves the implementing and managing the defined strategies. Managers of the CMP should work closely with the operating agencies that have participated in the CMP. Information developed throughout the process should be applied to establish priorities in the TIP, thereby facilitating the implementation of the CMP. This ensures a linkage between the CMP and funding decisions either through a formal ranking and weighting of strategies and projects, or through other formal or informal approaches.

Step 8 – Monitor Strategy Effectiveness

Finally, as with the objectives-driven, performance-based approach, the CMP is an iterative process. Each step is evaluated and opportunities for improvement are noted. Based on the feedback received, an MPO should revise its CMP and restart the process anew.

2.0 Beyond the “8 Steps”

Beyond developing a CMP, a region should consider the viability of its process too. In addition to the eight steps, some extra effort should be made to ensure that the CMP continues to meet the needs of a region. Among these recommendations:

- **Decide on what you want to accomplish.** There should be general agreement on how the goals and objectives expressed in the MTP are articulated in the CMP. Different stakeholders will have different objectives, which should be accommodated in the process.
- **Develop a working team or steering committee.** Existing organizational arrangements may be appropriate, or new committees can be formed. Either way, it is important for the groups to have a broad membership that includes planning and operations staffs from the member organizations of the MPO – representatives from local jurisdictions, State DOTs, and public transportation operators.

- **Prepare a timeline for developing the CMP.** As with any strategy, it is smart to set specific tasks, schedules, levels of effort, and responsibilities for carrying out the CMP. If the CMP is part of the MTP, strategies can be treated just like the other implementation measures. But, whether or not the CMP is prepared as an element of the MTP, the timeline ought to allow time for the CMP to “feed” projects and strategies to the MTP development process. The timeline also should identify an update schedule as well as data collection and analysis activities in support of periodic assessments of the effectiveness of implemented congestion management strategies.
- **Conduct a self assessment.** Assess not only where your MPO stands in developing a CMP, but what you are doing now to address congestion in terms of both long-range planning and short-range efforts to manage congestion.
- **Define a clear role for the State DOT and other operators.** While MPOs generally welcome the involvement of the State DOT in the metropolitan planning process, the active participation of the DOT in the CMP is not always clearly defined. The perspective of the DOT as an operator is important in sharing data and developing congestion mitigation strategies. Yet, it is also important that the DOT appreciate the perspective and priorities of other participants. “Acceptable” levels of congestion may differ according to transportation facility, geographic location (metropolitan area or subarea), and/or time of day. For instance, a higher level of congestion may be acceptable in a transit-oriented development (TOD) area where planners hope to encourage the use of public transportation, while system operators may wish to maintain a higher level of service in areas poorly served by transit. In any case, the operators of facilities – including the State DOT – should be sensitive to the priorities of various stakeholders in the CMP.

The Final Rule on Statewide and Metropolitan Transportation Planning makes clear that coordination and consultation between the State DOT and MPO is required; State DOTs are “encouraged to rely on information, stud-

ies, or analyses provided by the MPOs for portions of the transportation system located in metropolitan planning areas” (§450.208). Furthermore, the statewide planning process “shall (to the maximum extent practicable) be consistent with the development of applicable regional intelligent transportation systems (ITS) architectures...” The Final Rule also encourages “consultation with, or joint efforts among, the State(s), MPO(s), and/or public transportation operators” (§450.212). The States should be partners in the development and application of the CMP, particularly for portions of the transportation network within the MPO that are operated by the State DOT.

- **Collaborate.** Collaboration on regional operations, including the development and implementation of the CMP, is essential. Collaboration enables development of projects and policies that have a regional effect on users, including activities such as incident management, advanced traveler information services, public safety and security, management of the impacts of special events, and implementation of electronic payment measures. Moreover, collaboration among operators, service providers, and planners for all surface modes affecting, or affected by, congestion, helps to answer questions about the long-term operation, integration, and evolution of facilities and services.

3.0 Other Considerations

Applying the CMP in Developing the MTP

The congestion management process provides a mechanism for identifying short-, medium-, and long-term strategies for addressing congestion on a system-wide, corridor-level, or site-specific basis. Once operations objectives relevant to the area in question have been established, the CMP draws upon appropriate performance measures to identify specific congestion problems. Data from the MPO’s resources or from the appropriate operating agency is used to characterize the nature of the congestion problems, and technical tools are applied to help identify appropriate strategies.

The CMP uses a cooperative approach to involve both affected operators and the public in a consideration of strategies, both in terms of the effectiveness of proposed solutions and the acceptability to various stakeholders. Together, affected parties and system operators determine the availability of resources and the timing for implementation of proposed strategies. The actions identified through the CMP then become part of the alternatives analysis process, in which proposed solutions to the broad array of regional problems are considered in context. Actions offered through the CMP are then incorporated into the MTP, based on how they compete with projects and programs proposed by other interests during the planning process.

Relationship of the CMP to the Regional ITS Architecture

The CMP and the regional ITS architecture are both technical tools that assist planners and system operators in developing and selecting strategies for improving the movement of people and goods in a region. The regional ITS architecture focuses on the application of information and communications technology to transportation problems in a technologically coordinated way. A common framework guides practitioners in establishing communications (and, ideally, integration) across technology applications and helps them to choose the most appropriate strategies for processing transportation information. The regional ITS architecture defines the system components, key functions, organizations involved in developing an architecture, and the type of information to be shared between organizations and between parts of the system.

While the CMP is not focused on any particular set of strategies, an understanding of the regional ITS architecture is crucial in appreciating the existing and future interconnections, or even the simple ability to communicate, between agencies and systems. The ITS architecture, which is by design a living document that is intended to be updated on a periodic basis, provides an institutional framework as well as a vision for the interconnections among technologies, systems, and subsystems.

Applying the CMP in Nonattainment TMAs

SAFETEA-LU requires that “for transportation management areas classified as non-attainment for ozone

or carbon monoxide pursuant to the Clean Air Act, Federal funds may not be advanced in such area for any highway project that will result in a significant increase in the carrying capacity for single-occupant vehicles (SOV) unless the project is addressed through a congestion management process.” While capacity-expanding projects are not prohibited, the CMP requirement means that the MPO must consider alternatives to capacity increases, and that measures would be incorporated into the project to make the most efficient use of the new capacity once it has been constructed. In all TMAs, attainment or non-attainment, the CMP should identify strategies that complement proposed improvements. These may be measures such as ramp meters for new freeway lanes or access management on a parallel arterial. These complementary strategies extend the life of the SOV capacity in which we invest.

In ozone and carbon monoxide non-attainment TMAs, MPOs must establish a congestion management process that gives priority to strategies that reduce congestion and improve the movement of people and goods without requiring the construction of new highway capacity. The decision process in dealing with this restriction on SOV capacity-expanding projects must be documented as part of the CMP in these areas.

Addressing Recurring and Non-Recurring Congestion

The CMP should enable the MPO to address both recurring congestion (usually caused by “bottlenecks” where capacity is constricted or where merging and weaving patterns cause conflicts) and non-recurring congestion (resulting from incidents, special events, or other phenomena like adverse weather). Either type of congestion may require analysis at the corridor or facility level in order to pinpoint problem locations or to identify and evaluate potential mitigation strategies.

The CMP should also be designed to enable assessment of activities that may not apply to a particular location, such as incident response strategies. Incident-related delay accounts for a large and growing proportion of travel delay, particularly in regions where travel demand is already stressing an overburdened system.

Tying Funding to the CMP

Some CMP projects and strategies can be implemented by the MPO through inclusion in the TIP. It may be necessary to convince the TIP committee or decisionmaking body on the merits of the CMP projects by ranking projects relative to their benefits. Other CMP projects/strategies may need to be included in State or local programs to accomplish implementation. Those projects that support the goals and objectives of the plan should be implemented; projects should be ranked according to how well they meet the goals and objectives of the plan.

APPENDIX C. APPLICATIONS OF THE APPROACH

1.0 Linking Planning and NEPA

SAFETEA-LU illustrates the close links between the metropolitan transportation planning process as practiced by metropolitan planning organizations (MPOs) and the environmental analysis undertaken by project sponsors. Legal guidance previously distributed to planning agencies³⁵ notes that:

...much of the data and decision-making undertaken by State and local officials during the planning process carry forward into the project development activities that follow the TIP or STIP. This means that the planning process and the environmental assessment required during project development by NEPA (42 U.S.C. 4231 et seq.) should work in tandem, with the results of the transportation planning process feeding into the NEPA process.³⁶

The memorandum points out that this close linkage is not always observed in the course of project development. As stated by the authors of the memo:

In practice, the environmental analyses produced during the NEPA process are sometimes disconnected from the analyses used to prepare transportation plans, transportation improvement programs, and supporting corridor or subarea studies. Analyses and decisions occurring during transportation planning can be ignored or redone in the NEPA process, resulting in a duplication of work and delays in implementation of transportation projects. The sharp separation between the work done during the transportation planning process and the NEPA analysis and documentation process is not necessary.³⁷

As stated, planning information can and should be incorporated into the environmental review process, rather than starting with a blank page for every project.

As further discussed in the memo, “NEPA and the government-wide regulations that carry out NEPA (40 CFR Parts 1500 et seq.) clearly contemplate the integration of the NEPA process with planning processes.” In 40 CFR 1501.2, Federal agencies are required to “integrate the NEPA process with other planning at the earliest possible time to ensure that planning and (agency) decisions reflect environmental values....”³⁸

Sections of the Final Rule referring to transportation planning studies and project development (§450.318, p. 7274) discuss the high standards that must be met for incorporation of planning studies into the NEPA process. The Rule notes that:

Publicly available documents or other source material produced by, or in support of, the transportation planning process described in this subpart may be incorporated directly or by reference into subsequent NEPA documents, in accordance with 40 CFR 1502.21, if:

1. The NEPA lead agencies agree that such incorporation will aid in establishing or evaluating the purpose and need for the Federal action, reasonable alternatives, cumulative or other impacts on the human and natural environment, or mitigation of these impacts; and
2. The systems-level, corridor, or subarea planning study is conducted with:
 - i. Involvement of interested State, local, Tribal, and Federal agencies;
 - ii. Public review;
 - iii. Reasonable opportunity to comment during the metropolitan transportation planning process and development of the corridor or subarea planning study;

³⁵ Memorandum: Integration of Planning and NEPA Processes, February 22, 2005; D.J. Gribbin, Chief Counsel, FHWA and Judith S. Kaleta, Acting Chief Counsel, FTA, to Cindy Burbank, Associate Administrator, Office of Planning, Environment and Realty, FHWA, and David A Vozzolo, Deputy Associate Administrator, Office of Planning and Environment, FTA.

³⁶ Ibid.

³⁷ Ibid.

³⁸ Ibid.

- iv. Documentation of relevant decisions in a form that is identifiable and available for review during the NEPA scoping process and can be appended to or referenced in the NEPA document; and
- v. The review of the FHWA and the FTA, as appropriate.³⁹

Appendix A to 23 CFR 450, while addressing the level of detail appropriate for incorporating planning analysis in project development studies, notes that, for purposes of transportation planning alone, a planning-level analysis does not need to rise to the level of detail required in the NEPA process. Rather, the planning-level analysis needs to be accurate, up to date, and should adequately support recommended improvements in the statewide or metropolitan long-range transportation plan.

SAFETEA-LU requires transportation planning processes to focus on setting a context and following acceptable procedures. For example, SAFETEA-LU requires “a discussion of the types of potential environmental mitigation activities” and potential areas for their implementation, rather than details on specific strategies. SAFETEA-LU also emphasizes consultation with Federal, State, Tribal land management, wildlife, and regulatory agencies.

However, the environmental assessment (EA) or environmental impact statement (EIS) ultimately will be judged by the standards applicable under the NEPA regulations and guidance from the Council on Environmental Quality (CEQ). To the extent the information incorporated from the transportation planning process, standing alone, does not contain all of the information or analysis required by NEPA, it will need to be supplemented by other information

contained in the EIS or EA that would, in conjunction with the information from the plan, collectively meet the requirements of NEPA.

In this context, the congestion management process, if appropriately developed, can provide at a minimum a valuable starting point for the NEPA process, and, ideally, could give the agency a “running start” on critical components of the NEPA process such as purpose, need, and alternatives screening, among others.

The congestion management process is one of many elements feeding into the metropolitan transportation planning process. Along with requirements for coordination with State and local officials, consultation with Federal and tribal agencies, and consistency with the regional or statewide ITS Architecture, the CMP provides a mechanism for addressing regional, corridor-wide, and spot congestion issues in a comprehensive fashion. At the same time, the CMP works with the eight planning factors that should be considered in preparing long-range plans, and especially with promoting efficient and effective transportation system M&O.

The CMP is not intended to replace any of the existing elements of the planning process, but instead to complement and efficiently organize existing methods and techniques. The CMP also is focusing on management and operations strategies as potential means for mitigating or offsetting existing and future congestion. By emphasizing system performance measures and the data needs derived from such measures, the CMP helps system planners to identify ways to maximize the use of existing capacity, and to extend the usefulness of proposed improvements by enhancing operational efficiency and effectiveness.

³⁹ Federal Register: February 14, 2007 (Volume 72, Number 30), Statewide Transportation Planning; Metropolitan Transportation Planning; Final Rule, Discussion of Comments, p. 7274. Available at: <http://edocket.access.gpo.gov/2007/07-493.htm>, last accessed December 6, 2009.

Current Practice:

Linking NEPA studies with the Congestion Management System (CMS) Toolbox was a logical approach given that alternatives defined with congestion relief potential would be developed, screened, and evaluated for any NEPA study underway in the region.

The **Mid-America Regional Council** (MARC) serves eight counties and 116 cities in the greater Kansas City bi-State (Missouri and Kansas) region. In 2001, MARC developed an enhanced congestion management system (CMS) designed to integrate with the regional transportation plan (RTP), transportation improvement program (TIP), and corridor evaluations, including the major investment study (MIS) planning processes. In developing its CMS, MARC identified a “CMS Toolbox” that incorporated a broad catalog of potential strategies under the following headings:

1. Highway projects.
2. Transit projects.
3. Bicycle and pedestrian projects.
4. Transportation demand management strategies.
5. Intelligent transportation systems and transportation systems management strategies.
6. Access management strategies.
7. Land development strategies.
8. Parking management strategies.

MARC adopted a policy that its CMS Toolbox of strategies would be considered when the purpose and need for an environmental study includes congestion management. The agency wanted to demonstrate how any suggested capacity improvements had been evaluated using the congestion management process.

At the time MARC was developing its CMP, the agency had established a network of facilities on which it collected data, including travel time studies and traffic counts, but was only using CMS methods to support the regional planning process by providing data to potential project sponsors for the RTP and TIP. Because the system is less congested than most other metropolitan regions of comparable size, the CMS has been less of a planning focus than in other locations.

MARC wanted to develop a transparent process to show how a capacity improvement had gone through the congestion management process. Linking NEPA studies with the CMS Toolbox was a logical approach given that alternatives defined with congestion relief potential would be developed, screened, and evaluated for any NEPA study underway in the region. The MARC Congestion Management System Policy adopted the following language on the integration of major investment studies to the metropolitan planning process:

The CMS Toolbox provides alternative congestion management strategies for consideration in MIS [Major Investment Studies] and Corridor Studies. When traffic congestion is referenced in the Purpose and Need Statement for an MIS, the MIS shall consider the congestion management strategies included in the MARC CMS Toolbox as a starting point for the development of alternative strategies. This does not preclude the MIS from considering other strategies that may not be in the CMS Toolbox, nor does it require that the MIS select a strategy from the CMS Toolbox be the preferred alternative, however, the MIS document must include a discussion of how the CMS Toolbox strategies were addressed.⁴⁰

Currently, there is no NEPA requirement that the CMS be incorporated into the NEPA process. MARC’s policy that NEPA studies incorporate the CMS Toolbox is not codified in any agreements with implementing agencies, but instead is implemented on a voluntary and cooperative basis. However, MARC and the Missouri Department of Transportation (MoDOT) have worked closely in a number of instances to incorporate CMS Toolbox strategies into relevant projects.

A major benefit is that by coordinating planning and NEPA through the CMP, duplication or redoing the planning work in the NEPA process is avoided. This helps to “streamline” the NEPA process. Since adoption of the Policy, MARC has not been challenged about any projects in the TIP. MARC feels the region is accomplishing the goals that Congress had set for CMS when it was established, since transportation is being approached from a multimodal perspective. Overall, MARC feels that the partnerships among State, Federal, and regional government agencies are working well, with MARC staff continually involved in a significant number of projects.

See: <http://www.marc.org>

⁴⁰ Mid-America Regional Council, “MARC Congestion Management System Policy,” December 18, 2001. Available at: <http://www.marc.org/transportation/cms/policy.pdf>, last accessed February 9, 2010.

2.0 Freight Planning

Most metropolitan areas face challenges in transportation planning for freight mobility. Dramatically increasing freight flows in the metropolitan areas have contributed to increased congestion in the transportation system, imposing costs on shippers, consumers, and the environment. Using CMP tools, processes, and data assists in freight planning.

The U.S. DOT has developed a “Framework for a National Freight Policy.”⁴¹ This framework contains a vision of freight transportation systems that will ensure the efficient, reliable, safe, and secure movement of goods and support the Nation’s economic growth while improving environmental quality. The framework offers potential strategies that can be considered when assessing goods movement through the congestion management process.

The CMP can assist in addressing freight-specific congestion, and congestion impacting freight movement, by incorporating specific freight-related strategies in the development of an objectives-driven, performance-based approach to resolving congestion issues. Freight-specific strategies might include truck-only lanes, infrastructure improvements to remove freight bottlenecks, and designated truck routes.

3.0 Safety Planning

Incorporating safety as a regional priority and establishing specific safety-related performance objectives is an important first step toward having safety considerations included in the metropolitan transportation planning process. When safety objectives are included in the MTP, this drives the development of safety-related performance measures in the CMP. An emphasis on safety becomes integral to the collection of crash and injury data, which further supports the analysis of safety during the planning process. As local jurisdictions develop and maintain crash information databases and conduct independent safety analyses, such data can further support the identification of locations and types of safety improvements that are needed.

Involving local public safety officials as CMP stakeholders is key to identifying safety concerns and can provide useful input on key transportation safety issues. Planners can work with traffic, engineering, and public works staff to develop safety-related objectives in the CMP. These measures allow safety countermeasures to be incorporated into highway rehabilitation or improvement projects. Stand-alone projects to address critical safety issues also can be incorporated into the planning process.

4.0 Land Use Integration

The planning and management of urban land use greatly impacts transportation demand on the surface transportation system. Since land use decisions are generally made at the local level, considerations with respect to jurisdictional control should be considered when advancing land use strategies.

Including operational objectives dealing with land use in the MTP highlights the importance of transportation investment for land development, regional demographic growth, and economic development. Land development strategies have been used in some areas to manage demand on the transportation system, and to help agencies meet air quality conformity standards. Land use strategies can include limits on the amount and location of development until certain service standards are met, or policies that encourage development patterns better served by public transportation and non-motorized modes. Examples of land use strategies include transit-oriented development, densification and infill strategies, and encouragement of mixed-use development.

For more information:

To learn more about applications for the elements of the objectives-driven, performance-based approach to plan for operations, read six case studies from across the country:

<http://www.plan4operations.dot.gov/casestudies/benefits.htm>.

⁴¹ U.S. Department of Transportation, FHWA, Freight Transportation, “Framework for a National Freight Policy,” Available at: http://www.freight.dot.gov/freight_framework/index.cfm, last accessed December 6, 2009.

APPENDIX D. OPERATIONS OBJECTIVES AND PERFORMANCE MEASURES IN PRIVATE AND PUBLIC ORGANIZATIONS

The use of specific objectives and performance measures to manage operational performance is common practice among private companies and public organizations that are responsible for generating sufficient revenue to meet cost and/or produce profit through delivery of services in a competitive or service-driven context. The experiences of these organizations are a potentially rich source of information on how an objectives-driven, performance-based approach can be used to plan for and manage transportation operations in the public sector.

This appendix provides a brief look at two delivery companies or organizations, a tollway organization, and two power companies. Each organization delivers a service over a physical infrastructure and closely monitors its operations and customer service to maintain and expand its customer base.

Based on the information gathered on performance management in self-sustaining private and public organizations, the following list of activities were developed for consideration in planning and managing transportation operations in the public sector:

- **Develop a balanced set of objectives and performance measures.** In 1992, Kaplan and Norton developed a set of measures known as the “balanced scorecard” during a year-long research project with 12 companies at the leading edge of performance measurement. This scorecard gives top managers a quick but comprehensive view of the business from four important perspectives. It includes financial measures as well as three operational measures that are the drivers of future financial performance: customer satisfaction, internal processes, and the organization’s innovation and improvement activities. In the area of transportation operations, these four areas may be translated into external system outcomes (system efficiency/reliability), customer satisfaction, operator activities (internal processes), and innovation/improvement activities.
- **Develop objectives for different levels or tiers in the organization based on responsibility.** The Austin Energy Electric Service Delivery business area and a U.S. power company both develop and use objectives based on organizational level. At the highest level of the organization, the top-level management focuses on broad objectives and associated measures that describe how the organization is performing. At the lower levels of the organization, the objectives are increasingly specific and related to the responsibilities of the personnel at that level of the organization. This helps employees better understand what is expected of them and how they can contribute to the overall organizational objectives or goals.
- **Assign weights to performance objectives according to their impact on customer satisfaction.** Federal Express (FedEx) developed a 12-component index known as the Service Quality Indicator; each component is weighted to reflect how significantly it affects overall customer satisfaction. FedEx uses customer satisfaction surveys to update its measures and weights accordingly.
- **Set up a team for each objective or performance measure.** FedEx set up a cross-functional action team for each component of its Service Quality Indicator. Each team is headed by a senior executive and assures the involvement of employees from all part of the company when needed.
- **Communicate performance information regularly to staff.** TNT Express Delivery Service in the United Kingdom uses a 7-indicator service performance report that is updated weekly and circulated among each package coordination and collection depot. The performance of each depot is indicated on the report and this creates competition among the depots for top performance.

- **Ensure objectives have a senior level champion.** The package delivery companies of FedEx and TNT both have senior executives that serve as champions within the organization for the performance measurement system. At FedEx, one senior executive leads an action team on each performance indicator. An assessment of TNT by Moon and Fitzgerald contributes the successful use of a performance management system to push the strategic direction of the company to 5 properties. One of them is the corporate champion for the performance measurement system. There is a constant driving down of the corporate message from the head office that they believe in the system and attach great importance to its results.
- **Maintain a high-level of awareness of operational performance.** One of the common features of the performance management systems in the organizations examined was a very high level of awareness of the performance of the system. In the case of the Illinois Tollway, it regularly tracks data on incident detection, response, and clearance times with time stamps and weekly reports. To manage congestion in construction zones, the Tollway installs sensors prior to construction to establish a baseline for operational performance, monitor performance during construction, and monitor performance following construction to see improvements.

Below are brief case studies of the use of objectives and performance measures at two delivery companies or organizations, a tollway organization, and two power companies.

Federal Express

Prior to 1989, FedEx assumed that on-time delivery was what their customers expected and valued most; however, input from customers showed them that customers expected much more.⁴² In an effort to spur progress toward their ultimate target of 100 percent customer satisfaction, FedEx developed a 12-component index, known as the Service Quality Indicator (SQI). Each

item in the SQI describes work process failures, and each is weighted to reflect how significantly it affects overall customer satisfaction. The SQI includes the following components/performance indicators, along with their weighting factors (shown in parentheses):⁴³

- Right day late service failures (1)
- Wrong day late service failures (5)
- Traces (1)
- Complaints reopened by customers (5)
- Missing proofs of delivery (PODS) (1)
- Invoice adjustments requested (1)
- Missed pick-ups (10)
- Lost packages (10)
- Damaged packages (10)
- Overgoods (5)
- Abandoned calls (1)
- International SQI indicator (1)

FedEx uses advanced computers and tracking systems to gather and track data. Rapid analysis of operations data yields daily SQI reports transmitted to workers at all FedEx sites. Management meets daily to discuss the previous day's performance, and weekly, monthly, and annual trends are tracked. Quality action teams (QAT) analyze data contained in the company's major databases to identify the root causes of problems that surface in the SQI reviews.⁴⁴

To reach its aggressive quality goals, the company has set up one cross-functional team for each service component in the SQI. A senior executive heads each team and assures the involvement of front-line employees, support personnel, and managers from all parts of the corporation when needed.⁴⁵ In addition, the SQI measurements are directly linked to the corporate planning process. The SQI forms the basis on which corporate executives are evaluated and individual performance objectives are established and monitored.

⁴² Labovitz, G., Y.S. Chang, and V. Rosansky. *Making Quality Work: A Leadership Guide for the Results-Driven Manager*, John Wiley and Sons, 1994.

⁴³ Morris, D.D. and R.J. Baker, "Measuring what matters: [want to know how successful your firm is? Take the customer's point of view]," August, 2003. Available at: http://findarticles.com/p/articles/mi_m0ICC/is_2_72/ai_107755417, last accessed December 6, 2009.

⁴⁴ National Institute of Standards and Technology, "Malcolm Baldrige National Quality Award 1990 Winner Federal Express Corporation," October 17, 2002, http://www.quality.nist.gov/FederalExpress_90.htm (February 25, 2009).

⁴⁵ Ibid.

While the SQI measures internal process performance, FedEx relies on a customer satisfaction survey to measure satisfaction from the customer's perspective. Not only can the customer satisfaction survey capture aspects of service quality that the SQI does not include, it can also capture the changing expectations of customers. This allows FedEx to recheck customer requirements and perceptions and to update its measures and weights accordingly. This ensures that the customer's voice always drives FedEx's actions and processes.⁴⁶ The customer satisfaction survey consists of a quarterly telephone survey, a targeted customer survey, FedEx comment cards, a customer automation survey, and a Canadian customer survey.

Since being placed in service in the late 1980s, the SQI has enabled FedEx to increase its on-time delivery performance from 95 percent to 99.7 percent in 2003 without adding significant costs.⁴⁷ FORTUNE has ranked FedEx among the Global Most Admired Companies and America's Most Admired Companies lists since 2002 and 2001, respectively. The company has also been on the list of FORTUNE magazine's "100 Best Companies to Work For" for 12 of the past 13 years.⁴⁸ The connection between what the company measures and rewards and their industry dominance is solidly linked.⁴⁹

TNT Express Delivery Services

TNT provides global express delivery services, including parcels and freight. L. Fitzgerald and P. Moon conducted an in-depth study on the role of performance measurement at TNT Express Delivery Services in the United Kingdom (UK).⁵⁰ This case study summarizes the relevant findings of that research.

The operational system of TNT adopted by the company is structured like a giant wheel, with a central hub and a set of spokes. On the outer rim, there are 28 depots strategically situated around the country. Each weekday, each depot is responsible for the coordination and collection of all packages being sent by customers in their territory. These packages are sorted at the depot and those being sent outside of the territory are packed

on trucks and sent to the hub.

TNT's primary objective is to deliver the packages to the right place at the right time, and TNT employs a variety of metrics to measure and track its operational performance. Delivery performance is perceived to be fundamental to the success of TNT, and TNT has a clearly defined method for measuring their delivery performance. They do this using what they call the 7-Star Service Performance Report, which is measured weekly. The seven indicators, or performance measures, included on the report include:

- Percent delivery on time.
- Failures.
- Percent deliveries that result in credit notes or that are unmatched with invoices.
- Percent misroutes.
- Number of late trucks (trucks arriving late at the hub).
- Loss claims as a percent of revenue.
- Damage claims as a percent of revenue.

A standard target is set for each of the indicators, and any depot achieving the target or better across all categories would gain a 7 star rating for the week. Reports are generated weekly in the form of a league table, which rank orders the depots according to delivery on-time performance. Reports are circulated so that all depots know how they performed overall and in comparison to the other depots.

Based on an assessment by Moon and Fitzgerald, TNT has been successful at using its performance management system to push the strategic direction of the company into all aspects of its operations. Moon and Fitzgerald identify five properties of their performance management system that have allowed them to do this:

- **Measuring the right things.** The objectives and performance measures are well understood and communicated throughout the organization.

⁴⁶ Howell, M.T. *Actionable Performance Measurement: A Key to Success*, American Society for Quality, 2006.

⁴⁷ Morris and Baker (2003).

⁴⁸ Forbes.com, "FedEx Named Among FORTUNE Magazine's 2010 'Best Companies to Work For,'" January 21, 2010. Available at: <http://www.forbes.com/feeds/businesswire/2010/01/21/businesswire134307423.html> (accessed February 15, 2010).

⁴⁹ National Institute of Standards and Technology, 2002

⁵⁰ Moon, P. and L. Fitzgerald, "Delivering the goods at TNT: The role of the performance measurement system," *Management Accounting Research*, Vol. 7, 1996, pp. 431-457.

The specific measures cover a range of dimensions thought to be central to corporate success. Key issues are translated into detailed action plans so that every individual is aware of their role and the requirements of that role.

- **Internal benchmarking.** Internal benchmarking is used by TNT to provide sets of absolute standards that the depots are expected to maintain, and there is a continual push from central management to reach the standards.
- **Reward mechanisms.** Incentive schemes are used throughout the business, linking the achievement of company targets with financial rewards. Each functional area at the depots has its bonus scheme that focuses on the key performance measures for that function.
- **League tables.** League tables, generated weekly, display each depot's performance relative to the others. These tables encourage competition, in terms of performance, between the depots.
- **Corporate champion.** There is a constant driving down of the corporate message from the head office. They believe in the performance measurement system and attach great importance to the results and "getting the service level right."

Illinois Tollway⁵¹

The Illinois Tollway operates 286 miles of Interstate highway that serves approximately 1.4 million customers a day, about 11.5 percent of which is commercial vehicle traffic. The Tollway's mission is to provide and promote a safe and efficient system of toll-supported highways while ensuring the highest possible level of service to its customers. To provide customers with a premium ride, the Tollway relies on the top-down support considered critical to its overall performance and delivery of service.

The Tollway began developing and monitoring performance in the early 1980s when traffic volumes were growing, and it started seeing congestion at its toll plazas. It also began looking at incidents that were resulting from the increased congestion. In the late 1980s to early 1990s, the Tollway began a concerted effort to manage traffic over the entire network, and this has

evolved over time. It began with the use of a computer aided dispatch (CAD) system and then started using an integrated approach of dedicated police as well as maintenance staff to keep things moving. The Tollway created procedures and systems that were later integrated into a centralized traffic operations center.

The Illinois Tollway has worked to measure, monitor, and improve its performance in four key operations areas: overall traffic operations, toll collection, incident management, and construction work zone management.

Overall Traffic Operations

Since the early 2000s, the Tollway has focused on measuring how the system is operating and performing (e.g., locations of back-ups, slow downs, travel times). Performance measures for overall traffic operations include traffic volumes, speeds, travel times, and lengths of back-ups. While there are stated performance targets related to congestion, the Tollway has established levels of tolerance that have been adjusted over time to better meet needs. For example, the tolerance threshold for the length of a back-up has been cut in half.

Toll Collection

Key performance measures for toll collection operations include congestion, number of incidents, and the percent of customers using I-PASS (electronic toll collection). Customer feedback has resulted in the Tollway converting the entire system to open road tolling (ORT). As a result of the ORT, the Tollway has eliminated congestion that used to be at the toll plazas, and crashes have dropped dramatically.

Incident Management

The Tollway's objective is to clear incidents quickly and safely. Key performance measures for incident response include detection, confirmation, communication, response, and clearance times. It tracks these measures regularly with time stamps and weekly reports. The Tollway uses a computer-aided dispatch system integrated with a traffic incident management system to facilitate the process. In addition, it audits and monitors tow activity. The Tollway has numerous (35-45) agreements with private towing and recovery firms, all with response times and other performance criteria that they must adhere to. All towing performance is audited. The Tollway maintains 55 agreements with local fire departments and protection districts that cover emergency services provided on the Tollway.

⁵¹ Telephone Interview with John L. Benda, General Manager of Maintenance & Traffic, Illinois Tollway. March 2009.

Internally, the Tollway gains commitment to improved incident response performance through a high level of communication that includes incident debriefing and regular training. All maintenance employees are trained in incident response and are empowered to divert from routine maintenance activity to respond to a reported incident upon notification by central dispatch. Tollway employees are first on the scene in 60 percent of incidents. Externally, the Tollway gains commitment to performance through formal agreements that establish a framework for cooperation. They produce quarterly reports for the Governor's office regarding non-recurrent congestion.

Construction Work Zone Management

The Tollway's focus is on knowing how its system is operating during construction. Key performance measures for operations during construction include traffic volumes, congestion, average travel times, and number of incidents. The Tollway installs sensors prior to construction to establish a baseline, measure performance during construction, and measure improvements after construction is complete. CCTV cameras located at construction zone entrances and throughout the construction zone monitor the effectiveness of maintenance of traffic schemes and allow for quick assessments and adjustments as necessary to facilitate safe and efficient movement of vehicles through construction zones.

Because of this performance monitoring, the Tollway operators know where back-ups are going to be and can get the word out to their customers. The Tollway management strives for a high level of communication with the public both in advance of major construction and continuously throughout the construction season. It notifies the public a minimum of 10 days prior to construction or any major phase changes, provides daily updates, and actively sends messages to customers on work zone status via multiple means of communication, including press releases, email alerts, daily lane closure reports, dynamic message sign and portable changeable message sign deployments, as well as web-based regional automated traveler information system.

Austin Energy

Austin Energy is a community-owned electric utility located in Austin, Texas. The utility provides a portion of its profits each year to help fund city services. Austin Energy produces and delivers energy to approximately 400,000 customers. It is the 9th largest municipal electric company in the United States. Austin Energy generates power through coal, gas-fired, and nuclear plants, captures renewable wind energy, and purchases energy from outside providers. Austin Energy operates a transmission and distribution system.⁵²

Austin Energy has adopted three overarching strategies to maintain a successful organization. In support of these strategies, Austin Energy developed five strategic objectives. The strategies and strategic objectives are as follows:⁵³

- Strategy: Risk Management.
 - Objective: Maintain Financial Integrity.
- Strategy: Excellent Customer Service.
 - Objective: Create and Sustain Economic Development.
 - Objective: Customer Satisfaction.
 - Objective: Exceptional System Reliability.
- Strategy: Energy Resource.
 - Objective: Renewable Portfolio Standard and Energy Efficiency.

Each objective is tracked using one or more performance measures and associated performance targets. Austin Energy measures system reliability with six reliability performance measures. Three measures focus on the delivery of electric services and the other three measures focus on power production. The performance measures that Austin Energy uses to gauge the delivery of electric services are:

- SAIDI (System Average Interruption Duration Index): A common measure of the duration of power outages on the distribution system.

⁵² Austin Energy, "Company Profile." Available at: <http://www.austinenergy.com/About%20Us/Company%20Profile/index.htm>, last accessed December 31, 2009.

⁵³ Austin Energy, *Strategic Plan Update, 2008*. Available at: http://www.austinenergy.com/About%20Us/Newsroom/Strategic%20Plan/strategicPlanningUpdate_2008.pdf, last accessed December 31, 2009.

- SAIFI (System Average Interruption Frequency Index): A common measure of the frequency of power outages on the distribution system.
- SATLPI (System Average Transmission Line Performance Index): A measure of voltage sags or line faults on the transmission system.

The three performance measures that Austin Energy uses to access the reliability of its power production rely on a metric called the equivalent availability factor (EAF), a measure of the availability of power for use. The three measures using EAF include the availability of power at two power generating facilities and the availability of power during peak season.

The organization also aims to have renewable energy comprise 30 percent of its power generation portfolio and to improve energy efficiency by 15 percent by 2020. Austin Energy assesses stakeholder satisfaction with surveys of both customer and employee satisfaction. It aims to achieve a customer satisfaction target of 83 percent by fiscal year 2010, a measure based on the American Customer Satisfaction Index.⁵⁴

In 2006, Austin Energy's Electric Service Delivery business area began a formal quality management effort and in 2008, achieved certification under the ISO 9001:2000 standard. The ISO 9001:2000 standard specifies the requirements for a quality management system and emphasizes improvements in the effectiveness of processes through numerical performance measures. The Electric Service Delivery business area used a balanced scorecard approach to ensure service quality. It developed key performance indicators (performance measures and numerical targets) in the areas of cost, reliability/regulatory, customer satisfaction, safety, and employee satisfaction. With limited resources, the business area recognized the importance of balancing efforts to improve service with costs.⁵⁵

The Electric Service Delivery business area divided its key performance indicators into three tiers according to organizational responsibility. The strategic performance indicators are used at the first tier by executives to lead the business area. These measures are aligned with the overall Austin Energy organizational strategies and feed

into the organizational performance measures. The second tier key performance indicators are operational in nature and are used by managers to manage the business. Managers are held accountable for achieving the performance targets. The third tier of key performance indicators support the first two tiers and are focused on process and efficiency. They support action plans and are used by supervisors for day-to-day activities.

The first-tier performance measures are reported to the community as part of the overall organization's performance measures regularly through the Austin Energy website, bulletin boards, and a regular newsletter. Performance trends are reported monthly for cost, reliability/regulatory, and safety measures, whereas customer satisfaction and employee satisfaction trends are reported on an annual basis. Austin Energy strongly believes that tracking and reporting performance results is important for successfully managing and improving an organization.

The Austin Energy Electric Service Delivery business area vice president and the business area management meet every 6 months to discuss the effectiveness of the quality management system. As part of these meetings, performance results are examined for the key performance indicators and action plans are initiated for measures that are trending in the wrong direction. The meeting participants also re-evaluate the indicators and targets.

Several benefits have been realized by the Electric Service Delivery area because of its quality improvement effort including improvements in: communications and collaboration between operational work groups, the documentation of issues as they occur, identification of root causes, and action plans developed and carried out to address these issues. The quality improvement effort seems to be winning over many of the impacted employees. Austin Energy reported that the ISO 9000:2001 standard gave it a needed framework to help manage its business. For others working toward developing a quality management system, Austin Energy emphasized the importance of not trying to design a perfect system, but instead of developing a solid foundation that can be continuously improved over the long term.⁵⁶

⁵⁴ Austin Energy, *Strategic Plan Update, 2008*. Available at: http://www.austinenergy.com/About%20Us/Newsroom/Strategic%20Plan/strategicPlanningUpdate_2008.pdf, last accessed December 31, 2009.

⁵⁵ Telephone Interview with Mercedes Sanchez, Austin Energy. December 3, 2009.

⁵⁶ Telephone Interview with Mercedes Sanchez, Austin Energy. March 2009.

A U.S. Power Company

The representative of a power company located in the United States, which requested to remain anonymous for the purposes of this case study, provided information on the objectives and performance measures used at the company for managing operational performance.

The company uses four categories of operational performance measures that are typically tracked using a rolling 12-month average:

1. Safety
2. Reliability
3. Customer Satisfaction
4. Process Improvement

The performance goals are developed according to tiers in the organization. Goals at tier 0, the top level, address the highest level organizational objectives and do not necessarily apply to all departments. A hierarchy of tier 1, tier 2, and tier 3 goals address the objectives in increasing specificity. There are numerous specific tier 3 goals that are managed at the working group level.

The company measures reliability primarily through non-storm management indices, measures that do not account for problems encountered during storms. The main index used is the System Average Interruption Duration Index (SAIDI). This is a product of the number of customers with outages and the average duration of outages. The company has an initiative underway to identify customers with frequent outages (5+ per year) and improve their service.

The company collects reliability data on an hourly basis and compiles the data daily. Outage information is collected from call centers and, increasingly, from the grid itself.

The company assesses customer satisfaction through quarterly phone interviews of residential customers. Management sets a specific percentage of customer satisfaction as a goal. The company arrived at this target through benchmarking other power companies' customer satisfaction results, arriving at typical industry number, and adding to it to attempt to out-perform the industry. The company only recently began developing its process improvement objectives.

The company's performance measures were originally developed by benchmarking and analysis of best practices of comparable organizations. Identifying comparable organizations was difficult. For example, some have more underground assets or more network interconnects, making them less prone to outages. The performance measures were developed from the top down. The tier 0 goals were determined by defining the highest level organizational objectives. Tier 1 goals were developed to expand on the tier 0 goals. Tier 2 goals were developed to support the tier 1 goals, and so on.

Company management communicates its performance measures to staff by posting performance information on the company website and through bulletin boards. Operations managers hold monthly meetings to coordinate their activities and each working group has milestones and tracks its progress against them. Typically the top-level goals are simply reported as successes or failures and most performance measures are tracked publicly.

The power company representative reported that the company had benefitted from the performance measurement approach. Despite staff reductions over the last few years, the company has remained above average in national rankings. He also stated that performance measurement has elevated the importance of customer satisfaction.



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