



# Performance-Based Planning and Programming

*white paper*



U.S. Department of Transportation  
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# Executive Summary

In response to recent economic, political, and social trends that have placed greater emphasis on public-sector accountability and cost-effectiveness, transportation agencies across the country have increasingly embraced performance management and performance-based planning and programming as a way to ensure that transportation resources are spent on projects and strategies that best serve communities' needs.

This white paper describes the common elements of a performance-based transportation planning and programming process, building on work conducted by State departments of transportation (DOT), metropolitan planning organizations (MPO), and transit agencies. The white paper was initiated in response to a National Forum on Performance-based Planning and Programming conducted in September, 2010 in Dallas, TX and has been refined to reflect discussions at a follow up Workshop on Performance-based Planning and Programming held in Chicago, IL in September, 2011.

These two events have included representatives from state DOTs, MPOs, rural planning organizations, and transit agencies. Participants at both events have recognized performance-based planning and programming as a best practice for the transportation industry and desired to more concretely define what is meant by performance-based planning and programming, what action items will best advance its implementation across the industry, and what steps are necessary to overcome the practical challenges to its meaningful implementation.

Key findings of this white paper and the National Workshops include:

- Many transportation agencies are conducting performance-based planning and programming and a framework based on the elements common to these efforts may be useful to agencies considering implementing such a process.
- Performance-based planning and programming must be integrated into the existing planning process to be successful. Performance-based planning and programming involves data driven analysis, which is the focus of this white paper. But, planning and decision-making must balance a broad range of quantitative and qualitative concerns including public/stakeholder perspectives.
- Given the range of data, information, and tools available to transportation agencies, it is important to tailor the approach to work for areas with varying geographies, levels of development, governance structures, and size, as well as across various program or performance areas. These will include using qualitative methods or providing clear visual representations of performance that are clear for stakeholders and/or decision makers to understand.

- Performance-based planning and programming should build on successful planning efforts. Existing tools such as state pavement and bridge management systems, transit agency asset management plans, and complementary planning processes such as the Strategic Highway Safety Plan (SHSP), Congestion Management Process (CMP), Transit Development Plan (TDP) and other similar efforts provide a strong foundation for performance-based planning and programming.
- Fundamental to a performance-based approach is the recognition that agencies should first identify projects that are consistent with their goals and performance targets, and then determine the appropriate funding source for those projects. Unlike a traditional programming and budgeting process that identifies funding sources first, this approach first identifies the set of projects that best help the agency meet its goals or targets.
- The potential benefits from a performance-based planning and programming process include helping to guide resource allocation decisions in a constrained funding environment. However, it is recognized that a performance-based process alone, without sufficient resources, will not drive better performance results over the long term. A performance-based approach can help communicate needs and explain why performance may decline in the future. But implementing a performance-based approach itself may take additional organizational resources or at least a redistribution of existing resources devoted to planning and programming activities.

Table ES.1 presents a framework of elements that have been identified as part of any performance-based planning and programming effort.

**Table ES.1 Performance-based Planning and Programming Elements**

Elements	Description	Examples
<b>Strategic Direction</b> ( <i>Where do we want to go?</i> )		
Goals and objectives	Goals and objectives that capture an agency's strategic direction	Infrastructure condition, safety, mobility, reliability, and other goals established by an agency.
Performance measure	Agreed on measures for goals and objectives.	Percent of bridges in good condition, travel time index, and other measures linked to agency goals.
<b>Long Range Planning</b> ( <i>How are we going to get there?</i> )		
Identify targets and trends	Establish aspirational targets or preferred trends based on an understanding of a desirable future for each goal area and measure.	Desired conditions of pavement, bridge, and transit assets. Desired future corridor travel times or reliability levels. Desired future crash, injury, and fatality reductions

Elements	Description	Examples
Identify strategies	Strategies, policies, and investments that address transportation system needs within the identified goal areas.	Resurfacing, rehabilitation, replacement and reconstruction to support infrastructure condition. Signal timing, vehicle maintenance, service patrols, additional capacity, (transit or highway), tolling, and other strategies/investments to improve mobility or reliability. Seat belt or drunk driving enforcement, graduated drivers licenses, rumble strips, training, median barriers, and other investments to improve safety.
Strategy evaluation	Evaluate strategies and define program level system performance expectations, may be qualitative.	Examine impact of varying levels of investment on pavement and, bridge preservation and transit assets. Examine impact of packages of operations, capacity and other highway or transit investments on corridor travel time and/or reliability. Examine potential for reduction in crashes, injuries, and fatalities from a package of safety investments.
<b>Programming (What will it take?)</b>		
Investment plan	Identify the amount and mix of funding needed to achieve performance goals within individual program areas.	Investment plan for pavement, bridge, transit asset, operations, expansion, safety, and other projects consistent with strategy evaluation, including specific projects and high level summary of expected investment levels.
Resource constrained targets and trends	Established quantitative or qualitative targets or desired trends for each goal/measure.	Expected future conditions of pavement and, bridge conditions, and transit assets. Expected future corridor travel times or reliability improvements given a package of investments. Expected range of crash, injury, and fatality reduction from a package of safety investments.
Program of projects	Identify specific transportation projects for an agency capital plan, or S/TIP that are consistent with system performance expectations established in strategy evaluation.	S/TIP with specific projects identified in major program areas (pavement, bridge, transit assets, capital, operations, safety, etc.).
<b>Implementation and Evaluation (How did we do?)</b>		
Reporting and monitoring	Monitor progress on goals relative to targets and resource allocation efforts.	Report on pavement, bridge, transit assets, reliability, safety, and other metrics presented to stakeholders, public and decision makers.
Evaluation	Identify improvements in analytics, process, etc. to improve the planning process. Evaluating the mix of projects.	Examine actual conditions relative to expected conditions for assets, reliability, safety, and other areas. Identify where tools produced inaccurate estimates or investments and policies were more or less successful than planned.

The white paper introduces performance-based planning and programming, describes its relationship to the planning process and potential goals, and provides an in depth description of the elements of the framework. It includes detailed descriptions of several best practice examples and identifies the common elements of performance-based planning and programming.

While the process and framework described in this white paper is intended to improve decision making for States, MPOs and transit agencies, it is important to recognize that performance-based planning and programming will be impacted by factors such as local politics, funding availability, and changing economic or demographic conditions.

# 1.0 Introduction

The purpose of this white paper is to continue a dialog among the Federal Highway Administration (FHWA), the Federal Transit Administration (FTA) and their planning partners and stakeholder associations on the elements of a performance-based planning and programming process. Planning partners include State Departments of Transportation (DOT), Metropolitan Planning Organizations (MPO), and transit agencies. Stakeholder representatives are participating from the American Association of State Highway and Transportation Officials (AASHTO), the Association of Metropolitan Planning Organizations (AMPO), the American Public Transit Association (APTA), and the National Association of Development Organizations (NADO).

In response to recent economic, political, and social trends that have placed greater emphasis on public-sector accountability and cost-effectiveness, transportation agencies across the country have increasingly embraced performance management and performance-based planning and programming as a way to ensure that transportation resources are spent on projects and strategies that best serve communities' needs. In September 2010, a large group of staff and executives from State DOTs, MPOs, regional planning organizations, and transit agencies got together to discuss performance-based planning. That effort, with over 140 participants, was a first of its kind effort to bring together transportation agencies of all different types and sizes to discuss facets of performance-based planning.

A consistent message from the National Forum was that performance-based planning and programming represented best practice for the transportation agency and that additional work was needed both to define precisely what is meant by performance-based planning and programming and to identify the types of data and analysis tools to help agencies implement performance-based planning and programming within their own agencies.

More recently, in September 2011, FHWA and FTA, in cooperation with AASHTO, AMPO, APTA, and NADO held a National Workshop in Chicago, IL to continue to advance best practice in performance-based planning and programming by identifying common elements and a framework for implementing these practices within transportation agencies. This white paper was initially developed to support the National Workshop; the current version reflects the extensive feedback that was received at that workshop.

As with the previous effort, participants in the 2011 National Workshop agreed that performance-based planning and programming represented best practice for the transportation industry. But, many concerns were raised about how to implement these practices. Establishing a common framework for performance-based planning and programming will require collaboration across levels of

government, transportation modes, and other boundaries. The white paper developed here is intended to be a joint effort by FHWA and FTA in close collaboration with their planning partners and representatives.

## 1.1 KEY CONCEPTS

This section describes the key concepts that will be discussed throughout this white paper.

### Performance Management

Performance management is a strategic approach that uses system information to make investment and policy decisions to achieve performance goals. Performance management typically includes both the management of the transportation system and management of the organizations with responsibility for the transportation system.

### Performance-based Planning and Programming

Performance-based planning and programming is an attempt to apply performance management principles to transportation system policy and investment decisions, providing a link between management and long range decisions about policies and investments that an agency makes in its transportation system. Performance-based planning and programming is a system-level, data-driven process to identify the strategies and investments.

### Products of the Planning Process

Delivering a performance-based planning and programming process will require integrating performance management concepts into the existing process. The existing planning process includes a range of activities and products that take a transportation agency from broad goals and objectives to measurable indicators and then applies them in decision making regarding transportation investments and policy actions. These activities and products generally include:

- **Long-range transportation plans.** Required for both DOTs and MPOs, these documents vary significantly in terms of the material that is included and the depth of analysis used to create them, especially for DOTs. Some DOTs, MPOs, and local agencies also develop comprehensive visions that take into account transportation, land use, housing, environment, and other major issues that impact their communities, though these are not formally required.
- **Federally required program area plans and processes.** Currently, state DOTs are required to develop a Strategic Highway Safety Plan (SHSP) and MPOs in regions with over 200,000 residents are required to develop a Congestion Management Process (CMP). Air quality conformity analysis is also required for nonattainment areas. States with areas in nonattainment are required to develop State Implementation Plans (SIPs) that provide a source

of information for capturing performance in these areas. States DOTs, MPOs, and transit agencies also sometimes develop other program specific plans, such as asset management plans or multi-year capital programs.

- **Corridor, regional, and modal plans.** In addition to long-range and specific program plans, many DOTs, MPOs, and transit agencies develop a range of more detailed planning efforts to tackle transportation issues in a specific corridor, region, sub-region, mode, or other portion of the transportation system. For example, some transit agencies use transit development plans that help to identify needed transit investments. These modal, region, and other plans are developed using a variety of approaches and levels of detail but generally complement and expand the long range planning process.
- **Short-range Transportation Improvement Programs (STIPs and TIPs).** These documents identify the transportation investments to be made on the transportation system over the short-term (4-year). Currently, S/TIPs do not typically include analyses of system performance expectations.
- **Unified Planning Work Program and State Planning and Research program.** These documents describe the priority planning activities, such as studies, data collection, public engagement, etc., undertaken by MPOs, transit agencies, and State DOTs that are the means for implementing performance-based planning and programming, among other activities, in the planning processes they manage.

Beyond these steps, project design, operations and ITS plans, and other processes carry projects from planning studies to implementation.

## 1.2 ORGANIZATION OF THE WHITE PAPER

The white paper is organized as follows:

- Section 2.0 describes examples of agencies implementing performance-based planning and programming for State DOTs, MPOs, and transit agencies.
- Section 3.0 describes a set of common elements that emerge from the examples in Section 2.0, other examples of performance-based planning and programming in practice today, and the comments received from participants at the 2011 National Workshop. The result is a performance-based planning and programming framework for use by State, regional, transit, and other transportation agencies.
- Section 4.0 identifies critical next steps for advancing performance-based planning and programming at state and regional levels, drawing on feedback from the participants at both the 2010 National Forum and the 2011 National Workshop.

## 2.0 Performance-based Planning and Programming Examples

Performance-based planning and programming and performance management are not new concepts for transportation agencies. Over the last decade or so, many transportation agencies have begun using performance measures to help them manage their organizations and their investments in and policies for their transportation systems. The intent of this white paper is to build on existing best practice being put in place by State DOTs, MPOs, and transit agencies. This section begins by describing an example of performance-based planning and programming from each of these agencies and then attempts to capture the common elements of these efforts.

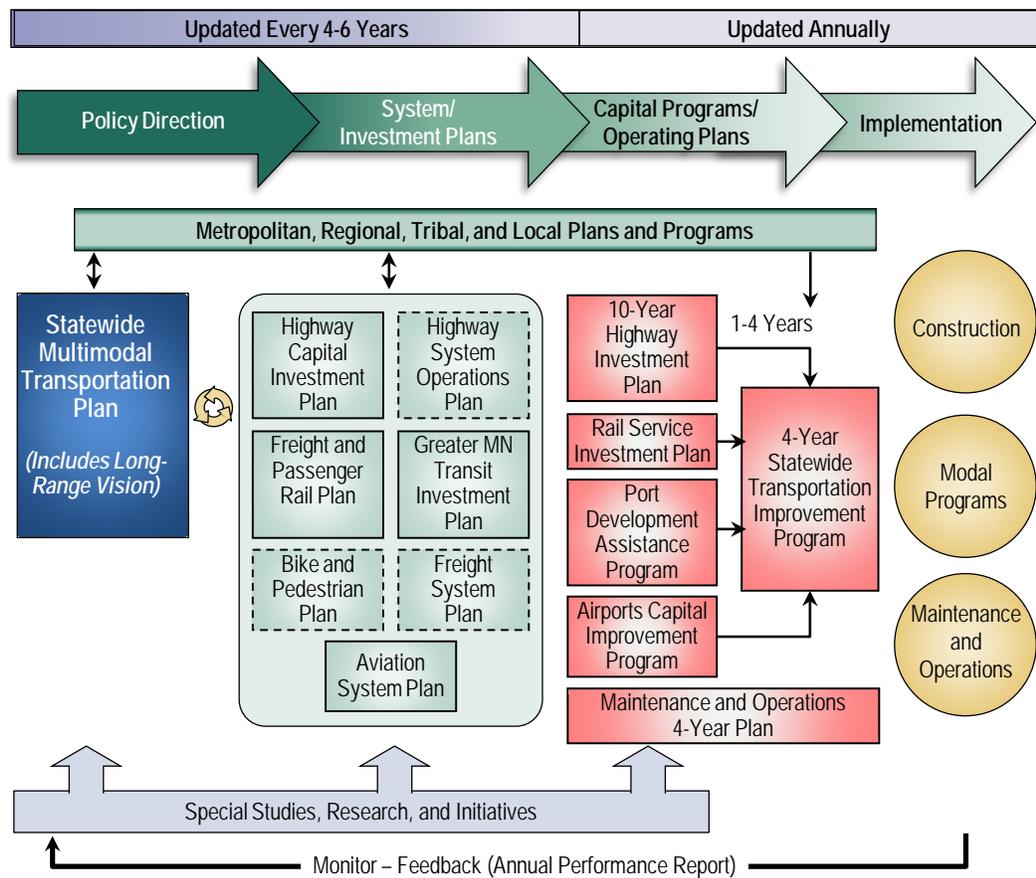
### 2.1 MINNESOTA DOT

The Minnesota DOT (Mn/DOT) has integrated performance-based decision-making into its planning, programming and project development processes through a family of plans (Figure 2.1), including:

- A performance-based Statewide Multimodal Transportation Plan with goals, measures, and targets. This plan provides overall policy direction and is updated every four to six years.
- System Investment Plans that use measures and targets to assess the status of the transportation system and identify needed and constrained system investment in each mode. These plans are also updated every four to six years;
- Capital Programs which guide the selection of projects for the annual highway construction program; and
- Incorporation of performance measures into the biennial legislative budget request.

Mn/DOT's first performance-based Statewide Multimodal Transportation Plan, adopted in 2003, defined three strategic goals (in the areas of preservation, safety, and mobility), aligned 10 policies under these goals, identified outcomes for each policy, and established specific modal performance measures and targets. To support the Plan, Mn/DOT adopted several specific statewide performance-based modal plans, including Freight, Bicycle, Transit, Highway Systems Operations, Highway Safety, and Aeronautics. Together these plans provide the foundation for a performance-based resource allocation process.

Figure 2.1 Mn/DOT Family of Plans

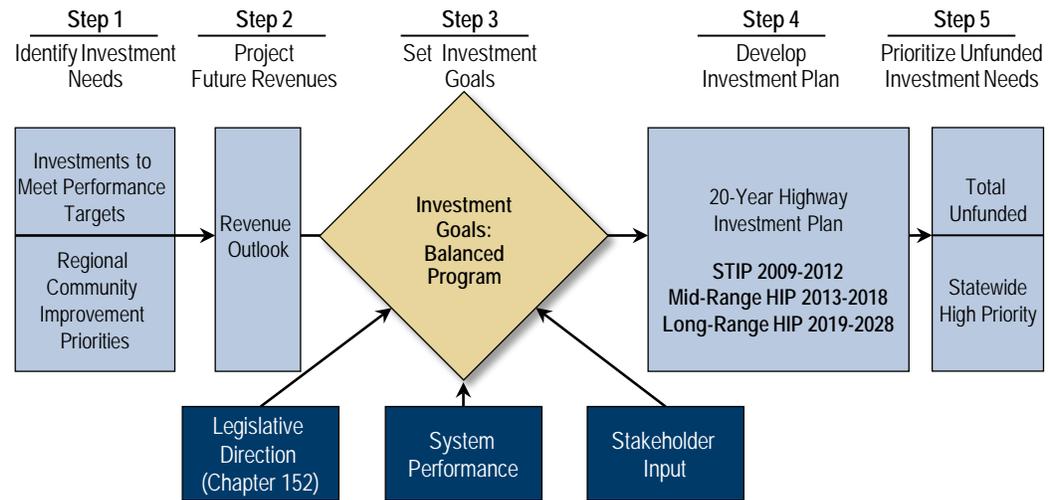


Source: Mn/DOT

### Investment Planning

The highway investment plan helps Mn/DOT understand overall system needs and identify preferred investment (Figure 2.2).

Figure 2.2 Mn/DOT Highway Investment Plan Approach



Source: NCHRP Report 666, *Target-Setting Methods and Data Management to Support Performance-Based Resource Allocation by Transportation Agencies*, Transportation Research Board, 2011

Each year every Mn/DOT district, following uniform guidance, identifies investment priorities. These priorities are based on quantifiable performance measures and targets that establish an impartial statewide basis for identifying critical transportation improvements for the entire trunk highway system. The basic steps of the highway investment planning process include:

- 1. Identification of Investment Needs.** Investment needs fall into two categories: those that address system performance and those that address regional or community priorities. A variety of analytic models and tools are used to identify needs in each policy area.
- 2. Project Future Revenue.** Revenues are projected based on the trends in State and Federal revenue sources for state highway construction.
- 3. Set Goals: A Balanced Program of Investments.** The current highway investment plan attempts to balance a program that supports the State's economy, optimizing investment in programs across goal areas, and achieves consistent investment across districts.
- 4. Develop Investment Plan.** Given the needs, projected revenues and investment goals, each district developed investment plans for 2009-2028. The investment plans are divided into three timeframes: short range (2009-2012), mid range (2013-2018), and long range (2019-2028).
- 5. Prioritize Unfunded Needs.** With a total estimated investment need exceeding \$65 billion over 20 years and projected revenues of about \$15 billion, the plan identifies almost \$50 billion in "unmet needs" over this period. To generate just an additional \$2.5 billion in revenue over 10 years would require the equivalent of a 12.5-cent increase in the State gas tax. To address this challenge, Mn/DOT has identified five percent of the "unmet needs" as high priority investment options should additional revenue be available during the next 10 years.

Once highway funding is approved by the State legislature, Mn/DOT's funds are distributed to the districts using a performance-based formula. The formula aligns with Mn/DOT's priorities: preservation, safety, and mobility, and is tied to measurable performance needs on the transportation system that reflect Mn/DOT's goals and policies. The statewide list of highway construction projects that emerge from this process constitute Mn/DOT's annual highway construction program.

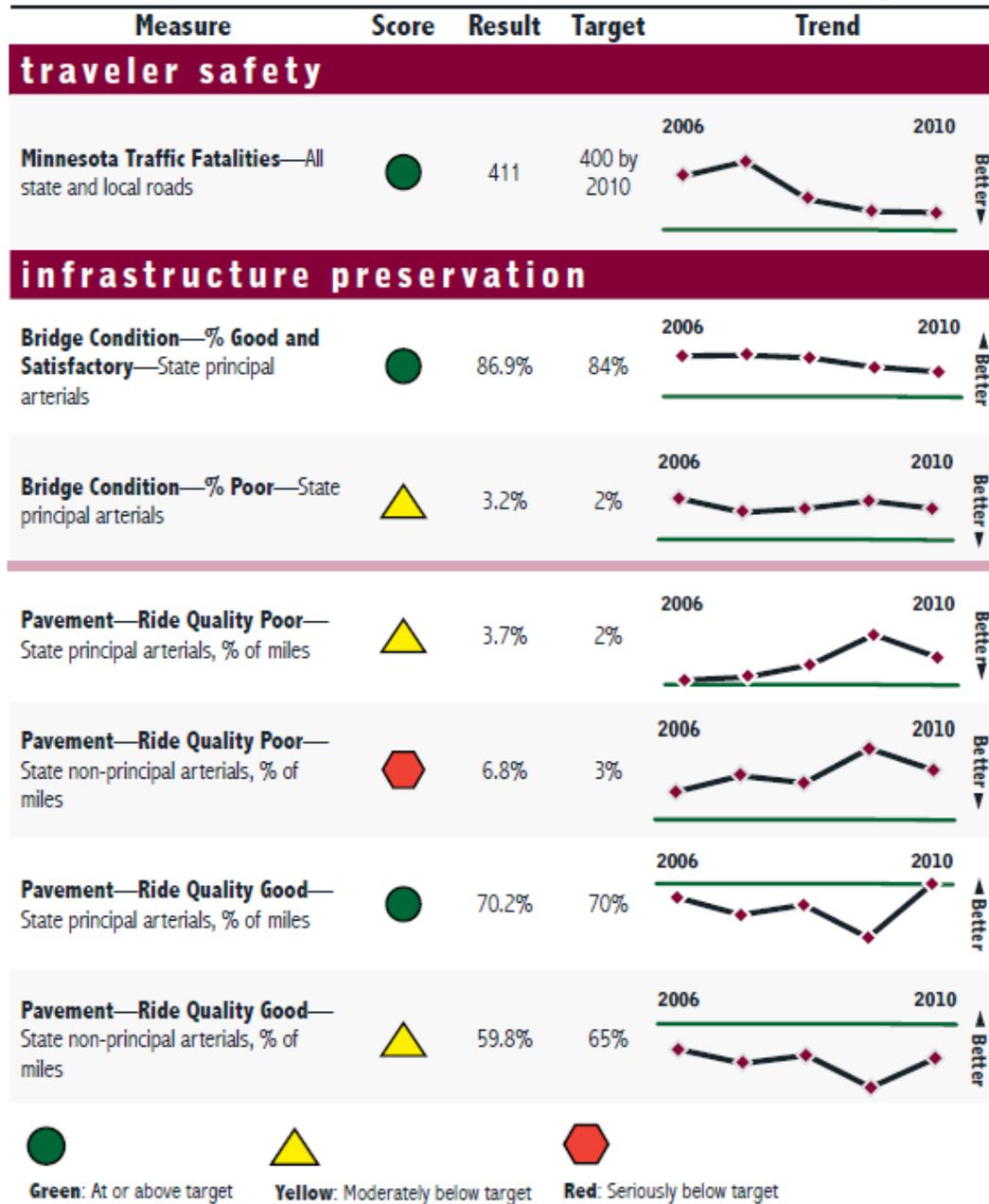
### *Performance Expectations and Target Setting*

Establishing realistic performance targets is key to Mn/DOT's performance-based planning process. Mn/DOT believes that targets should be "realistic." Setting targets too high can lead to over-investment and non-attainment. Setting targets too low can lead to underinvestment and a system that does not meet customer expectations. Mn/DOT used trend-based projections to estimate levels of performance, based on an extrapolation of recent trends. Policy-based targets are set to achieve desired performance levels, based on policy or customer expectations. The long-term targets were not constrained by current funding levels, but were expected to be attainable under some reasonable achievable, increased future funding scenario.

In combination, the targets establish a vision for the transportation system over the long term, based on Mn/DOT's understanding of system condition and customer preferences. The targets attempt to balance the needs in one area against the total set of needs in all areas and the degree of control or influence that it has over individual performance measures. For instance, Mn/DOT has direct control over the quality of pavement, but it can only influence transit service provided in the State through funding. In all instances, the level of influence that the department had over a particular measure affected the target that was eventually set. The effect of this approach is to drive improvement and drive proposals for acquisition of additional or reprioritized resources where they are necessary to meet targets.

Mn/DOT presents its future performance expectations in qualitative fashion, using a combination of symbols and colors to describe what it expects to achieve with its overall package of investments. Figure 2.3 presents the current future performance expectations.

Figure 2.3 Mn/DOT Performance Expectations



Note: This is a selection of measures used by Mn/DOT

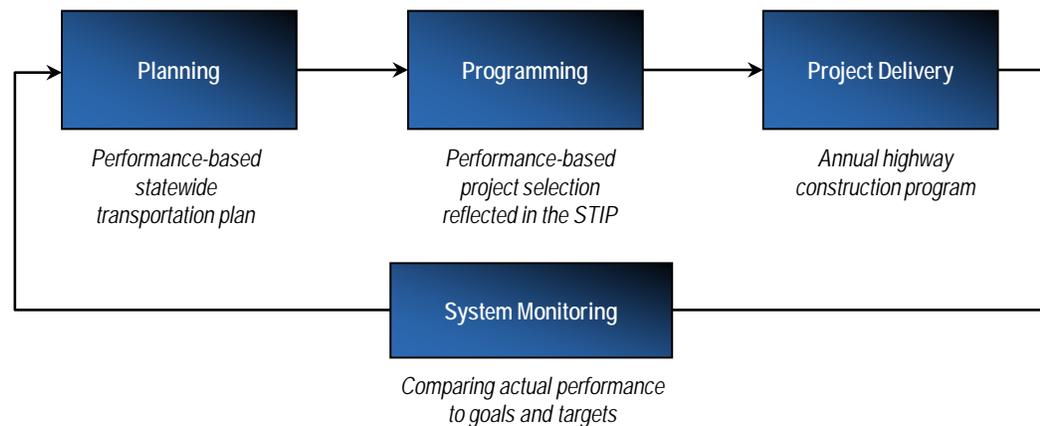
Source: Annual Minnesota Transportation Performance Report, 2010  
<http://www.dot.state.mn.us/measures/>

### Evaluation and Review

Mn/DOT has institutionalized several steps to ensure that the highway planning and programming process remains consistent with department goals and

policies. The most important step includes the periodic assessment of the transportation system’s performance with a regular review of the modal measures data by senior staff. This review has resulted in program adjustments in the 10-year capital investment program and in some cases the STIP. For example, in 2005, the senior staff remixed the projects in its highway construction program based upon data which indicated diminishing pavement conditions. Such actions are captured in the department’s annual publication of a “Snapshot” comparing actual performance goals to targets. The information in the Mn/DOT “Snapshot” provides the base-level information for developing a biennial budget request for the Minnesota State Legislature. This request is performance-based showing the specific impact of funding requests on transportation system performance measure targets. For example, in its 2005 legislative budget proposal, Mn/DOT requested a shift in funds from highway construction to highway maintenance based on pavement performance. The legislature, persuaded by the logic of the performance-based approach, agreed that a greater investment in maintenance would yield long-term savings. Figure 2.4 captures the overall process of planning, programming, project delivery, and system monitoring, as it is practiced at Mn/DOT.

Figure 2.4 Mn/DOT’s Performance-based Highway Investment Process



## 2.2 SOUTHEAST MICHIGAN COUNCIL OF GOVERNMENTS

The Southeast Michigan Council of Governments (SEMCOG) is the MPO for the Detroit, Michigan metropolitan area. As part of its regional transportation planning efforts, SEMCOG has focused on providing information to decision makers to help them understand the consequences of different distributions of investment across key program areas in the region. SEMCOG’s process, which focuses on trade-offs of investment in key program areas, includes the following steps:

1. Identifying key program areas and defining performance metrics for each;
2. Estimating the relationship between overall program investment and future expected performance;
3. Creating scenarios based on #2 that capture varying opportunities to invest in the region and presenting this information to decision makers;
4. Working with decision makers to select a preferred alternative; and
5. Monitoring the consistency of actual investment with the preferred alternative.

The first step in SEMCOG's approach is to define performance metrics within key program areas. Table 2.1 identifies the measures used to evaluate expected future performance.

**Table 2.1 SEMCOG Performance Measures**

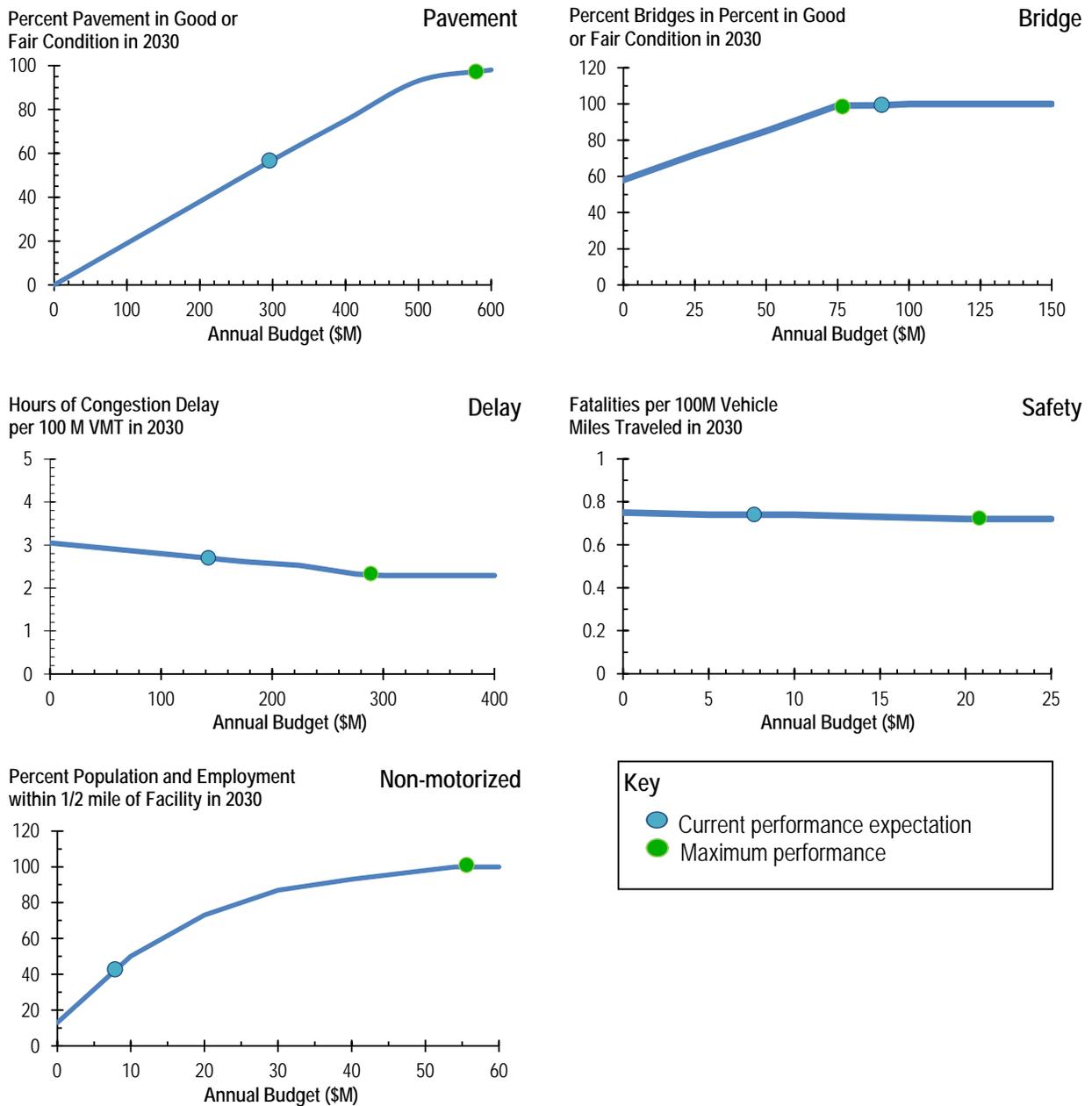
Program Area	Performance Measure
Pavement Preservation	Percent of pavement in good or fair condition
Highway Capacity	Hours of delay per 1,000 vehicle miles
Bridge Preservation	Percent of bridges in good or fair condition
Safety	Fatalities per 100 million vehicle miles
Transit	Extent of transit network
Nonmotorized	Population % within ½ mile of a facility
Roadway Operations	<i>Not currently addressed</i>

Source: Guerre and Evans, Applying System-Level Performance Measures and Targets in Detroit's Metropolitan Planning Process, Transportation Research Board Annual Conference, 2009

The key step in SEMCOG's approach is to then examine the relationship between investment levels and future performance. Several tools were used for this analysis, including SEMCOG's travel demand model and national tools such as the Highway Economic Requirements System - State Version (HERS-ST) and the National Bridge Investment Analysis System (NBIAS).

Figure 2.5 presents a set of graphs used by SEMCOG to describe the relationship between investment and performance for pavement, bridge, delay, safety, and nonmotorized investments. Each graph captures the level of performance expected per dollar of investment. A steeper slope indicates that investment is expected to bring greater returns in terms of future performance. The figures also indicate current performance.

Figure 2.5 SEMCOG Investment Analysis



Source: Guerre and Evans, Applying System-Level Performance Measures and Targets in Detroit's Metropolitan Planning Process, Transportation Research Board Annual Conference, 2009

SEMCOG combined the investment analysis into a set of potential funding scenarios organized around several key themes, including:

- **Current Allocation** - Distributed funding to programs consistent with the way they were allocated previously;
- **Public Opinion** - Used information from public involvement sessions conducted as part of the regional plan update to distribute more funding to programs identified as preferred by the public;
- **Preservation First** - Distributed funding to maximize pavement and bridge performance, then distributed the remaining funds to other programs; and
- **Transit First** - Distributed funding to maximize transit performance, then distributed the remaining funds to other program areas.

Table 2.2 summarizes these scenarios, including both the distribution of funding and expected future performance for each program area. These scenarios were presented to decision makers, who used this information to identify preferred funding levels for each program. Complete information was not available for this planning effort, but enough information was available to support the decision makers in their efforts to prioritize investments using performance measures. In particular, roadway operations were not directly integrated because performance information was not available. SEMCOG is working on updating their approach.

To link their planning and programming efforts, SEMCOG tracks investment levels in the TIP against the investment level targets identified in the preferred scenario and posts this information to their website. Table 2.3 presents the current tracking of investment levels.

**Table 2.2 SEMCOG Scenario Analysis**

Program Area	Measure of Effectiveness	Projected 2010	Current Allocation		Public Opinion		Preservation First		Transit First	
			Target	Funding (%)	Target	Funding (%)	Target	Funding (%)	Target	Funding (%)
Pavement Preservation	Percent of pavement in good or fair condition	57%	57%	21	49%	18	85%	31	40%	14
Bridge Preservation	Percent of bridges in good or fair condition	85%	100%	6	100%	7	85%	3	80%	3
Highway Capacity	Hours of delay per 1,000 vehicle miles	2.9	2.6	10	2.6	10	3.0	2	3.0	0
Safety	Fatalities per 100 million vehicle miles	0.77	0.74	0	N/A	0	0.73	1	0.73	1
Transit	Extent of transit network	Current system	Current system	21	Reduced System	12	Current System	21	Transit Vision	41
Nonmotorized	Population % within ½ mile of a facility	13%	44%	1	100%	5	44%	1		0
Roadway Operations	N/A			41%		41		41		41

Source: Guerre and Evans, Applying System-Level Performance Measures and Targets in Detroit’s Metropolitan Planning Process, Transportation Research Board Annual Conference, 2009

**Table 2.3 SEMCOG Transportation Improvement Program Consistency with Long-Range Plan**

Project Type	Estimated Funding (in millions)	Share of Funding TIP	Share of Funding Direction2035
Pavement	\$520.9	14.5%	24%
Bridge	\$203.5	5.2%	5%
Road Expansion	\$138.1	3.5%	8%
Safety	\$25.4	0.6%	1%
Transit Capital	\$276.3	7.0%	8%
Nonmotorized Facilities	\$41.6	1.1%	1%
Operating	\$2,685.0	68.1%	53%
Total	\$3,940.8	100.0%	100.0%

Source: Southeast Michigan Council of Governments, [http://www.semco.org/TIP\\_Consistency\\_Direction2035.aspx](http://www.semco.org/TIP_Consistency_Direction2035.aspx)

## 2.3 WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

The Washington Metropolitan Area Transit Authority (WMATA), the public transit provider in the Washington, DC region, has taken several steps towards creating a more accountable and transparent approach to managing its organization. In 2010, the Office of Performance was created to expand the use of performance information to guide decisions, to promote WMATA's benefits in the region and to unify employees to accomplish agency goals.. The Office developed a range of performance products (Figure 2.6) that connect day-to-day work of WMATA's employees, from the General Manager to the front line workers, to performance outcomes.

Figure 2.6 WMATA’s Performance Management Tools



Source: Performance-Based Planning and Programming: A Transit Perspective, presentation by Patricia Hendren, September, 2011

The Public and Board of Directors receive frequent performance updates from WMATA through various reports. For example, the Vital Signs Report communicates WMATA’s operational performance results in the strategic areas of safety, security, service reliability and customer satisfaction through a set of key performance indicators. The Vital Signs Report presents performance results, explains why performance has changed and identifies the actions that WMATA is taking to improve performance. The General Manager uses performance information documented in his Execution Plan as a management tool in 1-on-1 meetings with his executive team to keep focus on actions leading to results. Cascading downward, WMATA Departments also use Execution Plans (collection of measures and actions tied to agency goals) to focus staff and resources, make progress towards agency goals and argue for additional resources.

WMATA has also used performance information to describe expected outcomes of capital investments. In 2009, WMATA used agency strategic goals and objectives to prioritize each capital project in the FY2011 – 2020 Capital Needs Inventory. This enabled WMATA to communicate to the Board of Directors the impact different funding levels would have on competing agency priorities (see Figure 2.7). WMATA presented three scenarios that vary the level of investment in two types of projects:

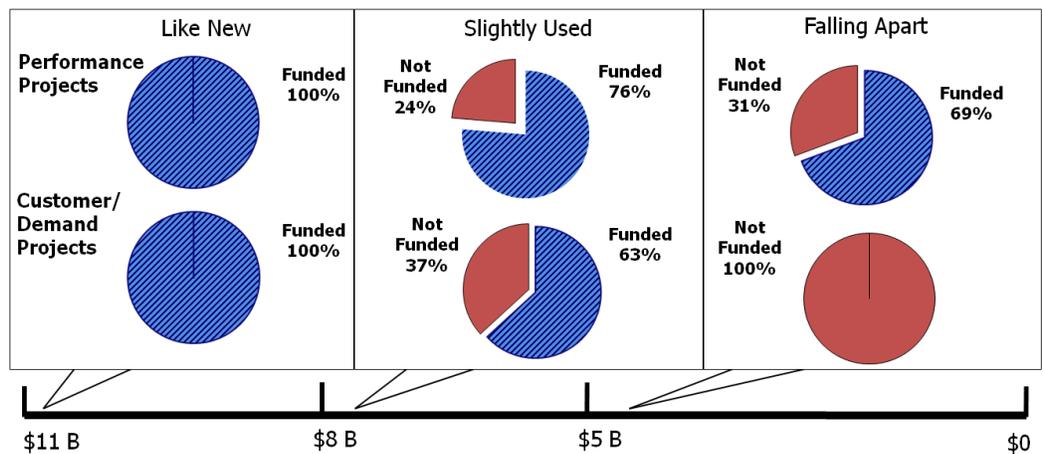
1. Performance projects. Projects that maintain and replace assets on a regular life cycle basis to deliver the same level of service. These include vehicle

replacement, track rehabilitation, maintenance of facilities, system and technology upgrades, and other improvements.

2. Customer/demand projects. Projects that help meet growing ridership and improve rider’s experience (e.g., fleet expansion, rail station enhancements, maintenance facility expansion).

At a high level, the capital prioritization effort demonstrated how much of WMATA’s capital needs could be met at different levels of investment and permitted potential consideration of trade-offs across priorities.

Figure 2.7 WMATA Capital Program Investment Analysis



Source: Performance-Based Planning and Programming: A Transit Perspective, presentation by Patricia Hendren, September, 2011

For WMATA, much of its operating budget is ‘locked in’ due to union contracts and fuel and material costs. For discretionary operating initiatives, WMATA is attempting to link these new initiatives to agency goals using a set of performance measures/factors for the FY13 budget (Table 2.4). This recent effort was challenged due to the difficulty in quantifying the performance outcomes for the various initiatives and internal resistance to using data to drive funding decisions.

**Table 2.4 WMATA Initiative Prioritization Factors**

WMATA Goal	Prioritization Measures/Factors
Safety and Security	Customer injury rate
	Employee injury rate
	Crime rate
Deliver Quality Service	On-time performance
	Mean distance between failure
	Escalator/elevator availability
	Customer comment rate
Use Resources Wisely	Reduce operating cost or generate revenue

Source: Performance-based Planning and Programming: A Transit Perspective, presentation by Patricia Hendren, September, 2011

## 3.0 Performance-based Planning and Programming

### 3.1 COMMON ELEMENTS OF PERFORMANCE-BASED PLANNING AND PROGRAMMING

While the three agencies described in Section 2.0 each have a unique approach to performance-based planning and programming, there are common elements from these and other examples that provide a framework for advancing performance-based planning and programming. The discussion below reflects these examples, the experience of other agencies in conducting performance-based planning and programming, and input from participants at the 2011 National Workshop held in Chicago, IL.

This section describes the common elements of an analytic approach to transportation planning and programming that represents a performance-based approach. These elements are rooted in a system or program level analysis that asks a basic question: what are the expected impacts of a set of strategies on future system performance? This analysis is a vital part of long-range planning and mid-range investment planning that State DOTs, MPOs, and transit agencies are increasingly using in statewide and metropolitan transportation planning to help guide future investments.

#### Setting Direction

Each of the examples cited in Section 2.0 began by identifying a strategic direction that consists of **goals and objectives**, and is supported by **performance measures**:

- **Goals and objectives.** A fundamental concept in performance-based planning and programming is that it be based on an agency's strategic direction. Agencies first need to determine their priorities and use these to shape the decisions they make about policies and investments.
- **Performance measures.** Any performance-based planning effort will necessarily include measures. Each of the examples described above define performance measures within their goals and objectives.

#### Long Range Planning

Most agencies that conduct performance-based planning and programming also conduct some type of **strategy evaluation**, though the specifics vary from one agency to another. The purpose of planning is to guide investment and policy

decisions over a long time frame (10 to 20 years). For performance-based plans, there is an expectation that agencies describe expected performance outcomes for a package of strategies across several goal areas and use this information to help them determine how best to focus their resources. However, many agencies still struggle with quantifying future performance outcomes. The components of strategy evaluation include:

- **Desired targets and trends.** Before evaluating the package of strategies, many transportation agencies identify targets to provide direction to strategy evaluation. At this stage, targets and trends may be aspirational, though they would be expected to build on previous iterations of target setting and strategy analysis. The desired targets may include both specific numerical targets and/or desired trends. Targets help make individual goals and objectives concrete. Developing targets is a well known challenge and it may not be possible to develop realistic, achievable targets in all areas. Table 3.1 presents several targets Mn/DOT has established for its infrastructure preservation programs. Other agencies use combinations of arrows and colors or other qualitative methods to indicate the direction they are trying to achieve in a particular performance area.

**Table 3.1 Mn/DOT Targets for Infrastructure Preservation**

Infrastructure Preservation Category	Performance Measure	Target	Method for Determining Needs
Pavement	RQI (Ride Quality Index)	PA > 70% good	Pavement Management System
		< 2% poor	
		Non-PA > 65% good	
Bridge	Structural Condition of Bridges over 20 ft and on Principal Arterials	PA < 3% poor	Bridge Management System
		>84% in Good or Satisfactory condition, <2% in Poor condition	
Other Infrastructure (signs, lighting, traffic signals, drainage, etc)	Condition or Life Cycle Replacement	Varies	Inventory and condition assessment Estimate of assets/replacement cost

Source: Performance-Based Planning and Programming at Mn/DOT, presentation by Tim Henkel, September 2011

- **Strategy identification.** Performance-based plans will need to indicate how State DOTs, MPOs, and transit agencies are working to improve performance in each goal – including policies, strategies, and investments. This step is not specific to performance-based planning and programming, but it is common to all performance-based planning efforts. Many complementary planning processes (SHSP, CMP, etc.) already identify strategies and it is important for performance-based plans to be consistent with and build on these other

efforts. In addition, it is important to recognize that strategies may impact multiple goal areas and it will be important in reviewing strategies to ensure coordination across goals and programs.

- **Strategy evaluation.** Where possible, performance-based plans would evaluate expected future performance of packages of strategies at a system level, rather than at a project level. The Mn/DOT Highway Investment Plan described in Section 2.0 provides a detailed analysis of the expected performance outcomes. This information may be presented in quantitative or qualitative terms. In fact, Mn/DOT summarizes the performance expectations in qualitative terms (see Figure 2.3). Similarly, WMATA used a qualitative approach to present the impact different funding levels would have on competing agency priorities (see Figure 2.7). The purpose of the strategy evaluation is to relate how the set of strategies and investments proposed are expected to improve performance of each of the goal areas. One key aspect of the strategy evaluation conducted by many transportation agencies is an examination of system-level trade-offs. SEMCOG provides a clear example of this process, which looks at how performance is expected to change based on varying the distribution of funds to major program areas. Predicting specific performance outcomes based on a set of strategies currently remains outside of many agencies' capabilities for a variety of reasons (e.g., externalities, data availability, modeling constraints).

## Programming

**Resource allocation** is the process of selecting specific investments in the transportation system. These investments are typically listed in an agency capital plan and/or in a STIP or TIP, which are federally-mandated documents that enable receipt of Federal funds. The S/TIP development process varies widely from region to region. In a performance-based framework, the resource allocation step links the system-level analysis of strategies described above to the programming of specific projects. There are three key elements of resource allocation:

- **Investment plan.** Increasingly, transportation agencies or individual functional units are developing overall investment plans for specific program areas that identify the funding needs and likely overall focus of a program given funding constraints. These plans help describe the tradeoffs that must be made across program areas and provide a system level understanding of the size and mix of investment in a given area.
- **Programming.** Short range programming documents, like S/TIPs, serve as a means to document the specific commitments made by a transportation agency. In a performance-based planning and programming approach, the specific project decisions are explicitly linked, one way or another, to the system level investment plan.
- **Resource constrained targets and trends.** While targets and trends are often set up front as aspirations, they are also commonly used to communicate

what is possible and expected given the strategies and investments being made in the transportation system. At this stage, targets can present the expected future performance of the system.

The agencies described in Section 2.0 use a variety of methods to make the linkage between system performance and project programming, including the step that translates system performance analysis into specific projects. This takes:

- **Consistency of outcome.** SEMCOG tracks the consistency of the projects in their TIP with the investment levels identified in their long range plan. The long range plan identifies preferred funding levels for each major program. Over the course of the plan, SEMCOG maintains a page on their website that tracks the consistency of actual projects programmed compared to the preferred levels.
- **Consistency of measurement.** WMATA has developed an analysis of proposed initiative that uses measures that are consistent with, though not exactly the same as, the measures used to evaluate the system in the Vital Signs report. Both sets of measures are based on WMATA's goals. Although WMATA's performance tools are used by different audiences (see Figure 2.6), the set of key performance indicators tracked in the Vital Signs Report permeate across all performance management efforts. In addition, all of the performance tools developed by WMATA are connected to agency goals.
- **Hierarchical distribution.** Mn/DOT first distributes funding to programs and districts using a performance-based formula and then prioritizes projects within those program areas.
- **Corridor approach.** Some agencies use a corridor-based approach that develops preferred investment strategies for major transportation corridors and then prioritizes and programs across those corridors based on various funding and other constraints.
- **Optimization approach.** Finally, some agencies use optimization techniques in some of their program areas to prioritize and program projects. These techniques identify not the best projects, but the projects that maximize performance of a full program of projects subject to a set of constraints (typically funding). These techniques are commonly used within bridge and pavement management systems to identify programs of projects that minimize the lifecycle cost of investments.

Each of these methods has performance-based aspects and, in practice, hybrids of these approaches are likely to be used to support resource allocation. For example, pavement and bridge management programs typically use a system optimization approach within their individual programs, while a corridor approach may be well suited to examine the range of capacity, transit service, highway operations, and certain safety improvements.

Fundamental to a performance-based approach is the recognition that agencies should first identify projects that are consistent with their goals and performance targets, and then determine the appropriate funding source for those projects. Unlike a traditional programming and budgeting process that identifies funding sources first, this approach first identifies the set of projects that best help the agency meet its goals or targets. The second step, then, is to identify what potential funding sources can be used to fund the preferred set of projects. Many Federal and State funding sources have some flexibility and can be used for multiple purposes or can be combined on projects to meet multiple goals.

### Implementing

While the previous sections describe how performance measures are used in preparing plans and programs of future investment, another key element of performance-based planning and programming is **tracking actual performance** through ongoing reporting. Two types of tracking are relevant:

- **Tracking trends in performance.** As transportation agencies implement their plans and programs, it is important to monitor how performance is changing, especially in relationship to forecasted performance described above. This step provides a means to address both the success of all types of strategies (investment, policy, resource allocation) and potentially identify gaps in tools and data that may improve forecasts in the future. For most measures, because strategy implementation and travel behavior change relatively slowly, performance is tracked as a trend over several years.
- **Comparing performance with targets and expected levels.** In addition to tracking the actual performance, part of performance-based planning and programming is tracking performance against a set of targets and/or expectations described above.

Finally, any planning process includes **evaluation** of the types of information used and the elements of the process. This evaluation includes providing feedback to other elements of the overall process and improving how the planning process is used to make decisions.

## 3.2 PERFORMANCE-BASED PLANNING AND PROGRAMMING PROCESS

Table 3.2 summarizes the elements described previously. This framework represents a vision for the future of planning and programming. This information would evolve over time as tools, data, and processes improve.

**Table 3.2 Performance-based Planning and Programming Elements**

Elements	Description	Examples
<b>Strategic Direction</b> ( <i>Where do we want to go?</i> )		
Goals and objectives	Goals and objectives that capture an agency's strategic direction.	Infrastructure condition, safety, mobility, reliability, and other goals established by an agency.
Performance measure	Agreed on measures for goals and objectives.	Percent of bridges in good condition, travel time index, and other measures linked to agency goals.
<b>Long Range Planning</b> ( <i>How are we going to get there?</i> )		
Identify targets and trends	Establish aspirational targets or preferred trends based on the an understanding of a desirable future for each goal area and measure.	Desired conditions of pavement, bridge, and transit assets. Desired future corridor travel times or reliability levels. Desired future crash, injury, and fatality reductions.
Identify strategies	Strategies, policies, and investments that address transportation system needs within the identified goal areas.	Resurfacing, rehabilitation, replacement and reconstruction to support infrastructure condition. Signal timing, vehicle maintenance, service patrols, additional capacity, (transit or highway), tolling, and other strategies/investments to improve mobility or reliability. Seat belt or drunk driving enforcement, graduated drivers licenses, rumble strips, training, median barriers, and other investments to improve safety.
Strategy evaluation	Evaluate strategies and define program level system performance expectations, may be qualitative.	Examine impact of varying levels of investment on pavement and, bridge preservation and transit assets. Examine impact of packages of operations, capacity and other highway or transit investments on corridor travel time and/or reliability. Examine potential for reduction in crashes, injuries, and fatalities from a package of safety investments.
<b>Programming</b> ( <i>What will it take?</i> )		
Investment plan	Identify the amount and mix of funding needed to achieve performance goals within individual program areas.	Investment plan for pavement, bridge, transit asset, operations, expansion, safety, and other projects consistent with strategy evaluation, including specific projects and high level summary of expected investment levels.
Resource constrained targets and trends	Established quantitative or qualitative targets or desired trends for each goal/measure.	Expected future conditions of pavement and, bridge conditions, and transit assets. Expected future corridor travel times or reliability improvements given a package of investments. Expected range of crash, injury, and fatality reduction from a package of safety investments.

Elements	Description	Examples
Program of projects	Identify specific transportation projects for an agency capital plan, or S/TIP that are consistent with system performance expectations established in strategy evaluation.	S/TIP with specific projects identified in major program areas (pavement, bridge, transit assets, capital, operations, safety, etc.).
<b>Implementation and Evaluation (How did we do?)</b>		
Reporting and monitoring	Monitor progress on goals relative to targets and resource allocation efforts.	Report on pavement, bridge, transit assets, reliability, safety, and other metrics presented to stakeholders, public and decision makers.
Evaluation	Identify improvements in analytics, process, etc., to improve the planning process.	Examine actual conditions relative to expected conditions for assets, reliability, safety, and other areas. Identify where tools produced inaccurate estimates or investments and policies were more or less successful than planned.

Figure 3.1 presents how these elements are arrayed into the planning process. As suggested by participants at the 2011 National Workshop, the figure describes how performance management would enhance the established transportation planning and programming process. The figure builds off of the FHWA and FTA Transportation Planning Capacity Building Team's *The Transportation Planning Process Key Issues: A Briefing Book for Transportation Decision Makers, Officials, and Staff*.<sup>1</sup> The figure identifies the steps of the federally required planning process, including:

- Setting vision, goals, and objectives to guide all planning efforts.
- Deriving performance measures that capture the fundamental outcomes of the agency's goals and objectives.
- Identifying strategies that are consistent with those identified in other planning efforts, including the CMP, SHSP, and other required and voluntary planning efforts (corridor plans, modal plans, and others).
- Evaluating and prioritizing packages of strategies through trade-off or scenario analysis.
- Using the results of the scenario analysis to guide setting resource constrained targets or trends for these measures and to develop preferred program investment levels as part of a long range transportation plan for the State or region covered by the plan.

<sup>1</sup> <http://www.planning.dot.gov>

- Conducting resource allocation exercises that translate an overall investment plan into a specific set of projects for a short range S/TIP or an agency's capital program.
- Project delivery and system operations that provide feedback into the planning process and provide data and information for performance measurement.
- Feedback of the decisions made and information used into early elements of the overall process.
- Ongoing coordination and collaboration with stakeholders and the public throughout the process.
- Data and tools used to support all aspects of planning, including the evaluation of strategies, development of targets, and allocation of resources to specific projects.

Figure 3.1 Performance-based Planning and Programming Process

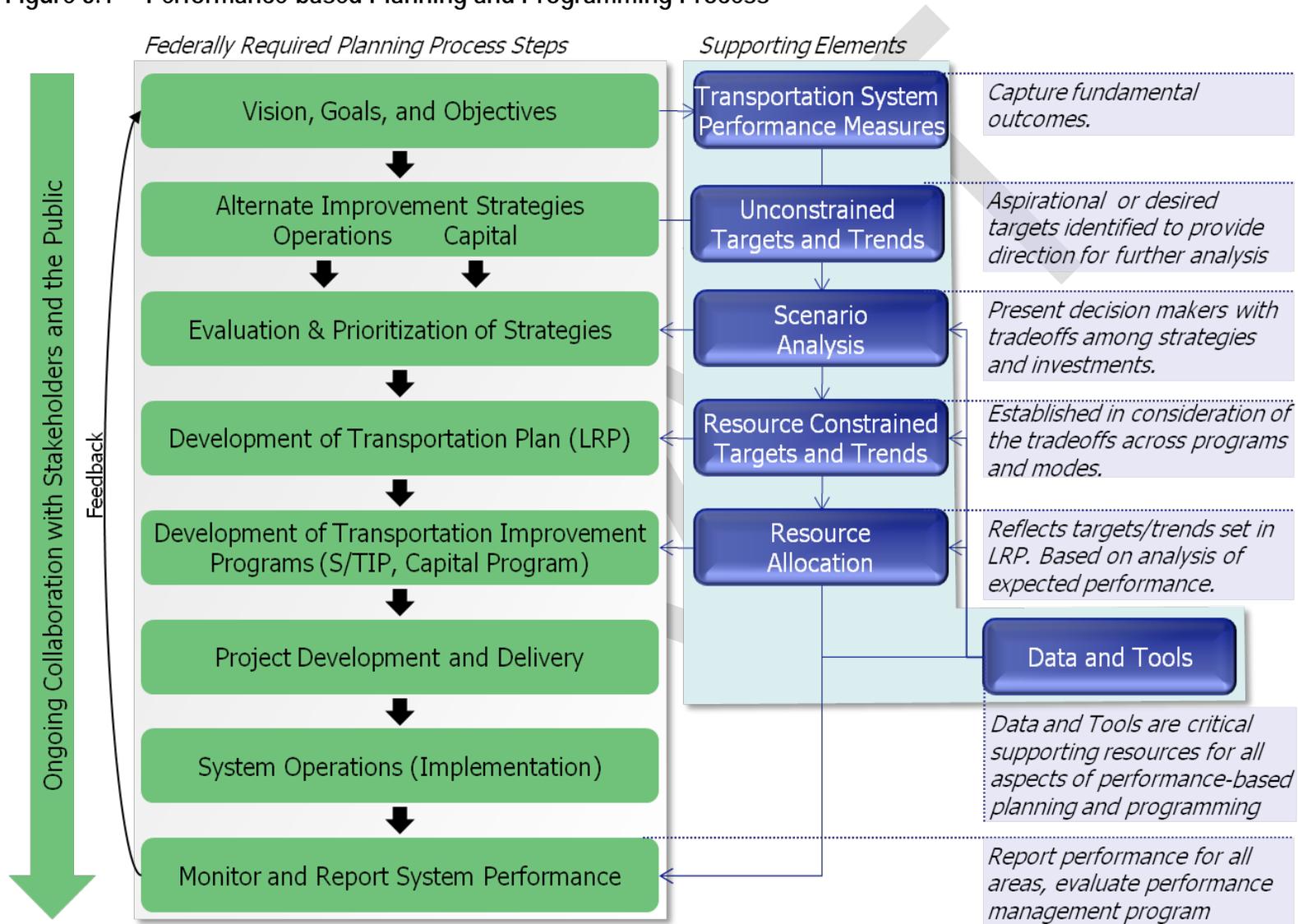
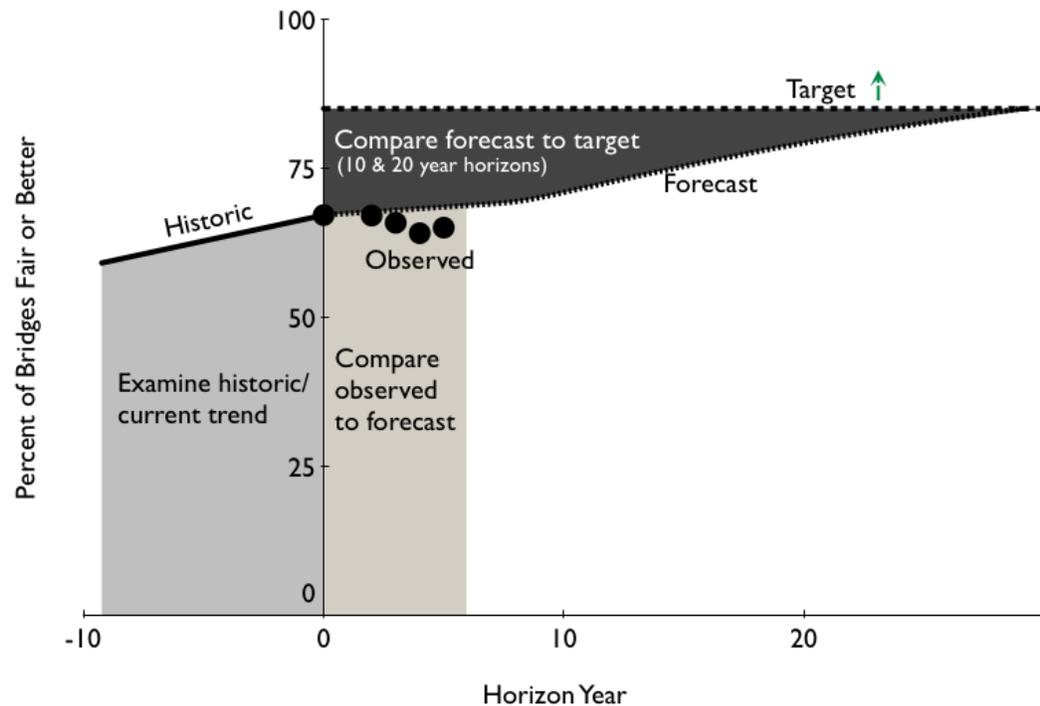


Figure 3.2 graphically illustrates the types of information that might be included in a performance-based plan for a given performance measure. It includes:

- The performance trend (medium gray). This provides a basis for understanding how performance is changing over time using historic estimates of performance for a given measure. For some measures, State DOTs, MPOs, and transit agencies may have this information already; for others it would require multiple cycles to provide.
- A comparison of performance forecast to a target (dark gray). This would require being able to forecast the expected performance impacts of projects and/or investment levels. Is the gap between current performance and the projected target level closing? Or is current performance, assuming it meets a target, being sustained?
- Performance monitoring (light gray). Over time a State DOT, MPO, or transit agency would compare observed performance to forecasts provided in long range planning and to the performance target.

Figure 3.2 Example of Information Expected in a Performance-based Planning and Programming Process



For all of this information, it is anticipated that plans and programs would provide substantial narrative to explain the quantitative findings and document the policies and strategies being implemented in each area.

### 3.3 OTHER ISSUES

This section summarizes several key issues that were identified in the development of the framework, including:

- Implementation;
- The resources needed to support the framework;
- The relationship of the framework to various planning analysis time frames; and
- The varying roles for State DOTs, MPOs, and transit agencies within this framework.

#### Implementation

In addition to the elements described above in the framework, important implementation steps include:

- **Project delivery.** As plans and programs are developed, it becomes important to ensure that they are delivered. Having as much quality information as possible about project costs, risks, and other information during planning and programming is important to ensure that the set of projects that is selected can actually be delivered. From a practical standpoint, changing circumstances (e.g., funding availability, commodity price fluctuations, political factors) frequently result in changes to plans and programs, impacting the ability to achieve targets.
- **Evaluation.** As agencies develop policies and make investments in the transportation system, they should examine how policies and investments impact system performance. At the same time, national organizations – TRB, FHWA, FTA, AASHTO, AMPO, APTA, NADO, and others – should examine policy and investments across a range of contexts to develop new approaches and share best practices for improving system performance. A strong evaluation process will help refine strategies and improve the tools used to analyze strategies. Today, post-project implementation evaluation is not common practice.

#### Data and Tools

While not a specific element in a planning process, data and analytic tools are critical resources for performance-based planning and programming. Conducting system or project analysis will require a suite of approaches, tools and methodologies to help DOTs, MPOs, and transit agencies both measure current performance and predict future performance, given a set of strategies and investments.

Tools and data vary by performance area and agency type and size. Some performance areas have well established tools (e.g., pavement and bridge management systems) or significant data collection efforts (e.g., the Fatality Accident

Reporting System, or FARS) that can help in measuring and evaluating expected future performance. Transit agencies operate numerous modes (e.g., heavy rail, bus, light rail, streetcar) in diverse conditions, making data collection and analysis more complex and less comparable across transit agencies. For a performance-based planning and programming approach to work, it needs to build on the success and information that is currently available, such as State DOT pavement and bridge management systems or transit asset management systems and planning processes like the SHSP and CMP. The range of approaches that may be acceptable will vary by the level of maturity, size, and other differences among State DOTs, MPOs, and transit agencies.

The ability to forecast future performance varies significantly depending on the type of strategy and investment. Additional capacity building will be needed to improve forecasting tools or to identify areas where a qualitative approach is more appropriate.

In the previous version of this effort, tools and data were identified as elements of the overall framework. At the suggestion of participants in the 2011 National Workshop, these have been moved to be identified as critical supporting resources for the overall framework, but not separate elements. Data and tools are required throughout the planning process, but are not themselves an element of the process.

### **Planning Analysis Time Frames**

Actual delivery of performance-based planning and programming will likely occur across the range of planning efforts and will apply to several analysis periods, including:

- **Long range.** Transportation agencies typically examine how the State and/or region will respond to the trends and challenges facing the transportation system over a 20 or more year period. At this stage, performance-based planning and programming is focused on defining goals, objectives, and measures, and targets to track overall performance. Current Federal regulations require State DOTs and MPOs to develop long range transportation plans with at least a 20-year horizon, though the specific requirements differ substantially for MPOs and State DOTs.
- **Mid range.** The framework presented above suggests the need to examine the expected performance of investment in major State and metropolitan transportation program areas over time. Several State DOTs, transit agencies, and MPOs have been developing these types of programs, which often examine performance over a 10-year period. Current Federal regulation does not require planning analysis over this time horizon, though some agencies have begun to use it to support their planning and programming efforts.
- **Short range.** Over the short range, often a four to five year time horizon, project evaluation and prioritization guides the selection of a program of projects. This program should be linked back to the long range and

investment planning steps described above. Current Federal regulations require State DOTs to develop STIPs and MPOs to develop TIPs.

- **Ongoing.** In addition to these three time frames, performance management programs generally include regular, likely annual, performance monitoring and reporting for tracking current system performance.

How these planning horizons are addressed within specific planning documents will vary from one agency to another.

## **Roles for State DOTs, MPOs, and Transit Agencies**

While the framework presented above is meant to apply broadly to transportation planning and programming, some aspects of the framework may apply more readily to certain types of agencies than others. Specifically:

- MPOs have traditionally not focused on infrastructure issues or even on safety, focusing their efforts on congestion management and other issues. Because most MPOs do not own or operate infrastructure, they rely on State DOTs and transit agencies to provide information about infrastructure condition and investment levels. An increasing number of MPOs have started to use Federal tools such as the Highway Economic Requirements System – State (HERS-ST) and the National Bridge Investment Analysis System (NBIAS) to help examine scenarios for investment. Scenario analysis helps some MPOs plan for the long term and enables the evaluation of trade-offs across different types of investment (i.e., should more be invested in infrastructure condition or congestion mitigation?). MPOs play highly variable roles in regional planning depending in many cases on State statutory authority. In some regions, the State DOT, a regional transit agency or another entity may take the lead on scenario planning.
- Transit agencies traditionally participate in the metropolitan planning process through MPOs and in the statewide planning process through State DOTs, although significant planning efforts may occur at the transit agency or through another entity. FTA and others are actively developing tools and methods to improve how transit agencies track the condition of transit infrastructure (including rail, vehicles, facilities, etc.).
- Some specific goal areas touch multiple agencies that may not traditionally be included in the planning process. For example, safety investments and policy are managed by several agencies, including State DOTs, governors highway safety offices, and others. Transportation system operations includes State DOT and other transportation staff that are not typically involved in the planning process, as well as other groups (police, emergency response, tow truck operators, etc.) who are not regular participants in the planning process.

For any given agency, it may be appropriate to begin development of a performance-based planning and programming process by focusing on a subset

of goals and expanding efforts over time. As described above, it will be important to coordinate with and build on work conducted through complementary planning processes (such as for strategic highway safety plans (SHSP)) because all units within a State DOT, MPO, or transit agency will have roles in the achievement of performance outcomes.

## 4.0 Next Steps

Many transportation agencies have begun to implement performance-based planning and programming. An important next step related to the current effort is being conducted by the AASHTO Standing Committee on Planning in collaboration with the FHWA (NCHRP Project 8-36 (104)). Through NCHRP Project 8-36 (104), three performance-based planning and programming pilot studies are being conducted with a focus on collaboration across State DOTs, MPOs, rural planning organizations, and transit agencies. The pilot studies locations and focus areas include:

- Kansas City, including Kansas and Missouri DOTs; the Mid-America Regional Council, the MPO for the Kansas City region; and the Kansas City Area Transit Authority. The focus of this pilot study is on safety.
- Pennsylvania, including the Pennsylvania DOT and all of the MPOs and regional planning organizations in Pennsylvania. The focus of this pilot study is on infrastructure condition.
- Washington, D.C., including the Maryland DOT; the Metropolitan Washington Council of Governments, the MPO for the Washington metropolitan area; and the Washington Metropolitan Area Transit Authority, the transit provider for the region. The focus of this pilot study is on congestion, with an emphasis on integrating highway and transit considerations.

Some additional next steps that may be relevant for this effort include:

- Support efforts by transportation agencies to implement a performance-based planning and programming process. Key activities within this area may include providing workshops and peer exchanges for practitioners to discuss and advance the concepts of performance-based planning and programming, supporting additional pilot studies, and providing technical assistance to these agencies. Clarifying how the application of the performance-based framework should vary by agency function (e.g., planning, operations, budgetary) will be critical to successful implementation.
- Improve availability and quality of data and tools to support performance-based planning and programming. Key activities within this area include researching and developing better methodologies for tradeoff analysis, identifying gaps in data and tools for common performance areas, compiling case studies of best practices on target setting, documenting the relationships between actions and performance outcomes and similar efforts.
- Increase collaboration on performance-based planning and programming. Key activities in this area may include improving how agencies communicate performance information to the public, developing review bodies or a performance council comprised of practitioners to provide feedback on individual

agency performance-based planning efforts, establishing benchmarking groups to share best-practices in a protected environment, investing in the development of visualization tools to support communication with the public and decision makers, and other similar efforts.



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