Approaches to Target Setting for PM3 Measures

October 2022

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16. Abstract

Targets and measures are key components of performance management and are critical to communicating information about the transportation system to decision-makers, stakeholders, and the traveling public. Target setting for travel time-based measures has emerged as a challenge in transitioning to a performance management-based approach for making transportation investment and policy decisions, as mandated by Moving Ahead for Progress in the 21st Century Act (MAP-21) and Fixing America's Surface Transportation (FAST) Act. This report provides potential approaches and resources to State Departments of Transportation (DOT) and local agencies to help overcome those challenges. Approaches include technical options for developing the information to support target setting.

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
	NOTE: volumes greater than 1000 L shall be shown in m^3			
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE (exact degrees)		
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	$candela/m^2$	cd/m^2
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
		TEMPERATURE (exact degrees)		
°C	Celsius	1.8C+32	Fahrenheit	°F
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	$candela/m^2$	0.2919	foot-Lamberts	fl
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380. (Revised March 2003)

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ACS	American Community Survey
Agency	Refers to either a State department of transportation or a metropolitan planning organization
AVO	Average Vehicle Occupancy
CFR	Code of Federal Regulations
CMAQ	Congestion Mitigations and Air Quality
DOT	Department of Transportation
FAST	Fixing America's Surface Transportation
FHWA	Federal Highway Administration
HCM	Highway Capacity Manual
HOP	Office of Operations
HOT	High-Occupancy Toll
HOV	High-Occupancy Vehicle
LOTTR	Level of Travel Time Reliability
MAP-21	Moving Ahead for Progress in the 21st Century Act
MPO	Metropolitan Planning Organization

NCDOT	North Carolina Department of Transportation
NCHRP	National Cooperative Highway Research Program
NHS	National Highway System
NPMRDS	National Performance Management Research Data Set
PBPD	Performance-Based Practical Design
PBPP	Performance-Based Planning and Programming
PHED	Peak-Hour Excessive Delay
PM3	Third Performance Measure Rule
RITIS	Regional Integrated Transportation Information System
RTPO	Rural Transportation Planning Organization
SOV	Single Occupancy Vehicle
STIP	Statewide Transportation Improvement Program
TIP	Transportation Improvement Program
TOCOR	Task Order Contracting Officer's Representative
TPB	Transportation Planning Board
TPM	Transportation Performance Management
TSMO	Transportation Systems Management and Operations

TTRI	Travel Time Reliability Index
TTTR	Truck Travel Time Reliability
USDOT	United States Department of Transportation
VMT	Vehicle-Miles Traveled
WSDOT	Washington State Department of Transportation

EXECUTIVE SUMMARY

Targets and measures are key components of performance management and are critical to communicating information about the transportation system to decision-makers, stakeholders, and the traveling public. In transitioning to a performance management-based approach for making transportation investment and policy decisions, as mandated by Moving Ahead for Progress in the 21st Century Act (MAP-21) (Pub. L. 112-141) and Fixing America's Surface Transportation (FAST) Act (Pub. L. 114-94), target setting for travel time-based measures has emerged as a key challenge. This report provides potential approaches and resources to State Departments of Transportation (DOT) and local agencies to help overcome those challenges. Approaches include technical options for developing the information to support target setting, as well as two examples of target setting by agencies.

The technical resources and case studies presented in the report suggest key findings, including:

- **Targets are Critical for Performance Management—**Targets are a critical component of performance management as they make an observable and quantifiable link between investment decisions and performance expectations. Furthermore, targets help bring transparency to the transportation decision-making process and are useful to State DOTs and Metropolitan Planning Organizations (MPO) beyond the need to meet Federal requirements. For example, as discussed in the Washington State Department of Transportation (WSDOT) case study, Washington State linked its design standards to performance targets via its Practical Design initiative. While the transportation planning process includes performance measurements and target setting, project-level decisions made during the design phase impact an agency's ability to achieve target levels.
- **Data Resources for Agencies**—The provision of the National Performance Management Research Data Set (NPMRDS) data by Federal Highway Administration (FHWA) for development of the Third Performance Measure Rule (PM3) (83 FR 24920) measures has greatly aided target-setting efforts as well.[1] However, beyond the PM3 measures, for States that are unable to purchase additional travel time data, the lack of coverage of the NPMRDS data on non-National Highway System (NHS) roadways presents a challenge.
- **Forecasting Performance for Travel Time Measures**—Forecasting reliability performance and predicting targets is an emerging practice and represents a challenge that State DOTs and local agencies face in order to transition from a performance measurement to a performance management approach. To date, extrapolation of past trends has been the most common method to provide the technical basis for setting PM3 targets. While most travel demand models have been developed to forecast performance measures, such as volume-to-capacity and vehicle-hours traveled, no State DOT or local agency appears to have developed a model to forecast any of the PM3 reliability or delay measures. Thus, the development of models and tools to aid in forecasting reliability is an important research area going forward.

[1] National Performance Management Measures; Assessing Performance of the National Highway System, Freight Movement on the Interstate System, and Congestion Mitigation and Air Quality Improvement Program.

Application of several of the Strategic Highway Research Program 2 (SHRP 2) reliability tools offer promise in this area.

- **Resources Available to Agencies**—Resources available to agencies to aid in target setting include data sources that supplement publicly available travel time data; models and analytical tools that aid in forecasting demand and performance; and the experience of peer agencies. Effectively leveraging these resources helps agencies to set realistic targets and avoid pitfalls that may result from external factors beyond their control.

CHAPTER 1. INTRODUCTION

Transportation performance management (TPM) is a strategic approach that uses system performance information to make investment and policy decisions to achieve transportation system performance goals.[2] As defined in the Moving Ahead for Progress in the 21st Century Act (MAP-21) and the Fixing America's Surface Transportation (FAST) Act, TPM emphasizes performance measures and targets to achieve these system performance goals. Performance management represents a broad, high-level perspective of system-level outcomes for transportation. TPM is systematically applied so it is a regular, ongoing process that provides key information to assist decision-makers in understanding the consequences of investment decisions and policy actions across multiple performance areas on the transportation system.

Targets and measures are key components of performance management and are critical to communicating information about the transportation system to decision-makers, stakeholders, and the traveling public. In transitioning to a performance management-based approach for making transportation investment and policy decisions, target setting has emerged as a challenge to State and regional agencies from multiple perspectives, especially for travel time-based targets. The purpose of this technical report is to provide examples of different options available to State DOTs and Metropolitan Planning Organizations (MPO) for setting roadway performance targets.

BACKGROUND

MAP-21 began and the FAST Act continued a performance-based Federal-Aid Highway Program. The Federal Highway Administration (FHWA) conducted rulemaking to address the MAP-21 and FAST Act performance management provisions across seven performance areas shown in figure 1: Safety, Infrastructure Condition, Congestion Reduction, System Reliability, Freight Movement and Economic Vitality, and Environmental Sustainability. Each performance area was addressed in a Final Rule, which was codified in title 23 of the Code of Federal Regulations (CFR) Part 490. The goals associated with each performance area are:[3]

- Safety—To significantly reduce traffic fatalities and serious injuries on all public roads.
- Infrastructure Condition—To maintain the highway infrastructure asset system in a state of good repair.
- Congestion Reduction—To significantly reduce congestion on the National Highway System (NHS).
- System Reliability—To improve the efficiency of the surface transportation system.

[2] Federal Highway Administration, TPM Guidebook.
[3] 23 U.S.C.150(b).

- Freight Movement and Economic Vitality—To improve the National freight network, strengthen the ability of rural communities to access National and international trade markets, and support regional economic development.
- Environmental Sustainability—To enhance the performance of the transportation system while protecting and enhancing the natural environment.

Figure 1. Infographic. Federal Highway Administration performance management rulemaking.[4]
(Source: Federal Highway Administration.)

Each performance area is supported by a set of metrics and/or performance measures. While the metrics represent quantifiable indicators of condition or performance, measures are expressions based on metrics that are used to establish targets and assess progress towards meeting targets. The latter is the focus of this report, as 23 CFR Part 490 directs State DOTs and MPOs to establish performance targets for all National performance measures and report progress towards

[4] 81 FR 13913, Mar. 15, 2016.

targets to FHWA on a regular basis.[5] Specifically, this report focuses on target setting for the travel time-based performance measures, including the challenges of setting travel time-based targets, resources that agencies may use to aid them in setting these targets, and potential approaches State DOTs and MPOs may take.

PURPOSE OF THE REPORT

The purpose of this report is to provide approaches available to State DOTs and MPOs for setting roadway performance targets, specifically for travel time-based performance measures. It reviews the concept of TPM (which is the impetus for target setting) and Performance-Based Planning and Programming (which is a key part of implementing TPM), provides an overview of Federal target-setting requirements, and identifies challenges and noteworthy practices from around the country. The report is based on a review of Federal regulations pertaining to target setting, past FHWA technical reports and presentations on performance management and the National performance measures, and case studies from transportation agencies that have been engaged in performance management and target setting.

ORGANIZATION OF THE REPORT

The remainder of the report is organized as follows:

- Chapter 2 discusses target setting within the context of TPM and performance-based planning and programming (PBPP), as well as discusses the Federal requirements for target setting.
- Chapter 3 presents some of the challenges that agencies often face when attempting to set targets.
- Chapter 4 discusses various approaches for setting targets while providing examples from State DOTs and local agencies.
- Chapter 5 illustrates the various resources that State DOTs and local agencies may utilize to aid them in target setting.

[5] 23 U.S.C. 150.

CHAPTER 2. TARGETS AND PERFORMANCE-BASED PLANNING AND PROGRAMMING

This section discusses target setting within the context of TPM and PBPP. It provides an overview of TPM and the PBPP process and discusses where and how target setting fits. After discussing the role of targets in PBPP, this section then articulates the link between target setting in PBPP and the target setting regulations as mandated by the FAST Act.

OVERVIEW OF TRANSPORTATION PERFORMANCE MANAGEMENT

TPM is a strategic approach that uses system performance information to make investment and policy decisions to achieve National performance goals.[6] TPM achieves this by helping transportation agencies determine what results (strategic goals) to pursue, then guide investments to achieve those results using information from past performance levels and forecasted conditions to select the best investments. Transportation agencies routinely measure progress toward their strategic goals and use progress reports to adjust planned expenditures to more effectively allocate available resources to meet the adopted performance goals. TPM is grounded in sound data management, usability, and analysis, as well as in effective communication and collaboration with internal and external stakeholders.

There are 10 distinct components to TPM, as shown in figure 2. These include:

1. Strategic Direction
2. Target Setting
3. Performance-Based Planning
4. Performance-Based Programming
5. Monitoring and Adjustment
6. Reporting and Communication
7. Organization and Culture
8. External Collaboration and Coordination
9. Data Management
10. Data Usability and Analysis

[6] Federal Highway Administration, TPM Guidebook.

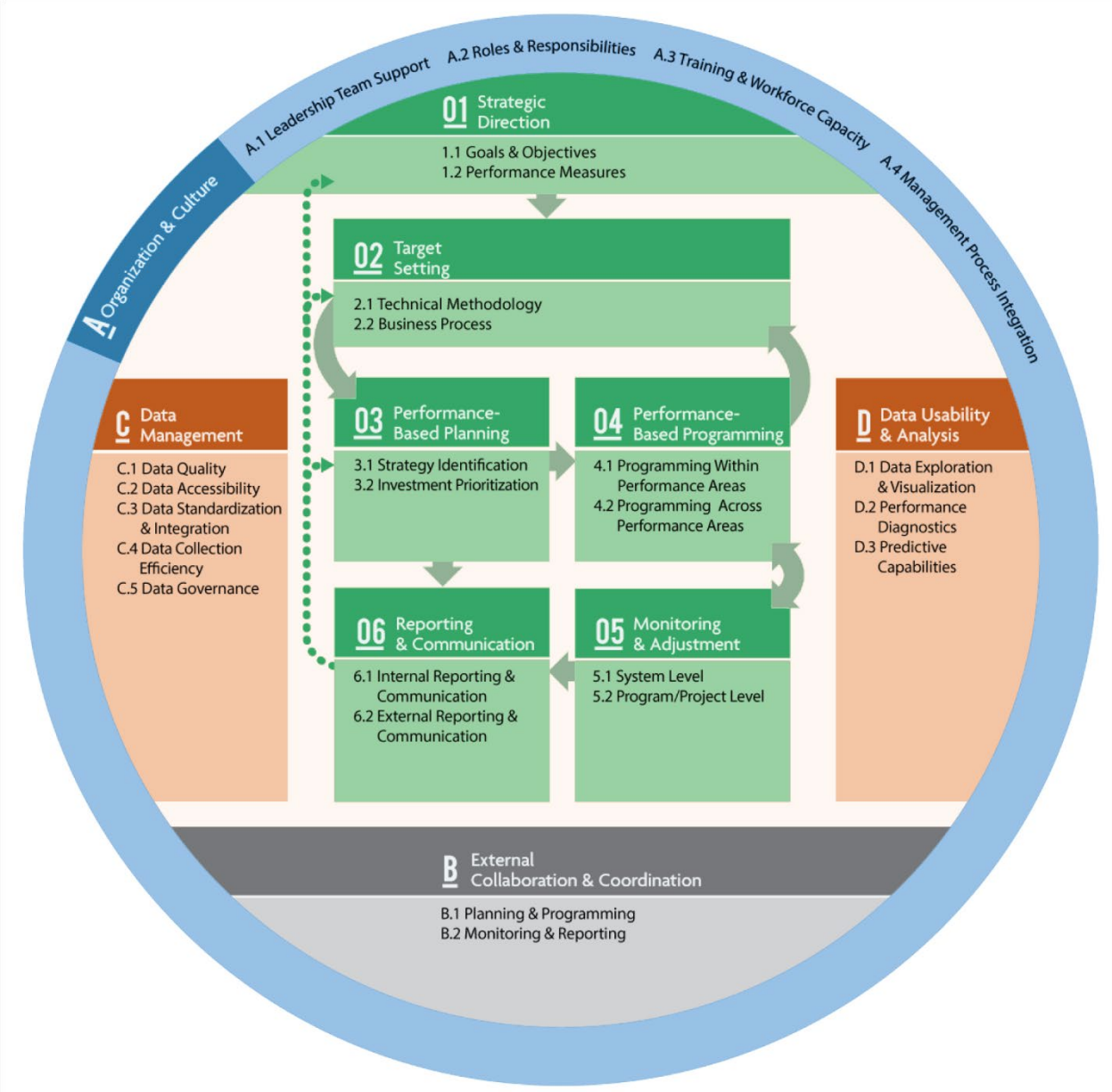

Figure 2. Diagram. Transportation Performance Management framework.
(Source: Federal Highway Administration, Transportation Performance Management Guidebook.)

Strategic Direction (Component 1) establishes an agency's direction through well-defined goals and objectives and enables assessment of the agency's progress towards meeting goals by defining a set of aligned performance measures. Strategic Direction is the critical first step in the TPM process and the foundation upon which all performance management rests. In order to be effective, the Strategic Direction should be integrated into a transportation agency's business plan and related documents.

Target setting (Component 2) is the use of baseline data, information on possible strategies, resource constraints, and forecasting tools to collaboratively establish a quantifiable level of performance the agency wants to achieve within a specific timeframe. Importantly, target setting should be evidence-based and data-driven. Targets make the link between investment decisions and performance expectations as established in the Strategic Direction. In addition, targets help bring transparency to the transportation decision-making process.

Performance-Based Planning (Component 3) is the use of agency goals, objectives, and performance trends to drive development of strategies and priorities in the long-range transportation plan and other performance-based plans and processes. The resulting planning documents become the blueprint for how an agency intends to achieve its desired performance outcomes.

Performance-Based Programming (Component 4) is the use of strategies and priorities to guide the allocation of resources to projects that are selected by agencies to achieve goals, objectives, and targets. Performance-Based Programming establishes clear linkages between investments made and expected outputs and outcomes.

Monitoring and Adjustment (Component 5) emphasizes that what agencies do with performance information distinguishes transportation performance management from performance measurement. *Management* is distinguished from *measurement* in that upon measuring performance, a management framework insists that this information be fed back into the framework in order to adjust programming decisions. In other words, performance management encourages agencies to actively use information gained from monitoring performance data to obtain key insights into the effectiveness of decisions and identify where adjustments in programming would be most effective.[7]

Reporting and Communication (Component 6) is the use of products, techniques, and processes to communicate performance information to different audiences for maximum impact. Reporting increases accountability and transparency to external stakeholders and helps explain to both agency staff and external stakeholders how TPM is driving a data-driven approach to decision-making, and why changes to previously developed plans need to occur in order to meet the strategic goals adopted by the agency.

Organization and Culture (Component 7) refers to the institutionalization of a transportation performance management culture within the agency, as evidenced by leadership support, employee buy-in, and embedded organizational structures and processes that support TPM.

External Collaboration and Coordination (Component 8) refers to the established processes to collaborate and coordinate with agencies and stakeholders on planning/visioning, target

[7] Transportation Performance Management, What, Why, and How.

setting, programming, data sharing, and reporting. External collaboration allows agencies to leverage agency resources and capabilities, as well as increase understanding of how activities impact and are impacted by external factors.

Data Management (Component 9) encompasses a set of coordinated activities for maximizing the value of data to an organization. It includes data collection, creation, processing, storage, backup, organization, documentation, protection, integration, dissemination, archiving, and disposal. The data management effort creates, organizes, and makes available the data resources needed for the final component.

Data Usability and Analysis (Component 10) takes the valuable data sets from the previous component and ensures both that those data are accessible and usable by the staff and stakeholders that need them, but that those individuals have the required analysis capabilities available to support both the production of the performance reports identified in Component 6, and the analytical tools needed to describe the value of alternative projects, plans, and strategies that are under consideration for achieving the desired strategic goals. While many agencies have a wealth of data, those data are often disorganized or cannot be analyzed effectively to produce useful information to support target setting, monitoring, project selection, decision-making, or other TPM practices.

As illustrated in figure 3, the target setting component touches all other TPM components. The target setting activity produces the quantifiable goals that the strategic direction is intended to achieve. This in turn should drive the planning and programming tasks, which are in turn dependent on the data analysis tasks and rely on an organizational culture and supportive external collaborations that understand and buy into the goal of achieving or striving to achieve those targets. The monitoring and reporting tasks combined then help the entire organization focus on the adopted goals.

Figure 3. Diagram. Target setting relationship to Transportation Performance Management components.
(Source: Federal Highway Administration, Transportation Performance Management Guidebook.)

OVERVIEW OF PERFORMANCE-BASED PLANNING AND PROGRAMMING

PBPP is the application of performance management principles within the transportation planning and programming processes to achieve desired performance outcomes for the transportation system. The term performance-based planning and programming simply refers to how the overall objective of TPM is implemented, in part, through the planning process. PBPP

helps transportation agencies to make infrastructure investment decisions based on their ability to meet performance goals.[8]

Figure 4 shows that performance-based planning and programming has three main components:

1. Planning
2. Programming
3. Implementation

These components are discussed in greater detail in the sections that follow.

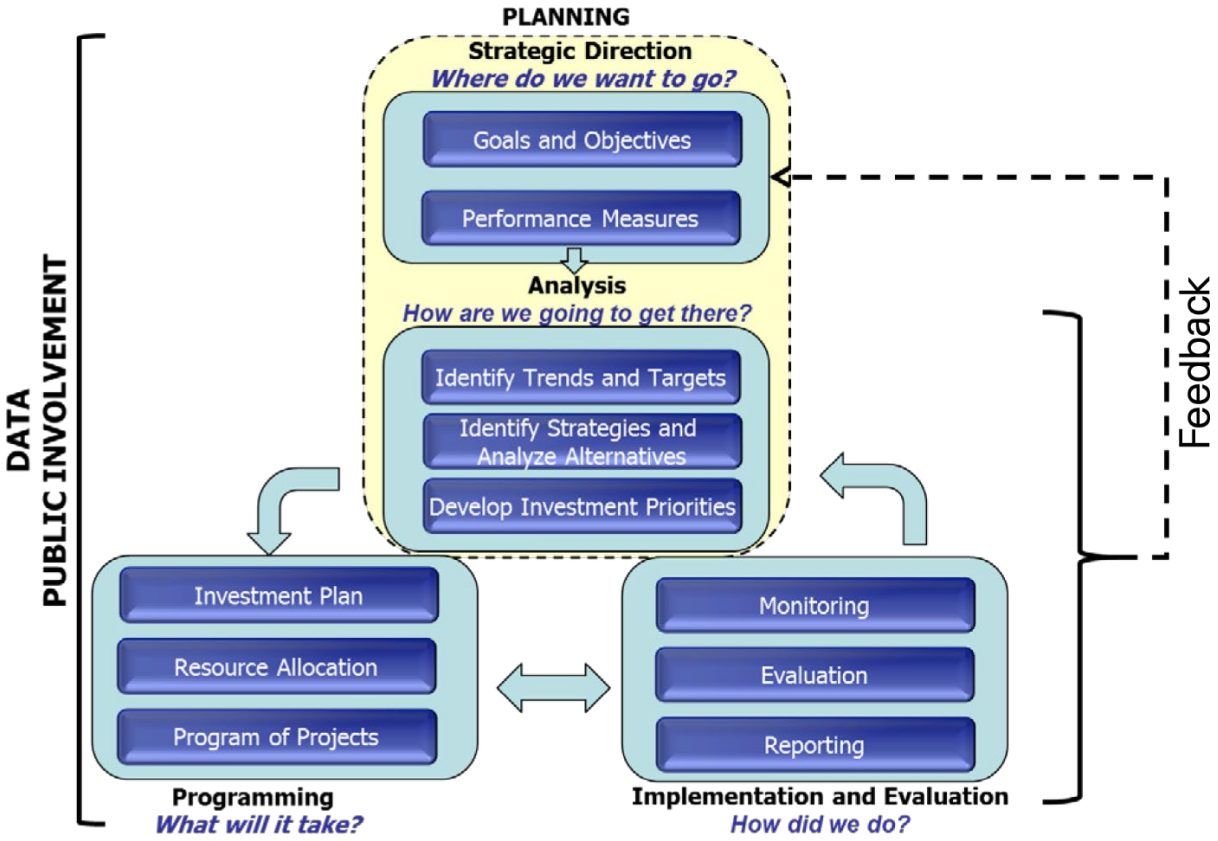

Figure 4. Flowchart. Framework for performance-based planning and programming. (Source: Federal Highway Administration, Performance-Based Planning and Programming Guidebook, September 2013.)

[8] Grant, Michael, D'Ignazio, Janet, Bond, Alexander, and McKeeman, Alanna, *Performance Based Planning and Programming Guidebook*, FHWA-HEP-13-041, September 2013,

Planning

In the context of PBPP, the planning process is designed to ask two basic questions: "where do we want to go?" and "how are we going to get there?" These questions are answered by first determining the direction in which a community wants its transportation to go, and then by establishing quantifiable measures by which progress can be assessed.

Where Do We Want to Go?

This question is answered by defining the vision that a State or a region has for its transportation system as described through goals, objectives and measures—a strategic direction. A strategic direction defines the trajectory in which a community wants its multimodal transportation system to go by shaping decisions about policies and investments. A region's strategic direction should incorporate National goals for consistency, but likely goes beyond those in any State or region to reflect and be responsive to local issues, priorities, and values. A strategic direction includes:

- **Goals and Objectives—**In the context of PBPP, a goal is a broad statement that describes a desired end state. An objective is a specific, measurable statement that supports achievement of a goal. Goals address key desired outcomes, and supporting objectives play a key role in shaping planning priorities. Objectives should be based on the principles of SMART as defined in the private sector for some time:[9]
  - *Specific*—Outline in a clear statement precisely what is required.
  - *Measurable*—Include a measure that enables the monitoring of progress and recognition of when the objective has been achieved.
  - *Achievable*—Objectives can be designed to be challenging, but it is important that failure is not built into objectives. Stakeholders should agree to the objectives to ensure commitment to them.
  - *Realistic*—Focus on outcomes rather than the means of achieving them.
  - *Timely (or time-bound)*—The date by which the outcome must be achieved.
- **Performance Measures—**Support objectives and serve as a basis for comparing alternative improvement strategies and for tracking performance over time.

A key to setting "where we want to go" and thus, the targets that quantify that direction, is that transportation agencies must set those directions across multiple, often competing goals, including not just transportation system use and performance, but current and desired land uses, environmental quality and sustainability, social equity, and financial reality. These constraints are both the reason why external collaboration and cooperation are so important to TPM and

[9] 25 Leadership SMART Goals Examples for Managers and Employees.

PBPP and key pieces of information needed when agencies ask the next question, "how are we going to get there?"

How Are We Going to Get There?

This question is the crux of the long-range planning process. It is answered by identifying the specific strategies an agency can take to improve performance and the projects that it will undertake to implement those strategies. As part of picking those projects, the project identification, planning, and analysis processes need to consider how the potential projects being evaluated help the agency reach the performance targets defined by the strategic goals. This project identification, evaluation, selection, and prioritization process is the desired planning analysis.

The planning analysis component of PBPP identifies achievable targets and investment priorities, including operating strategies that can be carried forward into programming. It includes:

- **Identify Trends and Targets—**Preferred trends or targets are established for each measure to provide a basis for comparing alternative packages of strategies and measuring actual progress by tracking current conditions against the desired trend. This step starts with an initial baseline of system performance. It then computes a trend line of historical performance so that the agency understands where it stands now and where current trends are taking performance. The agency then sets desired target values for future performance, taking into account the current performance trend, forecasts of future performance given expected population and economic growth, information on possible strategies and their impacts on performance, available funding, other constraints, and knowledge of the desired level of performance the public would like to see achieved. While PBPP recognizes the utility of aspirational targets, such as "zero traffic fatalities," to signal the broader societal importance of an issue, it also stresses that agencies should set realistic targets based on data to make material improvements in performance.
- **Identify Strategies and Analyze Alternatives—**Performance measures are then used to assess specific strategies and to prioritize options for system improvements. Scenario analysis may be used to assess alternative packages of strategies, to consider alternative funding levels, or to explore what level of funding would be required to achieve a certain level of performance.
- **Develop Investment Priorities—**Based on the results of the analyses performed above, the next step involves prioritizing strategies and making tradeoffs between investments within different goal areas. Final decisions on what projects to invest in are then made within the context of the system-level changes in performance which occur from any given mix of investments in specific technology, geographic, and modal areas. This step involves prioritizing what performance outcomes are most important to the agency, which should be reflected in the answers the agency adopted to the initial question of "where do we want to go?"

Programming

The programming component of PBPP addresses the question: "what are the schedule and budget details of the plan?" The programming component starts with the prioritized list of projects selected in the planning process and provides the details required to implement those projects. This often requires adjustments to the initial list of prioritized projects. It sets the schedules for when specific projects are implemented, ensures that the sources of funds needed to implement those projects exist, and exist at the time when those funds are required. This includes ensuring that funds or projects supplied or built by other agencies also are available and appropriately scheduled.

What Are the Schedule and Budget Details of the Plan?

This question is answered by considering tradeoffs across different programs and goals, making long-range investment plans and short-range programs of projects (i.e., transportation improvement program or statewide transportation improvement program) that all lead to a financially constrained set of proposed projects. The forecast outcome from these projects then creates an expected level of system performance over time, creating an expected trend, leading to the desired target for system performance. This relates to the target setting element of TPM. (That is, does the expected outcome of the programmed improvement plan achieve or exceed the performance target? If not, then the programmed plans describe the unfunded needs for the region. This information is then taken back to the region's decision-makers in the next round of Strategic Decision-making.)

The programming task also results in a defined resource allocation for the agency, with that resource allocation plan often tied to the resource allocation plans of other agencies in the region.

The programming component of PBPP should produce:

- **Investment Plan—**An investment plan details a set of strategies or projects that have not yet been programmed into a transportation improvement program (TIP) or a statewide transportation improvement program (STIP). It may be developed to cover a midrange (e.g., 10 years) outlook to bridge long-range planning efforts (e.g., 20 or more years) to a short-term investment program.
- **Resource Allocation/Program of Projects—**Project prioritization or selection criteria are used to identify specific investments or strategies for a capital plan or TIP/STIP. Projects included in the TIP/STIP are selected on the basis of expected performance and show a clear link to meeting performance objectives.

Implementation and Evaluation

A key part of PBPP is that in addition to simply implementing the programmed projects monitoring and reporting the performance of the system after those strategies and projects are implemented is conducted. The outcome of this performance review is then used to 1) adjust the plan, if needed, in order to more effectively achieve the performance targets; and 2) refine the techniques used to forecast system performance to better reflect the impacts achieved from the deployment of specific techniques and strategies. Thus, the implementation phase of PBPP not only implements the projects, it asks and answers the question: **"how did we do?"** as a result of implementing those projects.

Consequently, after executing the selected set of strategies or projects, it is important for the agency to assess how those strategies or projects contributed towards the progress required to meet the goals set in the Strategic Decision-making effort, which are reflected in the adopted performance targets.

How Did We Do?

This question addresses the reporting and evaluation process, so that future plans and programs make use of the lessons learned from previous iterations. Here is where PBPP makes use of the reporting, accountability, and transparency elements of TPM. Implementation and evaluation activities occur continuously and include:

- Monitoring.
- Evaluation.
- Reporting.

These TPM tasks ensure that decision-makers and stakeholders: (1) understand the current state of the system's performance; (2) can track current performance against the expected performance; (3) allow the differences between current and expected performance to be analyzed and understood; thus (4) are provided key insights into how plans or expectations may need to be adjusted moving forward.

FEDERAL REQUIREMENTS FOR TARGET SETTING

While the first two subsections of the report provided overviews of TPM, PBPP, and how target setting fits within these contexts, it is important to discuss Federal requirements on target setting within the transportation planning process. The general public-sector transportation planning process is provided in 23 CFR Part 450. These regulations give States and MPOs broad

responsibility for planning and programming transportation improvement projects. Statewide and metropolitan planning is required, per the U.S.C., chapter 23, sections 134 and 135, respectively.

MAP-21, passed in July 2012, mandated in 23 U.S.C. 150 that the U.S. Department of Transportation (USDOT) take a performance- and outcome-based approach to transportation planning. The objective of this approach was for States to invest resources in projects that collectively would make progress towards the achievement of National transportation goals. To this end, MAP-21 defined 7 National goals related to safety, infrastructure condition, congestion relief, system reliability, freight movement and economic vitality, environmental sustainability, and reduced project delivery delays. [10] The FAST Act, passed in December 2015, continued the performance-based transportation program of MAP-21.

FHWA adopted regulations for implementing transportation performance management in 23 CFR Part 490. regulations establish the National performance measures and detail the process for State DOTs and MPOs to establish performance targets.[11] These include targets for:

- The condition of pavements on the Interstate System (23 CFR 490.307(a)(1) and (2)).
- The condition of pavements on the NHS excluding the Interstate (23 CFR 490.307(a)(3) and (4)).
- The condition of bridges on the NHS (23 CFR 490.407(c)(1) and (2)).
- NHS Travel Time Reliability (23 CFR 490.507(a)(1) and (2)).
- Freight movement on the Interstate System (23 CFR 490.607).
- Traffic congestion (23 CFR 490.707(a)).
- On-road mobile source emissions (23 CFR 490.807).

The measures developed to cover NHS travel time reliability and freight movement on the Interstate System are referred to as the Third Performance Measure Rule (PM3) measures. Their definition and calculation have been documented by FHWA.[12]

Summary of Federal Requirements for Target Setting

As established in Federal legislation, the targets that State DOTs and MPOs are required to set can best be described as "realistic" within the PBPP context. As discussed in the PBPP section, while aspirational goals are useful for reflecting the importance of broader societal issues related

[10] 23 USC 150: National goals and performance management measures.

[11] 23 CFR 490: National performance management measures.

[12] Margiotta, Richard A., Turner, Shawn, Taylor, Rich, and Chang, Christopher, *National Performance Measures for Congestion, Reliability, and Freight, and CMAQ Traffic Congestion: General Guidance and Step-by-Step Metric Calculation Procedures*, FHWA-HIF-18-040, June 2018.

to the transportation system, data-driven realistic targets are necessary to achieve material improvements in performance. The Federal legislation recognizes and reflects this.

Under 23 U.S.C. 150(e), State DOTs also must document performance and progress towards achieving targets via a biennial report submitted to the FHWA.[13] The biennial report must describe:

- The condition and performance of the NHS in the State.
- The effectiveness of the investment strategy document in the State asset management plan for the NHS.
- Progress in achieving performance targets.
- The ways in which the State is addressing congestion at freight bottlenecks, including those identified in the National Freight Strategic Plan, within the State.

BENEFITS OF SETTING TARGETS TO AGENCIES

Target setting should not be viewed as simply a regulatory requirement. Instead, target setting should be viewed as a tool for helping agencies to advance their own mission and goals. The TPM framework makes the case for the importance of target setting while the PBPP framework demonstrates how it may be implemented in practice.

The national performance measures are useful for achieving agency-specific goals, but target setting does not have to be limited to those measures. Expanding the practice of target setting to other performance measures, including those derived from travel time data, can yield a number of benefits to agencies. These include:

- **Driving a conversation about current conditions and how to achieve future outcomes—** Targets can help agencies communicate to stakeholders the resources and policies (i.e., investments) needed to meet expectations.
- **Creating a method for evaluating processes currently in-place—**If a current process or practice does not help an agency meet one of its stated targets, then the usefulness of the process should be reevaluated. Target setting can help reveal to agencies practices that are no longer as useful as they once were.
- **Guiding the prioritization and allocation of resources—**Ideally, targets are bound to a performance period and reflect what can be realistically achieved within a set of investments, policies, and strategies defined within an implementation plan.
- **Enabling assessment of strategy effectiveness by focusing on linking goals, objectives, and measures to policy and investment decisions—**Assessing the potential effectiveness of

[13] 23 CFR § 490.107—Reporting on performance targets.

various strategies and investments for achieving stated goals and objectives before their implementation is central to performance management.

- **Forming a powerful argument for additional or alternative investments—**Targets help transportation agencies communicate to decision-makers, stakeholders, and the public the magnitude and types of investments that are needed to achieve a desired target level.
- **Managing expectations by clarifying what outcomes are desired—**In response to public outcry over a transportation issue, an external political body may mandate that a transportation agency improve the performance over some aspect of the transportation system, such as safety or congestion. In this scenario, targets can help communicate what is realistically achievable given technical and resource constraints.

CHAPTER 3. CHALLENGES TO TARGET SETTING

This section will discuss some of the challenges that agencies often face when attempting to set targets. Target setting challenges are divided into two categories: technical and other challenges. Technical challenges are focused on the analytical aspects of setting targets such as measuring baseline performance and forecasting future performance. Other challenges are those that involve overcoming financial, organizational, and other challenges to setting targets.

There are three technical methods that agencies can use in target setting. This section identifies the issues associated with them and in later sections demonstrate how they may be used by agencies.

TECHNICAL CHALLENGES

Inconsistent Historical Data

A major issue is establishing past trends is the existence of two different versions of the NPMRDS data. The NPMRDS is a National data set of average travel times on the National Highway System that was acquired by the FHWA for use in its performance measures and management activities. This data set also is available to State DOTs and MPOs to use for their performance management activities.

FHWA acquired the first version of the NPMRDS data set for 2014, 2015, and 2016 using travel time data from the private vendor HERE. The second version of the NPMRDS data set was acquired for 2017 onwards using travel time data from the private vendor INRIX. This change in vendors for acquiring the NPMRDS data set in 2017 directly impacts the results for performance measures. Version one of the NPMRDS used point speeds, whereas version 2 adds path processing to improve the accuracy of the data. The results observed nationwide indicate that the performance of non-Interstate NHS vastly improved in 2017 compared to previous years. This can be attributed in part to the differences in data sources between version 1 and version 2 of the NPMRDS.

Technical Method 1: Extrapolation of Past Trends

The extrapolation of past trends is a commonly used method by State DOTs and local agencies because it is simple to implement. However, a major issue in establishing past trends is the limited data available for the agencies to use. The NPMRDS data is available to the agencies for only four years, and version 2, which is supplied by a different vendor than version 1, began in 2017. The results of measure calculations with version 2 have proved to be different than those developed with version 1, especially for non-Interstates. If only version 2 is used, projecting

future performance based on past conditions creates huge challenges and errors when using such a limited data set, until sufficient data are accumulated under version 2 and future versions.

However, a method exists for combining two travel time datasets that have been processed differently. Instead of using absolute numbers, the ***annual rate of change*** in a performance measure can be tracked using the older dataset and applied to measures developed with the newer dataset. The example presented later for the North Carolina Department of Transportation's (NCDOT) target setting uses this approach.

Regardless of the travel time dataset used, tracking trends—as well as any forecasts—for the factors influencing congestion and reliability should also be accomplished. Chief among these factors is how vehicle-miles traveled (VMT) has changed over time, and how it is expected to change in the future. Economic conditions can also be tracked, but even though these are likely to be strongly correlated with VMT, the lag between economic variables and VMT should be noted.

Additionally, the agency should also consider internal factors that might affect congestion and reliability going forward. Historic and expected investments—or at least funding levels—for projects related to new physical capacity, transportation systems management and operations (TSMO), transit, and demand management should also be tracked and used to inform target setting.

Technical Method 2: Identifying Vulnerable Portions of the Network

Often, there are reporting segments on an agency's transportation network that are "vulnerable" to failing to meet performance thresholds. For example, an Interstate reporting segment with a level of travel time reliability (LOTTR) of 1.49 meets the 1.50 threshold, but just barely. Similarly, the reporting segments with an LOTTR of 1.51 do not meet the 1.50 threshold. Because the definition of reliability depends on LOTTR metrics for four time periods, it is also useful to know how many of the time periods are vulnerable.

These reporting segments that are "on the cusp" may be viewed as vulnerable links for the next performance period. Identifying these vulnerable portions of the network and accounting for them in target setting is a challenge for State DOTs and local agencies as it involves analysis techniques not commonly found in commercial tools. As with trend extrapolation, the agencies should consider and analyze VMT trends on the vulnerable segments, as well as if any capacity or operational improvement projects are being planned and take those into consideration while setting targets.

Technical Method 3: Forecasting Performance

As opposed to the previous methods identified, forecasting performance represents a mid to long-term challenge that State DOTs and local agencies must confront in order to transition from a performance measurement to a performance management approach. While most travel demand models have been developed to forecast performance measures such as volume-to-capacity and vehicle-hours traveled, models to forecast travel time reliability are not yet in widespread use.

A potential approach for forecasting mid and long-range reliability performance measures is to adapt the reliability forecasting methods and tools developed under the Strategic Highway Research Program 2 (SHRP 2), as listed below. While these tools were not explicitly designed to support target setting, they can be adapted for that use. Basically, these tools and methods can be used in the same way that average or typical conditions are forecasted with traditional tools, with the output now being reliability measures. A limitation of these tools and methods is that they were developed prior to the creation of the PM3 measures, so modification to the methods to produce them would be necessary.

- **Project C11:** Development of Improved Economic Analysis Tools. This tool is applied at the sketch planning level for individual projects. Input data are minimal: average annual daily traffic, either current or forecasted, capacity, truck percentage, and highway type. The method produces reliability measures and associated costs. A spreadsheet tool is available.
- **Project L05:** Incorporating Reliability Performance Measures into Transportation Planning and Programming. This method is applied at the sketch planning level. It is based on the Project C11 method with an extension to cover multiple highway projects.
- **Project L07:** Evaluation of Cost Effectiveness of Highway Design Features. This method is applied at the sketch planning; mainly project level at the preliminary design phase. This tool is applied at the sketch planning level for individual projects. This tool is similar to the Projects C11 and L05 but uses different input data: critical demand-to-capacity ratio, incident lane-hours lost, and number of annual annuals where rain exceeds 0.05 inches.
- **Project L08:** Incorporation of Travel Time Reliability into the Highway Capacity Manual (HCM).[14] This project led to an update of the HCM to include reliability prediction for freeway facilities and urban streets. Input data is the same as traditional HCM analyses for these facility types; users can override default factors for reliability-related factors (incident characteristics, demand variability, and weather characteristics).
- **Project L04:** Incorporating Reliability Performance Measures in Operations and Planning Modeling Tools. This method is for system-level analysis using linked travel demand and mesoscopic or microscopic simulation models.

[14] *Highway Capacity Manual, Sixth Edition: A Guide for Multimodal Mobility Analysis*, Transportation Research Board, 2021.

For further information on forecasting approaches for target setting, please refer to FHWA-HOP-21-014, Approaches to Forecasting the PM3 Measures for Target Setting.

Performance Management Horizon

Related to the challenge of forecasting performance, State DOTs and MPOs also must consider the relatively short performance management horizons (2 and 4 years) in conjunction with the timeline for project delivery. While transportation operational investments can be implemented more rapidly, transportation infrastructure investments take considerable time to identify, program, design, and construct—often longer than 2 to 4 years depending on the size and scope of the project. Thus, a challenge that agencies will face is ensuring that their desired targets and the timeline for achieving those targets are aligned with the timelines for delivering projects that advance performance to meet those specific target levels.

Targets for the PM3 measures, as specified in the Final Rule, are relatively short term in nature (two-and four-year horizons). However, as the Response to Comments section of the PM3 Final Rule states:[15]

…established targets (2-year and 4-year) would need to be considered as interim performance levels that lead toward the accomplishment of longer-term performance expectations in State DOT long-range statewide transportation plans and NHS asset management plans…

The FHWA strongly recommends that State DOTs and MPOs consider longer time horizons, which look beyond 4 years (i.e., multiple performance periods), for planning and programming of projects, so identification and selection of those projects is guided by the longer-term performance expectations.

Therefore, it is critical that agencies consider their long-range performance targets when setting the 2- and 4-year targets.[16]

Operational improvement projects have been known to improve reliability, reduce delay, and potentially reduce emissions. However, the resulting improvements in performance are hard to quantify consistently for varying operational improvements and is usually dependent on the local conditions and the specific nature of the improvement being implemented. This adds to the challenges faced by agencies while aligning improvement projects that advance performance to meet those specific target levels.

[15] 23 CFR 490.
[16] 82 FR 5970, 5989 (Jan. 18, 2017).

OTHER CHALLENGES

Financial Resources

Targets will be affected by the financial resources that are available to an agency to improve the transportation system's performance. For example, a region may have identified a corridor for a capacity expansion or transit investment to relieve congestion, but lacks the funds needed to make that investment—thus affecting its ability to improve performance and meet targets. Uncertainty in future funding levels and the scarcity of financial resources are enormous challenges in forecasting performance and thus setting targets.

Conflicting Stakeholder Perspectives

In addition to funding-related challenges, agencies also may face other challenges to improving performance and thus setting and meeting targets. For example, one group of stakeholders may desire greater transit investments as a method of relieving congestion while another group prefers a capacity expansion. Reconciling these differences are important for State DOTs and MPOs in their target setting approaches.

CHAPTER 4. TARGET SETTING APPROACHES

In discussing target setting approaches, it is important to be mindful of the Federal requirements for target setting. For that reason, throughout this portion of the report information from the Federal Requirements for Target Setting subsection will be reiterated where appropriate. In this manner, the report will demonstrate how various target setting approaches can be deployed to meet the needs of an agency's constituency while also facilitating compliance with Federal regulations.

OVERVIEW OF TARGET SETTING APPROACHES

Approaches for setting targets vary, though most agencies use a hybrid approach in which they not only use different approaches for different measures, but also multiple approaches for a single measure—reinforcing the concept that target setting is a multidimensional process. The Washington State Department of Transportation (WSDOT) example presented later in this document exemplifies the hybrid approach. This section of the report provides an overview and discussion of different approaches for target setting and how they apply to the PM3 performance measures.

Target Setting Approaches

Neither the legislative provisions nor the Federal regulations mandate that agencies use a certain approach to setting targets. There are many relevant factors to consider in target setting, customer and stakeholder perspective, agency experience, commitment to regular communicating and reporting, sphere of agency control, financial resources, and timeframe, among others. Agencies balance these oftentimes competing factors.

The FHWA PBPP Guidebook and the National Cooperative Highway Research Program (NCHRP) Report 666: Target Setting Methods and Data Management to Support Performance-Based Resource Allocation by Transportation Agencies identify several approaches for setting targets. In setting System Performance targets, State DOTs and MPOs may find that it is effective to deploy aspects of the multiple approaches identified below:

- **Policy driven—**Targets are set in a "top-down" manner, such as by senior executive management or a political body. As observed in NCHRP Report 666, this approach is often taken in response to public outcry over a particular transportation issue with direct action from elected officials being called for. Under this approach, senior management or a political body defines targets in the context of larger transportation goals or policies; staff is then tasked with developing an investment plan to meet the target and conducting analysis needed to demonstrate attainment of the target under a future funding scenario.

This is a very direct approach and has the benefit of providing agencies with a well communicated target that conveys a strong message. However, it also can create a challenge for agencies if practitioners were not involved in the target setting process and/or if the process was not informed by real-world planning, funding, and technical constraints that may impact attainment of the target.

- **Modeling/analysis driven—**Modeling may be used to assess progress towards targets or to help define a target level. Project and policy scenarios can be tested using travel demand models, microsimulation models, and other post-processing tools to include metrics to evaluate their relative contribution to progress toward targets. Models may be used to set targets in either a top-down or bottom-up manner. Top-down modeling determines the strategies or funding needed to achieve a target that meets requirements either set by the agency. In bottom-up modeling, target levels are limited to what is realistically achievable given resource constraints.
- **Consensus based—**With this approach, transportation staff set targets through an internal, consensus-based process drawing on the expertise and experience of staff across different units within the agency while taking into account funding and other resource constraints. Transportation agencies may collaborate with stakeholders and staff from other agencies in this process. This approach can lead to very meaningful and effective targets as it recognizes factors specific to a region or State, as well as limitations impacting target attainment.
- **Customer feedback based—**Under this approach, direct feedback on system performance and objectives are gathered from system users through surveys and other outreach methods. This feedback is then used by transportation agency staff to develop targets that are closely aligned with the needs of the "customer"—the system users.
- **Benchmark based—**Targets are established based on a review of similar investment approaches and results from other transportation agencies. With this approach, criteria should be set for peer group selection and analysis. Once an agency defines its peer group, the analysis will measure each peer's performance relative to the others with the results of the comparative analysis used to determine the target level for the agency.

Target Setting for PM3 Measures

A target by itself will not change the dialogue about resources, budget priorities, and funding allocation. What the targets can do, however, is provide additional support to ongoing discussions about funding adequacy, the operating practices, and the policies and processes that are used to develop and implement projects.

There are a few issues to consider along the path of setting and using performance measure targets. The following questions are important for agencies to consider:

- Is the responding agency a State DOT or an MPO?
- Will the targets and measures be a key part of local or State decision-making?

- Is the goal to meet the targets or use the targets as aspirational levels that might spur alternative practices, executive action, or legislation?
- Will the target setting begin with local/regional priorities or at the State level? What road systems will be included in the target setting of each agency? How will the targets be integrated in the transportation planning and project development process?
- How much experience does the agency have in using the data for system evaluation or reporting progress? What data sets does the agency have on-hand that would be useful for system evaluation and reporting? What other datasets might be useful to explain year-to-year changes?
- What is the plan for adjusting the targets—in response to experience, funding changes, policy actions, or other events?
- How will the results be communicated to the various audiences? How will we explain differences in datasets from year to year? If an agency uses other performance measures for their investment decisions, how do these measures relate to the PM3 measures? How will factors outside the agency control be handled?

The target setting process will evolve over time, as there is more clarity and experience with the data, measures, type, and scale of applications. Operationalizing these targets will be a challenge for many States and MPOs; a few key steps and considerations listed below are helpful, but there is no "cookbook" for target setting or for the follow-up communication program. Experience, agency policy, interest from the public, decision-maker input, and other factors also will shape the application and range of performance targets.

Target values, generally, represent the desired performance of a measure. In practice and in recognition of the complexity of the application, however, the target values will likely be a combination of the following:

- What is achievable in a physical and technical sense?
- What is supportable through discussion with the public and policy-makers?
- How do transportation performance measure targets relate to broader societal or governmental outcomes?
- What are the implications – in terms of financing, public perception, and procedural requirements for meeting or not meeting targets?

Whether the goals are of the "stretch" variety—performance levels that are difficult to achieve—or those that have achievable levels are a different topic (discussed below). Conceptually, all performance measures, goals, thresholds, and targets are a product of a fully involved planning process. A program of public engagement during the planning process that generates a picture of what the public wants their State/region to be when it "matures" uses targets as a numerical indicator of progress, not an end result. Getting to such a process will require a few iterations of planning and measurement, but it might be useful to think about the kind of information that this

process would yield when setting goals in the near term. Such a process, and the set of outcomes it would describe, allow transportation concerns to be appreciated in the broader discussion of economic and social issues, and provide a forum for a more explicit discussion about the transportation service and system performance levels that can be delivered for (1) the amount of funding that will be available; and (2) the amount of funding, policy, travel option, and planning changes that are needed to achieve the goals.

The Federal rules for system performance require State DOTs and MPOs to work together on target setting. The regulation deadlines show the State DOTs setting Statewide targets first, and then MPOs developing targets for their region.[17] This type of "State-in-the-lead" process makes sense in the infrastructure quality measures, such as pavement and bridge quality, where the State DOT has most of the data and a significant portion of the funding, as well as priority-setting responsibility for maintenance and rehabilitation. In the system performance realm, however, there are many States where one or more metropolitan regions will likely have congestion targets that are not in the rural style of "close to free-flow conditions." States with multiple urban areas may see differences between mobility targets in those urban areas. Most large and many medium-sized, metropolitan regions already have targets that function as "how many hours of stop-and-go traffic are acceptable over how much of the system?" In this situation, there appear to be two general approaches to the target setting process. Both approaches involve coordination between the State DOT, the MPO, and other local transportation agencies (e.g., municipalities, transit agencies). Options include the following:

- **Begin with a Statewide target.** This approach is procedurally consistent with the initial schedule in the MAP-21 legislation. State targets for the system performance and reliability measures are set before the metropolitan area targets. In this approach, the targets might be set for the roads on the Interstate Highway or NHS. This approach is grounded in the State responsibility for operating the transportation system.
- **Begin with local targets.** This approach builds from the premise that the metropolitan planning process and the funding procedures in many States involve the development of fiscally constrained transportation improvement programs based on the regional long-range transportation plans. The local agencies and the local DOT office would begin the discussion and value setting using the local plans. For States where more than one metropolitan region is setting targets, the statewide target might involve calculating the average of the metro area targets (likely some weighted average involving population or person-miles traveled).
- **Examine targets across multiple goal areas simultaneously (e.g., travel time/congestion, infrastructure condition, safety).** Such an approach requires the ability to analyze the cross-asset allocation of investments in each goal area. This form of tradeoff analysis provides a means for assessing the impacts of different approaches to investing. In performance management, tradeoff analysis is useful in establishing performance targets because it provides insight into the cost and performance implications of different strategies:
    - What is the effect of concentrating investments into a single performance category (i.e., pavement, safety, or congestion/mobility) rather than selecting projects purely on a

[17] 23 USC 134(h)(2); 49 USC 5303(h)(2); 49 USC 5304(d)(2); 23 USC 135(d)(2); 49 USC 5304(d)(2); and 23 USC 150(d).

benefit/cost basis? For example, if we choose to invest more heavily in pavement improvements, what are the performance impacts on safety and congestion?

- How do we decide which deficiencies to deal with first?
- Should minimum spending levels be established for each program area and how this would be accomplished?

The consideration of which approach to use might be determined by the long-term goals of a State's metro regions. If the transportation goals and land use patterns will be similar, the process should be less involved than if there are different goals. For example, a region that encourages dense development near the traditional town center and invests in public transportation, walking, and biking will likely have different congestion goals than a region emphasizing capacity expansion, system operations, and suburban growth patterns. Constructing the Statewide target, where every region is pursing the same long-term goals, might have different processes than a State with regions pursuing different goals.

The differences between the perceptions of congestion between large metro areas, small metros, or rural areas also might play a role in deciding the approach. The "start local" approach might accommodate the differing perceptions of acceptable performance among urban, suburban, and rural areas. No matter where the target setting process begins, coordination between Government levels and agencies will allow local area input, including getting citizen feedback, local policy decisions, available funding, and other important criteria.

Just as with area-to-area differences within a State, there also are differences in expected performance and mobility within a metropolitan region or on freight-intensive routes. Stop-and-go traffic in downtowns is typically more acceptable than in rural areas. Downtowns usually have shorter trips and more travel mode and route options than trips from rural or suburban regions. Downtown solution strategies usually do not include significant roadway widening projects as often as in rural corridors. The target setting process then might ultimately include subarea analyses in some future year. This will be more important if targets are used to decide which projects will be selected. When subarea or corridor conditions are better than the targets, projects, operations investment, and policy changes would be lower priority than in areas where conditions do not meet their targets. Center-city corridors that are congested, but above their target value, may not require additional study or investment, even though their congestion may be worse than some suburban region where acceptable performance is defined differently. This sort of process will take several cycles to optimize.

Target Setting Process Summary

The target setting process used by States and MPOs should satisfy the Federal regulations (23 CFR 490.105)[18] and incorporate local information and data analysis to address agency and

[18] 23 CFR 490.105.

constituent needs. Broadly speaking, the National performance measures also were designed to provide paths for agencies to use data, measures, and targets to identify system performance concerns; prioritize projects, programs, and policies to address them; and to allocate funding and promote accountability and transparency for their spending.

Once targets are set and used, the Federal regulation[19] allows for adjustments. This will be important early in the measure deployment process as experience is gained. Travel demand will change, transportation funding programs are periodically adjusted, and technology advances will alter the approach to transportation service. Target adjustment also is a part of the regular planning process and even if the Federal measures are not a component of decision-making, it is appropriate to spend time ensuring the targets are appropriate. There also will likely be a need for longer-term targets, as well as the near-term targets specified in the regulation.

Given the schedule for larger funding and development programs—the typical transportation improvement programs have 4- to 6-year periods and larger projects can take 10 to 15 years from the initial planning stage to opening—any move toward an aspirational target will take time. It will be important to specify the actions being taken to address needs and meet targets as a part of the evaluation discussion. It is likely that many States and regions can meet the requirement for "significant progress," even while system performance is getting worse if they show both the performance measure history and the change in trend while adjusting for changes in the external contributing factors.[20]

It is suggested that agencies should move toward a process where the system performance measure targets are decided in the same way that most funding decisions are made—coordinated between the State and metropolitan area levels in a process that involves the agencies, decision-makers, and the public. The project selection process decides the best use of metropolitan area funds and seeks to achieve community goals and vision. The goals and vision can be translated into congestion targets that all stakeholders can understand.

The process might use the following steps or questions to help the States and MPOs in the initial round of target setting, though this process and the steps are not required except where aspects are based on the statutory or regulatory provisions cited:

- **Define the purpose.** Why are you setting the target? One purpose could be to use the measures for agency-level project evaluation and selection. This has a broad set of implications and a potential for adopting measures that are (still) not well understood based on a dataset that is very new. Another purpose could be to ensure that the Federal requirements are met. This approach has less pressure and fewer ramifications for overall agency procedures. This does not mean that lessons cannot be learned and incorporated, but

[19] 23 CFR 490.105(e)(6).
[20] CFR 490.109.

the timeline for incorporating the targets into the regular project development and selection processes can be slower and the adaptations consistent with agency capabilities.

- **Set target parameters.** The timeframe for target achievement and the scope (areas, roads, modes included) are defined in the Federal regulations.[21] Conservative values should be used based on trends until the measures and affecting factor are understood. Agencies also should identify considerations, such as economic or population growth projections that might change future targets and expectations.
- **Assemble the baseline data and analyze the trends.** Measures should be calculated using the data in the NPMRDS second version (v2 and future versions) dataset for as many years as feasible. Agencies might use areas, regions, or corridors where operating conditions are well known to serve as benchmarks for the analysis.
- **Identify and assess influencing factors.** Possible influencing trends should be collected from agency datasets and experiences, as well as other agencies or jurisdictions. This should include consideration of the following factors:
  - The role of the economic recession of 2007/2009 in past trends, as well as the likelihood of future economic challenges at the region or National level.
  - Historic performance trends—What are the key elements of past trends and any policy, practice, or operating strategy changes that explain the measure values?
  - Fiscal limitations and tradeoffs—Many agencies have dealt with funding limits, relating past performance to those funding levels should inform future target discussions.
  - Effects of autonomous and connected vehicles—For example, how will connected vehicles alter crash and mobility trends? Will vehicles with no drivers have a beneficial effect on traffic or will driverless vehicles cause more congestion.
  - The amount of funding and policy flexibility in future decision-making is an important element in future target setting.
  - How will influencing factors will change over the time span of a target?
  - What risks are associated with each of the factors, including magnitude and likelihood of change in trend?
- Establish a target and an annual update plan. This is especially for the early years and it will be important to check in with the data to understand the trends and possible data irregularities.[22]

[21] 23 CFR 490.105(d) and 23 CFR 490.105(e)(4).
[22] 23 CFR 490.105.

TARGET SETTING EXAMPLE—WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

This section of the report describes an example of how one agency, the WSDOT, responded to the Federal requirement to adopt performance targets and the ongoing encouragement to use targets and performance measures to shift to more data driven, goal oriented, decision-making.

Washington State Department of Transportation Outcomes

WSDOT created Statewide (NHS) performance targets for the PM3 measures:

- **National Highway Performance Program** (the percentage of person-miles traveled on the Interstate System that were reliable and the percentage of person-miles traveled on the NHS, but off the Interstate System that were reliable).
- **Freight Movement on the Interstate** (the Truck Travel Time Reliability Index (TTRI)).
- The **Congestion Mitigation and Air Quality Improvement Program** (non-single occupancy vehicle travel in the Seattle urbanized area [NHS], peak hours of excessive delay per capita in the Seattle urbanized are [NHS]).

Table 1 shows the roadway performance targets adopted by WSDOT.

Table 1. Washington Department of Transportation PM3 roadway system performance targets.

Performance Category	Performance Measure Definition	Current Data	2-Year Target	4-Year Target
Highway System Performance (Congestion)	Percentage of person-miles traveled on the Interstate System that are reliable.	73%	70%	68%
Highway System Performance (Congestion)	Percentage of person-miles traveled on the non-Interstate National Highway System that are reliable.	77%	N/A	61%
National Freight Movement Program	Freight Reliability	1.63	1.70	1.75
Congestion Mitigation and Air Quality Program	Non-single occupancy vehicle travel in the Seattle urbanized area (National Highway System).	32%	32.8%	33.2%
Congestion Mitigation and Air Quality Program	Peak hours of excessive delay per capita in the Seattle urbanized area (National Highway System).	23	N/A	28

(Source: Washington Department of Transportation.)

A summary of the resulting WSDOT targets can be found at the WSDOT MAP-21 Accountability website. This website provides access to all of the MAP-21 performance measure information developed by WSDOT. A folio was specifically developed to present the target setting process and outcomes for the above categories of PM3 measures.

The initial targets for the State were adopted with an expectation that current performance trends would continue for the next 4 years. Therefore, to compute the expected outcomes, trend lines were computed and applied to the best available measurements of current conditions.

The decision was made to initially adopt a more conservative target, given the agency's ability to revise its targets at the midpoint of the four-year performance period. This allows the agency to gain a better understanding of the new data sources being used and how they data sources reflect roadway performance. Important factors will be the transportation system improvements being implemented within the State's major urban areas, where much of the congestion occurs, as well as how well the impacts of major disruptions in rural areas that are outside of the control of the agency (e.g., major snowstorms and major forest fires) are reflected in the performance metrics.

Role of Targets in Transportation Performance Management

Several years ago, WSDOT made the strategic decision to adopt a more PBPP process. As part of that decision, WSDOT adopted Practical Design principals within the agency, which it refers to as Practical Solutions.

Practical Design emphasizes a focus on identifying the core purpose and need for each project selected for agency funding, and then working to scope those projects so that the resulting design stays focused on achieving those needs and core purposes.[23] The intent is to create better informed decisions by emphasizing a performance-based practical design (PBPD) approach to project selection and design. Under Practical Design, the project development process attempts to find creative, lower cost solutions that resolve the core purpose and needs, while also considering short- and long-term project and system goals. The intended result is that the agency can eliminate nonessential project design elements, resulting in lower costs and improved value. Improving traffic operations is heavily weighted when congestion relief is an identified project need.

Because the Practical Design process is very different than how projects have traditionally been developed, scoped, and delivered, the WSDOT is very interested in being able to measure and describe the benefits of using the new process. This involves both using data to describe how needs are identified and tracking system performance over time to demonstrate the outcomes from the process.

23 Performance-Based Practical Design.

When operational improvements are made instead of conventional capacity improvements, many resulting performance improvements are found in more reliable travel conditions, rather than higher volumes or faster average speeds. Being able to use the PM3 statistics—and the NPMRDS data—to measure these performance improvements is very important for communicating with the legislature, as WSDOT strives to continue delivering performance improvements despite limited resources.

Challenges to Target Setting

WSDOT's biggest issue with target setting has been the availability of data and in particular its lack of data on roadway performance for non-NHS road segments. Because of FHWA's purchase of NPMRDS data, data are available for measuring and reporting roadway performance on the NHS. Unfortunately, WSDOT does not have data similar to the NPMRDS for roads under its jurisdiction (State Routes) that are not part of the NHS. Similarly, MPOs in the State do not have data for many roads within their jurisdictions that are not on the NHS but that are important to the transportation system's performance within their urban areas.

While this lack of data does not need to directly affect the computation of the National performance metrics or the setting of National PM3 targets, the lack of data on non-NHS roads under their jurisdiction creates difficulties for WSDOT and the MPOs in conducting their larger needs identification and performance monitoring efforts. And those difficulties create problems with the adoption of the PM3 measures and targets within the agencies' larger PBPP.

The issue is that, without data on non-NHS segments, if NPMRDS data are used for identifying needs and for monitoring roadway performance trends for NHS road segments, a different process will have to be used for non-NHS road segments than for NHS segments. This will create a lack of consistency within the agencies' monitoring and project prioritization procedures and will make it difficult for them to track outcomes—and thus achieve performance targets—across all roads under their jurisdiction.

To resolve this issue, WSDOT considered the following options for overall performance reporting and target setting:

1. Perform PM3 reporting and target setting only for NHS routes and only for Federal reporting purposes.
2. Buy more data, allowing expansion of the system to all roads in the State system and allowing expansion of the adoption and use of PM3 reporting to those other roads.
3. Use a different process than the NPMRDS for computing PM3 measures, but one for which the necessary data are available statewide.

The first of these options would meet FHWA requirements and would provide performance and reliability reporting on the largest and most important roads in the State. This would be very useful for examining the performance of those roads, but as noted above, it means that the State would not have consistent reporting on all of its roads. The lack of consistent reporting means that the Department would either need to: 1) use different procedures for evaluating performance, identifying needs, and judging the effectiveness of implemented projects for NHS and non-NHS roads; or 2) use different procedures for identifying needs for agency decision-making than the procedures used for reporting PM3 measures to FHWA.

The second option would involve purchasing the additional data needed to apply consistent procedures throughout the State. Multiple States have adopted this approach.

Using a different technique for computing PM3 from existing State resources was the remaining option. The positive aspect of this solution is that a consistent set of measures would be used for all State routes. The primary negative aspect of this approach is that the data sources that cover the entire State highway network are not as robust as the NPMRDS at monitoring roadway performance and, in particular, reporting on the reliability of roadway performance.

Ultimately, WSDOT chose the first option. It used the NPMRDS to produce the PM3 statistics required by MAP-21 and then set targets—but only for the NHS—based on those statistics. The steps used to perform this task, and the setting of targets, are described in the remainder of this chapter.

The downside of this decision is that the agency had two options:

- Using a different process as part of its Statewide needs identification process in order to use the same process for all roads in the State.
- Using two different procedures for NHS and non-NHS roads in the needs identification process.

WSDOT chose to use its historical needs identification process, rather than use two different procedures. This allows all roads in the State to be treated the same. For example, the use of NPMRDS provides much better temporal information about road performance, which yields a better understanding of the reliability of roads sections. Instead, the agency must rely on other data sources and procedures within its historical project and needs identification process.

While the needs identification process is still based on the agency's historical process, WSDOT is working to incorporate FHWA's PM3 measures and the NPMRDS into that process as one more data source for identifying and quantifying needs.

Technical Challenges to Setting Targets

Once WSDOT decided to use the NPMRDS data both for reporting federally required PM3 statistics and for developing targets for the NHS, the next task was to determine how to set those targets.

Several decisions were made after analysis of the alternatives. The first decision was to use American Community Survey (ACS) data to estimate the percentage of single-occupant vehicles (SOV). The ACS was selected because its use also allowed straightforward computation of urban areawide trends in SOV use. The ACS is readily available and can account for the changing mode split pattern occurring in the Seattle metropolitan region, where travel patterns are expected to continue to change over the four years covered by the PM3 targets.

The next technical decision WSDOT had to make was to use the average vehicle occupancy (AVO) statistics published by FHWA.[24] AVO is needed to estimate person-miles of travel from the vehicle volume estimates that currently are available.

For many years, the WSDOT collected large numbers of vehicle occupancy data on the Puget Sound (Seattle area) freeway system with the specific intent of monitoring use of the regional high-occupancy vehicle (HOV) lane system. These data could have been used to meet both the SOV and AVO data requirements. However, this data collection system was curtailed several years ago because of its cost. Therefore, for the PM3 reporting, WSDOT determined that direct collection of the required vehicle occupancy data would be too expensive.

The next technical challenge was to develop or select software tools that could effectively analyze the NPMRDS data. WSDOT had performed earlier research into the attributes and use of the version 1 NPMRDS database. On the basis of that research, it was clear that the task of creating the software needed to effectively use the NPMRDS was significant. To lower the cost of that task, WSDOT joined many other States in purchasing access to the Regional Integrated Transportation Information System (RITIS) MAP-21 tool created with American Association of State Highway and Transportation Officials (AASHTO) support. Use of this tool greatly simplified the analysis of NPMRDS data.

Determination and Extrapolation of Trends: Using the RITIS tool, WSDOT then examined how to best approach the development of targets. To inform its target adoption, WSDOT first wanted to gain an understanding of the PM3 measures and how those measures were changing over time, as this would allow the Department to better understand what targets were reasonable.

[24] Average Vehicle Occupancy Factors for computing Travel Time Reliability Measures and Total Peak Hour Excessive Delay Metrics, April 2018.

The biggest issue with understanding both current system performance using the PM3 metrics and the current trends of those PM3 metrics resulting from the change-over from the NPMRDS version 1 database to the NPMRDS version 2 database. These two versions of NPMRDS used different approaches to the analysis of vehicle probe data. Version 1 of NPMRDS did not allow the computation and use of space mean speed estimates calculated from collected vehicle probe data. Instead, it relied entirely on the geolocations and instantaneous speeds from reporting vehicle probes. Version 2 of the NPMRDS allows the computation of space mean speed from these data (i.e., the computed distance traveled between the time reported for consecutive geolocation points allows for the computation of the average speed at which that vehicle is traveling).

The result of this change is twofold: (1) the data in the version 2 database are expected to provide a more accurate estimate of roadway conditions; and (2) there is a discontinuity in estimated congestion levels on roads between the statistics produced with the version 1 and version 2 data sets.

An additional consideration of WSDOT was the fact that because the changeover from version 1 to version 2 occurred recently, there were not enough years of version 2 data for computing trends, but there was enough version 1 data for trend computation. If both version 1 and version 2 data were used in the trend computation, the discontinuity in the estimates would have a large effect on the estimated trend, and this was not a good outcome.

WSDOT resolved this technical challenge by using the version 1 data to compute ongoing trends in congestion, but using only the version 2 data for the current estimate of congestion conditions. This means that the forecast of future conditions is based on an initial starting point from the version 2 NPMRDS data set, and the trend line is computed from the version 1 NPMRDS data set. The process is similar to that used by the NCDOT discussed in the following section.

All version 1 data were collected and reported in a similar manner, and therefore, the trends revealed in those data should present an accurate estimate of changing congestion patterns and not represent changes in the measurement process itself.

WSDOT's analysis of the congestion trends using version 1 data showed that the best fit trend line was computed by using a compound growth rate.

The formulas from the trend models developed with version 1 data were then applied to version 2 data to predict expected performance two and four years into the future. This approach took advantage of the two data sets' strengths. Version 1 has the data needed to make the trend computations; version 2 has a better estimate of current conditions.

Because this entire process was new, WSDOT also conducted due diligence to provide the agency with confidence in the trend estimates' reliability. To perform this due diligence, WSDOT asked the outside consultant that staffed the urban mobility pooled fund study (Texas Transportation Institute) and reviewed the trends computed by that effort to confirm that the trends from that study produced outcomes similar to those computed with the NPMRDS. The trends from the pooled fund study project were similar to those developed with the version 1 NPMRDS work, so this approach was adopted.

WSDOT was not able to use the AASHTO MAP-21 RITIS tools to compute the peak hours of excessive delay in the Seattle urbanized area measure, as this tool was not yet functional. This PM3 measure was computed by using vehicle speed, delay, and volume data from WSDOT's Corridor Capacity Report.[25] WSDOT has performed detailed analysis of freeway use and performance annually in the Seattle metropolitan region since 1997. That allowed a very accurate computation of the average percent change in delay from year to year. The growth rate for freeway congestion from this analysis was assumed to continue for future conditions and was used for the peak hours of excessive delay statistic. The limitation with this historical analysis is that it relies on data collected by WSDOT's freeway surveillance and control system. This excellent data source is not available for roads outside of the State's urban freeway system.

Identifying Vulnerable Portions of the Network: While the NPMRDS data can be very useful in identifying vulnerable portions of the highway system, because NPMRDS data are not available for the entire State highway network and the agency does not have the money to buy such data for the entire State, WSDOT has not formally used the NPMRDS for this purpose. Instead, the agency has relied on its historical mechanisms for identifying vulnerable road segments. For example, before the PM3 requirement, WSDOT already had performed a specific project identifying sites problematic for freight movements, so the results of that effort were used to identify road segments that should be examined more closely.

Agency staff who analyze potential sites identified through the existing needs identification process do use NPMRDS and other vehicle probe data sets to examine the performance of those road segments, but that process currently is not a formal part of the Department's needs assessment process.

Performance Management: As part of the agency restructuring undertaken to better implement the Practical Solutions-based PBPP, WSDOT continues to refine its project identification, selection, and prioritization process. As part of that effort, the agency has created an Integrated Scoping Group, which is determining how to incorporate the wide range of needs, issues, and plans from across the Department that need to be included in the PBPP. The Integrated Scoping Group must include not just roadway performance but also pavement repair and rehabilitation, environmental improvements, and other important State needs.

The integrated scoping process that is part of the new Practical Solutions approach continues to evolve as the agency reviews the outcomes of the last round of this process, discusses those

[25] WSDOT and MPOs set MAP-21 targets for System Performance, Freight and CMAQ measures.

outcomes with the State legislature, and examines how to best expend the funds it has across the needs for data collection, analysis, and project delivery. The PM3 and other Federal targets play a role in this process, but Federal requirements are still only one factor among many that the agency must consider.

Other Challenges

In adopting the PM3 targets and in implementing PBPP principals in general, WSDOT chose to move toward a more performance-based planning approach for project selection and implementation. The fact that the Department adopted a very public approach to measuring and reporting changes in urban freeway congestion more than 20 years ago, helped considerably in encouraging adoption of the PBPP principals. However, WSDOT still faced three major challenges:

- A lack of financial resources to perform the PBPP tasks in ways that met both FHWA's desired outcomes and State-specific needs and constraints.
- Conflicting interests between different stakeholders, both within and outside of the Department.
- Concerns that many of the factors associated with performance outcomes were outside of the control of the agency and about what that meant for setting targets against which WSDOT would be judged.

The impacts of the first of these challenges have been discussed above. The heart of this challenge is that the Department lacks the budget to fully fund the data and analytical tasks needed to completely shift their needs assessment, project selection, and prioritization process to new data sources and analytical techniques. This challenge is compounded by the fact that many of the newer data sources are far from perfect and often have biases and errors that are not yet known, which leads to resistance to using them among some stakeholders.

While older procedures and historically used data sets also contain errors and biases, those systems have become "accepted practice." Changes from those accepted practices to new practices and procedures face internal resistance, as staff—and outside stakeholders—are rightly concerned about how the new biases and errors will affect outcomes, and therefore, how they should be identified and addressed in the new procedures.

Because many of the new data sources require the purchase of fairly expensive privately collected data sets, and the purchase cost of those data must come from already constrained financial resources, it can be difficult to generate internal support for those funds.

This outcome has set up the next challenge, stakeholder concerns that the use of two different performance-based systems (one on the NHS and one for roads off the NHS) would result in unequal consideration of the needs and priorities of those two different sets of projects. The

result has been delays in shifting to using the Federal PM3 metrics within the Department's internal decision-making process. While the results of Federal reporting are considered in the agency's identification of needs, they currently are not at the core of the decision-making process because they are not universally available.

Next, there have been challenges in selecting the targets that are adopted and submitted to FHWA. WSDOT is concerned with understanding how effectively the new performance monitoring systems will report changes in performance over time, especially given the difficulties that probe data sets have traditionally had in identifying the operational performance of HOV and high-occupancy toll (HOT) lanes that are physically contiguous to general purpose lanes. That is, if dynamic tolling and HOT lanes are a key part of the agency's congestion relief program, it is imperative that the metrics used to examine roadway performance account for the success of those efforts. Vehicle probe data sets have historically had difficulty separating the performance of physically contiguous roadway lanes. Consequently, the agency wishes to observe how the NPMRDS-based PM3 measures report those changes before setting performance targets.

In addition, growth in the Seattle metropolitan region has been among the highest in the Nation in recent years. While a large amount of regional growth has been absorbed by growth in multimodal travel, congestion growth on the region's freeway system remains an issue, and it is difficult for the agency to estimate the size and location of future population and employment growth within the context of the PM3 target setting process.

These issues have led the agency to be conservative in its approach to target setting, even as the Department has pushed for increased legislative support for funding for operational improvements and other congestion relief projects.

Washington State Department of Transportation Approach to Setting Targets

The WSDOT did consider adopting targets other than its adopted approach of "current trends will continue, and therefore our expected performance is current conditions plus the current trend."

One major reason for adopting this conservative approach to targets is that the Department has little experience with forecasting the impacts of major corridor specific changes on the new FHWA PM3 measures; this makes it unclear how those measures will affect future PM3 outcomes. For example, WSDOT has implemented new HOT lanes on I-405. These value pricing initiatives provide congestion relief options, but NPMRDS version 1 data are not able to accurately track changes in performance on these contiguously located facilities. It is unclear how effectively NPMRDS version 2 will track these changes. Adopting PM3 targets would make it difficult for WSDOT to account for these types of highly beneficial projects.

The FHWA regulations will allow the WSDOT to revise those targets to be more aggressive in a few years, if the newer adopted programs have their intended effects and the version 2 NPMRDS data capture those forecast improvements. Therefore, an initial, conservative position of "trends will stay the way they are," with the ability to adopt more stringent targets in two years, is a good approach to the initial PM3 targets.

The last target setting activity that had to take place was that MPOs and Rural Transportation Planning Organizations (RTPO) needed to select targets. Importantly, WSDOT spent a considerable amount of time and effort working with regional MPOs and RTPOs as the PM3 procedures and targets were developed. This means that MPOs and RTPO staff were well informed about their options, the requirements of the MAP-21 submittals, and the data and analytical packages available to them. After careful consideration, all the MPOs and RTPOs in the State chose to adopt the statewide targets. These agencies saw two major advantages of adopting this approach: (1) it limits the resources that an MPO would need to allocate to the effort to both compute and then justify the adoption of different target outcomes; and (2) for areas with smaller congestion growth, this also removes political pressure to achieve more congestion relief than could be achieved.

TARGET SETTING EXAMPLE—NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

Starting in fall 2017, the NCDOT began the target setting process for the PM3 measures. The effort included an array of technical and institutional activities: trend analysis, performance forecasting, subject matter expert interviews and workshops, leadership coordination, workshop facilitation, and documentation and rationale supporting final target submissions. Figure 5 outlines the process that NCDOT followed for target setting.

Figure 5. Diagram. Overview of North Carolina Department of Transportation target setting process.
(Source: North Carolina Department of Transportation.)

Target Definition

The process initiated through a compilation of key definitions, terms, and requirements associated with each measure, and also included a detailed schedule of activities and meetings required to meet the target submission deadlines.

Development of PM3 Reliability Measures

Through the use of the NPMRDS and other NCDOT data sources, a detailed trend analysis was conducted for each measure at the statewide, system, and regional level. These data were aligned with work zones, truck weigh stations, and other critical network impacts to determine the level of impact on each performance measure. An evaluation of a more than 5-year trend at the

Statewide, regional, and corridor scale for the System Performance and Freight measures was made.

An issue emerged when using the NPMRDS in that vendor supplying the data were changed starting in 2017. Discontinuities in the resulting trends were noticed when this change occurred for non-Interstate NHS roadways and the freight reliability measure. To compensate, it was assumed that 2017 was the baseline value for the measures and that the trend rate up to 2016 would be applied to extrapolate the baseline. Figure 6 through figure 8 present 5-year annual trends (2013 through 2017) for the three measures, as well as trend lines and associated potential target ranges.

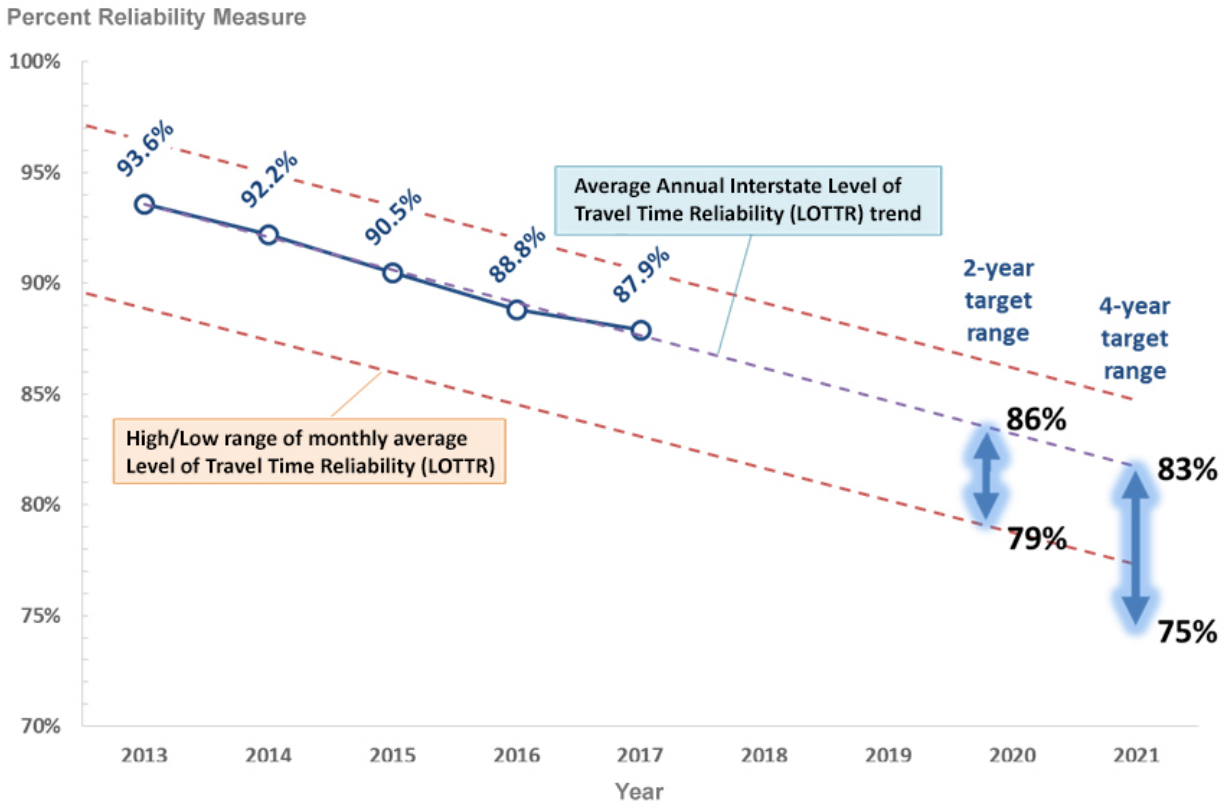

Figure 6. Graph. Percent of person-miles traveled on the Interstate that are reliable—trend and target ranges.
(Source: North Carolina Department of Transportation.)

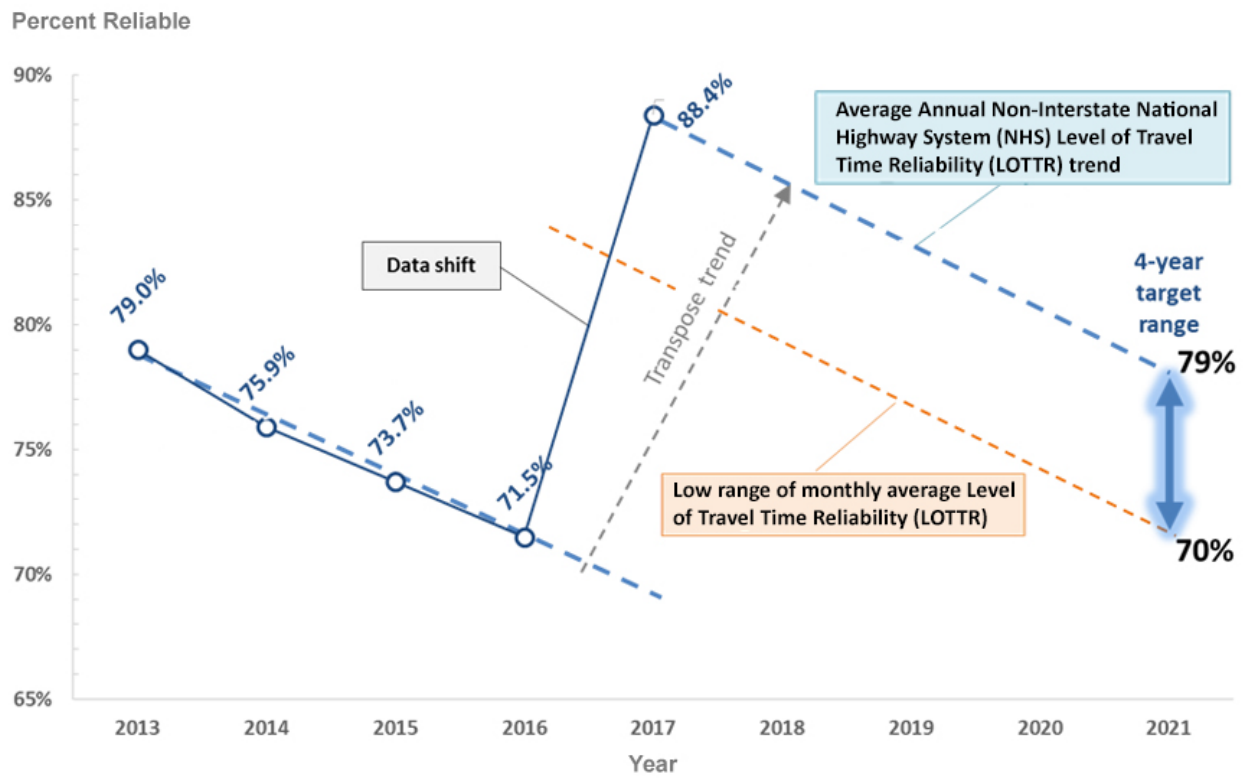

Figure 7. Graph. Percent of person-miles traveled on the non-Interstate National Highway System that are reliable—trend and target ranges.
(Source: North Carolina Department of Transportation.)

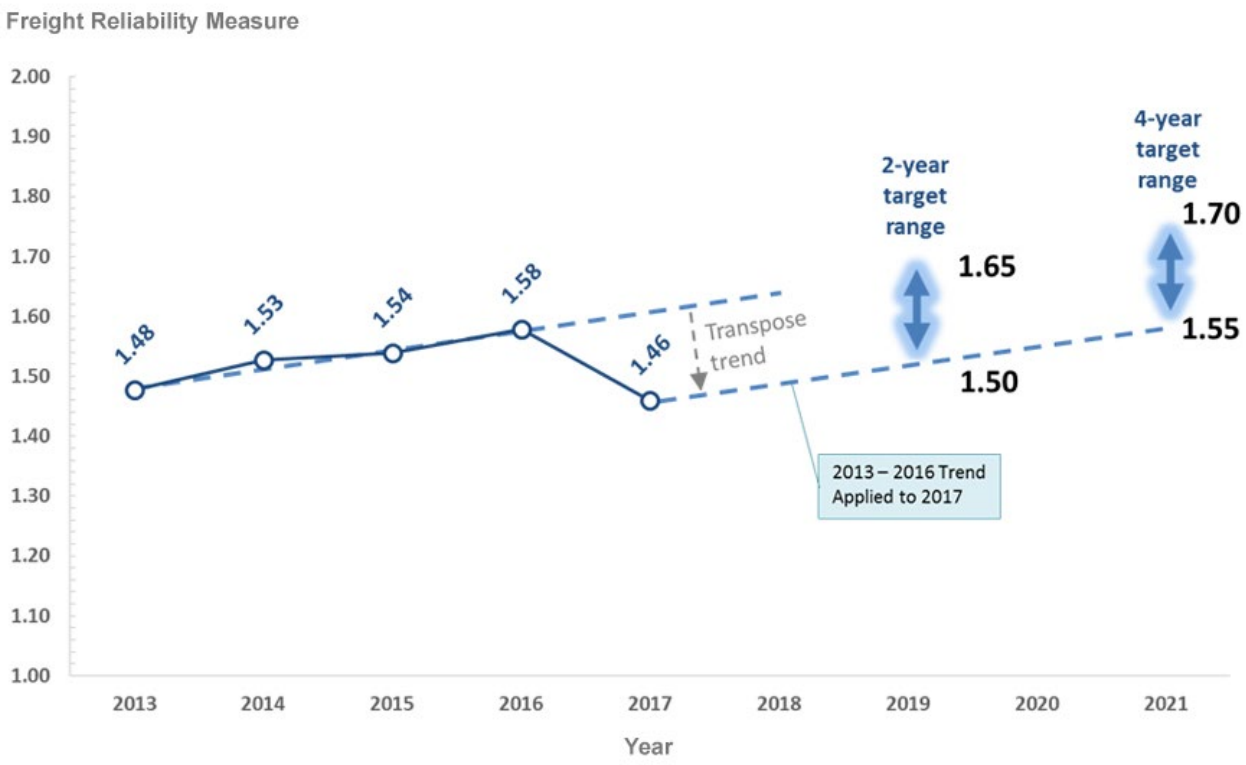

Figure 8. Graph. Interstate truck travel time reliability—trend and target ranges.
(Source: North Carolina Department of Transportation.)

Each measure was assessed at the regional scale and also aggregated by urban and non-urban facilities and individual corridors. It was found that the measure values for the Charlotte and Raleigh Durham urban areas heavily influenced the statewide values. The Statewide TTRI in 2017 is 1.40. Similar to the LOTTR metrics, statewide reliability is impacted significantly by the Charlotte and Raleigh/Durham regions which average a 1.78 truck travel time reliability and total 17.5 percent of Interstate truck VMT. Because this measure is weighted by facility miles, the non-urban 1.20 truck travel time reliability has a large impact on the Statewide average. Figure 9 presents a map of truck travel time reliability with weigh station locations identified. Weigh stations and work zones impact reliability—for example I-85 in Cabarrus/Rowan and I-85 in Warren County, are examples where work zones have led to degraded truck travel time reliability.

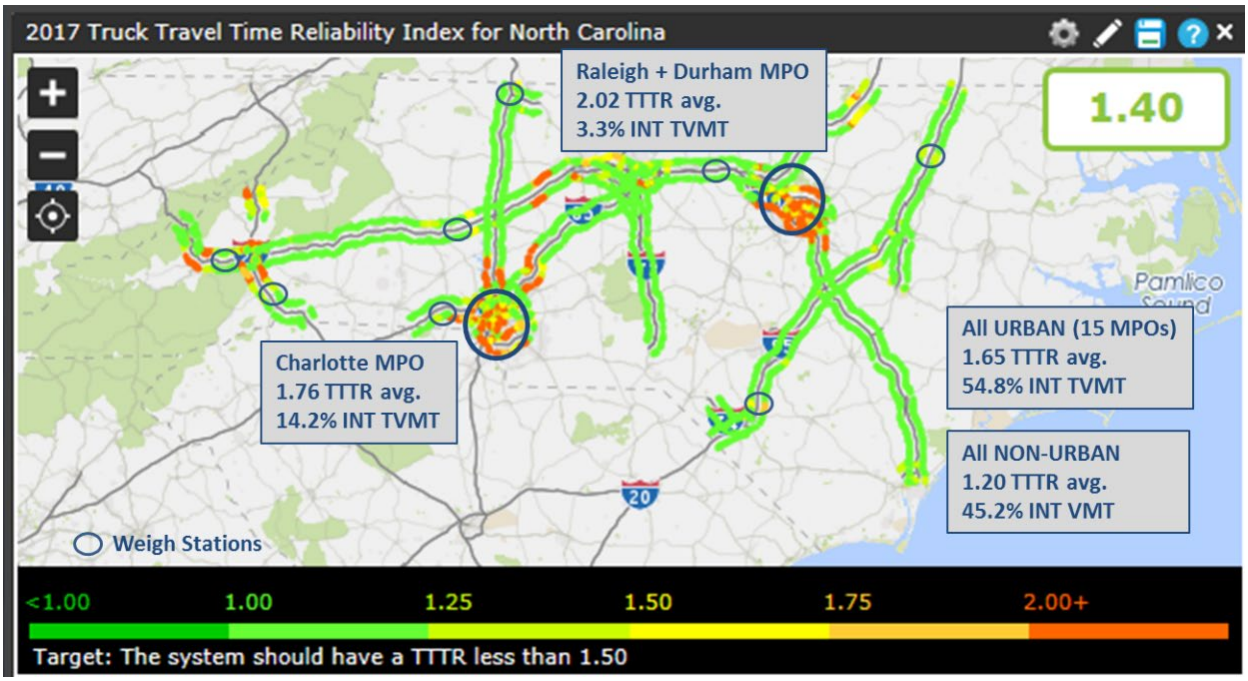

Figure 9. Map. 2017 freight reliability measure map.
(Source: North Carolina Department of Transportation.)

Consideration of External Factors

Several external factors that likely impacted the five-year performance trend and could impact future performance were examined. These factors were considered in conjunction with the trend extrapolations in setting the targets.

- **VMT Growth—**As presented in figure 10, since 2012, urban VMT has averaged a 2.8 percent increase per year while rural VMT has remained overall steady. VMT growth is a primary driver of decreasing reliability.

- **Truck Travel Demand—**The Statewide Multimodal Freight Plan projected future commodity flows, showing a 43 percent increase in total tonnage over the next 30 years, especially in bulk commodity groups. It is expected that many of the truck trips associated with the highway commodity flows will travel on non-interstate roadways for some portion of the trip. This growth will have significant impacts on both LOTTR and truck travel time reliability performance.

- **Severe Truck Crashes—**Crashes involving trucks can particularly impact truck travel time reliability. Per analysis in the Statewide Multimodal Freight Plan, between 2011 and 2015, over 49,000 truck-involved crashes occurred in the State, with the total number of crashes

increasing in each year. Ten counties accounted for nearly half of all truck crashes in the State, all of which are located within one of the State's major metropolitan regions: Charlotte, Triangle, Triad, Asheville, and Fayetteville regions.

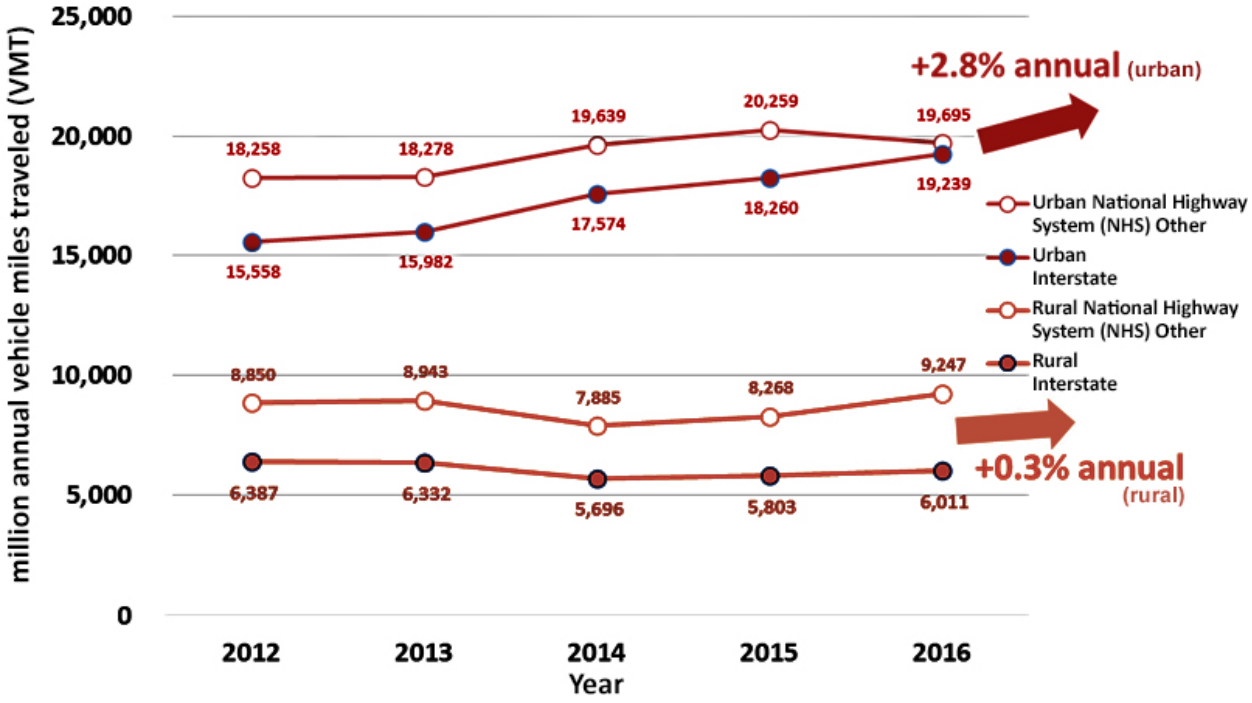

Figure 10. Graph. Urban and rural vehicle-miles traveled by system.
(Source: North Carolina Department of Transportation.)

- **2018 to 2027 Planned Statewide Transportation Improvement Program Investments—** Interstate and non-Interstate NHS expansion projects planned to be open to traffic by 2021 in the Charlotte and Raleigh/Durham regions were considered. There were 14 committed projects ($712 million) that could positively impact reliability over the next 4 years. Work zones associated with current and planned projects can have a significant impact on reliability; however, project management and phasing strategies can minimize this impact. Incident management strategies and traffic management can also significantly benefit reliability.

Development of PM3 Measures for Peak-Hour Excessive Delay Per Capita and Non-single Occupancy Vehicle Travel Measures

In North Carolina, the Peak-Hour Excessive Delay (PHED) per capita Non-Single Occupancy Vehicle (non-SOV) Travel measures currently apply only to the Charlotte, NC-SC Urbanized Area. A coordination group—the Metrolina Coordination Group—comprised of the multiple affected MPOs within the urbanized area (as well as NCDOT) was formed to conduct the target setting. The group reviewed PHED data for recent years to identify a range of possible targets

based on a trendline forecast for the first 4-year reporting period (figure 11). PHED increased year over year, from 14.69 hours per capita in 2014 to 19.30 hours in 2017.

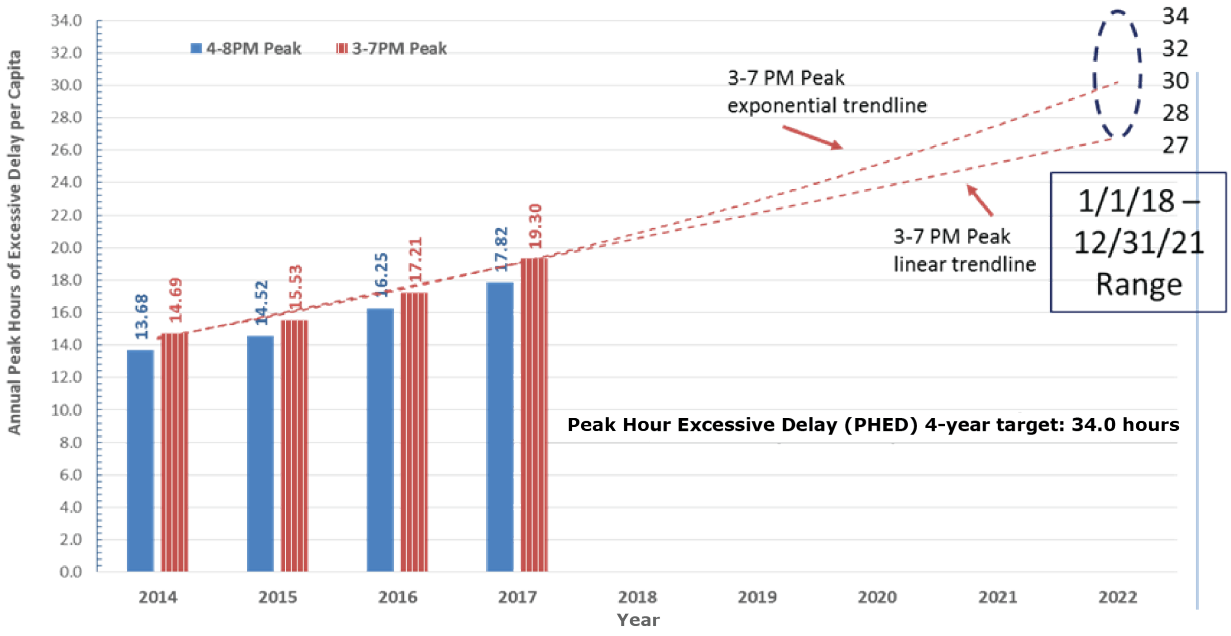

Figure 11. Graph. Recent trends—Annual hours of peak-hour excessive delay per capita for the Charlotte, North Carolina-South Carolina urbanized area.
(Source: North Carolina Department of Transportation.)

The group also reviewed ACS data for recent years to identify a range of possible non-SOV Travel targets. The percent of non-SOV travel has remained fairly steady between 2012 and 2016, ranging from 21.5 percent to 21.8 percent. The trendline shows a slight downward trend, which represents decreasing performance over the year period.

Final Targets North Carolina PM3 Targets

Table 2 presents the final PM3 targets for North Carolina that emerged from the target setting process described above.

Table 2. North Carolina Department of Transportation PM3 roadway system performance targets.

Performance Category	Performance Measure Definition	Current Data	2-Year Target	4-Year Target
Highway System Performance (Congestion)	Percentage of person-miles traveled on the Interstate System that are reliable.	87.9%	80%	75%
Highway System Performance (Congestion)	Percentage of person-miles traveled on the non-Interstate National Highway System that are reliable.	88.4%	N/A	70%
National Freight Movement Program	Freight Reliability.	1.46	1.65	1.70
Congestion Mitigation and Air Quality Program	Non-single occupancy vehicle travel in the Charlotte urbanized area (National Highway System).	21.5%	21%	21%
Congestion Mitigation and Air Quality Program	Peak hours of excessive delay per capita in the Charlotte urbanized area (National Highway System).	19	N/A	34

(Source: North Carolina Department of Transportation.)

CHAPTER 5. RESOURCES FOR TARGET SETTING

Several resources may be leveraged to effectively set targets. These include data on travel times and other aspects of the transportation system and surrounding environment, various models and analysis tools, insights from the experiences of peer agencies, and feedback from the public and stakeholders. This section of the report summarizes those resources and discusses their value to State DOTs and local agencies.

DATA AS A RESOURCE

Perhaps the most important data resource needed for target setting in this context is travel time data. As discussed in the Federal requirements for target setting, most of the PM3 measures rely on the availability and quality of travel time data.[26] The NPMRDS is the most common source of travel time data for target setting as it is made available to State DOTs and MPOs through FHWA. However, the NPMRDS coverage is only provided on the Interstate highway system and the NHS. As observed in the WSDOT case study in chapter 4, the extent of network coverage of a travel time database can significantly impact an agency's ability to apply consistent target setting practices across its system.[27]

While travel time data resources are important, they are not the only data resources that an agency will find valuable. The travel time-based performance measures, and their associated targets, also rely on other data. These include vehicle occupancy rates, traffic volumes, classification counts, and network characteristics. These are all data that are regularly collected by State DOTs and MPOs. In the case of these data, internal resources (e.g., various units within an agency) may prove to be the most useful.

MODELS AND TOOLS AS RESOURCES

Transportation models and statistical analysis tools represent another resource to State DOTs and MPOs engaged in target setting. There are numerous models and tools developed for the purpose of predicting future performance, some for transportation explicitly while others for general purposes that may be applied in a transportation context. While models that predict the demand for travel and congestion-related performance measures are commonplace, measuring and forecasting reliability is an emerging practice in transportation modeling. The ability of models and analysis tools to characterize reliability, assess the impact of reliability on the transportation

[26] 23 CFR 490.103(e).

[27] Note that the NPMRDS has wider application beyond just supporting the PM3 measures. It can also be used to develop a wide variety of travel time and reliability performance measures for activities such as annual mobility reports, before/after project evaluations, bottleneck analysis, and providing data for model inputs and calibration.

system and its users, and to determine the effectiveness of investments and operational countermeasures to improve reliability is an important area of future research.

State DOTs are currently experimenting with a number of methodologies to forecast reliability performance and predict targets. However, time series analysis was a common theme of the various methods identified by the project team. This includes the use of statistical models such as regression, moving averages, and exponential smoothing for example. The following example procedure demonstrates the steps that may be taken as a part of a target setting process that relies on trend line analysis, though the procedure and the steps are not required:

- Review the external (exogenous) factors. These factors are those that affect performance of the transportation system, but are typically outside the control (at least operationally) of transportation agencies. Common examples of external factors include fuel prices, economic conditions, and employment levels. FHWA has produced a report on this subject that is useful in examining external factors.[28]
- Review the internal (endogenous) factors that affect transportation system performance and are under the control of or can be managed by transportation agencies. The latest STIP for fiscal year 2018 to 2021 includes projects (both on Interstates and non-Interstates), which may potentially impact the system performance measures. The projects which may positively impact the system performance measures include the following category of projects: interchange, intersection improvement, intelligent transportation systems, managed lanes, passing lanes, and roadway widening. Additionally, the management of traffic incidents, work zones, and weather will have a positive effect on travel times and reliability.
- Conduct a trend line analysis for the performance measures using the baseline data. This analysis will provide a lower- and higher-end range for the projected future-year performance measures.
- Set the targets. Factors such as increasing travel demand, improving economic conditions, and increasing population would indicate that system performance could worsen in the future and that a conservative target is recommended.

As an example, the Washington, DC area National Capital Region Transportation Planning Board (TPB) applied three general methodologies to determine travel time performance forecasting.[29] TPB staff obtained data from the NPMRDS, and the utilization of RITIS with the MAP-21 widget. This enabled staff to review the travel time reliability and the truck travel time reliability (TTTR) for the TPB Planning Area from 2014 to 2017. With this collection of data, staff applied three general methodologies to determine performance forecasting: the extrapolation of measured performance, the use of travel demand model data, or the average of the two.

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[28] Dadashova, Bahar, Lasley, Phil, Koeneman, Pete, and Turner, Shawn, Approaches to Presenting External Factors with Operations Performance Measures, FHWA-HOP-18-002, February 2018.

[29] System Performance Targets Travel Time Reliability and Truck Travel Time Reliability – Draft, Performance-Based Planning and Programming, July 2018.

- **Extrapolation of Measured Performance:** For this approach, measured data for the previous years of 2014 through 2017 would be selected either by month or year. This data would then be extrapolated, via polynomial regression, through the year 2021. This would cover both the two- and four-year targets. This approach would result in either a fitted line or a best fit curve as a means of forecasting.
- **Travel Demand Model:** In 2016 TPB produced a travel demand model which produced congestion/related outputs for modeled years 2016, 2020, 2025, etc. Forecasting will be achieved by utilizing such outputs as percentage of congested AM peak-hour VMT estimates to project change in congestion, applying the percentage changes to measured performance.
- **Averaging:** Taking the average of both the extrapolation of measured performance and the utilization of the Travel Demand Model as a means of forecasting the targets.

Similar to TPB, Connecticut DOT uses extrapolation method for their target setting.[30]

PUBLIC AND STAKEHOLDER RESOURCES

The public and transportation system stakeholders can be a good resource to State DOTs and MPOs in setting targets. These groups can communicate their concerns and priorities in target setting. In some cases, stakeholders may provide information that is potentially important in setting targets at the State and regional levels. For example, a freight rail stakeholder may be planning an expansion of a rail intermodal terminal that could substantially increase truck traffic through an area and thus impact freight reliability targets; a local transit agency may be planning a major investment that they estimate will increase a region's average vehicle occupancy rate, impacting reliability targets for the Interstate and Non-Interstate NHS. Involving other transportation system stakeholders in the target setting process can help agencies account for some of the exogenous factors discussed in the Models and Tools as Resources subsection.

The importance of public and transportation system stakeholders is reflected in the FAST Act's encouragement of State DOTs to establish a State Freight Advisory Committee. For Freight Reliability, in particular, a State DOT's ability to achieve a target is impacted by the actions of private-sector stakeholders that determine how, when, and where freight moves. Thus, these stakeholders are important resources for setting freight reliability targets, especially at the MPO level where a smaller geography coupled with freight system changes results in magnified performance impacts.

The traveling public is a resource to agencies for target setting because they can communicate those performance measures and targets that they most value and should be prioritized by a State DOT or MPO. In many cases, it may represent an opportunity for an agency to communicate to

[30] Great Falls Area, Long Range Transportation Plan - 2018 Update, Appendix I: Performance Measures and Targets, October 2019.

the public the resources needed to achieve a desired level of performance and the magnitude of the funding gap that exists.

Public engagement also can help to reconcile targets that are in conflict. For example, some stakeholders may desire higher speeds on certain roadways which may conflict with safety targets for reduced fatalities or serious injuries. By engaging the public on target setting, State DOTs and MPOs have an opportunity to communicate how the various aspects of performance management fit together and improve the overall system.

PEER AGENCIES AS A RESOURCE

Peer agencies are a resource that State DOTs and MPOs should use in target setting. This is a natural extension of collaboration, which is a key feature of performance-based planning and programming. Performance levels achieved by peer agencies can serve as benchmarks for a State DOT or MPO setting its own targets:

- Compiling noteworthy practice case studies and lessons learned from peer agencies is a good starting point for target setting.
- Staff from a select group of agencies could be interviewed to learn more about their experience.
- Provides the opportunity to share data.

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