Performance Measurement in State Departments of Transportation: A Literature Review and Survey of Current Practice

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ABSTRACT

Appropriate performance measurement processes can ensure efficiency, accountability and transparency for transportation agencies. Accordingly, the next federal legislation for surface transportation will call for the explicit use of performance based measures as part of a strategic planning process. This paper aims to provide an understanding of current performance measurement practices in US State DOTs through a review of the literature and a comprehensive survey. Results from the literature review show that transportation performance measurement systems are being increasingly tied to long-term strategic goals, that performance measurement is used in asset management, and that comparative benchmarking is a valued performance measurement mechanism. While gaps exist in understanding performance target setting, recent efforts to learn from peer countries can allow future development in this area. Results from the survey confirm those suggested by the literature, and they reveal that target setting processes exist but could be more formalized. The implication of the results for transportation in the US is direct and significant in several ways. On a strategic level, the developments noted in performance measurement can aid transportation agencies to be better prepared for the reauthorization of the federal surface transportation legislation. The identification of a performance measurement system can help agencies stabilize their financial situation, and comprehensive strategic planning frameworks can lead to better integration and accountability through the local, state, and regional levels. Such systems will be dynamic and readily responsive to changes in DOTs, and they can eventually lead to long-term system effectiveness, transparency and longevity.
INTRODUCTION
Performance measures, defined as indicators of system effectiveness and efficiency, are increasingly becoming a central focus in transportation planning in the United States. A performance-based transportation planning system is important because as the saying goes, “what gets measured gets done.” A proper performance-based measurement system can help ensure effectiveness, efficiency, accountability and transparency. The next federal legislation for surface transportation will call for the explicit use of performance-based measures as part of a strategic planning process. The current US Department of Transportation (DOT) Strategic Plan is already performance based, where under each strategic goal, outcomes, strategies, performance measures and external factors are clearly laid out (1). It is a results-oriented strategic plan. DOTs at the state level adopt more concrete and context-specific strategic plans that can be used to execute, track and monitor progress to ensure accountability especially in light of the recent economic climate.

Clearly, understanding the current state of performance measurement practice in the United States is important for identifying areas of improvement and addressing them. The purpose of this paper is to illuminate the state of performance measurement practice in state transportation agencies. The paper does the following: 1) explores the use of performance measurement in state DOTs through a review of the literature, and 2) explores the use of performance measurement in general, in target setting and in asset management through a comprehensive survey. The results of the explorations should aid DOTs in preparing for the reauthorization of the federal surface transportation legislation and lead to long term agency effectiveness, efficiency, accountability and transparency.

LITERATURE REVIEW OF PERFORMANCE MEASUREMENT IN STATE DOTS
Review of Performance Measurement
State DOTs have long used performance measurement for analyzing system inputs, processes, outputs and outcomes as part of the engineering and planning disciplines. Outputs are “products and services delivered” by the agency (e.g., miles of roadway repaired), whereas outcomes are the “the consequences of what the program did,” (e.g. percent reduction in crashes) (2). Yet, using performance measurement to manage, especially for accountability, is a relatively new concept (3). Privatization or management reforms have affected performance management in state DOTs. For instance the balanced scorecard model, which is by far the most used business performance model, has also been widely adopted by transportation agencies. In addition to privatization and a need to be competitive, other important factors have triggered interest in DOT performance measurement. These include: 1) the need to support strategic planning processes with information on DOT performance; 2) demands for increasing accountability from the public, legislators, and governors; 3) government-wide mandates; 4) growing commitment to customers; 5) leadership changes; 6) funding and politics (3-5), and 7) the next reauthorization of surface transportation programs.

As far back as 1993, NCHRP Report 357 (6) intended to isolate and define the key program performance measures and indicators of state highway and transportation departments for effective and efficient administration. This report provided information on the value of goal setting, the necessity of tailoring performance measurement systems to the special characteristics and transportation needs of each state, and the need for public accountability. However, the
report also noted that while several states had initiated programs to develop and use performance measurement tools, no state had comprehensive experience (6).

NCHRP Report 357 (6) reflects a model of the first generation transportation agency, where measures were typically developed in response to internal initiatives or to specific legislative requirements. Performance measures were often robust and well developed, but they were usually not meaningfully linked to other agency processes. Second generation frameworks on the other hand, which emerged in the late 1990s, usually tied measurement to strategies for tracking business functions and planning goals (4). During this period, many states took significant steps to measure the performance of their programs and services, moving beyond traditional operation-level, system-oriented measures to monitoring inputs and immediate outputs. This generation of performance measurement also put greater emphasis the customer’s perspective. However, second generation performance measures were often too complex, making results difficult to communicate, and agencies struggled to develop tools for reporting to stakeholders (3, 4).

In 2000, a guidebook was published linking performance measurement to transportation planning. It was intended to provide transportation organizations, planning practitioners, and decision makers with practical tools for considering system performance in the multimodal transportation planning and decision-making process. It is also aimed to support the investment decisions needed in major transportation systems (7).

Subsequent publications have furthered these concepts and moved towards a third generation of performance measurement that uses dynamic approaches to provide real time information. Third generation frameworks respond to the needs of agency leadership and the political context while placing high value on accountability (3). Performance measurement is also increasingly tied with strategic planning, asset management and other program areas. For instance, a handbook for CEOs and executives was developed on strategic planning that combined performance measurement and strategic management into a strategic performance measurement system. The report included detailed information about setting up and maintaining a strategic performance measurement system that can energize strategic management efforts, maintain focus, and enable organizational change, in addition to being able to track progress (8).

NCHRP Synthesis 326 examines the experience of state and provincial DOTs with strategic planning in 2004. It synthesizes the existing approaches to strategic planning and decision making, including performance measurement. Although many DOTs still struggled with defining “meaningful, reliable, accessible and cost effective” (9) performance measures in 2004, they were placing a greater focus on customer satisfaction and feedback. Also, DOTs began using time-sensitive numerical targets around this time, and they began developing asset management programs within the frameworks of their strategic plans (9).

The importance of performance measurement and asset management is further explored in NCHRP Report 551 (2006), which describes several principles to support asset management. The report determines that performance measures should be policy driven, strategic in perspective, considerate of tradeoffs and options, and should be implemented across organizational units and levels. In addition, performance decisions should be based on good information and should be evaluated and monitored through a feedback process (10).

Comparative performance measurement, also known as benchmarking, was recognized as important in the 2006 report Measuring Performance Among State DOTs (11). It was found that many DOTs were still skeptical about benchmarking but were willing to try it. The report
summarized the basic elements for developing a comparative framework, including a multistate working group, adequate staff, identification of common strategic focuses, identification of templates for measures, data collection and analysis systems, and the sharing of information. A peer group study of several states tracked two performance measures, on-time performance and on-budget performance, and found that there is great variation between different states.

Learning from other countries can prove valuable. A 2004 scan of performance measurement systems in Australia, Canada, New Zealand and Japan showed that performance measures were used more extensively in those countries than in the US. These systems often emphasized safety; included output, outcome, customer satisfaction, and environmental indicators; integrated data collection; used before and after studies and benchmarks; and considered multimodal investment tradeoffs. Successful programs directly used performance measurement to influence programming decisions and budget allocation. The scan recommended, in particular, that safety and benchmarking should be emphasized more by the FHWA. Furthermore, the scan suggested that the US generate research, training, conference meetings, technical guidance and sustainability actions, using these international examples.

This review of the literature indicates that many states have committed to using performance measures, but the degrees to which performance measurement systems are developed may differ widely among states. A list of attributes of good performance measurement are generated below, synthesized from the best practices found in the literature.

**Review of Performance Targets**

Little attention has been given to setting performance targets and what role targets may play in transportation planning. NCHRP Report 551 provides some guidance on setting performance targets. The report recommends that the setting of targets should consider financial, policy, technical and economic factors. In addition, it suggests that the establishment of long term and short term targets should follow seven logical steps as follows:

1. “Define contexts and time horizons,”
2. “Select scope of measures for targets,”
3. “Develop long-term goals,”
4. “Consider funding availability,”
5. “Analyze resource allocation scenarios and tradeoffs,”
6. “Consider policy and public input,” and
7. “Establish targets and track progress.”

A 2006 examination of performance targets in the UK provides additional information on different methods for establishing performance targets, and the tradeoffs between them. It summarizes the motivations for developing targets as legal and contractual obligations, resource constraints, consumer orientation and political aspirations. Based on these motivations, three ways to set targets are discussed. Computer-based models examine how a given indicator varies under a range of scenarios. These are the most realistic methods and can allow for different scenarios to be examined. Where variables cannot be modeled, extrapolation and evidence-led judgment based on historical data can be used. The most subjective method is aspirational, based on the desires of agency decision makers. While each method has positive and negative aspects, the best method is perhaps one that can establish targets that are tied back to the most
The target setting procedure presented in NCHRP Report 551 appears to be a combination of the three methods.

The overseas literature on performance targets points to the need for the US to learn from its peers. A 2010 international scan, *Linking Transportation Performance and Accountability* (15), carried out in Australia, Great Britain, New Zealand and Sweden, studied how the transportation agencies of different countries use target setting to demonstrate accountability to elected officials and the public. This timely scan shed light on some important points about performance measurement and target setting in other countries:

1. “A limited number of high-level national transportation policy goals that are linked to a clear set of measures and targets are used,”

2. “Intergovernmental agreements on how state, regional, and local agencies will achieve the national goals” are negotiated “while translating them into local context and priorities,” and

3. “The real value of performance management is the development of an improved decision making and investment process, not the achievement of many arbitrary short-term targets.” (15)

The scan is a step in the right direction to help the US develop better performance measurement systems for accountability. Further, a web tool called *State Measures* has been created that synthesizes documents such as state transportation statistical, annual, and performance reports (16). These recent developments show that challenges in the area of performance measurement are being actively addressed, perhaps in anticipation of the performance measurement requirements expected with the pending reauthorization of the surface transportation bill.

**SURVEY ON PERFORMANCE MEASUREMENT AND TARGET SETTING IN STATE DOTS**

**Introduction**

The goal of this comprehensive survey was to identify common approaches to selecting performance measures and targets in state transportation agencies. While other surveys have been carried out to understand performance measurement, no survey was found that looks at performance measures holistically from an agency’s strategic planning perspective, and whether agencies have systematic procedures for target setting. This survey tries to fill in the knowledge gaps within the literature review above, in addition to providing information on state of the practice in asset management at DOTs.

**Survey Methodology**

The survey took place from September 2009 to February 2010, and was conducted through telephone interviews and online questionnaires, consisting of eight survey questions. Mainly planning and performance measurement departments or divisions within the DOTs were contacted. Respondents were given a choice between being asked the questions on the phone, or
filling out responses online. For the latter, respondents were further contacted to clarify responses if needed.

Survey Results
The overall response rate of the survey was quite good, as 39 State DOTs (or equivalents) responded to the survey out of the 50 states plus the District of Columbia. This corresponds to a response rate of 78%. Figure 1 below shows the geographic spread of the states that responded to the survey. The following sections present the survey results.

FIGURE 1 State DOTs that responded to survey (Responses were not received for Alaska and Hawaii).

1. Organizational Strategic Goals and Objectives
The purpose of this question is to find out whether an agency has a functional strategic plan on which performance measurement can be based. It also seeks to find how often the strategic plans are updated, how these plans are organized, and which specific goals are set.

Out of the 39 responses, 36 agencies responded “yes” indicating they have a strategic planning process, while 3 agencies responded “no”, reflecting a high positive response rate of 92%. However, it should be noted that while most DOTs understood that strategic plans are different from Long Range Transportation Plans (LRTP), certain DOTs gave objectives from their LRTPs.
The survey results show that most DOTs have a strategic plan that is updated annually, with some DOTs updating them biennially or in three- and four-year intervals. Plans updated less frequently than every five years are very rare. These results imply that most DOTs are proactive in responding to new planning imperatives. Short review intervals also provide feedback loops that can allow for faster improvements in performance.

There are different ways in which agency goals are organized. The most common organization is a one tier arrangement. For instance, Virginia DOT lists six broadly defined goals addressing transportation issues such as safety, systems preservation, and mobility; outcomes such as economic vitality and quality of life; and organizational issues such as financial accountability and inter-agency collaboration.

The second way that goals can be presented is through a multi-tiered arrangement, where goals are broadly defined, and more specific objectives are defined to clarify the broader goals. More intricate structures that are tied to a specific performance measurement framework, such as the balanced scorecard are also used. For instance, New Hampshire DOT’s goals are arranged according to a multi-tiered balanced scorecard structure, with four big-picture areas of performance, each with two to four specific goals.

The third way strategic goals can be arranged is in an area-specific manner, where different goals are listed for each division, and some agency-wide goals may overlap across divisions. The NYSDOT’s strategic goals are organized according to seven specific program areas: highway and bridge infrastructure, public transportation system, statewide rail system, aviation system, multimodal transportation mobility, environmental sustainability, and multimodal transportation safety. Goals are described within each area, and in some cases organized into multiple subareas; for instance, different statewide rail system goals are specified for passenger and freight rail.

Naturally, there is no best way to arrange an agency’s goals. So long as they are comprehensive and reflect the priorities of the agency and other stakeholders, they are potentially effective goals. Agencies range from having as few as four goals to having as many as hundreds of goals arranged in several categories. However, most agencies have fewer than 10 goals. Also, the survey has shown that most DOT goals fall into few major categories. Table 1 below lists 29 categories which capture all of the goals used by survey respondents, sorted from the highest to the lowest number of occurrences. Although some of these categories are closely related, they have been isolated based on the wording of the various survey responses.

It can be seen from Table 1 that goals related to safety, systems preservation, and mobility are the most common of all strategic goals. The “transportation system safety and security” category relates to safe roadway designs and is represented in 67% of all the survey responses. It is considered separately from the similarly worded “system preparedness, security” category, which relates to responsiveness in emergency situations; however if the two were considered together, they would be represented in 76% of responses. The “asset management and systems preservation” category is especially important to note, in light of the recent and upcoming legislative focus on better infrastructure management. Its broad representation (56%), is in stark contrast with that of “public and alternative transportation expansion and improvement” (10%), and “highway expansion and capacity increase” (5%) goals. “Transportation system mobility” seems to be similar to “transportation system effectiveness and efficiency,” which relate to such performance measures as travel time delay. Together these mobility and efficiency goals are represented in 53% of the responses.
## TABLE 1 DOT Goals and Objectives

<table>
<thead>
<tr>
<th>Goals</th>
<th>Tally</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation System Safety and Security</td>
<td>26</td>
</tr>
<tr>
<td>Asset Management and Systems Preservation</td>
<td>22</td>
</tr>
<tr>
<td>Transportation System Mobility</td>
<td>14</td>
</tr>
<tr>
<td>Employee and Organizational Development</td>
<td>11</td>
</tr>
<tr>
<td>Customer Satisfaction</td>
<td>11</td>
</tr>
<tr>
<td>Economic Growth and Vitality</td>
<td>11</td>
</tr>
<tr>
<td>Environmental Quality and Sensitivity</td>
<td>10</td>
</tr>
<tr>
<td>Transportation System Effectiveness and Efficiency</td>
<td>7</td>
</tr>
<tr>
<td>Integrated and Multimodal Transportation System</td>
<td>7</td>
</tr>
<tr>
<td>Agency Program Service Delivery</td>
<td>7</td>
</tr>
<tr>
<td>Better Freight Movement</td>
<td>6</td>
</tr>
<tr>
<td>Stewardship</td>
<td>4</td>
</tr>
<tr>
<td>Public and Alternative Transportation Expansion and Improvement</td>
<td>4</td>
</tr>
<tr>
<td>System Preparedness, Security</td>
<td>4</td>
</tr>
<tr>
<td>Quality of life</td>
<td>4</td>
</tr>
<tr>
<td>Agency Accountability and Transparency</td>
<td>4</td>
</tr>
<tr>
<td>Stakeholder Communication and Cooperation</td>
<td>4</td>
</tr>
<tr>
<td>Modal Shift and Auto Trip Reduction</td>
<td>3</td>
</tr>
<tr>
<td>Agency Conservation and Business Efficiency</td>
<td>3</td>
</tr>
<tr>
<td>Highway Expansion and Capacity Increase</td>
<td>2</td>
</tr>
<tr>
<td>Agency Program Funding</td>
<td>2</td>
</tr>
<tr>
<td>Employee Innovation</td>
<td>2</td>
</tr>
<tr>
<td>Land Use and/or Economic Development Connection</td>
<td>2</td>
</tr>
<tr>
<td>Congestion Reduction</td>
<td>2</td>
</tr>
<tr>
<td>Accessibility</td>
<td>2</td>
</tr>
<tr>
<td>Sustainability</td>
<td>2</td>
</tr>
<tr>
<td>Cost Effective Products</td>
<td>2</td>
</tr>
<tr>
<td>Agency Leadership</td>
<td>1</td>
</tr>
<tr>
<td>Needs vs. Community Wants</td>
<td>1</td>
</tr>
</tbody>
</table>

Compared with the goals mentioned above, which relate to the direct physical and functional aspects of the transportation system, outcome goals related to the economy, the environment, and society are less widely adopted. “Economic growth and vitality,” which is a community-oriented outcome, is a goal area for 28% of respondents. Organization-oriented goals related to the economy are also represented in 12% of responses: “agency conservation and business efficiency,” along with “cost effective products.” “Environmental quality and sensitivity” is specifically mentioned by 10 of the 39 respondents (25%), with others mentioning related ideas such as “stewardship” and “sustainability.”
“Customer satisfaction,” is the most popular socially-oriented goal area, appearing in 28% of responses. However, this relates more to agency image than community outcomes. Other agency-oriented social goals are related to “employee innovation” and “agency leadership.” Relatively few agencies set goals related to quality of life and accessibility, however, which are more community-oriented. Social equity was not mentioned explicitly by any of the respondents.

The concept of “sustainability,” which was mentioned explicitly by two survey respondents, implies a commitment to improving the economic, environmental, and social outcomes. Although the concept has become more widespread in recent years, the results of this survey show that sustainability is of less frequent concern to transportation agencies than are measures of effectiveness and efficiency. If agencies wish to improve their relative sustainability, they will need to incorporate human outcomes, related to the economy, the environment, and social equity, more explicitly into their strategic goals.

2. Strategic Planning and Performance Measures

This question seeks to find out the extent to which DOTs are using performance measures to monitor the progress of their strategic plan, and to find out how the performance measures are structured. It is not to find out exactly what performance measurements are used, but how they are tied to the overall strategic planning process. From the survey results, 23 out of the 39 DOTs indicated they do have performance measures that are used to gauge success in achieving their strategic goals and objectives. While the rest do not have performance measures linked to the strategic plan, several DOTs are in the process of adopting such a system.

Most of the measures are organized in a multi-level structure where the highest level usually consists of goals identified in the first question (also called Key Performance Indicators) and shape the overall priority of the organization. The second level contains more detailed objectives, and underneath that specific strategies (action-level measures) are identified. This indicates that most DOTs align their measures to strategies to help achieve their objectives in an organized manner.

The number of measures also varies greatly between different DOTs. While some DOTs have only a few measures (e.g. Oklahoma DOT has 12 measures in 5 goal areas), others, for instance Maryland, have over 400 measures in their different divisions. Several DOTs also follow a performance measurement framework that aids in measurement formulation and better feedback. For instance, Florida DOT has always used a well developed pyramid framework that sets the goals and objectives from the policy level down to the project level. Interesting to note, Florida DOT also has developed measures in a kind of multi-perspective structure, in order to answer three separate questions (17):

- How we report on what we are accomplishing
- How we are being measured by others
- How we measure ourselves on an ongoing basis

These three questions are important because they distinguish performance measurement from benchmarking, where the latter can sometimes be more effective in improving the organizations.

While measures are important in and of themselves, how well measures are tied to the overall planning process is perhaps more important. For instance, Caltrans provides a good framework in which the performance measurement system is directly linked to the operational plan, and informs strategic planning through program evaluation (18). Another good example
comes from Louisiana DOTD (19), which adopted a Performance Indicator Matrix that vertically integrates performance measures with objectives set at the program level. In this framework, each objective is clearly stated, and measures are divided into input, output, outcome, efficiency and quality categories. Also, Missouri DOT has a tracker system that is built around 18 tangible results that corresponds to over 100 performance measures. This system allows for easy updates to be made and easy tracking.

3. Performance Measurement Review
To carry the previous question further, this question attempts to find out how often the performance measures are reviewed. Out of the 23 DOTs that have a performance measurement system for strategic planning, 13 reported that they review their measures annually, four quarterly, three biennially and two semi-annually. The remaining one agency reported that they review their measures when their plans are updated. The results indicate that most agencies that have performance measures in their existing strategic plan review them frequently, usually coinciding with how often the plans are updated.

4. Role of Performance Measures in Functional Divisions
This question seeks to find out the extent to which performance measurement is used in each division of the DOT. For the 39 DOTs that responded, Table 2 lists the twelve most common functional divisions in which performance measurement is used. As can be seen from the results, performance measurement in planning and program development is considered important by most DOTs, followed by operations and engineering. In order for performance measurement in these areas to be effective, agencies will need clear and comprehensive strategic plans that can guide operations, engineering and other action areas. Other divisions, which were listed by very few DOTs and are not listed in the table, include environmental divisions, multimodal divisions and public private partnership initiatives. Also worth noting is that several DOTs report performance management within an operations division, but not within maintenance, although these two activities (“O&M”) are often thought of as closely linked. Certainly, some agencies may deal with maintenance within operations. Nonetheless, more research could uncover whether performance management practices in maintenance might facilitate the shift to a system preservation focus.

According to the survey results, there are two ways in which DOT functions are organized. The first consists of a one-tier structure, where the DOT functions are broken down into distinct divisions (usually above 10) and each manages their functions independently. The second is a two-tier system, where the DOT is broken down into broad functional areas, such as engineering, headed by a director, and each area is further broken down into several divisions, such as maintenance, civil rights, and planning. Regardless of the organizational structure, functional divisions should reflect a comprehensive picture of the priorities the agencies represent.

Regarding the role of performance measures in each division, DOTs generally responded that performance measures are used for overall management and planning to advance projects and make business decisions. While several DOTs use performance measurement in each of their units, most DOTs only use it in certain business units for internal tracking. For certain DOTs, different performance measurement models are used by different divisions to track progress. Or, as in the case of NYSDOT, the same division may use a combination of models. NYSDOT’s
Engineering Division utilizes a Performance Improvement Model (PIM), but the Office of Design, within the Engineering Division, has also incorporated a balanced scorecard approach and publishes its performance metrics and an overall index on the Department’s internal website. A few other respondents also stated their use of a balanced scorecard system, and several DOTs have spearheaded such a process. However, the majority of DOTs could better use performance measurement in a manner that is both horizontally integrated across divisions and vertically integrated within a division, linking performance measurement more clearly to division and agency goals.

### TABLE 2 Major Functional Divisions Within State DOTs

<table>
<thead>
<tr>
<th>Functional Division</th>
<th>Tally</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning/Programming/Development</td>
<td>28</td>
</tr>
<tr>
<td>Operations</td>
<td>21</td>
</tr>
<tr>
<td>Design/Engineering</td>
<td>18</td>
</tr>
<tr>
<td>Administration</td>
<td>17</td>
</tr>
<tr>
<td>Maintenance</td>
<td>14</td>
</tr>
<tr>
<td>Finance</td>
<td>11</td>
</tr>
<tr>
<td>Construction</td>
<td>10</td>
</tr>
<tr>
<td>Public Transportation</td>
<td>10</td>
</tr>
<tr>
<td>Aeronautics</td>
<td>7</td>
</tr>
<tr>
<td>Safety</td>
<td>5</td>
</tr>
<tr>
<td>Motor Vehicles</td>
<td>5</td>
</tr>
<tr>
<td>Program Delivery</td>
<td>4</td>
</tr>
</tbody>
</table>

5. Performance Measures and External Stakeholders

The extent to which performance measures are used to engage external stakeholders is looked at in this question. The 30 DOTs that do engage with external stakeholders reported that primary stakeholders are the public, legislature, governor and industries. Engaging with external stakeholders is important to ensure customer satisfaction, transparency, and accountability, and to improve the organization through useful and unbiased feedback. The most common ways DOTs use to engage with external stakeholders include customer satisfaction surveys, focus groups, public meetings and public hearings. Websites also contain information available to stakeholders, such as dashboard information. Simulation and trend analysis are used in public meetings to explain capital needs and budget impacts. Annual and quarterly reports are used to report progress to key stakeholders. Customer feedback can be used to improve performance. For instance, Missouri DOT’s Tracker program includes measures tracking the number and satisfaction of customers involved in public planning processes.

6. Setting Performance Targets

One of the observable gaps in the transportation performance management literature is the lack of guidance for setting performance targets, or standards for performance measurement. To fill this gap, the sixth question asks DOTs if they set target performance levels and how they go about setting their targets. Thirty-one out of the 39 DOTs responded that they do set targets. This
response rate is higher than for performance measures because many DOTs do not directly tie
targets to the strategic planning process or performance measurement. Based on the survey,
Table 3 shows the most common ways performance targets are set. Some agencies use multiple
methods, or multiple inputs, for setting targets.

Table 3 How Performance Targets Are Developed in DOTs.

<table>
<thead>
<tr>
<th>How Targets are Development</th>
<th>Tally</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Management</td>
<td>7</td>
</tr>
<tr>
<td>Program Manager</td>
<td>6</td>
</tr>
<tr>
<td>Funding Levels</td>
<td>5</td>
</tr>
<tr>
<td>Benchmarking</td>
<td>3</td>
</tr>
<tr>
<td>Stakeholder Input</td>
<td>3</td>
</tr>
<tr>
<td>Consensus</td>
<td>3</td>
</tr>
<tr>
<td>Historic Data and/or Past Experience</td>
<td>2</td>
</tr>
<tr>
<td>Customer or Public Input</td>
<td>2</td>
</tr>
<tr>
<td>Internal Discussion</td>
<td>2</td>
</tr>
<tr>
<td>Engineering Judgment</td>
<td>2</td>
</tr>
<tr>
<td>Expert Panel</td>
<td>2</td>
</tr>
<tr>
<td>Resource Management</td>
<td>1</td>
</tr>
<tr>
<td>Alignment with National Goals</td>
<td>1</td>
</tr>
<tr>
<td>Engineering Analysis</td>
<td>1</td>
</tr>
<tr>
<td>General Accepted Standards</td>
<td>1</td>
</tr>
</tbody>
</table>

It is clear from the results that the majority of DOTs do not follow a scientific process in
setting targets. Rather, funding opportunities and constraints play significant roles in determining
how ambitious targets will be. The results from this question also reveal that methods for setting
targets vary depending on the type of targets being set. For instance, Maryland DOT’s overall
outcome targets are established by senior leadership while output targets are determined by
program managers based on funding levels. Furthermore, benchmarks have been used as a target
setting tool for several DOTs. Missouri DOT, for instance, prefers benchmarking to traditional
performance measurement because it has improved their performance relative to other states.
This preference is also shared by Texas DOT, which focuses on continuous improvement
towards a goal such as ‘zero fatality” rather than setting an absolute standard.

7. Top Management and Performance Information

The review of performance data by top management is important to help keep an organization on
track with respect to strategic goals and to reflect necessary policy and strategic changes in a
timely manner. For instance, Missouri DOT indicated that strategies and actions to improve
performance are worked on and implemented continually to show improved results in the next
period. Thirty two DOTs responded that top management does review performance data. With
the overwhelming majority of these, data is reviewed on a quarterly basis in meetings. However,
these meetings might merely include informal reviews of any performance information, regardless of whether they are tied to a strategic framework.

Annual, semi-annual and continuous reviews are also carried out in several DOTs. For instance, in Minnesota DOT, top staff convenes once a year (during the first quarter) to review performance data across the functional areas and make decisions about results. To manage the capital budget, DOT and District top staff meet once a year to review the actual and predicted results of their four- and 10-year program against statewide performance targets for safety, smooth pavements, bridge preservation, and travel speeds. Each official prepares a performance-based scenario that identifies total resource needs to meet performance targets, and a fiscally constrained scenario that identifies projects to be built with available revenues. In addition, managers at the division level receive updates of the performance data quarterly.

8. Asset Management
Asset Management is seen as an important program area by state DOTs, as demonstrated by their objectives. This may be due to the increasingly constrained funding situation in transportation, which requires better management of assets to reduce costs in the long run. Twenty-seven state DOTs responded that they have an asset management program in place, while the rest are in the process of developing one or did not respond. Most state DOTs use their asset management programs for monitoring and determining the conditions of highways and bridges. Other areas where it can be used are maintenance, traffic Level of Service and safety. While many DOTs have asset management programs, almost all of these indicate that their asset management programs are not integrated across divisions. For instance, Colorado DOT employs different programs for three different assets (pavement, bridges, and maintenance) and uses different software for managing each. Top managers allocate resources among the three areas based on their needs relative to performance targets.

It is important to note that most DOTs have realized that an integrated and unified asset management program is beneficial and many have started developing such a program. Vermont Agency of Transportation (VTrans) is one example of an agency that has a well developed asset management and performance based program that shifts the agency’s focus to preservation and maintenance by emphasizing preservation of existing assets rather than the construction of new highways (20). In addition, New Hampshire DOT, together with Vermont and Maine, has a tri-state, collaborative asset management program, demonstrating mature inter-jurisdictional cooperation.

SUMMARY AND CONCLUSIONS
This paper has explored current practices in performance measurement through 1) review of the literature on performance measurement in state DOTs and abroad, and 2) a survey of the current use of performance measurement, target setting and on asset management in DOTs.

From the literature review, it can be seen that performance measurement has had a long history of being used in state DOTs. In the last two decades, however, significant development has occurred with movement through a first, second and third generation of performance measurement systems, reflecting a maturing application of performance measurement principles. Today, performance measurement systems in transportation agencies are increasingly more strategically focused, and tied to the long term goals of the organization. Performance
measurement is also used in various program areas, such as asset management, and it is being used in other ways such as benchmarking.

Articulation of the relationship between strategic plans, transportation system plans, and performance measurement systems in general is needed (5). Recent efforts to better understand performance targets, however, suggest a promising future of development in this area of performance measurement.

Current DOT practices largely coincide with what would be expected based on the literature review. The survey results show that performance measurement is widely used among DOTs, and many agencies have successfully integrated their performance measurement practice with strategic planning. Several methods of organizing the performance measurement program are used in the US, but the study does not suggest that any one of these methods is best. Furthermore, benchmarking is observed to be an important method for setting performance targets, although target setting is still an informal process for several DOTs. Finally, the survey has shown that asset management is being viewed as an important area by most DOTs, although more integrated systems are needed.

These results signify that progress has been made in performance measurement for transportation in the US. However, some significant challenges remain. For instance, target setting practices are less mature in the US than in other countries such as the UK. The NCHRP scan of international practices provides some useful guidelines in this area (10). As agencies seek continued improvement, they can develop more systematic, data-driven targets, which also account for stakeholder and public priorities. They can ensure that targets and performance measures are closely linked to their strategic planning processes, and that they are integrated horizontally and vertically throughout the organization. On a strategic level, these developments can aid transportation agencies to be better prepared for the reauthorizing of the federal surface transportation legislation, and agencies will experience benefits such as increased public transparency and accountability as they improve performance measurement practices.

In the future, studies will be needed to follow up on the progress of strategic planning, performance measurement, target setting, and asset management in state DOTs. As methods vary, specific future research could include surveys and case studies to identify best practices that maximize the benefits of performance measurement relative to strategic goals, also known as performance-based planning.

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