

# Minnesota Statewide Freight System Plan

*Task 4.1 - Freight Performance Measures*

## draft report

*prepared for*

**Minnesota Department of Transportation**

*prepared by*

**Cambridge Systematics, Inc.**

*with*

SRF Consulting Group, Inc.  
Kimley-Horn and Associates, Inc.  
Leo Penne Consulting



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Cambridge Systematics, Inc.  
115 South LaSalle Street, Suite 2200  
Chicago, IL 60603

*with*

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Kimley-Horn and Associates, Inc.  
Leo Penne Consulting

*date*

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# 1.0 Introduction

The topic of performance measures for Minnesota’s freight transportation system was explored as part of *Task 4 – Project Development Guidance* of the Statewide Freight System Plan (Plan), as well as being the focus area for one of the Ad Hoc Working Groups developed as part of the planning process. The objective of Task 4 was to assess the condition and performance of Minnesota’s freight transportation system and to identify the critical needs, issues and opportunities of that system. Freight system performance measures are critical to accomplishing this task, as they allow measurement of key attributes of the system and comparison across geography and time. Establishing a baseline and/or goal, tracking progress or managing performance, and communicating results are all ways in which performance measures are an important part of the project development process.

The Minnesota Department of Transportation (MnDOT) has an active performance measurement program, and the intent of identifying performance measures as part of this task was to build on that program by identifying ways existing measures could be viewed through a “freight lens.” Another focus of performance measure development in this task was to help prepare MnDOT for the expected U.S. DOT rulemaking for freight-specific measures in Summer 2015.

The process of identifying freight performance measures employed an Ad Hoc Working Group comprised of performance measure experts from MnDOT and other agencies who were tasked to explore and converge on a set of recommended measures. These measures will move forward into the evaluation phase of this project, and also to move into broader consideration within MnDOT’s Office of Transportation System Management, and the *Annual Transportation Performance Report* that they produce.

This Tech Memo presents the importance of performance measures and how they may be used, discusses the process for recommended freight system performance measures and identifies those measures, identifies gaps and opportunities for MnDOT to enhance the freight performance measurement in the future, and briefly outlines next steps for implementing these freight system performance measures.



## 2.0 About Performance Measures

In recent years, the use of performance measures in the public sector has grown significantly, yet implementation still remains limited. The scope of performance measures and implementation approaches both vary between states and regions, especially in the area of freight performance measurement. This is due in part to the shared public- and private-sector roles in freight system and “good” data available to develop measures. This section provides background on the purposes of performance measures, expected MAP-21 guidance related to performance measures, and MnDOT’s current approach to tracking transportation (and freight) system performance.

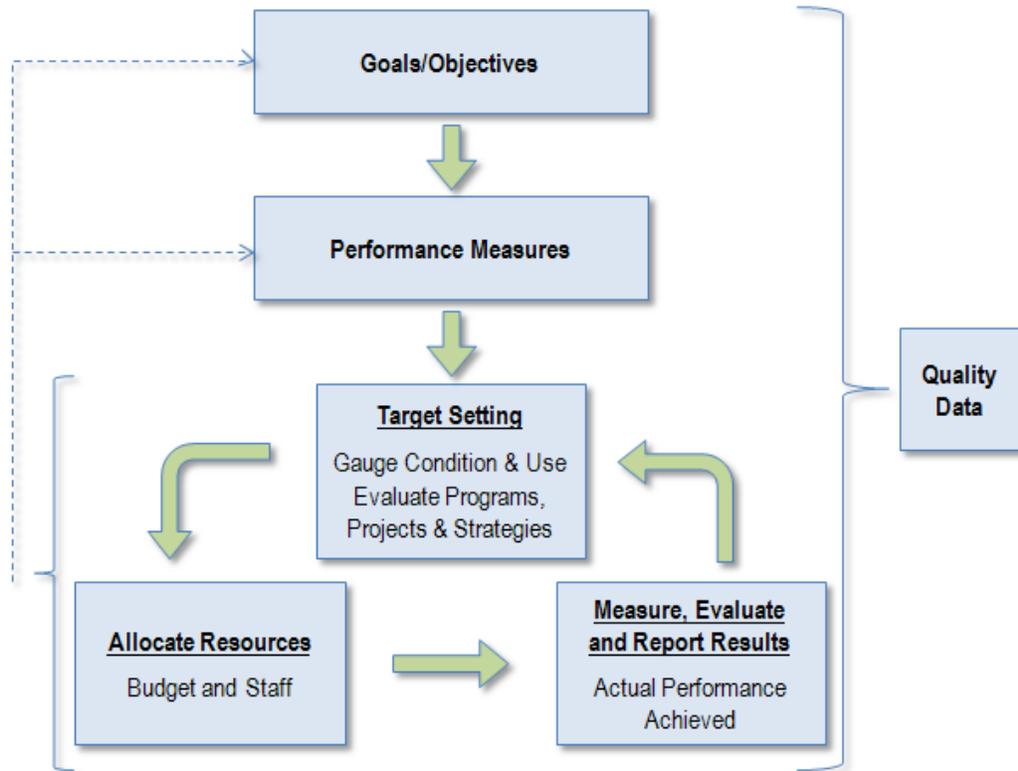
### 2.1 PURPOSE OF TRANSPORTATION SYSTEM PERFORMANCE MEASURES

The development and application of performance measures enable agencies to gauge system condition and use, evaluate transportation programs and projects, and help decision makers allocate limited resources more effectively than would otherwise be possible. These can be comprised of different individual types of measurement, such as output measures, outcome measures, indicators, or indices, but collectively are generally referred to as “performance measures.” Performance measures are typically applied for the following general purposes:

- **Linking Actions to Goals.** Performance measures can be developed and applied to help link plans and actions to MnDOT’s goals and objectives;
- **Prioritizing Projects.** Performance measures can provide information needed to invest in projects and programs that provide the greatest benefits;
- **Managing Performance.** Applying performance measures can improve the management and delivery of programs, projects, and services. The right performance measures can highlight the technical, administrative, and financial issues critical to governing the fundamentals of any program or project;
- **Communicating Results.** Performance measures can help communicate the value of public investments in transportation. They can provide a concrete way for stakeholders to see MnDOT’s commitment to improving the transportation system and help build support for transportation investments; and
- **Strengthening Accountability.** Performance measures can promote accountability with respect to the use of taxpayer resources. They reveal whether transportation investments are providing the expected performance or demonstrate need for improvement.

In order to best accomplish one or more of these general purposes, a comprehensive performance management process, illustrated in Figure 2.1, is part of the performance measure development process.

Figure 2.1 Performance-Based Planning and Programming Framework



Source: Cambridge Systematics

This iterative approach to performance-based planning is commonly comprised of six fundamental elements that include:

- **Setting Goals and Objectives.** An organization’s policy goals and objectives define agency priorities and provide the foundation for performance-based planning and management decisions;
- **Selecting Performance Measures.** Performance measures establish a set of metrics to help organizations gauge system condition and use monitor progress toward achieving a goal or objective;
- **Setting Performance Targets.** Establishing quantifiable targets for each performance measure allows agencies to gauge progress over time relative to a desired goal;
- **Allocating Resources.** An organization builds upon the preceding steps by allocating resources such as time and money through budgeting processes to achieve specific performance targets;

- **Measuring and Reporting Results.** Monitoring and reporting progress to decision-makers and other stakeholders allows organizations to identify key factors influencing performance and necessary actions to improve results; and
- **Data and Analysis Tools.** Effective decision-making through each element of the performance measurement framework requires a solid foundation of accurate, timely, and appropriate data.

While an agency may not have all elements of a comprehensive performance management process in place, most transportation agencies have incorporated at least one of the performance-based elements into their planning process, such as establishing overall agency goals and objectives.

## 2.2 MAP-21 PERFORMANCE MEASURE GUIDANCE

State and Federal transportation agencies have long used asset and performance management techniques to assess, measure, and gauge infrastructural and operational capabilities of their systems. Minnesota has been among the leaders in finding progressive and effective ways to apply performance measures to their system, however, each state tends to have individual interpretations as to how, if, and which performance measures should be incorporated into their planning and programming processes. While the approaches differ, agencies tend to measure the same basic physical and operational elements.

In an effort to incorporate uniformity in measures across states and regions and to emphasize a performance-based approach in applying the Federal Highway Program, the U.S. DOT, by way of Moving Ahead for Progress in the 21<sup>st</sup> Century (MAP-21) legislation, will propose performance measures across key management areas. This approach will incorporate performance management into Federal and state transportation programs, unify high-level national transportation goals, and link key measures to state and local funding opportunities, as shown in Figure 2.2.

Figure 2.2 Transportation Performance Management and MAP-21



Source: FHWA Transportation Performance Management

The performance measures, to be established by U.S. DOT, will be developed to align with the seven National Goals established as part of the MAP-21 legislation, which include:

- Safety
- Infrastructure Condition
- Congestion Reduction
- System Reliability
- Freight Movement and Economic Vitality
- Environmental Sustainability
- Reduced Project Delivery Delays

As shown, Freight Movement and Economic Vitality is a core goal area for U.S. DOT, but freight operations also touch and influence several other goal areas including safety and condition.

Rulemaking for the national performance measures is still in process (not all measures have been announced), but the following table provides an overview of the timeline of activities States and MPOs will need to prepare for once the rulemaking process has started.

Table 2.1 Performance Requirements Summary for Freight Movement

Performance Element	Performance Requirements for Freight Movement
Performance Measures	<ul style="list-style-type: none"> <li>• Not later than 18 months after date of enactment USDOT, in consultation with State DOTs, MPOs, and other stakeholders will promulgate a rulemaking that establishes measures.</li> <li>• Provide not less than 90 days to comment on regulation.</li> <li>• Take into consideration any comments.</li> <li>• Limit performance measures to those described under 23USC150(c).</li> <li>• USDOT will establish measures for States to use to assess freight movement on the Interstate system</li> </ul>
Performance Targets	<ul style="list-style-type: none"> <li>• States must coordinate, to the maximum extent practical with relevant MPOs in selecting a target to ensure for consistency</li> <li>• MPOs must coordinate, to the maximum extent practical, with the relevant State/s in selecting a target to ensure consistency</li> <li>• Coordination required with public transportation providers.</li> <li>• States and MPOs must integrate other performance plans into the performance-based process</li> </ul>
Performance Plans	State Freight Plan
Performance Reporting	<ul style="list-style-type: none"> <li>• State Report on Performance Progress <ul style="list-style-type: none"> <li>– Required initially by October 1, 2016 and every 2 years thereafter</li> <li>– Report includes: <ul style="list-style-type: none"> <li>» Performance of Interstate</li> <li>» Progress in achieving all State performance targets</li> <li>» Ways in which congestion bottlenecks in National Freight Plan are being addressed</li> </ul> </li> </ul> </li> <li>• Metropolitan System Performance Report <ul style="list-style-type: none"> <li>– Required in transportation plan every 4 or 5 years</li> <li>– Report includes: <ul style="list-style-type: none"> <li>» Evaluate condition and performance of transportation system</li> <li>» Progress achieved in meeting performance targets in comparison with the performance in previous reports</li> <li>» Evaluation of how preferred scenario has improved conditions and performance, where applicable</li> <li>» Evaluation of how local policies and investments have impacted costs necessary to achieve performance targets , where applicable</li> </ul> </li> </ul> </li> <li>• Statewide Transportation Plan <ul style="list-style-type: none"> <li>– No required frequency</li> <li>– Optional report on system performance</li> </ul> </li> </ul>

Source: FHWA, <http://www.fhwa.dot.gov/tpm/about/freight.cfm>, 03/05/2013.

## 2.3 AASHTO PERFORMANCE MEASURE RECOMMENDATIONS

The American Association of State Highway Transportation Officials (AASHTO) had an opportunity to inform FHWA’s rulemaking process by providing the U.S. DOT with a clear, defensible and unifying statement on each national-level performance measure. The AASHTO Standing Committee on Performance Management (SCOPM) created a Task Force on Performance Measure Development, Coordination and Reporting charged to “assist SCOPM and AASHTO to develop a limited number of national performance measures and help prepare AASHTO members to meet new Federal performance management requirements.” The Task Force recommended national-level performance measures in consult with AASHTO members with in-depth knowledge of the technical aspects of the individual performance measure areas.<sup>1</sup> The AASHTO recommendations, by performance area, are shown in the table below, and described in the following text.

**Table 2.2 AASHTO Recommended National-level Performance Measures**

Category	Expected Measure
Freight Movement and Economic Vitality	Annual Hours of Truck Delay (AHTD) Truck Reliability Index (RI80)
Safety	Number of Fatalities* Fatality Rate* Number of Serious Injuries* Serious Injury Rate*
Pavement Condition	Interstate Pavement in Good, Fair and Poor Condition based on the International Roughness Index (IRI)* Non-Interstate NHS Pavement in Good, Fair and Poor Condition based on the International Roughness Index (IRI)* Pavement Structural Health Index*
Bridge Condition	Percent of Deck Area on Structurally Deficient Bridges* NHS Bridges in Good, Fair and Poor Condition based on Deck Area*
System Performance	Annual Hours of Delay (AHD) Reliability Index (RI <sub>80</sub> )
Congestion Mitigation and Air Quality (CMAQ)	Criteria Pollutant Emissions Annual Hours of Delay (AHD)

Source: AASHTO SCOPM Task Force Findings on National-Level Performance Measures, 2012

\*Federal rulemaking has been announced

<sup>1</sup> AASHTO SCOPM Task Force Findings on National-Level Performance Measures, 2012

## Freight Movement and Economic Vitality

Freight movement and economic vitality measures are designed to improve the contribution of the freight transportation system through economic efficiency, productivity, and competitiveness. AASHTO recommended freight performance measures are:

- **Annual Hours of Truck Delay (AHTD).** Travel time above the congestion threshold in units of vehicle-hours for Trucks on the Interstate Highway System.
- **Truck Reliability Index (RI80).** The RI is defined as the ratio of the total truck travel time needed to ensure on-time arrival to the agency-determined threshold travel time (e.g., observed travel time or preferred travel time).

## Safety

Safety-related measures are designed to improve the safety, security, and resilience of the freight transportation system. AASHTO recommended safety performance measures are:

- **Number of Fatalities.** Five-year moving average of the count of the number of fatalities on all public roads for a calendar year.
- **Fatality Rate.** Five-year moving average of the Number of Fatalities divided by the Vehicle Miles Traveled (VMT) for a calendar year.
- **Number of Serious Injuries.** Five-year moving average of the count of the number of serious injuries on all public roads for a calendar year.
- **Serious Injury Rate.** Five-year moving average of the Number of Serious Injuries divided by the Vehicle Miles Traveled (VMT) for a calendar year.

## Pavement Condition

Pavement measures are designed to improve the state of good repair of the freight transportation system. AASHTO recommended pavement measures are:

- **Interstate Pavement in Good, Fair and Poor Condition based on the International Roughness Index (IRI).** Percentage of 0.1 mile segments of Interstate pavement mileage in good, fair and poor condition based on the following criteria: good if IRI<95, fair if IRI is between 95 and 170, and poor if IRI is greater than 170.
- **Non-Interstate NHS Pavement in Good, Fair and Poor Condition based on the International Roughness Index (IRI).** Percentage of .1 mile segments of non- Interstate NHS pavement mileage in good, fair and poor condition based on the following criteria: good if IRI<95, fair if IRI is between 95 and 170, and poor if IRI is greater than 170.
- **Pavement Structural Health Index.** Percentage of pavement which meet minimum criteria for pavement faulting, rutting and cracking.

## Bridge Condition

Bridge-related measures are designed to improve the state of good repair of the freight transportation system. AASHTO recommended bridge performance measures are:

- **Percent of Deck Area on Structurally Deficient Bridges.** NHS bridge deck area on structurally deficient bridges as a percentage of total NHS bridge deck area.
- **NHS Bridges in Good, Fair and Poor Condition based on Deck Area.** Percentage of National Highway System bridges in good, fair and poor condition, weighted by deck area.

## System Performance

System performance measures are designed to improve the contribution of the freight transportation system through economic efficiency, productivity, and competitiveness. AASHTO recommended system performance measures are:

- **Annual Hours of Delay (AHD).** Travel time above a congestion threshold (defined by State DOTs and MPOs) in units of vehicle -hours of delay on Interstate and NHS corridors.
- **Reliability Index (RI<sub>80</sub>).** The Reliability Index is defined as the ratio of the 80th percentile travel time to the agency-determined threshold travel time.

## Congestion Mitigation and Air Quality (CMAQ)

CMAQ performance measures relate to reducing congestion and adverse environmental and community impacts of the freight transportation system. AASHTO recommended system performance measures are:

- **Criteria Pollutant Emissions.** Daily kilograms of on-road, mobile source criteria air pollutants (VOC, NO<sub>x</sub>, PM, CO) reduced by the latest annual program of CMAQ projects.
- **Annual Hours of Delay (AHD).** Travel time above a congestion threshold (defined by State DOTs and MPOs) in units of vehicle-hours of delay reduced by the latest annual program of CMAQ projects.

## 2.4 MNDOT'S TRANSPORTATION SYSTEM PERFORMANCE MEASURES

MnDOT's Office of Transportation System Management, currently collects and compiles data from a multitude of departments within the agency to present measures across ten performance categories, in concert with objectives laid out in the Minnesota Statewide Multimodal Transportation Plan.

Of MnDOT's ten performance categories, one category is specifically devoted to freight and six others provide a link to freight performance. Specifically, MnDOT's current categories that are directly and tangentially related to freight performance measure categories are as follows:

- **Accountability, Transparency, & Communication.** MnDOT links this category to the Minnesota GO objective of making transportation system decisions through processes that are open and supported by data analysis; providing for and supporting coordination, collaboration and innovation; and ensuring efficient and effective use of resources. The key metric for this measure is citizen surveys based on MnDOT's approval rating.
- **Traveler Safety.** MnDOT links this category to the Minnesota GO objective of systematically and holistically improving safety for all forms of transportation. Being proactive, innovative and strategic in creating safe options. Key metrics for traveler safety involve detailed statistics for crash, injury, and fatalities and their respective rates across all modes. Causes of severe crashes are also reported and monitored.
- **Asset Management.** MnDOT links this category to the Minnesota GO objective of strategically maintaining and operating transportation assets; relying on system data, partners' needs and public expectations to inform decisions; putting technology and innovation to work to improve efficiency and performance; and recognizing that the system should change over time. Key metrics for asset management include pavement and bridge measures on the state's highway system. Pavement is measured by "Ride Quality", and bridges are measured by deck condition.

State highway operations, freight, and air transportation all relate to MnDOT's objective of identifying global, national, statewide, regional, and local transportation connections essential for Minnesotans' prosperity and quality of life; maintaining and improving these connections by maximizing return on investment; and considering new connections.

- **State Highway Operations.** Key highway operation metrics focus on congestion, travel speeds, and snow and ice control. This category provides focus both at the statewide level and in the metro area.
- **Freight.** Current freight metrics highlight detailed mode share data, based on tonnage and value, using the most recent Federal Highway Administration; Freight Analysis Framework, version 3 dataset. The section also includes Heavy Commercial Average Annual Traffic (HCAADT) by corridor, annual rail shipments based, annual container lifts at Twin Cities intermodal yards, and annual port shipment tonnage.
- **Air Transportation.** Current air transportation metrics focus on passenger-related performance, including seat miles and revenue passenger miles. Runway pavement is also monitored. From a freight perspective, MnDOT does not currently highlight air cargo performance measures.

- **Transportation in Context.** MnDOT links this category to the Minnesota GO objective of making fiscally responsible decisions that respect and complement the natural, cultural and social context; and integrating land uses and transportation systems to leverage public and private investment. This category also aligns with the GO strategy of working together to support and implement both system-wide and project specific approaches to avoid, minimize and mitigate adverse impacts to Minnesota’s natural and cultural resources.

## Annual Performance Report

Annually, MnDOT provides a reporting of their assessment of the performance of Minnesota’s multimodal transportation system. The most recent report, the *2012 Annual Performance Report*, is the second report MnDOT has developed since the adoption of MAP-21. Included in the report are two asset management measures – share of Interstates with Poor ride quality and share of non-Interstate NHS with Poor ride quality – which were developed by MnDOT in anticipation of MAP-21 requirements. Future performance reports will likely be expanded to include additional MAP-21 measures in the areas of system reliability and freight movement.

Figure 2.3 presents “The Minnesota 2012 Transportation Results Scorecard” which shows the 17 key performance measures found in the *2012 Annual Performance Report* that MnDOT uses to evaluate system progress. As noted in the report, MnDOT has primary responsibility for the measures highlighted by the MnDOT logo in the far right column. Measures with performance targets have a green, yellow or red symbol showing results. MnDOT uses performance targets to calculate needed investment levels, stimulate innovation and guide decision-making. These targets are set through public planning processes that incorporate numerous factors, including engineering standards and other technical criteria, historical experience and assessments of stakeholder expectations. In a few select cases, the scorecard includes a short description of a measure’s outlook. This is done for measures that MnDOT can predict future performance based on planned investment and well-founded assumptions about factors such as deterioration curves and future usage.<sup>2</sup>

While a freight indicator (i.e., freight mode share) is represented in the scorecard, the level of detail is generally insufficient to base freight investment decisions on, unlike other categories where performance measures are provided in the scorecard.

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<sup>2</sup> Annual Transportation Performance Report, MnDOT, 2012

Figure 2.3 Minnesota 2012 Transportation Results Scorecard

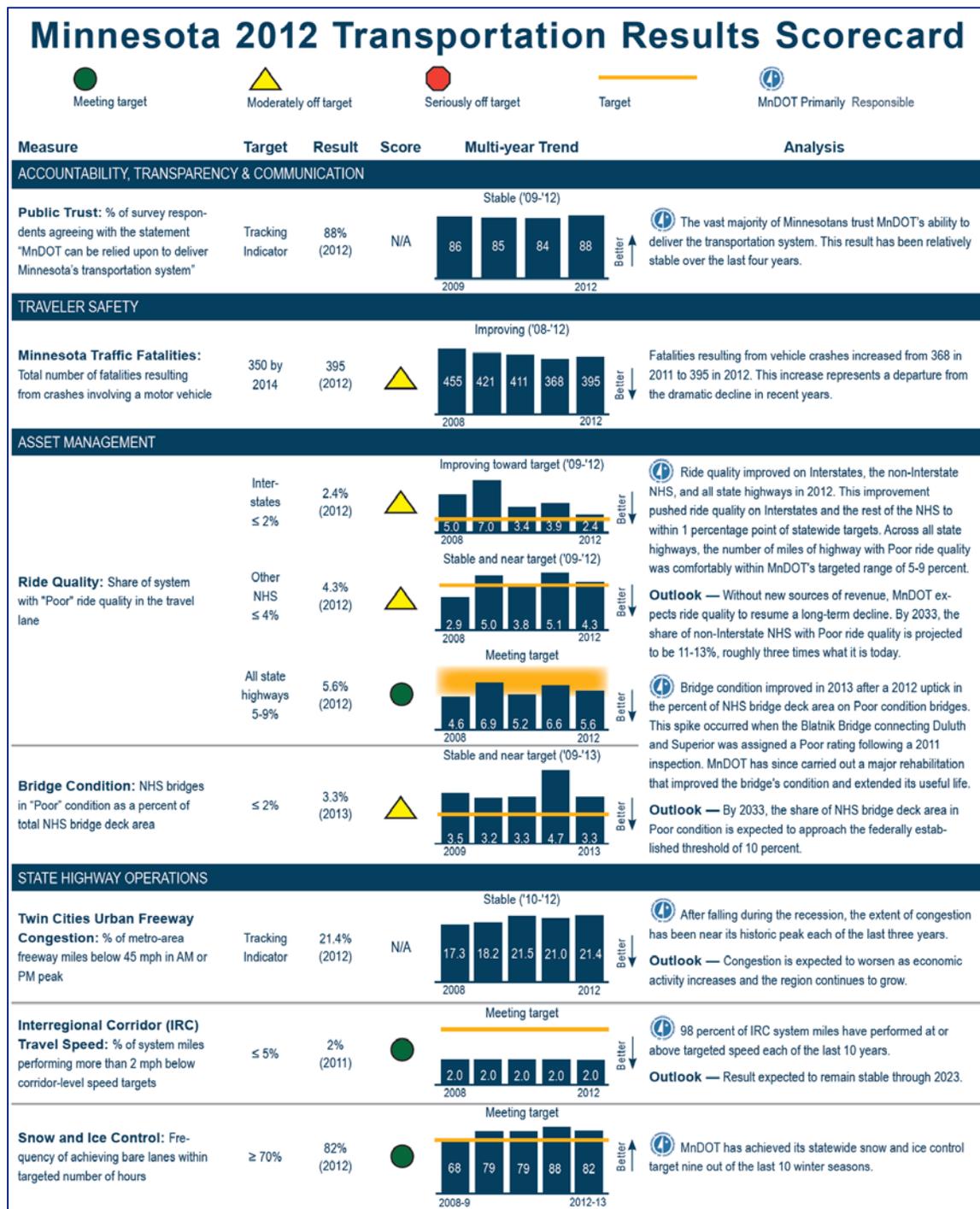
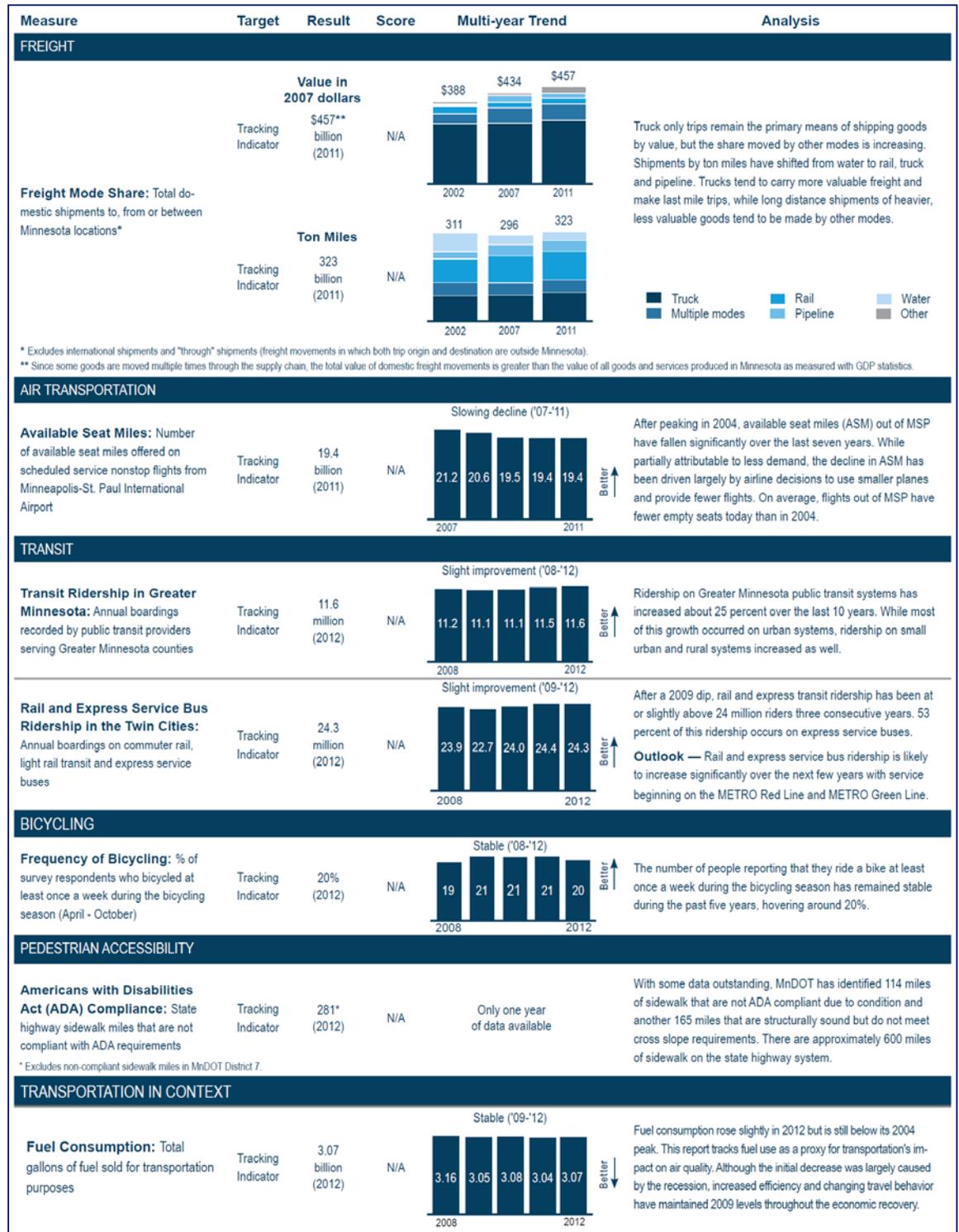


Figure 2.3 Minnesota 2012 Transportation Results Scorecard (con't)



Source: Annual Transportation Performance Report, MnDOT, 2012

## 3.0 Freight System Performance Measures

This section describes the process that was undertaken to engage a wide cross section of MnDOT and other planning interests on the topic of freight performance measures, and to better link MnDOT's current approach to tracking system performance, to what is expected to be required by U.S. DOT through MAP-21.

### 3.1 FREIGHT PERFORMANCE MEASURE DEVELOPMENT PROCESS

An Ad Hoc Working Group was assembled to help bring focus to the topic of freight performance measures during Plan development. This topic was selected to receive special attention for several reasons, described in the previous sections and summarized below:

- **MAP-21 Transportation Legislation.** MAP-21 requires the U.S. DOT to identify national-level performance measures for various performance management areas including freight. These performance measures will be required to be implemented by State DOTs.
- **MnDOT is active in performance measurement.** MnDOT publishes the *Annual Performance Report* and has a well-developed, established set of measures. It is expected that MnDOT will want to be active in meeting the MAP-21 requirements when the Notice of Proposed Rulemaking is released.
- **Improved tracking of freight activity.** While MnDOT has an aggressive performance measures program, the lens through which freight is examined is not as robust as other areas (e.g. state highway operations), in part due to historic federal requirements (or lack thereof), but also the lack of available data with which to track freight system activity.

Keeping these future opportunities and requirements in mind, the group reviewed and discussed current research and reports relevant to performance measurement, reviewed data provided by the consultant team and MnDOT, identified data gaps/deficiencies, and developed recommendations for freight performance measures to aid MnDOT in assessing the existing condition and performance of freight system (focusing on the highway system).

Key participants in the Performance Measures Ad Hoc Working Group were "implementers" within MnDOT that will be requested to follow through and act

upon Plan recommendations. Members of the group are shown in the following table.

**Table 3.1 Performance Measure Ad Hoc Working Group Membership**

Name	Affiliation	Title
John Tompkins	MnDOT Central Office	OFCVO - Freight Project Manager
Tim Spencer	MnDOT Central Office	OFCVO – Rail & Freight Director
Dave Christianson	MnDOT Central Office	OFCVO – Rail & Freight Planner
Peter Dahlberg	MnDOT Central Office	OFCVO – Rail & Freight Planner
Patrick Phenow	MnDOT Central Office	OFCVO – Ports & Waterways
Brad Estochen	MnDOT Central Office	Safety Engineer
Jason Junge	MnDOT Central Office	OTSM – Performance Analysis
Jonathan Mason	MnDOT District 3	District Planner
Rhonda Allis	MnDOT District 7	District Planner
Karen Scheffling	MnDOT Metro Division	District Planner
Mark Filipi	MetCouncil	Performance Analysis

### **3.2 LINKING MNDOT PERFORMANCE MEASURES TO EXPECTED U.S. DOT PERFORMANCE MEASURES**

One of the first activities of the Performance Measures Ad Hoc Working Group was to conduct an assessment of how closely MnDOT’s existing performance measures relate to those expected to be required by U.S DOT under MAP-21.<sup>3</sup> As shown in Table 3.2, there is a substantial amount of overlap between expected MAP-21 performance measures and the measures that MnDOT already actively manages.

Also included in Table 3.2 is an indication of the “type” of the measure, i.e., the aspect of system performance that the measure attempts to capture. Typical freight performance measure types include:

- Demand
- Mobility
- Infrastructure Condition
- Safety

<sup>3</sup> This report assumes that AASHTO recommended performance measures described in Section 2.0 will be the measures U.S. DOT requires.

- Environment
- Economy

Demand and economy are oftentimes outside the domain of a State DOT's data collection programs, and performance measures of these types may be difficult to track and maintain. The term performance "measure" implies that the data can be monitored and improved with specific strategies; the term performance "indicator" reflects data that can be monitored, but is more representative of current conditions and activity. As such, demand and economy performance types are usually reflected as performance "indicators" by State DOTs.

**Table 3.2 Linking MnDOT Performance Measures to Expected U.S. DOT Performance Measures**

Category	Type	Expected Measure	Existing MnDOT Measure?
<b>Freight Movement and Economic Vitality</b>	Mobility	<i>Annual Hours of Truck Delay (AHTD)</i>	<i>N</i>
	Mobility	<i>Truck Reliability Index (RI80)</i>	<i>N</i>
<b>Safety</b>	Safety	Number of Fatalities	Y
	Safety	Fatality Rate	Y
	Safety	Number of Serious Injuries	Y
	Safety	Serious Injury Rate	Y
<b>Pavement Condition</b>	Infrastructure Condition	Interstate Pavement in Good, Fair and Poor Condition based on the International Roughness Index (IRI)	Y
	Infrastructure Condition	Non-Interstate NHS Pavement in Good, Fair and Poor Condition based on the International Roughness Index (IRI)	Y
	Infrastructure Condition	Pavement Structural Health Index	Y
<b>Bridge Condition</b>	Infrastructure Condition	Percent of Deck Area on Structurally Deficient Bridges	Y
	Infrastructure Condition	NHS Bridges in Good, Fair and Poor Condition based on Deck Area	Y
<b>System Performance</b>	Mobility	<i>Annual Hours of Delay (AHD)</i>	<i>N</i>
	Mobility	<i>Reliability Index (RI<sub>80</sub>)</i>	<i>N</i>
<b>Congestion Mitigation and Air Quality (CMAQ)</b>	Environment	<i>Criteria Pollutant Emissions</i>	<i>N</i>
	Environment	<i>Annual Hours of Delay (AHD)</i>	<i>N</i>

Source: AASHTO SCOPM Task Force Findings on National-Level Performance Measures, 2012; Annual Transportation Performance Report, MnDOT, 2012

Note: Italics indicate not an existing MnDOT measure

A second activity the group undertook was to examine all other existing MnDOT performance measures and metrics to better understand:

- Other freight-related measures/indicators MnDOT tracks,
- Non-freight measures/indicators that could be viewed through a “freight lens,” and
- Gaps in freight-related measures/indicators.

This was an important step, as one of the goals of this effort is to build on what MnDOT already does, and to not introduce significant new measures that would detract from MnDOT’s already successful performance measurement program.

The concept of the “freight lens” was introduced to the discussion to reflect that by parsing out routes or roadway segments where freight activity is high (e.g., on the designated Minnesota Principal Freight Network), a better understanding of system condition and performance for freight may be understood (as compared to application of the measure at the state-level or to all roadways/facilities).

The following sections describe the freight system performance measures recommended by the Performance Measures Working Group, as well as gaps identified by the group that could be addressed in the long-term.

### **3.3 RECOMMENDED FREIGHT SYSTEM PERFORMANCE MEASURES**

The recommended performance measures presented in this section have been organized to align with expected categories defined by AASHTO, and presented in Section 2.0:

- Freight Movement and Economic Vitality,
- Safety,
- Pavement Condition, and
- Bridge Condition.

Early on, the Performance Measure Ad Hoc Working Group determined that within these categories MnDOT should focus on developing measures that help them 1) understand the system through a “freight lens,” and 2) build freight performance measures around what MnDOT currently tracks. Although System Performance and Congestion Mitigation and Air Quality (CMAQ) are categories recommended by AASHTO, they were not included in the recommendations. System Performance was not included due to the fact that the measures recommended by AASHTO are similar to those in the Freight Movement and Economic Vitality, only not freight specific. Additionally, the recommended measures in this category are not currently tracked by MnDOT. CMAQ was not included due to the fact that the AASHTO recommended measures are not currently tracked by MnDOT.

The following sections include tables that further describe the recommended performance measures. These tables present the recommended performance measures, a description of the data available to calculate the measure, the office within MnDOT that is responsible for the data, the current data reporting schedule, and whether the data can be scaled to a corridor or has spatial attributes.

The ability of the data to be presented at varying levels of detail is critical to looking at the transportation system through the “freight lens.” The group discussed the following levels of performance reporting:

- **Statewide.** This level of reporting provides a snapshot of the measures for all portions of the state system, in aggregate. Much of Minnesota’s Transportation Results Scorecard presents data for the entire state system in this way (as shown in Figure 2.3).
- **Minnesota Principal Freight Network.** During Plan development Minnesota’s Principal Freight Network was identified. This network is comprised of road, rail, water, air and pipeline assets that carry the highest volumes of freight and are principal points of freight activity in the state. This is a subset of the total statewide network.
- **Other Corridors.** In some cases, there may be interest in the condition and performance of individual roadways segments and corridors. This yet a finer subset of the total statewide network than the Minnesota Principal Freight Network.

If data are able to be presented at a finer level of detail than “statewide,” this is indicated in the “scalable to corridor level” column in the tables that follow.

Note, while this is a multimodal freight plan, the historic focus of MnDOT and FHWA related to performance measurement has been the highway system. Hence, most measures identified below apply to the highway system.

## Freight Movement and Economic Vitality

Freight Movement and Economic Vitality measures are designed to improve the contribution of the freight transportation system through economic efficiency, productivity, and competitiveness. Two performance measures are recommended for MnDOT in the Freight Movement and Economic Vitality category:

- **Annual Hours of Truck Delay (AHTD)**
- **Truck Reliability Index (RI80)**

These are the measures expected to be required by U.S. DOT, based on AASHTO recommendations. These measures can be evaluated using the National Performance Management Research Data Set (NPMRDS), which is a new Federally-sponsored passenger and freight probe data set that represents a dramatic improvement over previous attempts at measuring traffic speeds and

congestion. While coverage and sample size details are still being refined, it appears that U.S. DOT intends for agencies to have a reliable resource to support performance management and planning. Implementation of these performance measures is dependent on U.S. DOT providing to State DOTs and MPOs private sector speed data and vehicle miles traveled data from HPMS volume data and the respective analysis tools. U.S. DOT must provide processed traffic data in a “ready to use format” that can be readily integrated with other existing datasets in a state (traffic volume, number of lanes, roadway type, etc.).<sup>4</sup> Currently, MnDOT has access to the subscription-based NPMRDS dataset, but is awaiting final U.S. DOT rulemaking before incorporating it into analysis processes.

Some of the freight information represented in the state’s annual performance report can be more accurately categorized as performance indicators, not performance measures. The majority of freight information currently reported falls in the indicator category as they represent freight data points that are representative of economic activity and mobility trends in the state. MnDOT maintains mode-specific indicators for railroads, waterway, and intermodal operations in the state, and also reports mode-share information based on the most-recent FHWA FAF database as a means of capturing statewide freight trends based on tonnage and value.

The recommend performance indicators in the Freight Movement and Economic Vitality category are:

- **Total domestic shipments to, from or between Minnesota locations**
- **Freight Mode Share in Minnesota (tons)**
- **Freight Mode Share in Minnesota (value)**
- **Freight Mode Share in Minnesota (ton-miles)**
- **Heavy Commercial Vehicle Miles Traveled (HCVMT)**
- **Heavy Commercial Average Annual Daily Traffic (HCAADT) by Corridor**
- **Annual Rail Shipments in Minnesota (in millions of tons)**
- **Annual Container Lifts in Twin Cities intermodal yards (in thousands)**
- **Annual Port Shipment Tonnage (in millions of tons)**

All of these are currently tracked by MnDOT. More detail on all of the Freight Movement and Economic Vitality recommendations can be found in Table 3.3.

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<sup>4</sup> AASHTO SCOPM MAP-21 Notice of Proposed Rule-Making Checklist (Freight)

Table 3.3 Recommended Freight Movement and Economic Vitality Performance Measures and Indicators

Recommended Measure/Indicator	Type	Data Availability and Description	Mode(s) Incl'd*	Originating MnDOT Office	Current Reporting Schedule	Scalable to Corridor Level	Spatial Attributes ?
<b>Performance Measures</b>							
<b>Annual Hours of Truck Delay (AHTD)</b>	Mobility	The National Performance Management Research Data Set (NPMRDS) is the intended source for AHTD data. MnDOT currently has a access to the dataset but is awaiting final FHWA requirements before implementing NPMRDS analysis in performance measure reporting. The dataset will likely be richer for the metro areas of the state.	T	Office of Performance Measures and Investment Analysis (OPM)	Data is updated monthly	Yes	Yes
<b>Truck Reliability Index (RI80)</b>	Mobility	The National Performance Management Research Data Set (NPMRDS) is the intended source for truck reliability data. MnDOT currently has a access to the dataset but is awaiting final FHWA requirements before implementing NPMRDS analysis in performance measure reporting. The dataset will likely be richer for the metro areas of the state.	T	OPM	Data is updated monthly	Yes	Yes
<b>Performance Indicators</b>							
<b>Total domestic shipments to, from or between Minnesota locations</b>	Demand, Economy	FHWA Freight Analysis Framework (FAF)-based data, measured in value and ton-miles, updated intermittently. Excludes international shipments and "through" shipments.	T, R, W, A,P	Office of Freight & Commercial Vehicle Operations (OFCVO)	Data updated annually, projections updated in 5-year increments	No	Yes
<b>Freight Mode Share in Minnesota (tons)</b>	Demand, Economy	Freight Analysis Framework (FAF)-based data supplied by the MnDOT Office of Freight and Commercial Vehicle Operations. Reported by <i>tons</i> , 2002-2011	T, R, W, A,P	OFCVO	Data updated annually, projections updated in 5-year increments	No	Yes
<b>Freight Mode Share in Minnesota (value)</b>	Demand, Economy	Freight Analysis Framework (FAF)-based data supplied by the MnDOT Office of Freight and Commercial Vehicle Operations. Reported by <i>value</i> , 2002-2011	T, R, W, A,P	OFCVO	Data updated annually, projections updated in 5-year increments	No	Yes

Recommended Measure/Indicator	Type	Data Availability and Description	Mode(s) Incl'd*	Originating MnDOT Office	Current Reporting Schedule	Scalable to Corridor Level	Spatial Attributes ?
Freight Mode Share in Minnesota (ton-miles)	Demand, Economy	Freight Analysis Framework (FAF)-based data supplied by the MnDOT Office of Freight and Commercial Vehicle Operations. Reported by <i>ton miles</i> , 2002-2011	T, R	OFCVO		No	Yes
Heavy Commercial Vehicle Miles Traveled (HCVMT)	Demand, Economy	Commercial vehicle miles traveled on the Minnesota State Highway System (in billions). A product of automatic traffic recorder (ATRs), and road cost user studies.	T	Office of Transportation Data & Analysis (OTDA)	Annually, July/August	Yes	Yes
Heavy Commercial Average Annual Daily Traffic (HCAADT) by Corridor	Demand, Economy	Commercial vehicle miles traveled on the Minnesota State Highway System (in billions). A product of automatic traffic recorder (ATRs), and road cost user studies.	T	OTDA	Annually, July/August	Yes	Yes
Annual Rail Shipments in Minnesota (in millions of tons)	Demand, Economy	Currently collected by MnDOT staff for Annual Performance Report. Also available from annual STB waybill sample (more precise) or FAF database. Requires STB approval.	R	OFCVO	Annually, varies	Yes	Yes
Annual Container Lifts in Twin Cities intermodal yards (in thousands)	Demand, Economy	Currently obtained by MnDOT staff from facility operators. Also available from annual STB waybill sample analysis. Requires STB approval.	R	OFCVO	Annually, varies	N/A	N/A
Annual Port Shipment Tonnage (in millions of tons)	Demand, Economy	Currently obtained by MnDOT Ports and Waterways staff for Annual Performance Report	W	OFCVO	Annually	N/A	N/A

\*Modes – Truck (T), Rail (R), Water (W), Air (A), Pipeline (P)

## **Safety**

Safety-related measures are designed to improve the safety, security, and resilience of the freight transportation system. Four performance measures are recommended in the Safety category:

- **Number of Fatalities**
- **Fatality Rate**
- **Number of Serious Injuries**
- **Serious Injury Rate**
- **Incidents at Highway/Railroad Crossings**
- **Severe Crashes Involving Trucks**

MnDOT currently tracks the first five performance measures. The Performance Measures Working Group identified Severe Crashes Involving Trucks as a key freight measure to add. Crash reports currently include a 'flag' for crashes involving trucks and while it is not currently reported, it can be extracted from the existing crash database system.

More detail on the recommended performance measures can be found in Table 3.4.

Table 3.4 Recommended Safety Performance Measures

Recommended Measure	Type	Data Availability and Description	Mode(s) Incl'd*	Originating MnDOT Office	Current Reporting Schedule	Scalable to Corridor Level	Spatial Attributes?
<b>Number of Fatalities</b>	Safety, Environment, Community	MnDOT currently tracks the total number of fatalities resulting from crashes involving a motor vehicle, maintained by MnDOT Office of Traffic, Safety and Technology	T	Office of Traffic, Safety and Technology (OTST)	Annually, May	Yes	Requires cross-referencing
<b>Fatality Rate</b>	Safety, Environment, Community	MnDOT currently tracks the traffic fatality rate on all Minnesota roads (per 100 million VMT)	T	OTST	Annually, May	Yes	Requires cross-referencing
<b>Number of Serious Injuries</b>	Safety, Environment, Community	MnDOT currently tracks serious traffic injuries on all Minnesota roads	T	OTST	Annually, May	Yes	Requires cross-referencing
<b>Serious Injury Rate</b>	Safety, Environment, Community	MnDOT currently tracks the traffic injury rate on all Minnesota roads (per 100 million VMT)	T	OTST	Annually, May	Yes	Requires cross-referencing
<b>Severe Crashes Involving Trucks</b>	Safety, Environment, Community	MnDOT has the ability to extract severe crashes involving trucks from the crash database	T	OTST	N/A	Yes	Requires cross-referencing
<b>Incidents at Highway/Railroad Crossings</b>	Safety, Environment, Community	MnDOT extracts crossing incident data from the Federal Railroad Administration (FRA) crossing database	T, R	OFCVO	N/A	Yes	Requires cross-referencing

\*Modes – Truck (T), Rail (R), Water (W), Air (A), Pipeline (P)

## **Pavement Condition**

Pavement measures are designed to improve the state of good repair of the freight transportation system. Three performance measures are recommended in the Pavement Condition category:

- **Interstate Pavement in Good, Fair and Poor Condition based on the International Roughness Index (IRI)**
- **Non-Interstate NHS Pavement in Good, Fair and Poor Condition based on the International Roughness Index (IRI)**
- **Pavement Structural Health Index**

MnDOT doesn't technically currently track the first two performance measures, although similar data is tracked. It is expected recommended pavement measures will be based on the International Roughness Index (IRI), while MnDOT currently measures the "Ride Quality Index." While the systems and terminology differs, MnDOT's index is a conversion from the IRI data, therefore, the data is available within the agency.

More detail on the recommended performance measures can be found in Table 3.5.

## **Bridge Condition**

Bridge-related measures are designed to improve the state of good repair of the freight transportation system. Two performance measures are recommended in the Bridge Condition category:

- **Percent of Deck Area on Structurally Deficient Bridges**
- **NHS Bridges in Good, Fair, and Poor Condition**

MnDOT currently tracks both of these measures. MnDOT conducts regular, bi-annual inspections on the state's more than 4,500 bridges to assess the condition of their decks, superstructures and substructures.

More detail on the recommended performance measures can be found in Table 3.6.

Table 3.5 Recommended Pavement Condition Measures

Recommended Measure	Type	Data Availability and Description	Mode(s) Incl'd*	Originating MnDOT Office	Current Reporting Schedule	Scalable to Corridor Level	Spatial Attributes?
<b>Interstate Pavement in Good, Fair and Poor Condition based on the International Roughness Index (IRI)</b>	Infrastructure Condition	IRI data is currently collected, but not reported as MnDOT favors the "Ride Quality" Index, which is a function of collected Roughness Data.	T	Office of Materials & Road Research (OMRR)	Annually, February	Yes	Requires cross-referencing
<b>Non-Interstate NHS Pavement in Good, Fair and Poor Condition based on the International Roughness Index (IRI)</b>	Infrastructure Condition	IRI data is currently collected, but not reported as MnDOT favors the "Ride Quality" Index, which is a function of collected Roughness Data.	T	OMRR	Annually, February	Yes	Requires cross-referencing
<b>Pavement Structural Health Index</b>	Infrastructure Condition	MnDOT currently measures ride quality on the Interstate system, the non-Interstate National Highway System and on all state highways, and tracks percentage of highways with poor ride quality.	T	OMRR	Annually, February	Yes	Requires cross-referencing

\*Modes – Truck (T), Rail (R), Water (W), Air (A), Pipeline (P)

Table 3.6 Recommended Bridge Condition Performance Measures

Recommended Measure	Type	Data Availability and Description	Mode(s) Incl'd*	Originating MnDOT Office	Current Reporting Schedule	Scalable to Corridor Level	Spatial Attributes?
Percent of Deck Area on Structurally Deficient Bridges	Infrastructure Condition	MnDOT currently measures Bridge condition is calculated from the results of inspections performed at least every two years on all state highway bridges.	T	Bridge Office	Annually, February	Yes	Requires cross-referencing
NHS Bridges in Good, Fair and Poor Condition based on Deck Area	Infrastructure Condition	MnDOT currently measures Bridge condition is calculated from the results of inspections performed at least every two years on all state highway bridges.	T	Bridge Office	Annually, February	Yes	Requires cross-referencing

\*Modes – Truck (T), Rail (R), Water (W), Air (A), Pipeline (P)



## Summary of Recommended Freight System Performance Measures and Indicators

Tables 3.7 and 3.8 present a summary of the recommended performance measures and indicators described in this section.

**Table 3.7 Summary of Recommended Freight System Performance Measures**

Recommended Measures	Type	Mode(s) Included	Existing MnDOT Measure?
<b>FREIGHT MOVEMENT AND ECONOMIC VITALITY</b>			
Annual Hours of Truck Delay (AHTD)	Mobility	T	
Truck Reliability Index (RI80)	Mobility	T	
<b>SAFETY</b>			
Number of Fatalities	Safety, Environment, Community	T	X
Fatality Rate	Safety, Environment, Community	T	X
Number of Serious Injuries	Safety, Environment, Community	T	X
Serious Injury Rate	Safety, Environment, Community	T	X
Severe Crashes Involving Trucks	Safety, Environment, Community	T	
Incidents at Highway/Railroad Crossings	Safety, Environment, Community	T, R	X
<b>PAVEMENT CONDITION</b>			
Interstate Pavement in Good, Fair and Poor Condition based on the International Roughness Index (IRI)	Infrastructure Condition	T	X
Non-Interstate NHS Pavement in Good, Fair and Poor Condition based on the International Roughness Index (IRI)	Infrastructure Condition	T	X
Pavement Structural Health Index	Infrastructure Condition	T	X
<b>BRIDGE CONDITION</b>			
Percent of Deck Area on Structurally Deficient Bridges	Infrastructure Condition	T	X
NHS Bridges in Good, Fair and Poor Condition based on Deck Area	Infrastructure Condition	T	X

**Table 3.8 Summary of Recommended Freight System Performance Indicators**

Recommended Indicator	Type	Mode(s) Included	Existing MnDOT Measure?
<b>FREIGHT MOVEMENT AND ECONOMIC VITALITY</b>			
Total domestic shipments to, from or between Minnesota locations	Demand, Economy	T, R, W, A,P	X
Freight Mode Share in Minnesota (tons)	Demand, Economy	T, R, W, A,P	X
Freight Mode Share in Minnesota (value)	Demand, Economy	T, R, W, A,P	X
Freight Mode Share in Minnesota (ton miles)	Demand, Economy	T, R	X
Heavy Commercial Vehicle Miles Traveled (HCVMT)	Demand, Economy	T	X
Heavy Commercial Average Annual Daily Traffic (HCAADT) by Corridor	Demand, Economy	T	X
Annual Rail Shipments in Minnesota (in millions of tons)	Demand, Economy	R	X
Annual Container Lifts in Twin Cities intermodal yards (in thousands)	Demand, Economy	R	X
Annual Port Shipment Tonnage (in millions of tons)	Demand, Economy	W	X

\*Modes – Truck (T), Rail (R), Water (W), Air (A), Pipeline (P)

## 3.4 GAPS AND OPPORTUNITIES

As shown in the previous section, a robust list of performance measures/indicators that builds on what MnDOT already tracks, and aligns with expected U.S. DOT recommendations has been formed. However, in collaborating with the Performance Measures Ad Hoc Working Group, a number of gaps and opportunities for further enhancing performance measurement efforts were identified.

MnDOT monitors a number of useful metrics for freight-related purposes, particularly related to the highway systems physical infrastructure – bridges and pavement. There is also a wealth of critical safety data collected. However neither of these categories are focused on freight-specific needs. Throughout all categories of measurement there was interest in having a truly multimodal set of freight system performance measures in the future, to better reflect needs and issues on the non-highway portions of the system.

The following subsections provide some snapshot gaps/opportunities that MnDOT may want to consider tracking in the future, as resources are available to do so.

### Freight Movement and Economic Vitality

The Freight Movement and Economic Vitality category presents the most opportunity, as the current freight data largely reflects system demand and freight economic trends, which are generally not in concert with measuring how the freight system is performing. Additional measures MnDOT may consider in the future include:

- **Metro-area specific freight performance measures.** The Metro-area has a substantial amount of freight activity – both related to production and consumption – as well as the benefit of additional data and information resources that could support specific and localized performance measures. Most performance measures recommend could be calculated to show (and compare to the State) in the metro-area. Recent research by the University of Minnesota could provide a basis for this.
- **Economic competitiveness of freight infrastructure.** The Working Group discussions revealed that current freight measures are more measures of freight demand than performance. One suggested approach was to identify metrics that accurately measure economic aspects of the state’s freight transportation system, such as economic competitiveness of freight services, and “lane competitiveness” for freight shippers to access various markets.
- **Corridor-specific and connector-specific data focus areas.** There are a number of opportunities to drill-down the recommended performance measures and highlight how specific corridors and key connectors are performing as components of the freight system. The majority of data across

the freight, safety, pavement, and bridge categories is scalable with little to moderate data processing for this purpose.

- **Refine rail data.** Current rail shipment information is based on American Association of Railroads (AAR) data and is at a statewide level. An annual or bi-annual request for the Surface Transportation Board Waybill Sample would allow for a more granular perspective on goods movement trends on railways in the state.
- **Compile air cargo data.** In addition to MSP, Minnesota has multiple airports that handle air cargo and are also part of the freight network and linked to the NHS system. The Office of Aeronautics and Federal Aviation Administration both maintain annual landed cargo statistics, by airport.
- **Incorporating system performance and Congestion Mitigation, and Air Quality (CMAQ) components into freight performance measure framework.** As the freight performance measure system evolves, CMAQ and environmental measures that are based on freight movements could be explored. Currently, freight specific emissions, fuel usage, and related data is not available at a meaningful level.

## Safety

Additional measures MnDOT may consider in the future include:

- **Snow and ice response.** Tracking the maintenance activity along key routes can help ensure the system is in good order for the conveyance of goods during inclement weather.
- **Minnesota Principal Freight Network commercial vehicle and highway-railroad crossing incidents.** Incidents at Highway/Railroad Crossings is already tracked by MnDOT using the FRA rail crossing database, however placing emphasis on a subset of the most heavily used truck routes can help MnDOT prioritize where investments and other actions may be needed.
- **Railroad derailments and hazardous material incidents.** Rail safety continues to be a priority for MnDOT. In recent years hazardous material and risks associated with crude-by-rail transport have received national attention. Tracking the frequency and location of hazmat related rail incidents may help MnDOT proactively plan investment needs and other actions.

## Pavement Condition

Additional measures MnDOT may consider in the future include:

- **Minnesota Principal Freight Network and/or corridor-specific pavement conditions.** Currently, MnDOT reports pavement conditions for the state in aggregate. The data allows portions of the transportation system to be separated out, so that pavement conditions on that part of the system can be

better understood. This parsing out of routes could make sense if applied to the designated Minnesota Principal Freight Network, or other individual corridors, and then compared to the state as a whole.

## Bridge Condition

Additional measures MnDOT may consider in the future include:

- **Minnesota Principal Freight Network and/or corridor-specific bridge conditions.** Similar to pavement conditions, above, the parsing out of routes (such as the designated Minnesota Principal Freight Network, or other individual corridors) and examining their bridge conditions as compared to the state as a whole, could provide investment insight to MnDOT.
- **Bridge clearances.** This measure was recommended to identify and quantify the number and percent of highway (and railway, if available) vertical and horizontal clearance restrictions for standard commercial vehicles (i.e. 13'6" in height for trucks) along the Minnesota Principal Freight Network.
- **Compile rail infrastructure information.** Given the proprietary nature of railroad data, much of the network information is not available. However, one suggestion included compiling a database of railroad bridge condition for shortlines (non-Class I's) in the state, which would establish a starting point toward measuring rail infrastructure and identifying needs.



## 4.0 Next Steps

This Tech Memo has recommended a slate of freight system performance measures that will be used to analyze the freight system as part of Plan development. The application of these measures to assess freight system condition and performance, and form an initial set of needs and issues, can also be used to inform the next steps of performance measure implementation.

There are specific actions MnDOT must take in order to maximize the freight performance measurement process. In particular, the following questions will need to be addressed in the months following Plan completion, and pending final direction from U.S. DOT on the topic:

- Who will “own” each measure (agency and/or individual)?
- How will performance targets be established?
- How will targets be linked to strategies and actions?
- What will be the process for revising and modifying measures and targets?
- How will the effectiveness of measures be evaluated?
- How will freight performance measures be incorporated into MnDOT’s performance management processes and *Annual Performance Report*?

The final Minnesota Statewide Freight System Plan will include more fully developed descriptions of next steps, reflect anticipated U.S. DOT guidance, and be based on the results of application of the performance measures, as available.