TRANSPORTATION PERFORMANCE MANAGEMENT

PAVEMENT PERFORMANCE REQUIREMENTS

The Federal Highway Administration (FHWA) published in the Federal Register (82 FR 5886) a final rule establishing performance measures for State Departments of Transportation (DOTs) to use in managing pavement and bridge performance on the National Highway System (NHS). The National Performance Management Measures; Assessing Pavement Condition and Bridge Condition for the National Highway Performance Program Final Rule addresses requirements established by the Moving Ahead for Progress in the 21st Century Act (MAP-21) and reflects passage of the Fixing America’s Surface Transportation (FAST) Act. The rule became effective May 20, 2017.

The federal rule requires MDOT to establish targets for pavement condition measures Percent Good and Percent Poor on the Interstate and non-Interstate NHS. Targets are required for two and four-year intervals for each measure, with eight targets in total. For the Interstate measures, there will be no two-year targets for the first (2018-2021) performance period per 23 CFR Part 490, therefore, there will only be six targets in the first period.

The rule requires states to measure, monitor and set targets based upon a composite index of pavement condition measures (PCM). The four metrics to be used are International Roughness Index (IRI), Cracking Percent, Rutting, and Faulting as reported by states to the FHWA’s Highway Performance Monitoring System (HPMS). All four metrics will be used to determine the condition for Interstate. If all three metrics on a segment are “good,” then a pavement is rated in good condition. If two or more metrics are “poor,” it is to be considered in poor condition. Only IRI will be used to determine non-Interstate condition for the 2018-2024 performance period, after which it will use PCM. Cracking Percent and IRI are to be reported on all pavement types. Rutting is to be reported only on asphalt pavements, and faulting, on jointed concrete pavements. The table below indicates the metric thresholds for condition on each pavement type, as defined by the rule.

<table>
<thead>
<tr>
<th>Metric Value Range</th>
<th>Metric Value Range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Metric</strong></td>
<td><strong>Surface Type</strong></td>
</tr>
<tr>
<td>IRI (inches/mile)</td>
<td>Asphalt Pavement, Jointed Concrete Pavement, CRCP¹</td>
</tr>
<tr>
<td>&lt;95</td>
<td>95 - 170</td>
</tr>
<tr>
<td>170</td>
<td></td>
</tr>
<tr>
<td>Cracking Percent (percent of total area)</td>
<td>Asphalt Pavement, Jointed Concrete Pavement, CRCP¹</td>
</tr>
<tr>
<td>&lt;5%</td>
<td>5 - 20%</td>
</tr>
<tr>
<td>20%</td>
<td></td>
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<tr>
<td>Rutting (inches)</td>
<td>Asphalt Pavement</td>
</tr>
<tr>
<td>&lt;0.20</td>
<td>0.20 - 0.40</td>
</tr>
<tr>
<td>0.40</td>
<td></td>
</tr>
<tr>
<td>Faulting (inches)</td>
<td>Jointed Concrete Pavement</td>
</tr>
<tr>
<td>&lt;0.10</td>
<td>0.10 - 0.15</td>
</tr>
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<td>0.15</td>
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</table>

The table indicates the metric thresholds for condition on each pavement type, as defined by the rule.

TARGET SETTING AND SIGNIFICANT PROGRESS

• **Targets:** The Transportation Performance Management (TPM) Pavement Rule designates recurring four-year performance periods for which MDOT is required to establish two-year (midpoint) and four-year (full performance) targets for pavement condition on the National Highway System (NHS).

• **Performance Measures:** There are four performance measures for assessing pavement condition based on composite analysis of the metrics above:
  1) percent of Interstate pavement in Good Condition
  2) percent of Interstate pavement in Poor Condition
  3) percent of Non-Interstate NHS pavement in Good Condition
  4) percent of Non-Interstate NHS pavement in Poor Condition

States were required to establish targets for each measure by May 20, 2018.
**MPO Targets:** MPOs are required to establish four-year targets for these measures and have two options for target selection: agree to plan and program projects that support MDOT targets or commit to their own targets for their Metropolitan Planning Area (MPA).

**MPO Targets Due:** MPO targets are due on November 16, 2018, 180 days after MDOT’s targets. These targets are not reported to FHWA but must be reported to MDOT in a manner both parties agree to. MPOs will include targets in their TIPs and LRPs and explain how their projects and programs support either MDOT’s or the MPO’s targets.

**Significant Progress:** FHWA will determine significant progress on the Mid- and Full Performance Period Progress Reports. Significant progress is defined as achieving a condition that is equal to or better than the target, or better than the baseline condition. If significant progress is not achieved, MDOT must document how it plans to achieve it for the next report.

**ROAD OWNERSHIP**

The rule applies to the entire National Highway System (NHS), which includes the Interstate, and Non-Interstate NHS. The Non-Interstate portion of the system is comprised of trunkline (MDOT owned) and non-trunkline (local government owned) roads. Local agencies own 19 percent of the NHS in Michigan, while MDOT maintains ownership of approximately 81 percent (see table below). MDOT and MPO targets must cover the entire NHS, regardless of ownership, meaning these agencies may have a limited capacity to achieve these targets. To account for this, the rule requires MDOT and MPOs to coordinate target setting, planning, and programming, ensuring targets are feasible, and projects are geared toward achieving them.

**MDOT Investment Strategy Process**

Department goals for state trunkline pavement condition are established by the State Transportation Commission (STC) and influence the way MDOT invests in and maintains state-owned transportation infrastructure. To do this, MDOT conducts investment planning. Investment strategies guide the allocation of capital resources to achieve the goals established. Investments are focused where they will most benefit the public, consistent with the direction established.

Investment strategies are developed utilizing anticipated available funding, life cycle planning, and performance gap analysis, and the results of risk analysis. The various strategies are also analyzed and compared to determine how they would impact the overall goals and objectives set by the STC. The desired mix of fixes, investment levels, and funding targets are developed for the selected investment strategy and provided in the Highway Call for Projects memo. They form the basis for project selection and prioritization. The selected investment strategy is communicated to the public by way of the annual Five-Year Transportation Program. MDOT’s investment strategy to achieve the constrained Michigan targets for asset condition are reflected in the 2017-2020 STIP program of projects.

**MICHIGAN STATEWIDE PAVEMENT TARGETS**

The TPM Pavement Team reviewed historical trends of condition metric data from the last decade (2007-2017) to support future target establishment. FHWA and MDOT use the Highway Performance Monitoring System (HPMS) to report pavement condition. According to the rule, HPMS data must be submitted annually by April 15 for Interstate data, and June 15 for Non-Interstate NHS data. These figures were used as a baseline to establish the statewide targets. With MDOT’s current funding levels, trunkline pavement condition is anticipated to decline over the course of the next decade, and therefore, MDOT has chosen conservative targets to reflect this decline. Given the
definition of significant progress (equal to or better than the target, or better than the baseline condition), MDOT can achieve significant progress while targets are declining if condition does not fall below the targets.
Conservative Targets
The conservative nature of the approved targets is based on several factors:

1) Forecasts of the trunkline pavement condition based on Remaining Service Life (RSL) is declining.
2) Sample size for the cracking measure will move from 30% to 100% of roads sampled.
3) Issues surrounding the data such as the use of new vendors and the introduction of more advanced data collection may make data collection inconsistent.
4) A buildup in the Interstate IRI category at the edge of good gives the potential for a significant number of segments to fall into fair.
5) The use of a composite score means that all three measures must be good to be counted as good. If only one measure was to fail the whole segment is no longer considered good.
6) At the current time the sample size available for previous years is relatively small for the use of trend analysis.

Other major potential hindrances include climate changes, funding uncertainties, and funding levels.

REPORTING

National Goal: FHWA will annually assess the percent of Interstate pavement in poor condition to ensure compliance with a minimum condition level requirement that no more than five percent of the Interstate System be in poor condition. This is the only portion of the rule with a financial penalty for pavement funding and prioritizes the Interstate System by directing MDOT pavement funding toward it. Reports are structured on a 4-year reporting cycle, with midpoint (2-year) reports. Between October 2018 and October 2022, state DOTs will be required to submit three performance reports to FHWA.

Baseline Performance Report: In this report, MDOT must establish 2-year and 4-year targets, describe baseline conditions, urbanized area boundaries and population data, NHS limits, and relationships with other performance expectations. The Baseline Performance Report will include HPMS data collected in 2016 and 2017. States will be able to adjust the 4-year targets in the Mid Performance Progress Report based on data collected in 2018 and 2019. To allow for the phasing in of new reporting requirements for Interstate pavement conditions, states are only required to establish 4-year targets for Interstate pavements in the Baseline Performance Report that is due October 1, 2018. Both 2-year and 4-year targets are required for non-Interstate NHS pavements. Baseline Performance Report due 10/1/18.

Mid Performance Progress Report: MDOT must report on 2-year conditions and performance, investment strategy effectiveness and discuss progress in achieving targets. States have the option to adjust 4-year targets at this time. In this report states may include a discussion of target achievement and extenuating circumstances. Because states are not required to establish 2-year targets for Interstate pavements in the Baseline Performance Report, they would use the Mid Performance Progress Report to update baseline condition/performance data and, if necessary, adjust the 4-year targets. Mid-Performance Period Progress Report due 10/1/20.

Full Performance Progress Report: This report includes the same content as the Mid Performance Period Progress Report but reports on the 4-year targets. If a state has not made significant progress for achieving the NHPP targets in two consecutive biennial determinations, then the state DOT will include a description of the actions they will undertake to better achieve the NHPP targets in the next performance period. Even though significant progress is assessed for all four pavement performance measures, pavement condition penalties only apply for Interstate pavements. As part of the Full Performance Progress Report, MPOs will report targets and progress toward the achievement of targets. MPOs will report their established targets, performance, progress, and achievement of the targets to their respective state DOT in a manner that is agreed upon by both parties and documented in the Metropolitan Planning Agreement. Full Performance Period Progress Report due 10/1/20.
Penalties
MDOT will be penalized if it does not meet the interstate pavement condition requirement. If FHWA determines that a State DOT’s Interstate pavement condition is below the minimum condition level for the “most recent 2 years,” then that State DOT would be subject to the penalty under the rule. The FHWA will notify MDOT annually of its compliance status regarding the minimum condition requirement prior to October 1 of the year in which the determination is made. State DOTs are subject to a statutory penalty that would obligate a portion of NHPP funds and transfer a portion of STP funds to address Interstate pavement conditions if they fail to meet this minimum condition requirement for 2 consecutive years. Specifically, if the state is out of compliance, they would be required to obligate the following:

- From the amount apportioned to the State for the NHPP, an amount that is not less than the interstate Maintenance apportionment for fiscal year 2009 plus 2 percent per year compounded annually for the five additional fiscal years after 2013.
- For apportioned transfer Surface Transportation Program funds, an amount equal to 10 percent of Interstate Maintenance apportionment for fiscal year 2009.

These funds would need to be used to improve Interstate pavement conditions (as provided under the pre-MAP-21 Interstate Maintenance Program). This requirement will remain in effect until the Interstate system pavement condition exceeds the minimum condition level.

Available Data
A web application is available online showing pavement conditions and inventory for Interstate PCM and Non-Interstate IRI data. This tool is available for use by the MPOs. The link to the application is below.

http://mdot.maps.arcgis.com/apps/MapSeries/index.html?appid=35d2f76862e74c5a89319a9d5a55e5bd

For More Information
Pavement condition data: Mike Sokolnicki
517-241-0736; SokolnickiD@michigan.gov

Pavement condition information: Craig Newell
517-373-9074; NEWELLC@michigan.gov
BRIDGE PERFORMANCE MANAGEMENT

BRIDGE CONDITION

Federal law, outlined in the National Bridge Inspection Standards (NBIS), defines a bridge as a structure carrying traffic with a span greater than 20 feet and requires that all bridges be inspected every two years to monitor and report condition ratings. The FHWA requires that for each applicable bridge, the performance measures for determining condition be based on the minimum values for substructure, superstructure, deck, and culverts. The FHWA further requires counting this condition by the respective deck area of each bridge and express condition totals as a percentage of the total deck area of bridges in a state.

Condition ratings are based on a 0-9 scale and assigned for each culvert, or the deck, superstructure and substructure of each bridge. These ratings are recorded in the National Bridge Inventory (NBI) database. Condition ratings are an important tool for transportation asset management, as they are used to identify preventative maintenance needs, and to determine rehabilitation and replacement projects that require funding.

REPORTING ON BRIDGE CONDITION

The Transportation Performance Management (TPM) Bridge Condition Rule designates recurring four-year performance periods for which MDOT is required to two-year (midpoint) and four-year (full performance) targets for bridge condition on the National Highway System (NHS). MDOT is required to submit three performance reports to FHWA within the 4-year performance period.

- Baseline Performance Report - October 1st, 2018
- Mid-Performance Period Progress Report - October 1st, 2020
- Full Performance Period Progress Report - October 1st, 2022

The two performance measures for assessing bridge condition are:

- % of NHS bridges in Good Condition; and
- % of NHS bridges in Poor Condition.

MDOT established bridge targets on May 20, 2018.

NBI Condition Ratings

<table>
<thead>
<tr>
<th>Rating</th>
<th>Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-9</td>
<td>Good Condition</td>
<td>Routine maintenance candidate.</td>
</tr>
<tr>
<td>5-6</td>
<td>Fair Condition</td>
<td>Preventative maintenance and minor rehabilitation candidate.</td>
</tr>
<tr>
<td>4</td>
<td>Poor Condition</td>
<td>Major rehabilitation or replacement candidate.</td>
</tr>
<tr>
<td>2-3</td>
<td>Serious or Critical</td>
<td>Emergency repair or high priority major rehabilitation or replacement candidate. Unless closely monitored it may be necessary to close until corrective action can be taken.</td>
</tr>
<tr>
<td>0-1</td>
<td>Imminent Failure or Failed</td>
<td>Major rehabilitation or replacement candidate. Bridge is closed to traffic.</td>
</tr>
</tbody>
</table>
REPORTING ON BRIDGE CONDITION, CONTINUED

• **MPO Targets:** MPOs are required to establish four-year targets for these measures and have two options for target selection: agree to plan and program projects that support MDOT targets or commit to their own targets for their Metropolitan Planning Area (MPA).

• **MPO Targets Due:** MPO targets are due on November 16, 2018, 180 days after MDOT’s targets. These targets are not reported to FHWA but must be reported to MDOT in a manner both parties agree to. MPOs will include targets in their TIPs and LRP and explain how their projects and programs support either MDOT’s or the MPO’s targets.

• **Significant Progress:** FHWA will determine significant progress on the Mid- and Full Performance Period Progress Reports. Significant progress is defined as achieving a condition that is equal to or better than the target, or better than the baseline condition. If significant progress is not achieved, MDOT must document how it plans to achieve it for the next report.

<table>
<thead>
<tr>
<th>Owner</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trunkline</td>
<td>823</td>
<td>1768</td>
<td>138</td>
<td>2729</td>
</tr>
<tr>
<td>Bridge Authority</td>
<td>3</td>
<td>5</td>
<td>0</td>
<td>8</td>
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<tr>
<td>Local</td>
<td>92</td>
<td>94</td>
<td>39</td>
<td>225</td>
</tr>
<tr>
<td>Total</td>
<td>918</td>
<td>1867</td>
<td>177</td>
<td>2962</td>
</tr>
</tbody>
</table>

End of 2017 NHS Bridge Condition by Deck Area - Statewide

<table>
<thead>
<tr>
<th>Owner</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>Total (sft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trunkline</td>
<td>11,145,968</td>
<td>18,568,765</td>
<td>3,221,383</td>
<td>32,936,116</td>
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<tr>
<td>Bridge Authority</td>
<td>291,482</td>
<td>1,707,000</td>
<td>- 1</td>
<td>1,998,482</td>
</tr>
<tr>
<td>Local</td>
<td>782,324</td>
<td>1,197,624</td>
<td>446,003</td>
<td>2,425,951</td>
</tr>
<tr>
<td>Total</td>
<td>12,219,774</td>
<td>21,473,389</td>
<td>3,667,386</td>
<td>37,360,549</td>
</tr>
</tbody>
</table>

NATIONAL HIGHWAY SYSTEM

While the National Bridge Inspection Standards applies to all publicly owned highway bridges, the TPM Targets are only applied to those bridges carrying routes on the NHS including bridge on- and off-ramps connected to the NHS. The NHS consists of roadways important to the nation’s economy, defense, and mobility. The NHS includes the following subsystems of roadways: interstate, other principal arterials, strategic highway network, major strategic highway network connectors, and intermodal connectors. Condition totals as a percentage of the total deck area of bridges in a state.

Local agencies own 6 percent of the NHS bridge deck area in Michigan, while MDOT and the Bridge Authorities maintain ownership of approximately 94 percent of bridge deck area (see table above). MDOT and MPO targets must cover the entire NHS, regardless of ownership. To account for this, the rule requires MDOT and MPOs to coordinate target setting, planning, and programming, ensuring targets are feasible, and projects are geared toward achieving them.
BRIDGE DETERIORATION MODELS

As a bridge ages, its condition declines and an increasing amount of work is required to restore condition or extend the usable life of the bridge. By tracking the rate at which bridges have declined in the past, MDOT is able to predict the rate at which a bridge will decline in the future. MDOT has an established process through which trends in bridge deterioration rates can be evaluated at regular intervals. These periodic reviews will show whether preventive maintenance and other small actions taken on bridges are effective over time. This process is documented in the report “A Process for Systematic Review of Bridge Deterioration Rates” which is available on the MDOT website at: http://www.michigan.gov/documents/mdot/A Process for Systematic Review of Bridge Deterioration Rates_5224227.pdf.

![Prestressed Concrete Beam Deterioration](image)

As shown in the image above, the minimum NBI condition rating is the y axis, and the number of years in each condition state is the x axis. As the Target setting periods are two and four years, the key transition times for this analysis are the Transition from Good to Fair (the time it takes to drop from 7 to 6) and the Transition from Fair to Poor (the time it takes to drop from 5 to 4). Outside of the initial drop for 9 (Excellent) to 8 (Very Good), a bridge would not be predicted to fall multiple condition ratings over a span of four years as it is based on statewide averages. This can sometimes occur in practice and is part of the error involved in predictions.

PROJECT IMPACTS

**MDOT PROJECT SELECTION** - As the product of ongoing asset management by MDOT and our local agencies, projects are programmed each year to extend life or improve condition throughout the bridge network. MDOT analyzes the candidates for each of the major work types – preventive maintenance, rehabilitation and replacement – and identifies a strategy that is the most cost-effective means to achieve and sustain a state of good repair within financial constraints. Starting from this initial strategy, the regions then perform more detailed analysis and scopes, coordinating with other programs such as road, and selecting projects through the annual Call for Projects process.

A small number of MDOT bridges are managed centrally within the Big Bridge Program. The Big Bridge Population is a unique subset of MDOT’s trunkline bridge population that includes twenty-three large deck bridges (deck area in excess of 100,000 sq ft), thirteen complex bridges, and twelve moveable bridges. These forty-eight bridges are unique not only from an engineering standpoint, but they also represent large capital investments in terms of their initial construction costs and in terms of their long-term preservation and rehabilitation costs. Because of the significant investment these bridges represent, MDOT’s goal is to preserve and maintain the Big Bridge inventory in a continuously good or fair condition state. This population is also of unique importance to the Performance Management Target Settings as the 37 structures that carry NHS comprise 14% of the trunkline NHS deck area.

**LOCAL AGENCY PROJECT SELECTION** - As the product of ongoing asset management by MDOT and our local agencies, projects are programmed local agency bridge projects included in this analysis are those that have been selected through the local bridge program. Legislation enacted October 1, 2004 created a local bridge fund, a local bridge advisory board (LBAB) and seven regional bridge councils (RBC). The legislation places control of the funding allocations of the local bridge fund in the hands of the local agencies of Michigan through the LBAB and RBCs. A call for applications is sent to all local agencies on an annual basis. The submitted applications are reviewed by the staff of MDOT local agency program’s bridge unit for completeness and funding eligibility. Formula rating points are computed and each region’s applications are submitted to their respective RBC for addition of discretionary points. A 3-year bridge program is maintained by each RBC.

Local Agencies may also identify bridge projects through their Metropolitan Planning Organization or Rural Task Force, although because of the dollar amounts available these projects are rare. Many local agencies do projects on their bridges with their Act 51 fund distributions. These projects, however, do not have to be entered as a programmed project within the Planning Schema and would not be reflected in the results. Due to the relatively small amount of local agency deck area, this is considered an acceptable omission at this time, but is an area identified for future improvement.
DEVELOPING TARGETS
Starting from the condition reported with the NBI submittal on March 14th of 2018, the expected improved condition from projects and reduced condition from deterioration was summarized into expected condition in 2020 and in 2022. The deck areas in good, fair and poor conditions at each year was summarized. To account for uncertainty, the amount of deck area in good condition was conservatively reduced by 1%, and the amount of deck area in poor condition was increased by 1%. A 1% reduction for uncertainties reflects about 30 average size structures that either deteriorated faster than predicted or that did not see as much of an improvement as predicted.

ANALYZING TARGETS
Overall, the number of good bridges is expected to decline significantly as preservation efforts tend to extend life in fair condition. While the amount of bridges in good condition is predicted to decrease, the amount of deck area in poor condition is also predicted to decrease. While the decrease in poor deck area is important towards achieving and then maintaining a state of good repair, the amount of fair deck area will require a sustained commitment to preservation in order to prevent an unsustainable amount of fair bridges from falling into poor condition.

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### Actual - 2018
**Percent by NHS Deck Area**
- Good: 33%
- Fair: 10%
- Poor: 57%

### Target - 2020
**Percent by NHS Deck Area**
- Good: 27%
- Fair: 7%
- Poor: 66%

### Target - 2022
**Percent by NHS Deck Area**
- Good: 26%
- Fair: 7%
- Poor: 67%

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### Predicted NHS Bridges Cycle of Life
**Baseline to 4-Year Target Statewide**
**Percent of bridges by deck area**
- Good: 24.9% Unchanged
- Fair: 53.4% Unchanged
- Poor: 2.9% Deteriorating
- 11.7% Debritching
PENALTY
MDOT will be penalized if it does not meet the NHS bridge condition requirement. If FHWA determines that a State DOT’s Interstate pavement condition is below the minimum condition level for 3 consecutive years, then that State DOT would be subject to the penalty under the rule. The FHWA will notify MDOT annually of its compliance status regarding the minimum condition requirement prior to October 1 of the year in which the determination is made. The minimum NHS bridge condition level is that no more than 10 percent of total deck area of NHS bridges can be classified in poor condition. If the minimum condition level is not met for 3 consecutive years, the State must set aside NHPP funds for eligible bridge projects on the NHS.

For More Information

<table>
<thead>
<tr>
<th>Rebecca Curtis</th>
<th>Amy Gill</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDOT</td>
<td>MDOT</td>
</tr>
<tr>
<td>Bridge Preservation and Management Administrator</td>
<td>Bridge Program Performance Engineer</td>
</tr>
<tr>
<td>517-449-5243</td>
<td>517-241-2365</td>
</tr>
<tr>
<td><a href="mailto:CurtisR4@michigan.gov">CurtisR4@michigan.gov</a></td>
<td><a href="mailto:GillA@michigan.gov">GillA@michigan.gov</a></td>
</tr>
</tbody>
</table>
WHAT IS TRAVEL TIME RELIABILITY?

New federal rules require states to measure, monitor, and set goals based upon a composite index of travel time reliability metrics. Travel time reliability measures how consistent the travel time is from one point to another, from one day to the next. To determine reliability, data on travel time is examined to see how it varies over time. Travel time for each discrete segment of the National Highway System (NHS) is placed in order from the shortest time (fastest speed), which is the 1st percentile speed, to the longest time (slowest speed), which is the 100th percentile speed. Three performance measures are examined to compare the “normal” travel time, (which is defined as the 50th percentile travel time) on a segment, with either the 80th percentile or the 95th percentile travel time to determine the overall reliability. If the difference between the normal travel time and the longer travel time (80th or 95th percentile time) is greater than 50%, then the segment is unreliable.

To help understand this concept and how travel time reliability is applied, consider the following highly simplified hypothetical example. Suppose an individual person’s normal travel time from home to work is 20 minutes. The 80th percentile is defined as one out of every five days, or approximately once a work week. If in a typical week, it takes this individual 30 minutes or longer to travel to work (one or more times), then his/her route would be designated as unreliable.

Comparatively, the truck travel time measure uses the 95th percentile which is one out of every twenty days.

**Travel Time Reliability is not the same as Congestion.** Reliability is important, because travelers prefer a consistent travel time to their destination over whether or not the route is congested. If people understand that a route is congested, they can plan accordingly, but if a route is unreliable, they really have no understanding of how long it will take to get to their destination, which creates greater frustration. In addition, segments of roads can be both congested, and reliable (e.g., reliably congested), whereas others can be congested, but unreliable.

**Example of Unreliable Corridor**

Day 1 – 50th Percentile (Average or Normal Travel Time)  
Day 2 – 80th Percentile Longer Travel Time
TRAVEL TIME RELIABILITY MEASURES

Federal regulations require states and Metropolitan Planning Organizations (MPOs) to use three performance measures for assessing travel time reliability. Travel time data used to calculate each measure is purchased by the Federal Highway Administration (FHWA) and made available for use by states and MPOs. The vehicle probe data set used for the federally required measures is called the National Performance Management Research Data Set (NPMRDS). The data is processed through an analytical software tool known as Regional Integrated Transportation Information System (RITIS). The travel time reliability measures, as defined in the PM3 federal rule are:

+ **Level of Travel Time Reliability (LOTTR) on the Interstate:** % of person-miles traveled on Interstate that are reliable
+ **LOTTR on the Non-Interstate NHS:** % of person-miles traveled on the Non-Interstate NHS that are reliable
+ **Freight Reliability Measure on the Interstate:** Truck Travel Time Reliability (TTTR) Index

Performance Measure Description

**Level of Travel Time Reliability (LOTTR)**
- 2- and 4-Year Targets**
- Interstate and Non-Interstate NHS
- Four (4) Time Periods
- Fifteen (15) Minute Travel Intervals
- Longer Travel Time: 80th Percentile
- Normal Travel Time: 50th Percentile
- **Threshold:** Reliability is <1.50
- **Factors Applied:** Vehicle volumes (HPMS) and Vehicle Occupancy Factor (provided by FHWA)

**Truck Travel Time Reliability (TTTR)**
- 2- and 4-Year Targets
- Interstate
- Five (5) Time Periods
- Fifteen (15) Minute Travel Intervals
- Longer Travel Time: 95th Percentile
- Normal Travel Time: 50th Percentile
- **Threshold:** None
- **Factors Applied:** No additional factors are applied

**Level of Travel Time Reliability (LOTTR) Example**

**Segment:** Longer Travel Time (80th) ÷ Normal Travel Time (50th) = # seconds ÷ # seconds = LOTTR

<table>
<thead>
<tr>
<th>Segment</th>
<th>Monday – Friday</th>
<th>Monday – Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>6am – 10am</td>
<td>LOTTR = 44 sec ÷ 35 sec = 1.26</td>
<td></td>
</tr>
<tr>
<td>10am - 4pm</td>
<td>LOTTR = 1.39</td>
<td></td>
</tr>
<tr>
<td>4pm – 8pm</td>
<td>LOTTR = 1.54</td>
<td></td>
</tr>
<tr>
<td><strong>Weekends</strong></td>
<td><strong>LOTTR = 1.31</strong></td>
<td></td>
</tr>
</tbody>
</table>

Reliability: **LOTTR below 1.50 during ALL of the time periods** **Segment is NOT reliable**

**Measure:** Percent of person-miles traveled on the [Interstate/Non-Interstate NHS] that are reliable
1. Length x Volume (AADTx365) x Occupancy = person miles
2. \( \sum \) (Reliable Person-Miles) ÷ \( \sum \) (Total Person-Miles) = Reliability

**Truck Travel Time Reliability (TTTR) (This is an index, not a reliability threshold) Example**

**Segment:** Longer Travel Time (95th) ÷ Normal Travel Time (50th) = # seconds ÷ # seconds = TTTR

<table>
<thead>
<tr>
<th>Segment</th>
<th>Monday – Friday</th>
<th>Monday – Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>6am – 10am</td>
<td>TTTR = 72 sec ÷ 50 sec = 1.44</td>
<td></td>
</tr>
<tr>
<td>10am - 4pm</td>
<td>TTTR = 1.39</td>
<td></td>
</tr>
<tr>
<td>4pm – 8pm</td>
<td>TTTR = 1.49</td>
<td></td>
</tr>
<tr>
<td><strong>Weekends</strong></td>
<td><strong>TTTR = 1.31</strong></td>
<td></td>
</tr>
<tr>
<td>** Overnight**</td>
<td><strong>TTTR = 1.20</strong></td>
<td></td>
</tr>
</tbody>
</table>

| **Maximum TTTR** | 1.49 |

**Measure:** Truck Travel Time Reliability (TTTR) Index
1. Length x MaxTTTR = Length-weighted TTTR
2. \( \sum \) (All segment length weighted TTTR) ÷ \( \sum \) (All segment lengths)
TRAVEL TIME RELIABILITY TARGETS AND METHODOLOGY
PM3 Reliability Measures – Final State of Michigan Targets

<table>
<thead>
<tr>
<th>Measure</th>
<th>Baseline from Jan 2017 to May 2018 (Source: NPMRDS – RITIS)</th>
<th>Recommended 2-Year Target(s) CYE 12/31/2019</th>
<th>Recommended 4-Year Target(s) CYE 12/31/2021</th>
</tr>
</thead>
</table>
| Interstate Travel Time Reliability | 2017 - 85.2%  
2018 - 85.8%                                               | 75%                                         | 75%                                        |
| Non-Interstate NHS Travel Time Reliability | 2017 - 86.1%  
2018 - 85.8%                                               | --                                          | 70%                                        |
| Freight Reliability           | 2017 - 1.38  
2018 – 1.49                                               | 1.75                                        | 1.75                                       |

Baseline Data: 2017 and 2018 data shows that the Michigan’s interstate highways and non-interstate NHS highways have been between 85 and 86 percent reliable, meaning that greater than 85% of the person miles traveled on the NHS system are meeting the threshold, as defined in the federal rules (the ratio between the 50th percentile and the 80th percentile is below 1.5). For trucks, due to the higher threshold of comparing the 95th percentile to the 50th percentile, the overall truck travel time index on the interstates has remained near 1.5.

Target Methodology - Targets have been set conservatively for this first reporting cycle. There is only 17 months of data to establish a baseline, and month-to-month comparisons vary due to weather, construction, data coverage gaps and other factors. As more data is collected over the next 2 years, the detection of trends should become more observable and distinctive and MDOT will re-evaluate the targets for possible adjustments. In the interim, the trends and influencing factors reflect the best information available.

Application of these measures in MDOT’s prioritization process: These three measures are monitored and considered as factors in the overall decision making process for transportation investments in Michigan. MDOT is currently evaluating the types of projects and funding templates that will have an impact on travel time reliability, and have developed an initial list of project types to be considered; however, due to the lack of historical data, it is not possible to truly quantify the level of impacts for each of these project types at this time. The initial list of project types includes: capacity improvements or widenings, ITS and operational improvements, safety projects that improve operational flow, and road and bridge reconstruction and rehabilitation projects that improve segments from poor condition to good/fair condition.
REPORTING ON TRAVEL TIME RELIABILITY

The Transportation Performance Management (TPM) System Performance Rule designates recurring four-year performance periods for which two and four-year targets are required to be established for travel time reliability on the NHS for person miles and freight. There are three sets of targets: 1) percent of person miles traveled on the Interstate System that are reliable, 2) percent of person miles traveled on the Non-Interstate NHS that are reliable, and 3) truck travel time reliability index on the Interstate. The first performance period takes place from January 1, 2018 to December 31, 2022, with state targets due on May 20, 2018. MDOT is required to submit biennial progress reports to FHWA. There are a total of three progress reports due for each performance period:

- Baseline Performance Report (due October 1, 2018)
- Mid-Performance Period Progress Report (Oct. 1, 2020)
- Full Performance Period Progress Report (Oct. 1, 2022)

FHWA will determine significant progress using the Mid and Full Performance Period Progress Reports. Significant progress is defined as achieving a condition that is equal to or better than the target, or better than the baseline condition. If significant progress is not achieved, MDOT must document how it plans to achieve it by the next reporting cycle.

MPO Coordination

MPOs are required to establish four-year targets for these measures, and have two options for target selection: agree to plan and program projects that support state targets, or commit to their own targets for their Metropolitan Planning Area. MPO targets are due on November 16, 2018, 180 days after state targets are established. MPO targets are not reported to FHWA, but must be reported to MDOT using mutually agreed upon method. MPOs will include targets in their Transportation Improvement Programs and Long-Range Transportation Plans, and explain how their projects and programs support either MDOT’s or the MPO’s targets.