

Iowa DOT System Performance and Freight Performance Measures

October 2022

Required performance measures

Through the Moving Ahead for Progress in the 21st Century (MAP-21) Act, Congress required the establishment of measures to assess performance in several areas, including performance of the Interstate and non-Interstate National Highway System (NHS), codified in 23 CFR 490.507, and freight movement on the Interstate System, codified in 23 CFR 490.607. Departments of Transportation (DOTs), as well as Metropolitan Planning Organizations (MPOs) with applicable roadways within their metropolitan planning areas, set targets for the following performance measures, known as “PM3.”

1. Percent of person-miles traveled on the Interstate that are reliable
2. Percent of person-miles traveled on the non-Interstate NHS that are reliable
3. Truck Travel Time Reliability Index (Interstate only)

Targets are set for all roadways on the applicable system within a state or MPO, regardless of ownership. Target setting occurs for 4-year periods, with the first targets having been established in 2018 for the performance period of calendar year (CY) 2018-2021. States must now set 2- and 4-year targets for the second reporting period of CY 2022-2025. Once states establish targets, MPOs will have 180 days to take action to either support the state’s 4-year targets or set their own.

Data and methodology

Data for these measures is provided by the Federal Highway Administration (FHWA) through the National Performance Management Research Data Set (NPMRDS). This is a national data set of average travel times on the NHS. Since February 2017, speed and travel time data from INRIX has been used for the NPMRDS, which is hosted by the University of Maryland Center for Advanced Transportation Technology Laboratory (CATT Lab). States and MPOs can access the raw data at no cost. The CATT Lab has also developed a MAP-21 tool to assist states and MPOs in calculating PM3 measures. This tool is available through a technical services program (TSP) administered by the American Association of State Highway and Transportation Officials (AASHTO). Iowa DOT is currently participating in the TSP; this participation also provides Iowa’s MPOs access to the MAP-21 tool and output.

State DOTs must establish 2- and 4-year targets for the percent of reliable person-miles on the Interstate System and the non-Interstate NHS. The level of travel time reliability (LOTTR) is the metric for determining the performance measures. The LOTTR is calculated for four time periods:

1. Weekdays from 6:00 a.m. – 10:00 a.m.
2. Weekdays from 10:00 a.m. – 4:00 p.m.
3. Weekdays from 4:00 p.m. – 8:00 p.m.
4. Weekends from 6:00 a.m. – 8:00 p.m.

Data for all vehicle traffic are analyzed based on 15-minute bins of speeds and travel times for traffic message channels (TMCs), which are highway segments that NPMRDS data are reported for. For each time period across an entire year, the TMC's LOTTR is defined as the ratio of the longer travel time (80th percentile) to a "normal" travel time (50th percentile) for all vehicles. FHWA defines a segment as reliable if its LOTTR is less than 1.50 during all four time periods. If the maximum LOTTR from the four time periods is 1.50 or higher, the segment is unreliable. To translate the LOTTR to the performance measure, the length of each segment is multiplied by its annual average daily traffic (AADT) and average occupancy factor for all vehicles (FHWA's default is 1.7), which results in person-miles. This calculation is done for reliable segments and for all segments. Dividing the sum of reliable segment person-miles by the sum of all segment person-miles provides the measure of percent of travel time reliability.

State DOTs must also establish 2- and 4-year targets for truck travel time reliability (TTTR) on the Interstate System. This measure is calculated similarly to the LOTTR-based measures, but the metric's parameters are slightly different and it is not translated into a percentage of reliable person-miles. This measure also uses a subset of the NPMRDS data that contains only truck data, rather than all-vehicle data.

The TTTR index is the metric for determining the performance measure. The TTTR index is calculated for five time periods:

1. Weekdays from 6:00 a.m. – 10:00 a.m.
2. Weekdays from 10:00 a.m. – 4:00 p.m.
3. Weekdays from 4:00 p.m. – 8:00 p.m.
4. Overnight (all days) from 8:00 p.m. – 6:00 a.m.
5. Weekends from 6:00 a.m. – 8:00 p.m.

Data for truck traffic are analyzed based on 15-minute bins of speeds and travel times for TMCs. For each time period across an entire year, the TTTR is defined as the ratio of the longer truck travel time (95th percentile) to a "normal" truck travel time (50th percentile). For each TMC, the highest TTTR value from the five time periods is carried forward into the measure calculation. To translate the individual TMC values into the overall TTTR index, the length of each segment is multiplied by its maximum TTTR from the five time periods. These length-weighted TTTRs are then added together and divided by the sum of all segment lengths to result in the TTTR index for the performance measure. A lower TTTR index indicates a higher amount of system reliability per the performance measure, with 1.0 being the lowest possible value.

The CATT Lab tool provides output necessary for the state DOT's required data submission to the Highway Performance Monitoring System (HPMS), including the LOTTR and TTTR metrics for each TMC for each time period. The tool also provides the overall LOTTR and TTTR for the state or MPO on an annual and monthly basis. The monthly output helps shown seasonal patterns in reliability, but there is not a significant statistical relationship between the monthly and annual data because in each case the percentiles are being calculated based on all travel time bins within the timeframe being evaluated. During the prior performance period, with only one initial year of data to review, it was hypothesized that the monthly variance could be used as a proxy for annual variance. With several additional years of data now available, there does not appear to be a strong correlation

between the monthly and annual data, and it was decided to modify the target setting approach for the current performance period accordingly.

To develop targets, annual performance from 2017-2021 was reviewed. This showed that Iowa consistently has extremely high reliability per these measures, but there are minor variations on an annual basis. A review of unreliable Interstate TMCs per the LOTTR metric showed that they were typically associated with one or more of three categories: major work zones, high volume commuter corridors, and data errors. The third category has improved over time as the dataset has been refined and additional quality checks have been conducted. A review of unreliable non-Interstate NHS segments showed that the majority occur in urban areas (over 5,000 population), which makes sense given that these areas will have more corridors with slower speeds, more commuter traffic, traffic control devices, and other urban characteristics that can impede traffic. A review of Interstate TTR data has shown the most significant impact during the past five years was the extreme flooding in western Iowa in 2019, which resulted in repeated closures of I-29 for weeks or months in some locations.

Given there is still a relatively limited historical dataset (five years) to work with, Iowa DOT decided to set targets that are conservative relative to past performance, but that still represent extremely high system reliability. This will allow for fluctuations in reliability due to issues like major work zones and unanticipated events such as closures due to extreme weather or natural disasters. Figure 1 shows the historical performance and proposed targets for travel time reliability for both the Interstate System and the non-Interstate NHS. Figure 2 shows the historical performance and proposed targets for the truck travel time reliability index for the Interstate System. Table 1 summarizes Iowa DOT's PM3 targets. The 2- and 4-year targets were held constant, though the 4-year targets will be reviewed at the midpoint of the performance period and adjusted if appropriate.

Figure 1: Interstate and non-Interstate NHS travel time reliability – historical condition, prior targets, and proposed targets

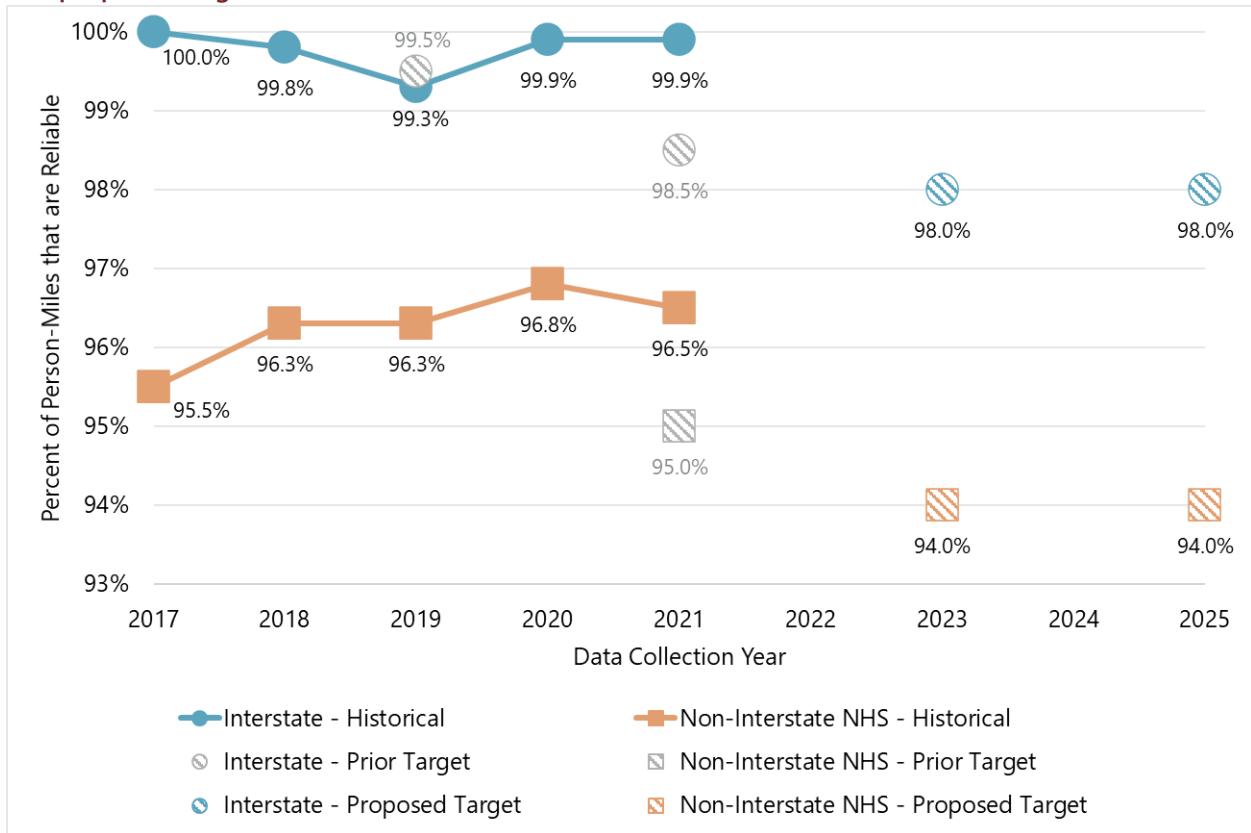


Figure 2: Interstate truck travel time reliability index – historical condition, prior targets, and proposed targets



Table 1: Iowa DOT PM3 system performance and freight targets for 2022-2025

Performance measure(s)	Baseline (CY 2021 data)	Proposed 2-year target (CY 2023 data)	Proposed 4-year target (CY 2025 data)
Percent of person-miles traveled on the Interstate that are reliable	99.9%	98.0%	98.0%
Percent of person-miles traveled on the non-Interstate NHS that are reliable	96.5%	94.0%	94.0%
Truck Travel Time Reliability Index (Interstate only)	1.13	1.25	1.25

Note: the years represent the calendar year in which data was collected. Data is reported through the HPMS the following year; e.g., the baseline data for CY 2021 was reported to the HPMS in CY 2022.

It is important to note that these targets are based on FHWA definitions of reliability, which have been nationally defined to achieve a standard measurement across states. These metrics and definitions of reliability may not be the same as other reliability metrics the Iowa DOT uses to evaluate system performance and may not be the best indicator of what a typical traveler considers to be a reliable transportation system. Overall, these metrics show that Iowa has a very reliable Interstate System and non-Interstate National Highway System.