FHWA Computation Procedure for Travel Time Based and Percent Non-Single Occupancy Vehicle (non-SOV) Travel Performance Measures

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16. Abstract The FHWA Computation Procedure for Travel Time Based and Percent Non-Single Occupancy Vehicle (non-SOV) Travel Performance Measures presents the steps for Federal Highway Administration (FHWA) to compute measures for the purpose of determining whether a State DOT has made significant progress towards the achievement of its National Highway Performance Program and National Highway Freight Program targets (23 CFR 490.109). While designed for internal use, FHWA is making the document public, to be transparent and give State DOTs a frame of reference when establishing their targets. Also, the targets for CMAQ traffic Congestion measures (Annual Hours of Peak Hour Excessive Delay Per Capita measure (PHED measure) and Non-SOV Travel measure) are not subjected to FHWA significant progress determination under 23 CFR 490.109. The FHWA, however, plans to compute the PHED measure and Non-SOV Travel measure (using the method described in this document) for each applicable urbanized area and plans to make them available to the State DOTs to ensure consistency in measure computation process.			
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September 4, 2018	Made clarification for secgment length computation where a reporting segment is consists of multiple sections in HPMS Data Item 71. Section 2.3 - Table 1 on Page 19	*[Item_71].[End_Point] - [Item_71].[Begin_Point]* *WHERE* *[Item_71].[Value_Text] = [Travel_Time_Metric_Dataset].[Travel_Time_Code]*	***SUM(****[Item_71].[End_Point] - [Item_71].[Begin_Point]****)*** *WHERE* *[Item_71].[Value_Text] = [Travel_Time_Metric_Dataset].[Travel_Time_Code]*

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1 Overview

This document presents the steps for Federal Highway Administration (FHWA) to compute Travel time based and Percent Non-Single Occupancy Vehicle (non-SOV) Travel performance measures specified in title 23 Code of Federal Regulations[1] (CFR), part 490 subparts E, F, and G which reflect the final rule[2] on the national performance measures. The national performance measures - Percent of the person-miles traveled on the Interstate that are Reliable (23 CFR 490.507(a)(1)); Percent of person-miles traveled on the non-Interstate NHS that are Reliable (23 CFR 490.507(a)(2)); Truck Travel Time Reliability (TTTR) Index Measure (23 CFR 490.607); and Annual Hours of Peak Hour Excessive Delay (PHED) Per Capita Measure (23 CFR 490.707(a)) – are collectively referred to as the "Travel-Time Based Performance Measures" in this document.

The structure query language (SQL) and pseudo-codes used in the document are only for illustrating computation logic and they are not intended for any specific database or computer application.

1.1 Performance Measures

Two Travel Time Reliability Measures for carrying out the National Highway Performance Program (NHPP) were established under subpart E of 23 CFR Part 490, which are:

- **Percent of the person-miles traveled on the Interstate that are Reliable (referred to as the "Interstate Travel Time Reliability Measure"); and**
- **Percent of person-miles traveled on the non-Interstate NHS that are Reliable (referred to as the "Non-Interstate Travel Time Reliability Measure").**

One Freight Reliability Measure to assess the freight movement on the Interstate System was established under subpart F of 23 CFR part 490, which is:

- **Truck Travel Time Reliability (TTTR) Index (referred to as the "Freight Reliability Measure")**

Two performance measures to assess traffic congestion for the purpose of carrying out the CMAQ program (referred to collectively as the "CMAQ Traffic Congestion Measures") were established under subpart G of 23 CFR part 490, which are:

- **Annual Hours of Peak Hour Excessive Delay (PHED) Per Capita (referred to as the "PHED Measure"); and**

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[1] Available at: http://www.ecfr.gov/cgi-bin/retrieveECFR?gp=&SID=7c955ec3c47ba5f35529b89f21c02213&mc=true&n=pt23.1.490&r=PART&ty=HTML

[2] Final Rule on "National Performance Management Measures; Assessing Performance of the National Highway System, Freight Movement on the Interstate System, and Congestion Mitigation and Air Quality Improvement Program": Docket No. FHWA–2013–0054, RIN 2125–AF54, Federal Register - Vol. 82, No. 11 , Pg. 5970 - January 18, 2017: https://www.gpo.gov/fdsys/pkg/FR-2017-01-18/pdf/2017-00681.pdf

- **Percent of Non-SOV Travel**[3] **(referred as the "Percent Non-SOV Travel Measure").**

To ensure consistent definitions, a distinction between "performance measure" and "performance metric" was made in 23 CFR 490.101. A "metric" is defined as a quantifiable indicator of performance or condition whereas a "measure" is defined as an expression based on a metric that is used to establish targets and to assess progress toward meeting the established targets. As an example, a "metric" refers to a segment-level value such as Level of Travel Time Reliability (LOTTR),[4] Truck Travel Time Reliability,[5] and Total Peak-Hour Excessive Delay[6] reported in the Highway Performance Monitoring System (HPMS) whereas a "measure" refers to a network-level (or a system-level) value[7] computed using the reported "metrics".

1.2 Data Sources

For the purpose of computing measures, the following data will be used.

- **Highway Performance Monitoring System**: As defined in 23 CFR 490.101, a travel time data set is either the National Performance Management Research Data Set (NPMRDS) or an FHWA-approved equivalent data set.[8] This travel time data set is used for deriving metric values that States submitto HPMS.[9] The governing data source for computing all travel time based measures (Interstate Travel Time Reliability Measure, Non-Interstate Travel Time Reliability Measure, Freight Reliability Measure, and PHED Measure) is the State DOT submitted "Travel Time Metric Dataset"[10] to the Highway Performance Monitoring System (HPMS). The "Travel Time Metric Table" represents data items for the State DOTs to submit annual performance metric and related data to the HPMS that comports with the reporting requirements and specifications of 23 CFR 490.511(e), 490.611(b), and 490.711(f). Please refer to the "Travel Time Metric Data Reporting Requirements & Specifications"

[3] 23 CFR 490.101 defines "Non-SOV travel" as any travel mode other than driving alone in a motorized vehicle (i.e., single occupancy vehicle (SOV) travel), including travel avoided by telecommuting.

[4] 23 CFR 490.511 – metrics for the Interstate Travel Time Reliability Measure and Non-Interstate Travel Time Reliability Measure

[5] 23 CFR 490.611 – metrics for Freight Reliability Measure

[6] 23 CFR 711 – metric for PHED Measure

[7] Percent of the person-miles traveled on the Interstate that are reliable, Percent of person-miles traveled on the non-Interstate NHS that are reliable, TTTR Index, and Annual Hours of PHED Per Capita

[8] 23 CFR 490.103(e)

[9] 23 CFR 490.511(e), 490.611(b), and 490.711(f)

[10] Travel Time Metric Specifications Dataset (Table 1 in Travel Time Metric Data Reporting Requirements & Specifications (February 2018)): https://www.fhwa.dot.gov/tpm/guidance/pm3_hpms.pdf

document[11] and HPMS Field Manual[12] for more details. Please note that the variables in brackets [ ] in this document represent values for corresponding data fields specified in the "Travel Time Metric Dataset" for Travel Time Reliability, Freight Reliability, and PHED measures. For example, [DIR_AADT] represents an annual average daily travel value for a given direction of travel for a reporting segment, and [TTTR_AMP] represents a Truck Travel Time Reliability metric value for the "AM Peak" for a reporting segment.

- ***Metric Data Items for Travel Time Based Measures*:** For Interstate Travel Time Reliability Measure and Non-Interstate Travel Time Reliability Measure, four time period LOTTR metrics[13] for each reporting segment[14] will come from the "Travel Time Metric Dataset" in HPMS: AM Peak Level of Travel Time Reliability ([LOTTR_AMP]), Midday Level of Travel Time Reliability ([LOTTR_MIDD]), PM Peak Level of Travel Time Reliability ([LOTTR_PMP]), and Weekend Level of Travel Time Reliability ([LOTTR_WE]). For determining person-mile traveled on each reporting segment, the required values will come from the Data Fields in the Travel Time Metric Dataset: Directional Annual Average Daily Travel[15] ([DIR_AADT]) and Occupancy Factor[16] ([OCC_FAC]).

  For Freight Reliability Measure, five time period Truck Travel Time Reliability metrics[17] for each reporting segment will come from the Data Fields in the "Travel Time Metric Dataset" in HPMS: AM Peak Truck Travel Time Reliability ([TTTR_AMP]), Midday Truck Travel Time Reliability ([TTTR_MID]), PM Peak Truck Travel Time Reliability ([TTTR_PMP]), Overnight Truck Travel Time Reliability ([TTTR_OVN]), and Weekend Truck Travel Time Reliability ([TTTR_WE]).

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[11] Travel Time Metric Data Reporting Requirements & Specifications (February 2018): https://www.fhwa.dot.gov/tpm/guidance/pm3_hpms.pdf - This document serves as supplemental guidance to the Highway Performance Monitoring System (HPMS) Field Manual (December 2016) and advises State DOTs as to how they must process and report travel time-related performance metric data as required by the National Performance Management Measures: Assessing Performance of the National Highway System, Freight Movement on the Interstate System, and Congestion Mitigation and Air Quality Improvement Program. See footnote 2 above. More specifically, this document provides information on how to submit annual performance metric and related data via the HPMS that comports with the reporting requirements and specifications of 23 CFR 490.511(e), 490.611(b), and 490.711(f).

[12] HPMS Field Manual, December 2016: https://www.fhwa.dot.gov/policyinformation/hpms/fieldmanual/

[13] 23 CFR 490.511(b)

[14] 23 CFR 490.101 defines "reporting segment" as the length of roadway that State DOT and MPOs define for metric calculation and reporting and is comprised of one or more travel time segments. It also defines "mainline highways" as the through travel lanes of any highway. Mainline highways specifically exclude ramps, shoulders, turn lanes, crossovers, rest areas, and other pavement surfaces that are not part of the roadway normally traveled by through traffic.

[15] 23 CFR 490.509(c)

[16] 23 CFR 490.509(d)

[17] 23 CFR 490.611

For PHED Measure, a Total Peak-Hour Excessive Delay metric for each reporting segment will come from the Data Field [PHED] in the "Travel Time Metric Dataset" in HPMS.[18]

- ***Related Data Items for Travel Time Based Measures*:** 23 CFR 490.511(e)(1), 490.611(b)(1), and 490.711(f) provide three different options on how State DOTs report metric and related data to HPMS for the travel-time based measures.

  - **State DOT elects to use, in part or in whole, the equivalent travel time data set** - As required in 23 CFR 490.511(e)(1), 490.611(b)(1), and 490.711(f), if a State DOT elects to use, in part or in whole, the equivalent data set,[19] all reporting segments must be referenced by HPMS sections. The "Travel Time Metric Data Reporting Requirements & Specifications" document provides method of referencing the reporting segment to HPMS sections by State DOT submittal of HPMS Data Item 71[20] – Travel Time Code (Travel Time Reporting Segment) for all corresponding reporting segments in "Travel Time Metric Dataset". Also as part of referencing the reporting segment to HPMS sections, the "Travel Time Metric Data Reporting Requirements & Specifications" document provides that the attribute data items in "Travel Time Metric Dataset" be consistent with the rest of HPMS data.[21] Since HPMS Data Item 71 is sections data,[22] the length of a section is the difference between the beginning and ending milepoints of a section.[23] Accordingly, for measure computation in Section 2, the length of each reporting segment is computed by subtracting beginning milepost of the reporting segment ([Item_71].[Begin_Point]) from the ending milepost of a reporting segment (([Item_71].[End_Point]) coded in the Data Item 71.

  - **State DOT elects to use NPMRDS and referencing reporting segments by NPMRDS TMCs** - 23 CFR 490.511(e)(1), 490.611(b)(1), and 490.711(f) also specify that if a State DOT elects to use all of its reporting segments from the NPMRDS, then the reporting segments must be referenced by either NPMRDS TMCs or HPMS sections.

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[18] 23 CFR 490.711

[19] 23 CFR 490.103(e). The requirements under 23 CFR 490.103(e) ensure travel time data set(s) other than NPMRDS are "equivalent" to the use of NPMRDS.

[20] 490.103(e)(5)(vi) – FHWA-approved equivalent data source(s) must Include the location (route, functional class, direction, State), length and begin and end points of each segment.

[21] Related attribute data items in "Travel Time Metric Dataset" are: functional class ([F_System]); urban code ([Urban_Code]); facility type ([Facility_Type]); national highway system designation ([NHS]); segment length ([Segment_Length]); directional average annual daily traffic ([DIR_AADT]). The values for these data items are to be derived from the HPMS Data Items via linear referencing for the same data year. Please see Section 1.6 of the Travel Time Metric Data Reporting Requirements & Specifications (February 2018) for more details: https://www.fhwa.dot.gov/tpm/guidance/pm3_hpms.pdf

[22] Section 1.6 of the Travel Time Metric Data Reporting Requirements & Specifications (February 2018): https://www.fhwa.dot.gov/tpm/guidance/pm3_hpms.pdf

[23] See Table 3.8 in the HPMS Field Manual (December 2016): https://www.fhwa.dot.gov/policyinformation/hpms/fieldmanual/hpms_field_manual_dec2016.pdf

For reporting segments referenced by NPMRDS TMCs, the "Travel Time Metric Data Reporting Requirements & Specifications" document states that State DOTs submit [F_System], [Urban_Code], [Facility_Type], [NHS], [Segment_Length], [DIR_AADT] values in the "Travel Time Metric Dataset" directly from or derived from the the "Traffic Messaging Code (TMC) Identification Table" in the NPMRDS. Since reporting segments are referenced by NPMRDS TMCs, Item 71 for the reporting segments is not needed. For measure computation in Section 2, the length of each reporting segment is the [Segment_Length] values coded in the "Travel Time Metric Dataset."

- **State DOT elects to use NPMRDS and referencing reporting segments by HPMS sections** - 23 CFR 490.511(e)(1), 490.611(b)(1), and 490.711(f) provide an option for State DOT to use all of its reporting segments from the NPMRDS and those reporting segments to be referenced by either NPMRDS TMCs or HPMS sections. For referencing NPMRDS TMC segments by HPMS sections, the "Travel Time Metric Data Reporting Requirements & Specifications" document provides that State DOTs submit HPMS Data Item 71 for all corresponding reporting segments (i.e., NPMRDS TMC segments) in "Travel Time Metric Dataset". If this option is selected, as part of referencing the reporting segment to HPMS sections, the "Travel Time Metric Data Reporting Requirements & Specifications" document provides that the attribute data items in "Travel Time Metric Dataset" be consistent with the rest of HPMS data.[24] Since HPMS Data Item 71 is sections data,[25] the length of a section is the difference between the beginning and ending milepoints of a section.[26] For measure computation in Section 2, the length of each reporting segment is computed by subtracting beginning milepost of the reporting segment ([Item_71].[Begin_Point]) from the ending milepost of a reporting segment (([Item_71].[End_Point]) coded in Data Item 71.

- ***Data Year***: The "year" in HPMS dataset name refers to the year in which a snapshot of condition/performance is represented. The HPMS uses an equivalent terminology "Inventory Year.[27]" For example, "2017 HPMS Data" means the dataset that includes the

[24] Related attribute data items in "Travel Time Metric Dataset" are functional class ([F_System]); urban code ([Urban_Code]); facility type ([Facility_Type]); national highway system designation ([NHS]); segment length ([Segment_Length]); directional average annual daily traffic ([DIR_AADT]). The values for these data items are to be derived from the HPMS Data Items via linear referencing for the same data year. Please see Section 1.6 of the Travel Time Metric Data Reporting Requirements & Specifications (February 2018) for more details: https://www.fhwa.dot.gov/tpm/guidance/pm3_hpms.pdf

[25] Section 1.6 of the Travel Time Metric Data Reporting Requirements & Specifications (February 2018): https://www.fhwa.dot.gov/tpm/guidance/pm3_hpms.pdf

[26] See Table 3.8 in the HPMS Field Manual (December 2016): https://www.fhwa.dot.gov/policyinformation/hpms/fieldmanual/hpms_field_manual_dec2016.pdf

[27] HPMS Field Manual: http://www.fhwa.dot.gov/policyinformation/hpms/fieldmanual/

metric data derived from the travel time data collected from January 1, 2017 through December 31, 2017.

- ***Data Collection & Reporting Frequency*:** In accordance with 23 CFR 490.511(e), 23 CFR 490.611(b), and 23 CFR 490.711(f), State DOTs are required to report metrics and related data for all travel time based measures by June 15th of each year for the previous year's collected data. Further information on the processing and reporting of this data is included in "Travel Time Metric Data Reporting Requirements & Specifications"[28] and HPMS Field Manual.[29] Travel time data collection and reporting metrics are required every year.[30] The "year" (i.e., performance/inventory year) in HPMS dataset name could be verified through the data values in YEAR_RECORD Field in the reported the "Travel Time Metric Dataset" and HPMS Data Item 71.

- **American Community Survey via American FactFinder** : The governing data source for determining urbanized area population for PHED Measure is the annual American Community Survey (ACS) 5-year estimates data contained in the ACS (published by the U.S. Census Bureau via American FactFinder) at the time of State DOT Biennial Performance Reports are due.[31] Please note that the most recent annual ACS 5-year estimates data (not annual ACS 1-year estimates data)[32] at the time of at the time of State DOT Biennial Performance Reports are due will be used for computing PHED Measure. For example, on October 1, 2018, "2012-2016 ACS 5-year estimates" (referred to as the "2016 ACS 5-year estimates") will be available.[33]

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[28] Travel Time Metric Data Reporting Requirements & Specifications (February 2018): https://www.fhwa.dot.gov/tpm/guidance/pm3_hpms.pdf - This document serves as supplemental guidance to the Highway Performance Monitoring System (HPMS) Field Manual (December 2016) and advises State DOTs as to how they must process and report travel time-related performance metric data as required by the third regulation on the National Performance Management Measures. More specifically, this document provides information on how to submit annual performance metric and related data via the HPMS that comports with the reporting requirements and specifications of 23 CFR 490.511(e), 490.611(b), and 490.711(f).

[29] HPMS Field Manual (December 2016): https://www.fhwa.dot.gov/policyinformation/hpms/fieldmanual/hpms_field_manual_dec2016.pdf

[30] 23 CFR 490.511(e), 23 CFR 490.611(b), and 23 CFR 490.711(f)

[31] 23 CFR 490.709(g) and 23 CFR 490.713(b)

[32] The U.S. Census Bureau publishes both 1-year and 5-year population estimates data annually as part of the ACS. The annual ACS 1-year estimates data are typically released in September, and the annual ACS 5-year estimates data are typically released in December. https://www.census.gov/programs-surveys/acs/news/data-releases/2016/release-schedule.html. The FHWA chose 5-year estimates over 1-year estimates because FHWA believes the data release date for 1-year estimate (September) may not provide adequate time for State DOT target establishment and reporting to meet the October 1 deadline for State Biennial Performance Reports (23 CFR 490.107(b)(1)(i)).

[33] Published in December 2017 – ACS News & Updates – Data Releases: https://www.census.gov/programs-surveys/acs/news/data-releases.html

2 Measure Computation Methodology

This section describes the methods for computing measures for Travel Time Reliability, Freight Reliability, Peak Hour Excessive Delay (PHED), and Percent Non-SOV Travel.

2.1 Measure Equations

This section outlines the equations that will be used for computing the various measures. For travel time based measures, the variables in brackets [] in the equations represent values for corresponding data fields in "Travel Time Metric Dataset" described in the "Travel Time Metric Data Reporting Requirements & Specifications"[34] for Travel Time Reliability, Freight Reliability, and PHED measures. For example, [DIR_AADT] represents an annual average daily travel value for a given direction of travel, and [TTTR_AMP] represents a Truck Travel Time Reliability metric value for the "AM Peak." The subscript "r" denotes the values in the variables apply to a reporting segment submitted to HPMS.

2.1.1 Travel Time Reliability Measures

In accordance with 23 CFR 490.513(b) and (c), two Travel Time Reliability Measures, Percent of the person-miles traveled on the Interstate System that are Reliable (denoted as IS_TT_Reliability below) and Percent of person-miles traveled on the non-Interstate NHS that are Reliable (denoted as NON_IS_TT_Reliability below), are computed as follow:

$$\text{IS_TT_Reliability} = \frac{\sum_{r=1}^{RI} (SL)_r \times [DIR_AADT]_r \times (\text{number of days in the data year}) \times [OCC_FAC]_r}{\sum_{r=1}^{IS} (SL)_r \times [DIR_AADT]_r \times (\text{number of days in the data year}) \times [OCC_FAC]_r} \times 100$$

$$\text{NON_IS_TT_Reliability} = \frac{\sum_{r=1}^{RN} (SL)_r \times [DIR_AADT]_r \times (\text{number of days in the data year}) \times [OCC_FAC]_r}{\sum_{r=1}^{NIN} (SL)_r \times [DIR_AADT]_r \times (\text{number of days in the data year}) \times [OCC_FAC]_r} \times 100$$

Where,

IS_TT_Reliability:	Percent of the person-miles traveled on the Interstate System that are Reliable (Interstate Travel Time Reliability Measure) *to the nearest tenth of a percent*;
NON_IS_TT_Reliability:	Percent of the person-miles traveled on the Non-Interstate NHS that are Reliable (Non-Interstate Travel Time Reliability Measure) *to the nearest tenth of a percent*;
r:	a reporting segment on the NHS reported to HPMS;

[34] Travel Time Metric Data Reporting Requirements & Specifications (February 2018): https://www.fhwa.dot.gov/tpm/guidance/pm3_hpms.pdf

RI: total number of reporting segments on the Interstate System that are exhibiting an LOTTR below 1.50 *during all four time periods;*[35]

IS: total number of reporting segments on the Interstate System;

RN: total number of reporting segments on the Non-Interstate NHS that are exhibiting an LOTTR *to the nearest hundredth* (computed by 80th percentile travel time divided by the 50th percentile travel time) below 1.50 for *all of the time periods;*[36]

NIN: total number of reporting segments on the Non-Interstate NHS;

$(SL)_r$: Length of reporting segment "r", *to the nearest thousandth of a mile*;

$(SL)_r = [Segment_Length]_r$: Length of reporting segment "r", is $[Segment_Length]_r$ value reported to HPMS where all reporting segments were derived from NPMRDS and no Data Item 71 ($Item_71$) has been submitted to HPMS for the reporting segments. Note if reporting segments are derived from NPMRDS, Item 71 submittal for the reporting segments is not required;

$(SL)_r = [Item_71].[End_Point]_r - [Item_71].[Begin_Point]_r$: Length of reporting segment "r", is computed by subtracting beginning milepost of the reporting segment "r" ($[Item_71].[Begin_Point]_r$) from the ending milepost of the reporting segment "r" ($[Item_71].[End_Point]_r$) of the Data Item 71 where all reporting segments were derived from NPMRDS and State DOT elects to submit Data Item 71 to HPMS for the reporting segments. If a reporting segment is represented by multiple sections in Data Item 71, then the length of that reporting segment is computed by adding sections lengths (the difference between beginning and ending mileposts in

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[35] 23 490.513(b) and (c). Four time periods provided in 23 CFR 490.511(b) are:

(1) "AM Peak" is between the hours of 6:00 a.m. and 10:00 a.m. for every weekday (Monday through Friday) from January 1st through December 31st of the same calendar year;

(2) "Midday" is between the hours of 10:00 a.m. and 4:00 p.m. for every weekday (Monday through Friday) from January 1st through December 31st of the same calendar year;

(3) "PM Peak" is between the hours of 4:00 p.m. and 8:00 p.m. for every weekday (Monday through Friday) from January 1st through December 31st of the same calendar year; and

(4) "Weekend" is between the hours of 6:00 a.m. and 8:00 p.m. for every weekend day (Saturday and Sunday) from January 1st through December 31st of the same calendar year.

[36] Ibid.

Data Item 71) of all relevant sections for that that reporting segment;

$(SL)_r$ = $[Item_71].[End_Point]_r - [Item_71].[Begin_Point]_r$: Length of reporting segment "r", is computed by subtracting beginning milepost of the reporting segment "r" ($[Item_71].[Begin_Point]_r$) from the ending milepost of the reporting segment "r" ($[Item_71].[End_Point]_r$) of the Data Item 71 where any one of the reporting segments submitted to HPMS was derived from equivalent travel time dataset. If a reporting segment is represented by multiple sections in Data Item 71, then the length of that reporting segment is computed by adding sections lengths (the difference between beginning and ending mileposts in Data Item 71) of all relevant sections for that that reporting segment;

$[DIR_AADT]_r$: Annual Average Daily[37] Travel (AADT), *to the nearest integer*, for a given direction of travel for reporting segment "r"; and

$[OCC_FAC]_r$: Average vehicle occupancy, *to the nearest tenth*,[38] for a given direction of travel for reporting segment "r." If $[OCC_FAC]_r$ is unreported or zero, then the value will come from the most recently available data tables published by FHWA.[39] If $[OCC_FAC]_r$ is reported in the "Travel Time Metric Dataset" in HPMS then the value will come from the reported values in $[OCC_FAC]$ in the "Travel Time Metric Dataset."

2.1.2 Freight Reliability Measure

In accordance with 23 CFR 490.613(b), the Freight Reliability Measure (denoted as $TTTR_Index$ below) is computed as follow:

$$TTTR_Index = \frac{\sum_{r=1}^{IS} (SL)_r \times \mathbf{max}([TTTR_AMP]_r, [TTTR_MIDD]_r, [TTTR_PMP]_r, [TTTR_OVN]_r, [TTTR_WE]_r)}{\sum_{r=1}^{IS} (SL)_r}$$

Where,

$TTTR_Index$: Truck Travel Time Reliability (TTTR) Index (Freight Reliability Measure) *to the nearest hundredth*;

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[37] The total annual traffic volume of a reporting segment is required for measure computation, as described in 23 CFR 490.513. However, the number of calendar days per year (23 CFR 490.509(c)) cancels out in the measure computation equation.

[38] 23 CFR 490.511(e)(2)

[39] 23 CFR 490.509(d)

r: a reporting segment on the Interstate System;

IS: total number of reporting segments on the Interstate System;

$(SL)_r$: Length of reporting segment "r", *to the nearest thousandth of a mile*;

$(SL)_r = [\text{Segment_Length}]_r$: Length of reporting segment "r", is $[\text{Segment_Length}]_r$ value reported to HPMS where all reporting segments were derived from NPMRDS and no Data Item 71 (Item_71) has been submitted to HPMS for the reporting segments. Note if reporting segments are derived from NPMRDS, Item 71 submittal for the reporting segments is not required;

$(SL)_r = [\text{Item_71}].[\text{End_Point}]_r - [\text{Item_71}].[\text{Begin_Point}]_r$: Length of reporting segment "r", is computed by subtracting beginning milepost of the reporting segment "r" ($[\text{Item_71}].[\text{Begin_Point}]_r$) from the ending milepost of the reporting segment "r" ($[\text{Item_71}].[\text{End_Point}]_r$) of the Data Item 71 where all reporting segments were derived from NPMRDS and State DOT elects to submit Data Item 71 to HPMS for the reporting segments. If a reporting segment is represented by multiple sections in Data Item 71, then the length of that reporting segment is computed by adding sections lengths (the difference between beginning and ending mileposts in Data Item 71) of all relevant sections for that that reporting segment;

$(SL)_r = [\text{Item_71}].[\text{End_Point}]_r - [\text{Item_71}].[\text{Begin_Point}]_r$: Length of reporting segment "r", is computed by subtracting beginning milepost of the reporting segment "r" ($[\text{Item_71}].[\text{Begin_Point}]_r$) from the ending milepost of the reporting segment "r" ($[\text{Item_71}].[\text{End_Point}]_r$) of the Data Item 71 where any one of the reporting segments submitted to HPMS was derived from equivalent travel time dataset. If a reporting segment is represented by multiple sections in Data Item 71, then the length of that reporting segment is computed by adding sections lengths (the difference between beginning and ending mileposts in Data Item 71) of all relevant sections for that that reporting segment;

$\max(\ldots)$: returns the largest value of a set of values contained within the parenthesis;

$[\text{TTTR_AMP}]_r$: TTTR metric *to the nearest hundredth* (computed by dividing 95th percentile truck travel time by the 50th percentile truck travel time) for "AM Peak"[40] for reporting segment "r";

$[\text{TTTR_MIDD}]_r$: TTTR metric *to the nearest hundredth* (computed by dividing 95th percentile truck travel time by the 50th percentile truck travel time) for "Midday"[41] for reporting segment "r";

$[\text{TTTR_PMP}]_r$: TTTR metric *to the nearest hundredth* (computed by dividing 95th percentile truck travel time by the 50th percentile truck travel time) for "PM Peak"[42] for reporting segment "r";

$[\text{TTTR_OVN}]_r$: TTTR metric *to the nearest hundredth* (computed by dividing 95th percentile truck travel time by the 50th percentile truck travel time) for "Overnight"[43] for reporting segment "r"; and

$[\text{TTTR_WE}]_r$: TTTR metric *to the nearest hundredth* (computed by dividing 95th percentile truck travel time by the 50th percentile truck travel time) for "Weekend"[44] for reporting segment "r";

2.1.3 PHED Measure

The Peak Hour Excessive Delay Measure applies to the both traveling directions of the mainline highway segments on the NHS that cross any part of an urbanized area with a population more than 1 million (a population greater then 200,000, starting with HPMS reporting in 2022) within its State geographic boundary and that urbanized area contains any part of nonattainment or maintenance areas for any one of criteria pollutants (O_3, CO, PM_{10} or $PM_{2.5}$) listed under the National Ambient Air Quality Standards (NAAQS), as specified in 23 CFR 490.105(e)(8) and 490.703.

In accordance with 23 CFR 490.713(b), the Annual Hours of Peak Hour Excessive Delay Per Capita (denoted as PHED_Measure below) for an applicable urbanized area is computed as follow:

$$\text{PHED_Measure} = \frac{\sum_{r=1}^{U} [\text{PHED}]_r}{\text{UZA_Population}}$$

[40] 23 CFR 490.611(a) - "AM Peak" is between the hours of 6:00 a.m. and 10:00 a.m. for every weekday (Monday through Friday) from January 1st through December 31st of the same calendar year.

[41] 23 CFR 490.611(a) - "Midday" is between the hours of 10:00 a.m. and 4:00 p.m. for every weekday (Monday through Friday) from January 1st through December 31st of the same calendar year.

[42] 23 CFR 490.611(a) - "PM Peak" is between the hours of 4:00 p.m. and 8:00 p.m. for every weekday (Monday through Friday) from January 1st through December 31st of the same calendar year.

[43] 23 CFR 490.611(a) - "Overnight" is between the hours of 8:00 p.m. and 6:00 a.m. for everyday (Sunday through Saturday) from January 1st through December 31st of the same calendar year.

[44] 23 CFR 490.611(a) - "Weekend" is between the hours of 6:00 a.m. and 8:00 p.m. for every weekend day (Saturday through Sunday) from January 1st through December 31st of the same calendar year.

Where,

PHED_Measure:	Annual Hours of Peak Hour Excessive Delay Per Capita (PHED_Measure), *to the nearest tenth,* for an applicable urbanized area[45];
r:	a reporting segment on the NHS located within the applicable urbanized area;
U:	total number of reporting segments on the NHS located within the applicable urbanized area;
$[PHED]_r$:	Total Peak Hour Excessive Delay metric (*nearest to the thousandth*) for reporting segment "r" within the applicable urbanized area; and
UZA_Population:	the total population in the applicable urbanized area from the most recent annual population published by the U.S. Census (ACS 5-year estimates) at the time that the State Biennial Performance Period Report is due to FHWA (see Appendix B for more details on obtaining the annual population estimates);

2.1.4 Percent Non-SOV Travel Measure

23 CFR 490.101 defines "non-SOV travel" as any travel mode other than driving alone in a motorized vehicle (i.e., single occupancy vehicle or SOV travel), including travel avoided by telecommuting. 23 CFR 490.713(c) provides general equations and description of the three options (Method "A", "B", and "C") for computing the Percent Non-SOV Travel Measure (denoted as PCT_NON_SOV_Travel below) for an applicable urbanized area.[46]

As specified in 23 CFR 490.709(f)(2) and (3), State DOTs must report the data collection method that is used to determine the Percent Non-SOV Travel Measure for each applicable urbanized area in the State to FHWA in their first Baseline Performance Period Report (due on October 1, 2018) required in 23 CFR 490.107(b)(1). The State DOT must include sufficient detail to understand how the data are collected if either Method "B" or Method "C" are used for the urbanized area. This method must be used for the full performance period for each applicable urbanized area.

If State DOTs and MPOs that contribute to an applicable urbanized area elect to change the data collection method reported in their first Baseline Performance Period Report, then each respective State DOT must report this change in their next Baseline Performance Period Report. The new method reported as a requirement of this paragraph must not be used until the beginning of the next

[45] An urbanized area with a population more than 1 million (more than 200,000 beginning in 2nd Performance Period) and that urbanized area contains any part of a nonattainment or maintenance area designated for ozone (O_3), carbon monoxide (CO), or particulate matter (PM_{10} and $PM_{2.5}$) National Ambient Air Quality Standards (NAAQS). 23 CFR 490.703.

[46] Ibid.

Performance Period for the Baseline Performance Report in which the method was reported to be changed. For example, if State DOTs and MPOs that contribute to an applicable urbanized area elect to use Method "B" for the 1st Performance Period and Method "C" for the 2nd Performance Period, those State DOTs must report 4-year condition/performance (23 CFR 490.107(b)(3)(ii)(A)) using Method "B" in their Full Performance Period Progress Report for the 1st Performance Period (due on October 1, 2022) and must report baseline condition/performance (23 CFR 490.107(b)(1)(ii)(B)) using Method "C" in their Baseline Performance Period Report for the 2nd Performance Period (also due on October 1, 2022).

2.1.4.1 Method "A" - American Community Survey

As provided in 23 CFR 490.713(d)(1), Percent Non-SOV Travel Measure using Method "A" is computed as follows:

$$\text{PCT_NON_SOV_Travel} = 100\% - \text{PCT_SOV_Travel}$$

Where,

PCT_NON_SOV_Travel :	Percent Non-SOV Travel Measure, *to the nearest tenth of a percent,* for an applicable urbanized area[47] (see Section 1.4 for more details);
PCT_SOV_Travel :	The most recent percent estimate in ACS 5-year estimates for "Percent; COMMUTING TO WORK - Workers 16 years and over - Car, truck, or van -- drove alone", *to the nearest tenth of a percent,* for an applicable urbanized area[48] as of August 15th of the year in which the State Biennial Performance Report is due to FHWA (see Appendix C);

Please refer to Appendix C for obtaining PCT_SOV_Travel travel values for each urbanized area from the American Community Survey. Appedix C also includes an example of computing Percent Non-SOV Travel Measure (PCT_NON_SOV_Travel).

2.1.4.2 Method "B" – Local Survey

As provided in 23 CFR 490.713(d)(2), Percent Non-SOV Travel Measure using Method "B" is computed using the data derived from a local survey focused on either work travel or household travel for the urbanized area and conducted as recently as 2 years before the beginning of the performance period.

As described in 23 CFR 490.709(f)(1)(ii), the survey method must estimate travel mode choice for the full urbanized area using industry accepted methodologies and approaches resulting in a margin of

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[47] An urbanized area with a population more than 1 million (more than 200,000 beginning in 2nd Performance Period) and that urbanized area contains any part of a nonattainment or maintenance area designated for ozone (O_3), carbon monoxide (CO), or particulate matter (PM_{10} and $PM_{2.5}$) National Ambient Air Quality Standards. 23 CFR 490.703.

[48] Ibid. See also 23 CFR 490.709(f)

error that is acceptable to industry standards, allow for updates on at least a biennial frequency, and distinguish non-SOV travel occurring in the area as a percent of all work or household travel.

By using this method, applicable State DOTs and MPOs must compute the Percent Non-SOV Travel Measure to represent travel that is not occurring by driving alone in a motorized vehicle (including travel avoided by telecommuting) as a percentage of all surface transportation occurring in the applicable urbanized area. Percent Non-SOV Travel Measure using this method must be computed to the nearest tenth of a percent.

Note that if applicable State DOT and MPOs choose this option of computing the Percent Non-SOV Travel Measure for an urbanized area, State DOTs must report data collection method for the measure in their State DOT Baseline Performance Report (23 CFR 490.107(b)(1)(ii)(I)), and FHWA will obtain the reported condition/performance from the State DOT Biennial Performance Reports (23 CFR 490.107(b)(1)(ii)(B), 23 CFR 490.107(b)(2)(ii)(A), and 23 CFR 490.107(b)(3)(ii)(A)).

2.1.4.3 Method "C" – System Use Measurement

23 CFR 490.713(d)(3) provides Percent Non-SOV Travel Measure computation based on the travel volume of surface modes of transportation from the measurements of actual use of each transportation mode.

23 CFR 490.709(f)(1)(iii) specified that sample or continuous measurements could be used to count the number of travelers using different surface modes of transportation. This method, used to count travelers, must estimate the total volume of annual travel for the full urbanized area within a margin of error that is acceptable to industry standards and allows for updates on at least a biennial frequency. This method must include sufficient information to calculate the amount of non-SOV travel occurring in the applicable urbanized area as a percentage of all surface transportation travel. State DOTs are encouraged to report counts to FHWA that are not included in currently available national data sources. Applicable State DOTs and MPOs must compute the Percent Non-SOV Travel Measure using this method in the following general form:

$$\text{PCT_NON_SOV_Travel} = \frac{\text{APTV}_{\text{NON SOV}}}{\text{APTV}_{\text{SOV}} + \text{APTVolume}_{\text{NON SOV}}} \times 100$$

Where,

PCT_NON_SOV_Travel : Percent of non-SOV Travel (Percent Non-SOV Travel Measure), *to the nearest tenth of a percent,* for an applicable urbanized area[49] (see Section 1.4 for more details);

[49] An urbanized area with a population more than 1 million (more than 200,000 beginning in 2nd Performance Period) and that urbanized area contains any part of a nonattainment or maintenance area designated for ozone

$APTV_{SOV}$: Annual total volume of person travel by driving alone in a motorized vehicle for an applicable urbanized area;[50] and

$APTV_{NON\ SOV}$: Annual total volume of person travel occurring on modes other than driving alone in a motorized vehicle for an applicable urbanized area[51] and expressed as follow.

$$APTV_{NON\ SOV} = \sum_{m=1}^{T} APTV_m$$

Where,

m: travel mode other than driving alone in a motorized vehicle, including travel avoided by telecommuting;

T: total number of modes other than driving alone in a motorized vehicle, including travel avoided by telecommuting; and

$APTV_m$: annual total volume of person travel for each mode, "m".

Note that if applicable State DOT and MPOs choose this option of computing the Percent Non-SOV Travel Measure for an urbanized area, State DOTs must report data collection method for the measure in their State DOT Baseline Performance Report (23 CFR 490.107(b)(1)(ii)(I)), and FHWA will obtain the reported condition/performance from the State DOT Biennial Performance Reports (23 CFR 490.107(b)(1)(ii)(B), 23 CFR 490.107(b)(2)(ii)(A), and 23 CFR 490.107(b)(3)(ii)(A)).

2.2 Data for Computing Travel Time Based Measures

As defined in 23 CFR 490.101, a *travel time data set* is either the National Performance Management Research Data Set (NPMRDS) or an FHWA-approved equivalent data set. This data set is used for deriving metric values to be submitted to HPMS.[52] A *travel time segment* is a contiguous stretch of the NHS for which average travel time data are summarized in the travel time data set[53] (either in NPMRDS or equivalent data set[54]). A *reporting segment* is the length of roadway that the State DOT and MPOs

(O_3), carbon monoxide (CO), or particulate matter (PM_{10} and $PM_{2.5}$) National Ambient Air Quality Standards. 23 CFR 490.703.

[50] Ibid.

[51] Ibid.

[52] 23 CFR 490.511(e), 490.611(b), and 490.711(f)

[53] 23 CFR 490.101

[54] 23 CFR 490.103(e)(5)

define for metric calculation and metric value reporting to HPMS, and is comprised of one or more travel time segments.[55]

2.2.1 Travel Time Based Metric Data

All Travel Time based measures will be computed using the "Travel Time Metric Dataset" in HPMS for the *reporting segments*. Beginning in 2018, the State DOTs are required to submit travel time-related metric data and the data necessary for measure computation for reporting segments on NHS into HPMS (i.e., "Travel Time Metric Dataset" in HPMS) by June 15th of each year,[56] and the travel time based metrics are:

- Level of Travel Time Reliability (LOTTR) metrics, corresponding 80th and 50th percentile travel times, directional Average Annual Daily Traffic (DIR_AADT), and vehicle occupancy factor[57] for each of the reporting segments on NHS, as required in 23 CFR 490.511(e).

- Truck Travel Time Reliability (TTTR) metrics, corresponding 95th and 50th percentile truck travel times for each of the reporting segments on Interstate System, as required in 23 CFR 490.611(b).

Total Peak Hour Excessive Delay (PHED) metric data, as required in 23 CFR 490.711(f), for each of the reporting segments on NHS in urbanized areas with a population over one million (starting in 2022, a population over 200,000) that is, in all or part, designated as nonattainment or maintenance areas for ozone (O_3), carbon monoxide (CO), or particulate matter (PM_{10} and $PM_{2.5}$) National Ambient Air Quality Standards (NAAQS), as provided in 23 CFR 490.703.

Please see State DOT metric data reporting requirements in the document "Travel Time Metric Data Reporting Requirements & Specifications (February 2018)"[58] for more detail. A graphical representation of "Travel Time Metric Dataset" in HPMS (also referred to as Travel_Time_Metric_Dataset) is shown in Figure 1 below.

[55] 23 CFR 490.101

[56] 23 CFR 490.511(e), 490.611(b), and 490.711(f)

[57] 23 CFR 490.511(e)(2) – Only if a State DOT does not elect to use the most recently available data tables published by FHWA.

[58] Travel Time Metric Specifications Dataset (Table 1 in Travel Time Metric Data Reporting Requirements & Specifications (February 2018)): https://www.fhwa.dot.gov/tpm/guidance/pm3_hpms.pdf

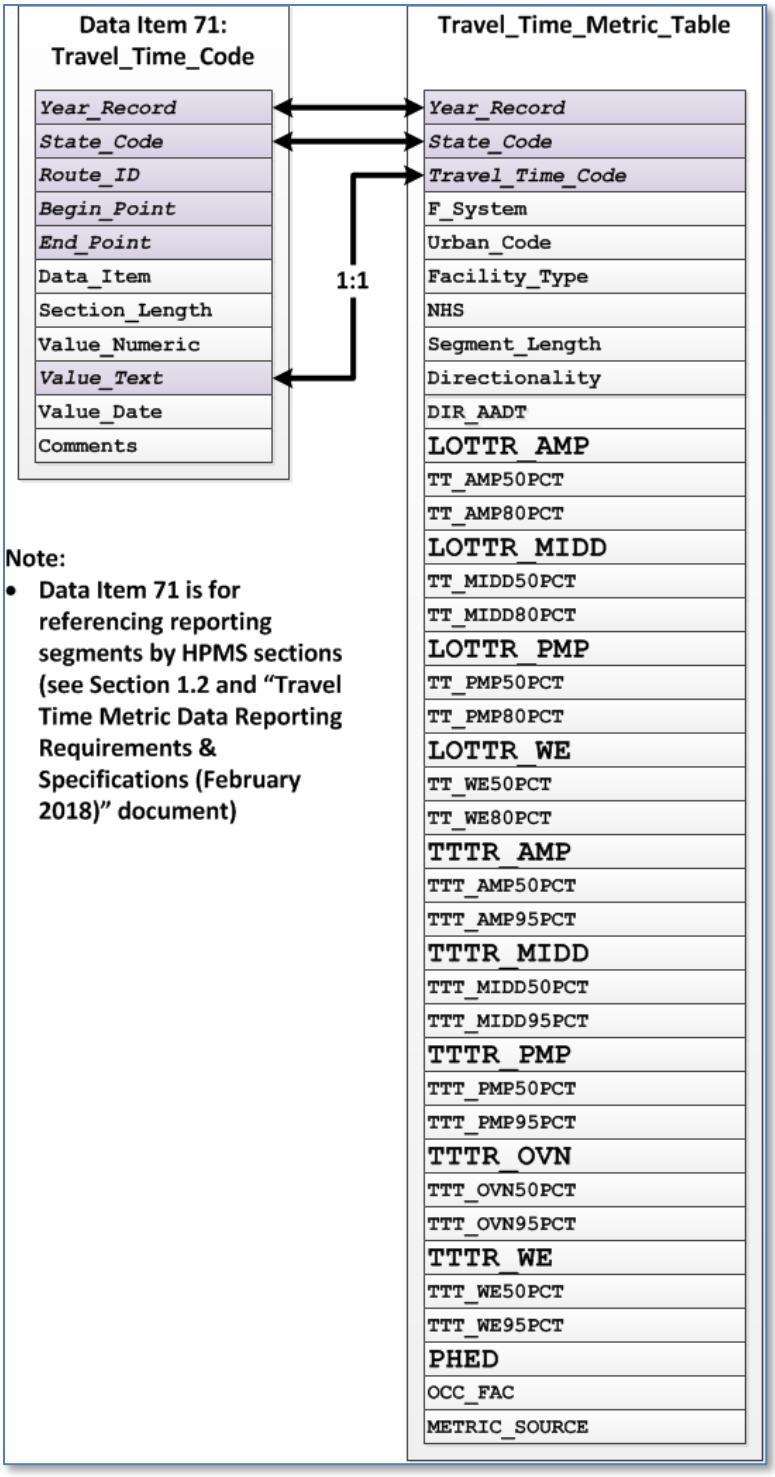

Figure 1 – Graphical Illustration of Travel Time Metric Dataset for Travel Time Based Measures

2.2.2 Travel Time Metric Data Validation

When a State DOT submits the data items described in the "Travel Time Metric Data Reporting Requirements & Specifications" document[59] and HPMS Field Manual,[60] HPMS Software performs its general data validation[61] and validation specific to travel time metric data. Based on the validation results, State DOTs may correct and resubmit the data, upon FHWA request.

For the purpose of determining whether a State DOT has made significant progress towards the achievement of its National Highway Performance Program (NHPP) and National Highway Freight Program (NHFP) targets, FHWA will compute Travel Time Reliability and Freight Reliability measures using the method described in Sections 2.3.1 through 2.3.3 and the data contained within the HPMS on August 15th of the year in which the significant progress determination is made.[62] The FHWA will also compute the baseline conditions/performances for Travel Time Reliability and Freight Reliability measures using the measure computation methods, described in Sections 2.3.1 through 2.3.3, and HPMS data reported in the year in which Baseline Period Performance Report is due to FHWA.[63]

Although the target achievement for CMAQ traffic Congestion measures (PHED and Non-SOV Travel measures) is not subject to an FHWA significant progress determination, FHWA plans to compute the PHED measure (using the method provided in Section 2.3.4) and Non-SOV Travel measure (method described in Appendix C) for each applicable urbanized area and plans to make them available to the State DOTs to ensure consistency in measure computation process.

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[59] Travel Time Metric Data Reporting Requirements & Specifications (February 2018): https://www.fhwa.dot.gov/tpm/guidance/pm3_hpms.pdf

[60] HPMS Field Manual, December 2016: https://www.fhwa.dot.gov/policyinformation/hpms/fieldmanual/

[61] https://www.fhwa.dot.gov/policyinformation/hpms/softwareguide/hpms_software_guide.pdf

[62] 23 CFR 490.109(d)(1) and (d)(2),

[63] 23 CFR 490.109(d)(1)(vi) and (d)(2)(ii)

2.3 Travel Time Based Measure Computation Procedure

As indicated previously, "Travel Time Metric Dataset" (denoted as Travel_Time_Metric_Dataset in this section) and HPMS Data Item 71 - Item_71 (Travel Time Reporting Segment) will be used for measure computation. Also as descrived before there are 3 possible ways for a State DOT could submit data, and Table below describes how data sets are joined and how reporting segment lengths are determined for measure computation.

Table 1 – Metric Data Submittal Options and Data Items Required for Measure Computation

Submitted Metric Data	Required Data Set for Measure Computation	Reporting Segment Length for Measure Computation $(SL)_r$
All reporting segments in **Travel_Time_Metric_Dataset** were from NPMRDS (without Data Item 71)	Data items only from **Travel_Time_Metric_Dataset**	[Travel_Time_Metric_Dataset].[Segment_Length]
All reporting segments in **Travel_Time_Metric_Dataset** were from NPMRDS (with Data **Item 71**[64])	Data items from JOINED[65] **Travel_Time_Metric_Dataset** AND **Item_71** (Data Item 71 sections data) JOIN by [Item_71].[Value_Text] = [Travel_Time_Metric_Dataset].[Travel_Time_Code]	SUM([Item_71].[End_Point] - [Item_71].[Begin_Point]) WHERE [Item_71].[Value_Text] = [Travel_Time_Metric_Dataset].[Travel_Time_Code]
Any or all reporting segments in **Travel_Time_Metric_Dataset** were from equivalent data set with Data Item 71[66]	Data items from JOINED[67] **Travel_Time_Metric_Dataset** AND **Item_71** (Data Item 71 sections data) JOIN by [Item_71].[Value_Text] = [Travel_Time_Metric_Dataset].[Travel_Time_Code]	SUM([Item_71].[End_Point] - [Item_71].[Begin_Point]) WHERE [Item_71].[Value_Text] = [Travel_Time_Metric_Dataset].[Travel_Time_Code]

[64] State DOT elects to use NPMRDS and referencing reporting segments by HPMS sections. Please see Section 1.2.

[65] Please see graphical illustration of tabular join in Figure 1 above.

[66] State DOT elects to use, in part or in whole, the equivalent travel time data set. Please see Section 1.2..

[67] Please see graphical illustration of tabular join in Figure 1 above.

2.3.1 Interstate Travel Time Reliability Measure

As provided in Section 2.1.1, the following equation is for the Interstate Travel Time Reliability Measure (IS_TT_Reliability) in accordance with 23 CFR 490.513(b).

$$\text{IS_TT_Reliability} = \frac{\sum_{r=1}^{RI} (SL)_r \times [\text{DIR_AADT}]_r \times (\text{number of days in the data year}) \times [\text{OCC_FAC}]_r}{\sum_{r=1}^{IS} (SL)_r \times [\text{DIR_AADT}]_r \times (\text{number of days in the data year}) \times [\text{OCC_FAC}]_r} \times 100$$

2.3.1.1 Step 1: Obtain Interstate Reporting Segment Data

The data records in the Travel_Time_Metric_Dataset must meet the criteria below to be considered as data for the reporting segments on the mainline highway of the Interstate System for a State.

SELECT * FROM Travel_Time_Metric_Dataset

WHERE

(([F_System] =1) AND

([Facility_Type] IN (1, 2, 6)) AND

([NHS] IN (1, 2, 3, 4, 5, 6, 7, 8, 9)) AND

([Urban_Code] > 0)**)**

2.3.1.2 Step 2: Populate Average Occupancy Factor

$[OCC_FAC]_r$ in above equation is average vehicle occupancy for a given direction of travel for reporting segment "r." As described in Section 2.3 above, if $[OCC_FAC]_r$ is unreported or zero, then appropriate value(s) will be populated for each reporting segment with the most recently available data published by FHWA.[68]

IF ([OCC_FAC] = 0 OR [OCC_FAC] IS NULL)

THEN [OCC_FAC] = FHWA provided data

If [OCC_FAC] value(s) are reported in the Travel_Time_Metric_Dataset, then the reported values will be used for measure computation.

2.3.1.3 Step 3: Compute Annual Person Miles for Each Reporting Segment

For each reporting segment, annual person-miles of a reporting segment is computed by multiplying the following four values:

[68] 23 CFR 490.509(d)

- length of reporting segment "r" ($(SL)_r$) described in Table 1 above for an applicable dataset;
- average vehicle occupancy for a given direction ($[OCC_FAC]_r$) described in Step 2;
- the number of days in the data year; and
- annual Average Daily Travel for a given direction of travel for reporting segment "r" ($[DIR_AADT]_r$).

2.3.1.4 Step 4: Classify Reporting Segments

A reporting segment is classified as "Reliable," unless a reporting segment satisfies any one of following conditions is met:

([LOTTR_AMP] >= 1.5) OR

([LOTTR_MIDD] >= 1.5) OR

([LOTTR_PMP] >= 1.5) OR

([LOTTR_WE] >= 1.5)

Where [LOTTR_AMP] is the LOTTR metric for a reporting segment for "AM Peak"; [LOTTR_MIDD] is the LOTTR metric for a reporting segment for "Midday"; [LOTTR_PMP] is the LOTTR metric for a reporting segment for "PM Peak"; and [LOTTR_WE] is the LOTTR metric for a reporting segment for "Weekend."

There may be situations where travel times are not available in NPMRDS or "Equivalent Data Set" for a time period (or time periods) for a reporting segment.[69] For these cases, above criteria will be evaluated only based on reported LOTTR(s).

For example, if a reporting segment has following LOTTRs:

[LOTTR_AMP] = 1.05; [LOTTR_MIDD] = 1.06; [LOTTR_PMP] = 2.45; and LOTTR_WE] = Unreported

then this particular reporting segment will be classified as "Not Reliable" because [LOTTR_PMP] >= 1.5 as the critera shown above.

Similarly, if a reporting segment has following LOTTRs:

[69] The FHWA believes that missing travel times for a time period for the entire calendar is a rare case and most likely due to lack of traffic on a reporting segment. Consequently, FHWA believes it is reasonable to assume that missing (unreported) LOTTR value for a reporting segment due to missing travel times does not make that reporting segment "Not Reliable."

[LOTTR_AMP] = Unreported; [LOTTR_MIDD] = 1.06; [LOTTR_PMP] = 1.24; and LOTTR_WE] = Unreported

then this reporting segment will be classified as "Reliable" because it does not meet the critera above (i.e., [LOTTR_MIDD] < 1.5 and [LOTTR_PMP] < 1.5).

Also, there may be situations where no travel time is available in NPMRDS or "Equivalent Data Set" for a reporting segment for the entire calendar year.[70] In such case (i.e., [LOTTR_AMP] = Unreported; [LOTTR_MIDD] = Unreported; [LOTTR_PMP] = Unreported; and LOTTR_WE] = Unreported), then this reporting segment will be classified as "Reliable."

Lastly, for the purpose of measure computation, reported percentile travel times (e.g., TT_PMP50PCT, TT_PMP80PCT) will not be used to correct an invalid or an unreported LOTTR metric (e.g., LOTTR_PMP).

2.3.1.5 Step 5: Compute Percentage

The numerator of the equation is computed by adding all annual person miles (in Step 3) for the reporting segments classified as "Reliable" in Step 4. The denominator of the equation is the sum of annual person miles (in Step 3) for all Interstate reporting segments determined in Step 1.

An hypothetical values for a state are shown below for an illustrative purpose:

State_Code	Travel_Time_Code	F_System	DIR_AADT	Segment_Length	OCC_FAC	LOTTR_AMP	LOTTR_MIDD	LOTTR_PMP	LOTTR_WE	annual_person_miles	Reliability
24	110+04640	1	94095	1.200	1.67	1.05	1.04	1.13	1.05	68826728.70	Reliable
24	110+04641	1	77248	2.205	1.67	2.29	1.02	1.04	1.03	103825773.07	Not_Reliable
24	110+04644	1	102040	0.241	1.67	1.15	1.07	1.46	1.07	14989834.16	Reliable
24	122P04867	1	8706	0.469	1.67	1.05	1.05	1.05	1.05	2488862.14	Reliable
24	122P08164	1	8166	0.637	1.67	1.07	1.06	1.07	1.08	3170721.84	Reliable

$$\text{IS_TT_Reliability} = \frac{68{,}826{,}728.70 + 14{,}989{,}834.16 + \cdots + 2{,}488{,}862.14 + 3{,}170{,}721.84}{68{,}826{,}728.70 + 103{,}825{,}773.07 + 14{,}989{,}834.16 + \cdots + 2{,}488{,}862.14 + 3{,}170{,}721.84} \times 100$$

Please note that this example is providing with an assumption that all reporting segments in Travel_Time_Metric_Dataset were from NPMRDS without Data Item 71. Please see Table 1 in Section 2.3. for appropriate method of determining reporting segment length $(SL)_r$ for measure computation.

[70] The FHWA believes that missing travel times for all time periods for the entire calendar is a rare case and most likely due to lack of traffic on a reporting segment. Consequently, FHWA believes it is reasonable to assume that missing (unreported) LOTTR values for a reporting segment due to missing travel times does not make that reporting segment "Not Reliable."

2.3.2 Non-Interstate Travel Time Reliability Measure

As provided in Section 2.1.1, the following equation is for the Non-Interstate NHS Travel Time Reliability Measure (NON_IS_TT_Reliability) in accordance with 23 CFR 490.513(c).

$$\text{NON_IS_TT_Reliability} = \frac{\sum_{r=1}^{RN} (SL)_r \times [DIR_AADT]_r \times (\text{number of days in the data year}) \times [OCC_FAC]_r}{\sum_{r=1}^{NIN} (SL)_r \times [DIR_AADT]_r \times (\text{number of days in the data year}) \times [OCC_FAC]_r} \times 100$$

2.3.2.1 Step 1: Get non-Interstate NHS Data

The data records in the Travel_Time_Metric_Dataset must meet the criteria below to be considered as data for the reporting segments on the mainline highway of the non-Interstate NHS for a State.

SELECT * FROM Travel_Time_Metric_Dataset

WHERE

(([F_System] IN (2, 3, 4, 5, 6, 7)) AND

([Facility_Type] IN (1, 2, 6)) AND

([NHS] IN (1, 2, 3, 4, 5, 6, 7, 8, 9)) AND

([Urban_Code] > 0))

2.3.2.2 Steps 2 through 5

The Steps 2 through 5 for computing Non-Interstate NHS Travel Time Reliability Measure (NON_IS_TT_Reliability) is the same as the Steps 2 through 5 for computing the Interstate Travel Time Reliability Measure (IS_TT_Reliability), described in Sections 2.3.1.2 through 2.3.1.5.

2.3.3 Truck Travel Time Reliability (TTTR) Index (referred to as the "Freight Reliability Measure")

As provided in Section 2.1.1, the following equation is for the Freight Reliability Measure (denoted as TTTR_Index below) in accordance with 23 CFR 490.613(b):

$$\text{TTTR_Index} = \frac{\sum_{r=1}^{IS} (SL)_r \times \mathbf{max}([TTTR_AMP]_r, [TTTR_MIDD]_r, [TTTR_PMP]_r, [TTTR_OVN]_r, [TTTR_WE]_r)}{\sum_{r=1}^{IS} (SL)_r}$$

As indicated in Section 2.1.1, $[TTTR_AMP]_r$ represent TTTR metric for "AM Peak" for reporting segment "r"; $[TTTR_MIDD]_r$ represent TTTR metric for "Midday" for reporting segment "r"; $[TTTR_PMP]_r$ represent TTTR metric for "PM Peak" for reporting segment "r"; $[TTTR_OVN]_r$ represent TTTR metric for "Overnight" for reporting segment "r"; and $[TTTR_WE]_r$ represent TTTR metric for "Weekend" for reporting segment "r."

2.3.3.1 Step 1: Obtain Interstate Reporting Segment Data

As provided in 23 CFR 490.603, the Freight Reliability Measure is applicable to the Interstate System. The data records in the Travel_Time_Metric_Dataset must meet the criteria below to be considered as data for the reporting segments on the mainline highway of the Interstate System for a State.

SELECT * FROM Travel_Time_Metric_Dataset

WHERE

(([F_System] =1) AND

([Facility_Type] IN (1, 2, 6)) AND

([NHS] IN (1, 2, 3, 4, 5, 6, 7, 8, 9)) AND

([Urban_Code] > 0)**)**

2.3.3.2 Step 2: Determine Maximum TTTR Metric Value

The term **max**($[TTTR_AMP]_r$, $[TTTR_MIDD]_r$, $[TTTR_PMP]_r$, $[TTTR_OVN]_r$, [TTTR_WE]) in the measure equation means the largest of the five truck travel time reliability metric values (TTTR). For example, if a segment with reported TTTR as follow:

[TTTR_AMP] = 4.66

[TTTR_MIDD] = 4.95

[TTTR_PMP] = 10.04

[TTTR_OVN] = 1.10

[TTTR_WE] = 1.73

The the **max**($[TTTR_AMP]_r$, $[TTTR_MIDD]_r$, $[TTTR_PMP]_r$, $[TTTR_OVN]_r$, [TTTR_WE]) term becomes:

max(4.66, 4.95, 10.04, 1.10, 1.73) = 10.04

There may be situations where travel times are not available in NPMRDS or "Equivalent Data Set" for a time period (or time periods) for a reporting segment.[71] For these cases, above criteria will be

[71] The FHWA believes that missing travel times for a time period for the entire calendar is a rare case and most likely due to lack of traffic on a reporting segment during that time period. Consequently, FHWA believes it is reasonable to determine maximum TTTR of the reporting segment by excluding unreported (NULL) TTTR for a reporting segment.

evaluated only based on reported TTTR(s) with valid values[72]. Please note that if one or more TTTR is not reported (NULL) for a reporting segment, then the reported metrics will be used to determine **max**([TTTR_AMP]$_r$, [TTTR_MIDD]$_r$, [TTTR_PMP]$_r$, [TTTR_OVN]$_r$, [TTTR_WE]) for that reporting segment. For example, if a segment with reported TTTR as follow:

[TTTR_AMP] = 4.66

[TTTR_MIDD] = 4.95

[TTTR_PMP] = Unreported

[TTTR_OVN] = 1.10

[TTTR_WE] = 1.73

The the **max**([TTTR_AMP]$_r$, [TTTR_MIDD]$_r$, [TTTR_PMP]$_r$, [TTTR_OVN]$_r$, [TTTR_WE]) term becomes:

max(4.66, 4.95, 1.10, 1.73) = 4.95

Also, there may be situations where no travel time is available in NPMRDS or "Equivalent Data Set" for a reporting segment for the entire calendar year.[73] If none of the five metrics is reported for a reporting segment, then that reporting segment will be excluded from the measure computation.

Lastly, for the purpose of measure computation, reported percentile travel times (e.g., TTT_PMP50PCT, TTT_PMP95PCT) will not be used to correct an invalid or an unreported TTTR metric (e.g., TTTR_PMP).

2.3.3.3 Step 3: Compute TTTR Index

For each reporting segment, the **max**([TTTR_AMP]$_r$, [TTTR_MIDD]$_r$, [TTTR_PMP]$_r$, [TTTR_OVN]$_r$, [TTTR_WE]) term (also referred to as $\mathrm{maxTTTR}$) is multiplied by reporting segment length $(\mathrm{SL})_r$. Then the product sum of $\mathrm{maxTTTR}$ and (SL) all Interstate reporting segments is divided by sum of SL of all Interstate reporting segments.

An hypothetical values for a state are shown below for an illustrative purpose:

[72] Travel Time Metric Specifications Dataset (Table 1 in Travel Time Metric Data Reporting Requirements & Specifications (February 2018)): https://www.fhwa.dot.gov/tpm/guidance/pm3_hpms.pdf

[73] The FHWA believes that missing travel times for the entire calendar is highly unlikely (particularly for reporting segments on Interstate Sustem). However, if all five TTTRs are unreported due to missing travel times for the entire year, those reporting segments missing all five TTTRs will be excluded from both numerator and the denominator in the measure computation equation to prevent erroneous results.

State_Code	Travel_Time_Code	F_System	Segment_Length	TTTR_AMP	TTTR_MIDD	TTTR_PMP	TTTR_WE	TTTR_OVN	maxTTTR
51	110-04120	1	1.517	1.18	1.35	2.42	1.20	1.18	2.42
51	110-04121	1	1.119	1.23	2.41	2.04	1.42	1.20	2.41
51	110-04122	1	0.935	1.25	3.35	1.82	1.46	1.24	3.35
51	110-04123	1	0.186	1.31	2.70	2.25	1.20	1.30	2.70
51	110P15859	1	0.272	1.09	1.05	1.00	1.07	1.08	1.08
51	110P16029	1	0.200	1.09	1.11	1.13	1.07	1.11	1.13
51	110P16046	1	0.322	1.62	1.26	1.66	1.27	1.29	1.66
51	110P16072	1	0.387	2.00	1.25	1.96	1.24	1.16	2.00

$$\text{TTTR_Index} = \frac{(1.157\times2.42) + (1.119\times2.41) + (0.935\times3.35) + \cdots + (0.200\times1.13) + (0.322\times1.66) + (0.387\times2.00)}{(1.157 + 1.119 + 0.935 + \cdots + 0.200 + 0.322 + 0.387)}$$

Please note that this example is providing with an assumption that all reporting segments in Travel_Time_Metric_Dataset were from NPMRDS without Data Item 71. Please see Table 1 in Section 2.3. for appropriate method of determining reporting segment length $(SL)_r$ for measure computation.

2.3.4 PHED Measure

The Peak Hour Excessive Delay (PHED) Measure is computed for the entirety of an applicable urbanized area (i.e., summing the PHED metrics of all reporting segments in each of the urbanized area in accordance with 23 CFR 490.713(b)). If an urbanized area has been determined[74] as an "applicable urbanized area" for traffic congestion measures, all reporting segments on the mainline NHS within that urbanized area are subjected to PHED Measure for that urbanized area. The [URBAN_CODE] values in the "Travel Time Metric Dataset" (also referred to as Travel_Time_Metric_Dataset) delineate reporting segments for an applicable urbanized area. A "Travel Time Metric Dataset(s)" submitted by State DOT(s) contains reporting segments located within geographical boundary of the State(s). A list of applicable urbanized areas and State DOTs responsible for submitting [PHED] metrics in their Travel_Time_Metric_Dataset for those applicable urbanized areas are listed in Table D1 of Appendix D. Table D2 in Appendix D provides the same information as Table D1, but sorted by State DOTs who are required implement PHED Measure for those applicable urbanized areas. Please note that the lists apply to the 1st performance period. Since PHED Measure is computed for the entirety of an applicable urbanized area, if an applicable urbanized area spans across multiple states, Travel_Time_Metric_Datasets from those State DOTs are needed for computing PHED Measure for that applicable urbanized area.

[74] Traffic Congestion Measure Applicability for the 1st Performance Period (October 2017): Applicable Urbanized Areas and Corresponding State DOTs - https://www.fhwa.dot.gov/environment/air_quality/cmaq/measures/cmaq_applicability/page04.cfm; Applicable State DOTs and Corresponding Applicable Urbanized Areas - https://www.fhwa.dot.gov/environment/air_quality/cmaq/measures/cmaq_applicability/page02.cfm#toc494364637

To compute PHED Measure for an applicable urbanized area, Travel_Time_Metric_Dataset(s) submitted by corresponding State DOT(s) for that applicable urbanized area must be gathered.

As provided in Section 2.1.3, the equation below is for PHED Measure (denoted as PHED_Measure) in accordance with 23 CFR 490.713(b).

$$\text{PHED_Measure} = \frac{\sum_{r=1}^{U} [\text{PHED}]_r}{\text{UZA_Population}}$$

PHED Measure (PHED_Measure) is Annual Hours of Peak Hour Excessive Delay Per Capita for an applicable urbanized area.

2.3.4.1 Step 1: Obtaining Dataset for an Applicable Urbanized Area

The total number of reporting segments on the NHS located within the applicable urbanized area (denoted as "U" in the equation) is determined by by applying the following criteria.

SELECT * FROM Travel_Time_Metric_Dataset(S)

WHERE

([State_Code] IN (##, …)) AND

([F_System] IN (1, 2, 3, 4, 5, 6, 7)) AND

([Facility_Type] IN (1, 2, 6)) AND

([NHS] IN (1, 2, 3, 4, 5, 6, 7, 8, 9)) AND

([Urban_Code] = #####)

If the entire applicable urbanized area is completely located within a State geographic boundary, then the Travel_Time_Metric_Dataset from that State DOT is needed for computing PHED measure for that urbanized area. Note the term ([State_Code] IN (##, …)) above indicates that if an applicable urbanized area spans across multiple states, then Travel_Time_Metric_Datasets from more than one State DOT is needed.

For example, to compute PHED Measure (PHED_Measure) for Atlanta, GA Urbanized Area, Travel_Time_Metric_Dataset submitted by Georgia Department of Transportation ([State_Code] = 13) is needed (see Table D1 in Appendix D). To extract the appropriate dataset for computing PHED measure for the Atlanta, GA Urbanized Area, the following query must be used on the Travel_Time_Metric_Dataset from Georgia Department of Transportation.

SELECT * FROM Travel_Time_Metric_Dataset

WHERE

([F_System] IN (1, 2, 3, 4, 5, 6, 7)) AND

([Facility_Type] IN (1, 2, 6)) AND

([NHS] IN (1, 2, 3, 4, 5, 6, 7, 8, 9)) AND

([Urban_Code] = 3817)

For computing PHED Measure for an applicable urbanized area spans across multiple states, Travel_Time_Metric_Dataset from each of the applicable State DOTs are needed. For example, to compute PHED Measure for Charlotte, NC-SC Urbanized Area, Travel_Time_Metric_Datasets submitted by both North Carolina Department of Transportation (NCDOT) and South Carolina Department of Transportation (SCDOT) are needed (see Table D1 in Appendix D). To extract the appropriate dataset for computing PHED measure for the Charlotte, NC-SC Urbanized Area, the following query must be used on the combined Travel_Time_Metric_Datasets from both NCDOT and SCDOT.

SELECT * FROM Travel_Time_Metric_Dataset[75]

WHERE

([State_Code] IN (37, 45)) AND

([F_System] IN (1, 2, 3, 4, 5, 6, 7)) AND

([Facility_Type] IN (1, 2, 6)) AND

([NHS] IN (1, 2, 3, 4, 5, 6, 7, 8, 9)) AND

([Urban_Code] = 15670)

2.3.4.2 Step 2: Obtain Urbanized Area Population Estimate

For the denominator of the equation (i.e., UZA_Population), the total population of an applicable urbanized area must be from the most recent annual population published by the U.S. Census (ACS 5-year estimates) at the time that the State Biennial Performance Period Report is due to FHWA, as required in 23 CFR 490.713(b). Please see Appendix B for more details on obtaining annual population estimates for the applicable urbanized areas.

[75] Combined Travel_Time_Metric_Tables from both NCDOT and SCDOT

2.3.4.3 Step 3: Compute PHED Measure

Once the datasets are queried, as described in Section 2.3.4.1, the [PHED] Metrics are added together for an applicable urbanized area. Then the sum of [PHED] metrics for an urbanized area is divided by the urbanized area population estimate (described in Section 2.3.4.1).

An hypothetical values for states are shown below for an illustrative purpose. For computing the PHED_Measure for Washington DC-MD-VA Urbanized Area (Urban_Code = 92242) is derived from the combined Travel_Time_Metric_Datasets from District of Columbia (State_Code = 11), Maryland (State_Code = 24), and Virginia (State_Code = 51) State DOTs.

Year_Record	State_Code	Travel_Time_Code	Urban_Code	PHED
2017	11	110-04131	92242	1970.961
2017	11	110-04132	92242	1797.505
2017	11	110-04133	92242	16813.670
2017	11	110-041[illegible]	92242	9008.750
2017	11	110P16647	92242	4670.964
2017	11	110P16650	92242	434.551
2017	11	110P17142	92242	7185.788
2017	24	110-04098	92242	9172.884
2017	24	110-04102	92242	46807.565
2017	24	110-041[illegible]	92242	251.720
2017	24	110P18329	92242	127.845
2017	24	110P18331	92242	5.797
2017	24	110P18332	92242	155.262
2017	51	110-04120	92242	34593.499
2017	51	110-04121	92242	24438.457
2017	51	110-041[illegible]	92242	4048.273
2017	51	110P18188	92242	480.056
2017	51	110P18189	92242	6227.380

Based on the 2016 5-year ACS Data, Washington DC-MD-VA Urbanized Area has a population of 4,897,996. So the PHED_Measure for that urbanized area is computed as shown below.

$$\text{PHED_Measure} = \frac{1{,}970.961 + 1{,}797.505 + 16{,}813.670 + \cdots + 434.551 + 7{,}185.788 + 9{,}172.884 + 46{,}807.565 + \cdots + 5.797 + 155.262 + 34{,}593.499 + 24{,}438.457 + \cdots + 480.056 + 6{,}227.380}{4{,}897{,}996}$$

Appendix A – References & Acronyms Table

- American Community Survey: https://www.census.gov/programs-surveys/acs/
- Travel Time Metric Data Reporting Requirements & Specifications (February 2018): https://www.fhwa.dot.gov/tpm/guidance/pm3_hpms.pdf
- HPMS Field Manual (December 2016): https://www.fhwa.dot.gov/policyinformation/hpms/fieldmanual/

- Final Rule on "National Performance Management Measures; Assessing Pavement Condition for the National Highway Performance Program and Bridge Condition for the National Highway Performance Program": Docket No. FHWA–2013–0053, RIN 2125–AF53, Federal Register - Vol. 82, No. 11, Pg. 5886 - January 18, 2017: https://www.gpo.gov/fdsys/pkg/FR-2017-01-18/pdf/2017-00550.pdf

- National Household Travel Survey: http://nhts.ornl.gov/
- National Performance Management Research Data Set: https://ops.fhwa.dot.gov/freight/freight_analysis/perform_meas/vpds/npmrdsfaqs.htm
- U.S. EPA Green-book: https://www.epa.gov/green-book and https://www.epa.gov/green-book/green-book-gis-download

Acronyms Table

Acronym	Full Form
CFR	Code of Federal Regulation
CY	Calendar Year
FHWA	Federal Highway Administration
FR	Federal Register
FY	Federal Fiscal Year
HPMS	Highway Performance Monitoring System
LOTTR	Level of Travel Time Reliability
MPO	Metropolitan Planning Organizations
PHED	Peak Hour Excessive Delay
SQL	Structural Query Language
State DOT	State Department of Transportation
TTTR	Truck Travel Time Reliability
U.S.C.	United States Code
UZA	Urbanized Area

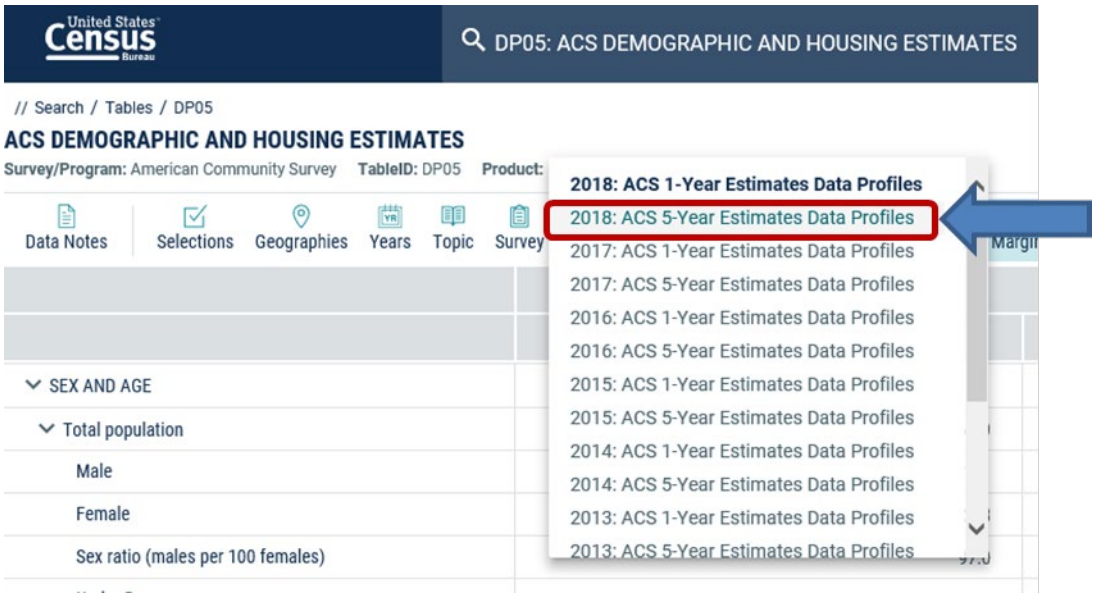
Appendix B – Method for Obtaining Annual Population Estimates for Urbanized Areas from the American Community Survey

This section describes steps obtaining annual population from the Table DP05 of the American Community Survey for urban areas. As 23 CFR 490.709(g) described, populations of urbanized areas must be as identified based on the most recent annual estimates published by the U.S. Census available 1 year before the State DOT Baseline Performance Period Report is due to FHWA (23 CFR 490.105(e)(8)(iii)(D) & 23 CFR 490.105(f)(5)(iii)(D)) to identify applicability of the CMAQ Traffic Congestion Measures for each performance period. For computing the PHED Measure, the most recent annual population estimate published by the U.S. Census, at the time when the State DOT Biennial Performance Period Report is due to FHWA (23 CFR 490.713(b)) must be used.

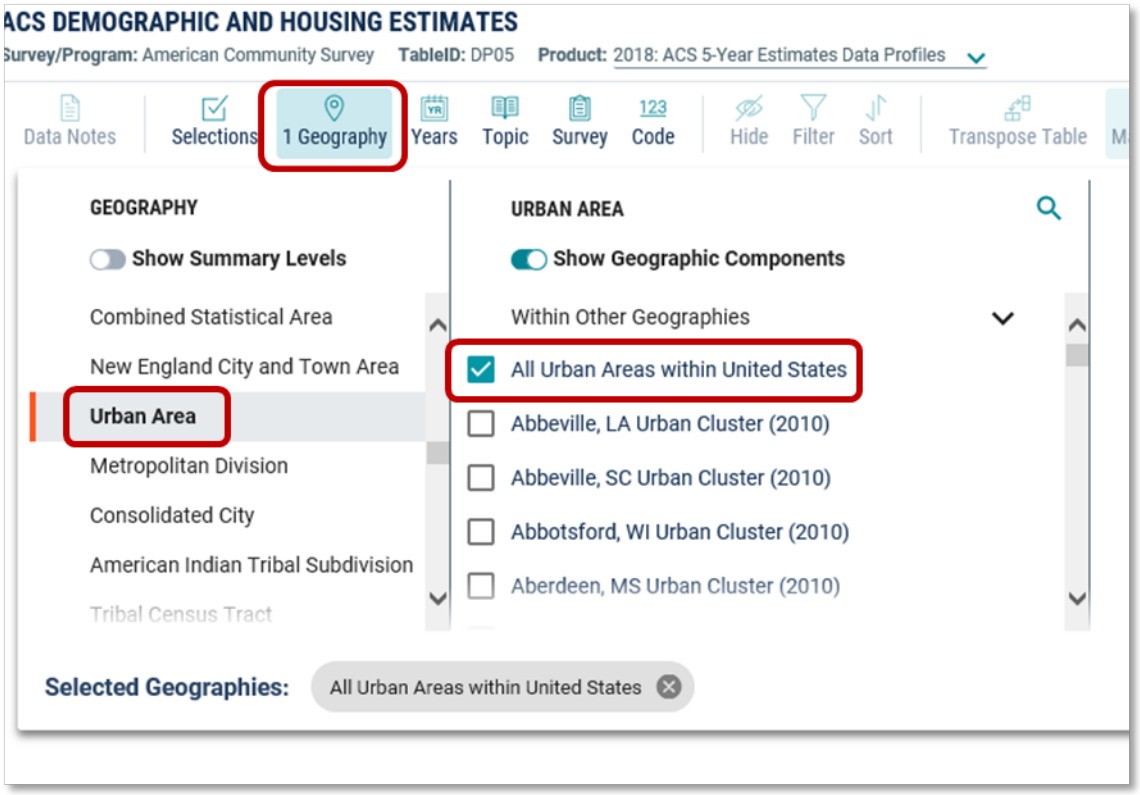
1. Go to the U.S. Census Bureau Website: https://data.census.gov/cedsci/

2. Type "DP05" in "Search" Text Box and click "DP05: ACS DEMOGRAPHIC AND HOUSING ESTIMATES" under the drop-down menu.

3. Under the "Product" Drop-down menu, select the appropropriate 5-year estimates (note in this example, "2018 ACS 5-year Estimates Data Profiles" was selected for the TPM Data Year 2019).



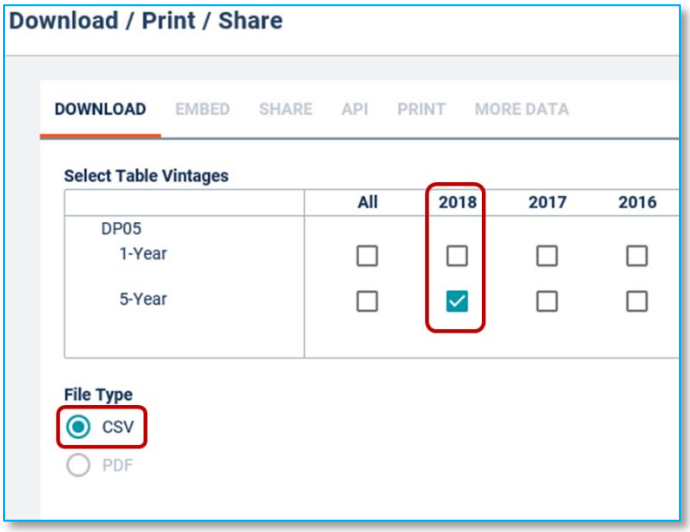
4. Click on the “Geography” Button. Under the drop-down menu, select “Urban Area” and All Urban Areas within United States”.



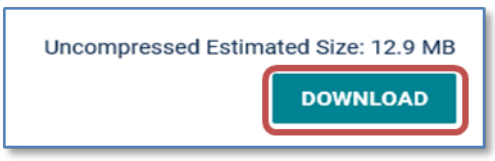
5. Close the “Geography” Menu by clicking “CLOSE” Button on the bottom right.

6. Click “DOWNLOAD TABLE” Button.

7. In the “Download/Print/Share” Window, select 5-year estimate for the appropriate year (note in this example, 2018 ACS 5-year estimates was selected for the TPM Data Year 2019). Select “csv” File Type.



8. Click on “DOWNLOAD” Button.



9. Once the csv data is downloaded, the values under Field **DP05_0001E (Estimate!!SEX AND AGE!!Total population)** are annual population estimates for respective urban area. In this example,

Atlanta Urbanized Area has a population of 4,955,538 in the 2018 ACS 5-year estimates (TPM Data Year 2019)

GEO_ID	NAME	DP05_0001E
id	Geographic Area Name	Estimate!!SEX AND AGE!!Total population
400C100US03817	Atlanta, GA Urbanized Area (2010)	4955538
400C100US03844	Atlanta, TX Urban Cluster (2010)	5799
400C100US03871	Atlantic, IA Urban Cluster (2010)	6107
400C100US03898	Atlantic City, NJ Urbanized Area (2010)	243549
400C100US03925	Atmore, AL Urban Cluster (2010)	6737
400C100US03957	Atoka, TN Urban Cluster (2010)	19668
400C100US03979	Attica, IN Urban Cluster (2010)	5097
400C100US04006	Attica, NY Urban Cluster (2010)	6386

Appendix C – Method for Obtaining Percent SOV Travel by Urbanized Area from the American Community Survey

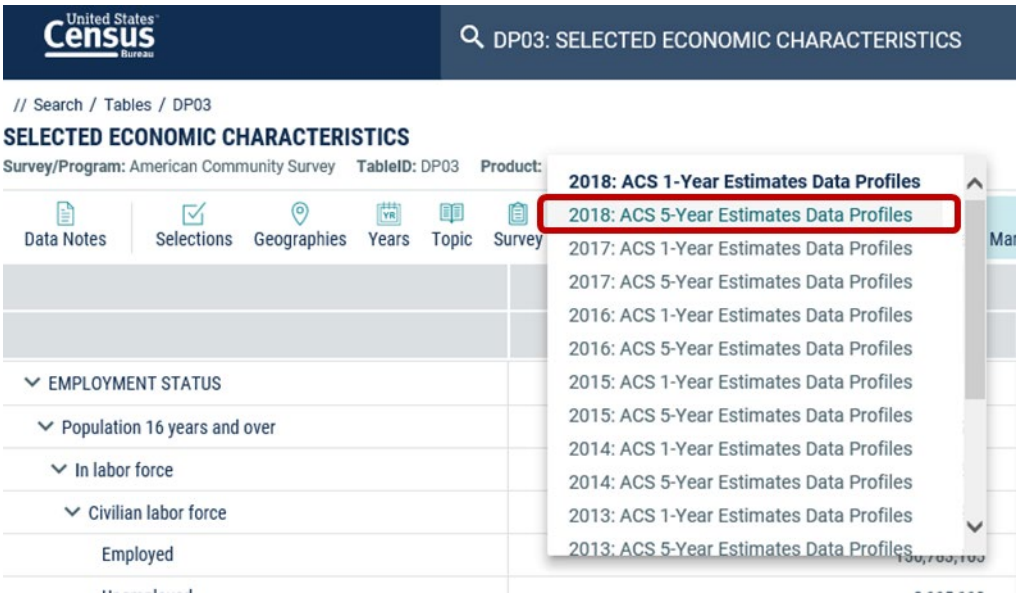
This section describes steps obtaining Percent Non-SOV Travel Measure values from the Table DP03 of the American Community Survey for urban areas, as provided in 23 CFR 490.709(f)(1)(i).[76] As 23 CFR 490.709(f)(1)(i) described, if State DOTs and MPOs collectively choose this method for Non-SOV Travel Measure for an urbanized area, then Percent Non-SOV Travel Measure must be developed from the most recent data as of August 15th of the year in which the State DOT Biennial Performance Report, required in 23 CFR 490.107, is due to FHWA.

1. Go to the U.S. Census Bureau Website: https://data.census.gov/cedsci/

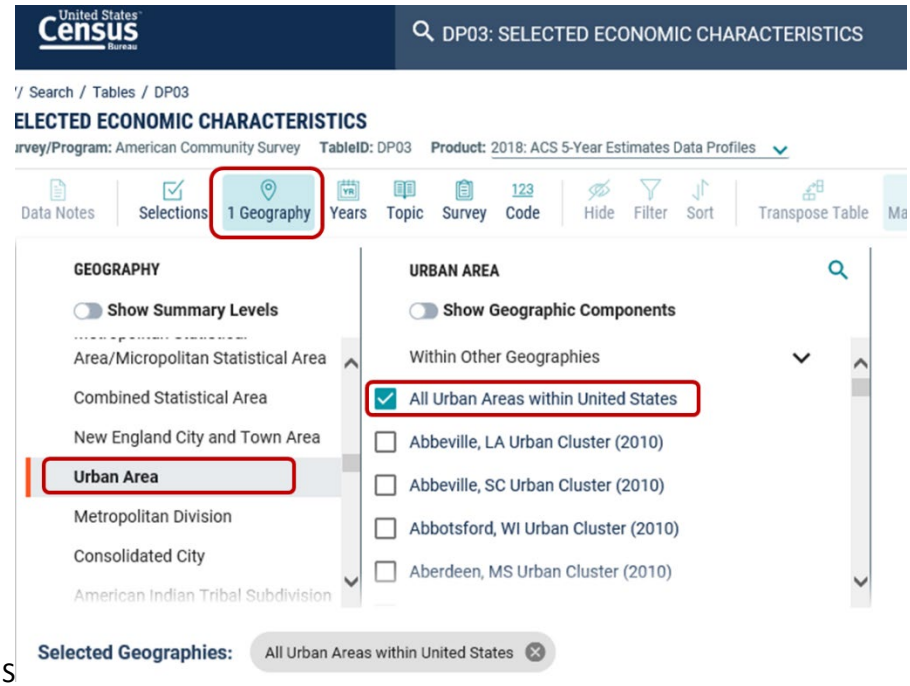
2. Type in "DP03" in Text Box and click "DP03: SELECTED ECONOMIC CHARACTERISTICS" under the drop-down menu.

3. Under the "Product" Drop-down menu, select the appropropriate 5-year estimates (note in this example, "2018 ACS 5-year estimates Data Profile" was selected for the TPM Data Year 2019).

[76] Method A - American Community Survey: Populations by predominant travel to commute to work may be identified from Table DP03 of the American Community Survey using the totals by transportation mode listed within the "Commuting to Work" subject heading under the "Estimate" column of the table. The "5 Year Estimate" DP03 table using a geographic filter that represents the applicable "Urban Area" shall be used to identify these populations. The Percent of Non-SOV Travel measure shall be developed from the most recent data as of August 15th of the year in which the State Biennial Performance Report is due to FHWA.



4. Click on the “Geography” Button. Under the drop-down menu, select “Urban Area” and All Urban Areas within United States”.

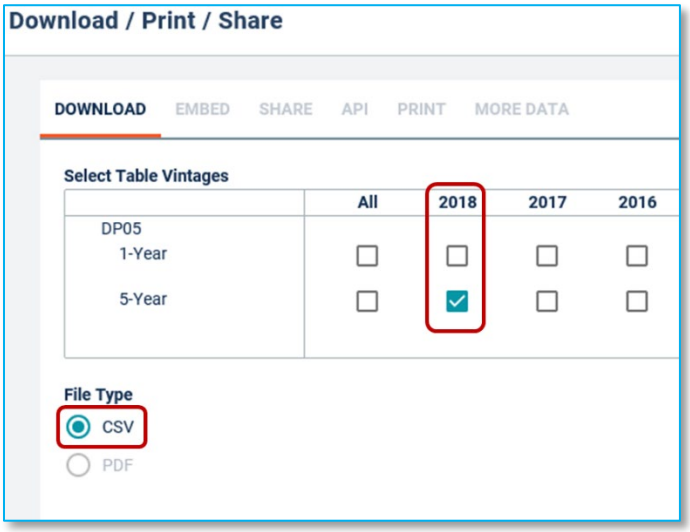


S

5. Close the “Geography” Menu by clicking “CLOSE” Button on the bottom right.

6. Click “DOWNLOAD TABLE” Button.

7. In the “Download/Print/Share” Window, select 5-year estimate for the appropriate year (note in this example, 2018 ACS 5-year estimates was selected for the TPM Data Year 2019). Select “csv” File Type.



8. Click on “DOWNLOAD” Button.

9. Once the csv data is downloaded, the values under Field DP03_0019PE (Percent Estimate!!COMMUTING TO WORK!!Workers 16 years and over!!Car, truck, or van -- drove alone) are annual Percent Single Occupant Vehicle Travel estimates for respective urban area.

   The measure is Non-SOV Travel so the values would need to be subtracted from 100%. In this example, Atlanta Urbanized Area has 76.8% for the Percent SOV Travel in the 2018 ACS 5-year estimates (TPM Data Year 2019). So Percent Non-SOV Travel Measure for the Atlanta Urbanized Area is 23.2% (100% - 76.8%) in accordance with 23 CFR 490.713(d)(1).

GEO_ID	NAME	DP03_0019PE
id	Geographic Area Name	Percent Estimate!!COMMUTING TO WORK!!Workers 16 years and over!!Car, truck, or van -- drove alone
400C100US03817	Atlanta, GA Urbanized Area (2010)	76.8
400C100US03844	Atlanta, TX Urban Cluster (2010)	87.9
400C100US03871	Atlantic, IA Urban Cluster (2010)	79.2
400C100US03898	Atlantic City, NJ Urbanized Area (2010)	76.3
400C100US03925	Atmore, AL Urban Cluster (2010)	93.5
400C100US03957	Atoka, TN Urban Cluster (2010)	89.1
400C100US03979	Attica, IN Urban Cluster (2010)	75.4
400C100US04006	Attica, NY Urban Cluster (2010)	81.7

Appendix D – Applicable State DOTs and Urbanized Area for PHED Measure (1st Performance Period)

Table D1 below provides a list of applicable urbanized areas for urbanized-specific PHED measure, and the list is from the FHWA determination[77] for the 1st performance period.

Table D1 – Applicable Urbanized Areas for PHED Measure & Associated State DOTs

Applicable Urbanized Area	URBAN_CODE	State DOT	State_Code
Atlanta, GA	3817	Georgia Department of Transportation (GDOT)	13
Baltimore, MD	4843	Maryland Department of Transportation (MDOT)	24
Boston, MA--NH—RI	9271	Massachusetts Department of Transportation (MassDOT)	25
		New Hampshire Department of Transportation (NHDOT)	33
Charlotte, NC-SC	15670	North Carolina Department of Transportation (NCDOT)	37
		South Carolina Department of Transportation (SCDOT)	45
Chicago, IL—IN	16264	Illinois Department of Transportation (IDOT)	17
		Indiana Department of Transportation (INDOT)	18
Cincinnati, OH--KY--IN	16885	Ohio Department of Transportation (ODOT)	39
		Kentucky Transportation Cabinet (KYTC)	21
Cleveland, OH	17668	Ohio Department of Transportation (ODOT)	39
Columbus, OH	19234	Ohio Department of Transportation (ODOT)	39
Dallas--Fort Worth--Arlington, TX	22042	Texas Department of Transportation (TxDOT)	48
Denver--Aurora, CO	23527	Colorado Department of Transportation (CDOT)	8
Detroit, MI	23824	Michigan Department of Transportation (MDOT)	26
Houston, TX	40429	Texas Department of Transportation (TxDOT)	48

[77] Traffic Congestion Measure Applicability for the 1st Performance Period (October 2017): Applicable Urbanized Areas and Corresponding State DOTs - https://www.fhwa.dot.gov/environment/air_quality/cmaq/measures/cmaq_applicability/page04.cfm; Applicable State DOTs and Corresponding Applicable Urbanized Areas - https://www.fhwa.dot.gov/environment/air_quality/cmaq/measures/cmaq_applicability/page02.cfm#toc494364637

Applicable Urbanized Area	URBAN_CODE	State DOT	State_Code
Indianapolis, IN	41212	Indiana Department of Transportation (INDOT)	18
Las Vegas--Henderson, NV	47995	Nevada Department of Transportation (NDOT)	32
Los Angeles--Long Beach--Anaheim, CA	51445	California Department of Transportation (Caltrans)	6
Memphis, TN--MS--AR	56116	Arkansas Department of Transportation (ADOT)	5
		Mississippi Department of Transportation (MDOT)	28
		Tennessee Department of Transportation (TDOT)	47
Milwaukee, WI	57466	Wisconsin Department of Transportation (WisDOT)	55
Minneapolis--St. Paul, MN--WI	57628	Minnesota Department of Transportation (Mn/DOT)	27
		Wisconsin Department of Transportation (WisDOT)	55
New York--Newark, NY--NJ--CT	63217	New Jersey Department of Transportation (NJDOT)	34
		New York State Department of Transportation (NYSDOT)	36
Philadelphia, PA--NJ--DE--MD	69076	Delaware Department of Transportation (DelDOT)	10
		Maryland Department of Transportation (MDOT)	24
		New Jersey Department of Transportation (NJDOT)	34
		Pennsylvania Department of Transportation (PENNDOT)	42
Phoenix--Mesa, AZ	69184	Arizona Department of Transportation (ADOT)	4
Pittsburgh, PA	69697	Pennsylvania Department of Transportation (PENNDOT)	42
Portland, OR--WA	71317	Oregon Department of Transportation (ODOT)	41
		Washington Department of Transportation (WSDOT)	53
Riverside--San Bernardino, CA	75340	California Department of Transportation (Caltrans)	6
Sacramento, CA	77068	California Department of Transportation (Caltrans)	6
Salt Lake City--West Valley City, UT	78499	Utah Department of Transportation (UDOT)	49

Applicable Urbanized Area	URBAN_CODE	State DOT	State_Code
San Diego, CA	78661	California Department of Transportation (Caltrans)	6
San Francisco--Oakland, CA	78904	California Department of Transportation (Caltrans)	6
San Jose, CA	79039	California Department of Transportation (Caltrans)	6
San Juan, PR	79093	Departamento de Transportación y Obras Públicas (DTOP)	72
Seattle, WA	80389	Washington Department of Transportation (WSDOT)	53
St. Louis, MO--IL	77770	Illinois Department of Transportation (IDOT)	17
		Missouri Department of Transportation (MoDOT)	29
Washington, DC--VA--MD	92242	District Department of Transportation (DDOT)	11
		Maryland Department of Transportation (MDOT)	24
		Virginia Department of Transportation (VDOT)	51

Table D2 below provides the same information as Table D1 above, but sorted by State DOTs who are required to submit PHED metric data and implement PHED Measure for the 1st performance period.

Table D2 – List of State DOTs & Corresponding Applicable Urbanized Areas for PHED Measure

State DOT	HPMS State_Code	Applicable Urbanized Area	HPMS URBAN_CODE
Arizona Department of Transportation (ADOT)	4	Phoenix--Mesa, AZ	69184
Arkansas Department of Transportation (ADOT)	5	Memphis, TN--MS--AR	56116
California Department of Transportation (Caltrans)	6	San Jose, CA	79039
	6	San Francisco--Oakland, CA	78904
	6	Sacramento, CA	77068
	6	San Diego, CA	78661
	6	Los Angeles--Long Beach--Anaheim, CA	51445
	6	Riverside--San Bernardino, CA	75340
Colorado Department of Transportation (CDOT)	8	Denver--Aurora, CO	23527
Delaware Department of Transportation (DelDOT)	10	Philadelphia, PA--NJ--DE--MD	69076

State DOT	HPMS State_Code	Applicable Urbanized Area	HPMS URBAN_CODE
Departamento de Transportación y Obras Públicas (DTOP)	72	San Juan, PR	79093
District Department of Transportation (DDOT)	11	Washington, DC--VA--MD	92242
Georgia Department of Transportation (GDOT)	13	Atlanta, GA	3817
Illinois Department of Transportation (IDOT)	17	Chicago, IL--IN	16264
	17	St. Louis, MO--IL	77770
Indiana Department of Transportation (INDOT)	18	Indianapolis, IN	41212
	18	Chicago, IL--IN	16264
Kentucky Transportation Cabinet (KYTC)	21	Cincinnati, OH--KY--IN	16885
Maryland Department of Transportation (MDOT)	24	Baltimore, MD	4843
	24	Washington, DC--VA--MD	92242
	24	Philadelphia, PA--NJ--DE--MD	69076
Massachusetts Department of Transportation (MassDOT)	25	Boston, MA--NH--RI	9271
Michigan Department of Transportation (MDOT)	26	Detroit, MI	23824
Minnesota Department of Transportation (Mn/DOT)	27	Minneapolis--St. Paul, MN--WI	57628
Mississippi Department of Transportation (MDOT)	28	Memphis, TN--MS--AR	56116
Missouri Department of Transportation (MoDOT)	29	St. Louis, MO--IL	77770
Nevada Department of Transportation (NDOT)	32	Las Vegas--Henderson, NV	47995
New Hampshire Department of Transportation (NHDOT)	33	Boston, MA--NH--RI	9271
New Jersey Department of Transportation (NJDOT)	34	Philadelphia, PA--NJ--DE--MD	69076
	34	New York--Newark, NY--NJ--CT	63217
New York State Department of Transportation (NYSDOT)	36	New York--Newark, NY--NJ--CT	63217
North Carolina Department of Transportation (NCDOT)	37	Charlotte, NC--SC	15670
Ohio Department of Transportation (ODOT)	39	Cleveland, OH	17668
	39	Columbus, OH	19234
	39	Cincinnati, OH--KY--IN	16885

State DOT	HPMS State_Code	Applicable Urbanized Area	HPMS URBAN_CODE
Oregon Department of Transportation (ODOT)	41	Portland, OR--WA	71317
Pennsylvania Department of Transportation (PENNDOT)	42	Philadelphia, PA--NJ--DE--MD	69076
	42	Pittsburgh, PA	69697
South Carolina Department of Transportation (SCDOT)	45	Charlotte, NC--SC	15670
Tennessee Department of Transportation (TDOT)	47	Memphis, TN--MS--AR	56116
Texas Department of Transportation (TxDOT)	48	Houston, TX	40429
	48	Dallas--Fort Worth--Arlington, TX	22042
Utah Department of Transportation (UDOT)	49	Salt Lake City--West Valley City, UT	78499
Virginia Department of Transportation (VDOT)	51	Washington, DC--VA--MD	92242
Washington Department of Transportation (WSDOT)	53	Seattle, WA	80389
	53	Portland, OR--WA	71317
Wisconsin Department of Transportation (WisDOT)	55	Milwaukee, WI	57466
	55	Minneapolis--St. Paul, MN--WI	57628