

# **APPENDIX H**

# PERFORMANCE MEASURES

## FFY 2019 Traffic Safety Performance

Background:

INDOT has been proactively engaged regarding safety targets with FHWA from the beginning of the proposed rulemaking for establishing safety performance measures in 2014 through the promulgation of final rules in March 2016. Within months of the final rules promulgation, INDOT initiated dialogs with our state partners in target setting. Between August 2016 and June 2017, INDOT coordinated with the Indiana Criminal Justice Institute to ensure targets for fatalities, fatality rate, and suspected serious injuries will match in reports to NHTSA and FHWA. During the same period, INDOT coordinated with Indiana Metropolitan Planning Organizations regarding the state’s methodology for establishing safety targets for the succeeding year. This coordination established the sources of data and the methodology for the calculating performance targets, as well as options for MPOs to accept state targets or establishing local targets.

In 2012, the short-term surface transportation funding legislation, Moving Ahead for Progress in the 21<sup>st</sup> Century – better known as MAP-21 was passed at a time when the nation was fresh off “The Great Recession” and there was great interest in being strategically frugal. It established requirements that state’s use of federal transportation funds report on traffic safety performance. The National Highway Transportation Safety Administration and the Governor’s Highway Safety Association’s 2008 report on Traffic Safety Performance Measures became the source referenced in MAP-21 for safety measures. There were 14 measures, which centered on NHTSA focused traffic safety initiatives.

**Table 7: INDOT SAFETY PERFORMANCE TARGETS**

Number of Fatalities	<b>907.7</b>
Data Source: Fatality Analysis Reporting System	
2009-2015	FARS Final File Count
2016	FARS Annual Report File
2017	Indiana State Police FARS Report
<p>For the purpose of comparison to the SHSO annual report, the 5 year average performance target listed above is based on a projected calendar <b>2020 value of (965)</b> as described in the following methodology. Baseline projections are calculated using fatality counts and applying an equation to generate predictive values for 2019-2020. This was accomplished by the software built into Microsoft Excel for applying a logarithmic trend line with a forward forecast of two years. The equation is of the form <math>[y = A*\ln(x) + B]</math>. The resulting equation is then adjusted to more closely fit recent peak years by shifting the value of B to produce a matching value for the recorded peak. INDOT estimates seven fatalities annually may be influenced by</p>	

every .1% change in annual unemployment. Recent economic forecasts indicate an additional decrease in annual unemployment of .2% during the 2018-2020 period can be reasonably anticipated in Indiana. Consequently, the fatality count projections include an additional seven fatalities each year in anticipation of an improving economic climate influencing greater risk-taking and unfortunately increased severe crash outcomes.

Number of Serious Injuries	<b>3467.4</b>
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Data Source: Automated Reporting Information Exchange System (ARIES)

2009- 2013 the “As reported” count of “Incapacitating Injuries”

2014-2017 an estimated count amounting to 7.2% of all non-fatal injuries

For the purpose of comparison to the SHSO annual report, the 5 year average performance target listed above is based on a projected calendar **2020 value of (3,628)** as described in the following methodology. Baseline projections are calculated using incapacitating injury counts (or estimations) and applying an equation to generate predictive values for 2014-2018. This was accomplished by the software built into Microsoft Excel for applying a logarithmic trend line with a forward forecast of four years. The equation is of the form  $[y = A \cdot \ln(x) + B]$ . The resulting equation is then adjusted to more closely fit recent peak years by shifting the value of B to produce a matching value for the recorded peak.

Fatality Rate	<b>1.097</b>
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Data Source: Fatality Analysis Reporting System

The NHTSA calculated and reported values through 2016.

For the purpose of comparison to the SHSO annual report, the 5 year average performance target listed above is based on a projected calendar **2020 value of (1.154)** as described in the following methodology. Estimated/Predicted values for 2018-2020: The FHWA approved VMT for 2017 was significantly lower than the INDOT reported value there for an adjustment was made to the projection of annual Vehicle Miles Traveled (VMT) growth rate estimates. For 2018 a growth of 1.2% was used as in past years however for each of the next two years growth is estimated to be 1.05% to account for the effect on projections due to the last FHWA approved (2017) VMT of 817.52 hundred million VMT. INDOT’s Technical Planning Support & Programming Division estimates VMT by averaging the last 5 years of Annual Growth Rates for each of five factor groups and then averaging them. The Office of Traffic Safety uses those predicted annual estimates along with estimated fatalities then evaluated with the projected VMTs for their respective future years to produce predicted fatality rates per 100-million VMT.

Serious Injury Rate	<b>4.178</b>
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Data Source: Automated Reporting Information Exchange System (ARIES)

The INDOT calculated and reported values through 2013. Using estimated incapacitating injuries and the FHWA VMT values for 2014-2018.

The 5 year average performance target listed above is based on a projected calendar **2020 value of (4.342)** as described in the following methodology.

Estimated/Predicted values for 2017-2020: The FHWA approved VMT for 2017 was significantly lower than the INDOT reported value there for an adjustment was made to the projection of annual Vehicle Miles Traveled (VMT) growth rate estimates. For 2018 a growth of 1.2% was used as in past years however for each of the next two years growth is estimated to be 1.05% to account for the effect on projections due to the last FHWA approved (2017) VMT of 817.52 hundred million VMT.

INDOT's Technical Planning Support & Programming Division estimates VMT by averaging the last 5 years of Annual Growth Rates for each of five factor groups and then averaging them. The Office of Traffic Safety uses those predicted annual estimates for incapacitating injuries along with the projected VMTs for their respective future years to produce predicted fatality rates per 100-million VMT.

Total Number of Non-Motorized Fatalities and Serious Injuries	<b>405.9</b>
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Data Source: Fatality Analysis Reporting System (Non-motorist persons)  
 2009-2014 FARS Final File Count  
 2016-2017 FARS Annual Report File  
 2018 Indiana State Police FARS Report  
 Data Source: Automated Reporting Information Exchange System (ARIES) (Non-motorist persons)\*  
 2009-2013 the "As reported" count of "Incapacitating Injuries"  
 2014-2018 an estimated count amounting to 13% of all non-fatal injuries

"The 5 year average performance target listed above is based on a projected calendar 2019 value of (420) as described in the following methodology." Baseline projections of Non-Motorist Fatalities are calculated using FARS Fatality counts and applying an equation to generate predictive values for 2018-2020. This was accomplished by the software built into Microsoft Excel for applying a logarithmic trend line with a forward forecast of two years. The equation is of the form  $[y = A \ln(x) + B]$ . The resulting equation is then adjusted to more closely fit recent peak years by shifting the value of B to produce a matching value for the recorded peak.

Non-Motorist incapacitating injuries are projected logarithmically as above for 2019-2020 with non-motorist incapacitating injuries projected as 13% of projected all non-motorist non-fatal injuries.

\*In addition to persons classified as pedestrians or pedal-cyclists, persons classified as animal drawn vehicle operators are included in the calculation. This is due to the significant number of crashes involving these vehicles across Indiana.

\*Based on 2016 – 2020 five--year average

Three years later in the Fixing America's Surface Transportation Act or "FAST Act" advocates for non-motorized transportation lobbied for greater transportation funding, and so performance measures needed to be created to determine impacts of federal funds used to improve those modes. About a year after the FAST Act became law, US DOT promulgated regulations on what data states must monitor, establish target goals for, and report on progress to achieve those targets. When the regulations were published only three of the original 14 performance measures noted in MAP-21 were deemed appropriate for performance management targets involving DOT's. Two new measures were established for a total of five.

The first three come from 2008 NHTSA/GHSA Traffic Safety Performance Measures report,

- The Number of Fatalities as determined by Final FARS counts, or if unavailable the FARS Annual Report File, or if unavailable the state's crash records system.
- The Rate of Fatalities per 100 million vehicle miles traveled using projected VMT data.
- The Number of "Suspected Serious Injuries"

The next two were added to address FHWA requirements.

- The Rate of Suspected Serious Injuries per 100 million vehicle miles traveled.
- Finally the number of Non-motorized Fatalities and Non-motorized Suspected Serious Injuries.

The first three performance measures are required for reporting to NHTSA and FHWA must match, requiring the state reporting agencies to collaborate and agree upon the data, methodology, and resulting targets. The final two performance measure targets are only required in state reports to FHWA.

The reports of safety targets in the Indiana Highway Safety Plan (HSA) to NHTSA is due July 1<sup>st</sup> and then in the Highway Safety Improvement Program (HSIP) to FHWA annual report August 31 of each year.

Note that these projections are not Indiana's Traffic Safety Goals, rather they are projections of what is estimated to occur based upon past performance and other anticipated influences.

#### **Data Sources:**

Fatalities: Preference - Fatality Analysis Reporting System when available followed by the ARIES System

1. FARS Final File
2. FARS Annual Report File
3. Indiana State Police FARS Report

Suspected Serious Injuries (KABCO "A") - Preference - Automated Reporting Information Exchange System (ARIES)

1. For years up through 2013, the "As reported" count of "Incapacitating Injuries"
2. For years from 2014 to the present, an estimated count amounting to 7.2% of all non-fatal injuries

Vehicle Miles Traveled - Preference - FHWA Highway Statistics Series when available followed by INDOT Volume Projections

1. For years up through a period two years before the prior year, the FHWA Table VM-2 total for Indiana (FHWA VMT)
2. For projections made from the prior year through the target year a VMT growth rate is estimated by INDOT (current growth rate is estimated to be 1.2% per year)

#### **Fatality Rate: Fatality Analysis Reporting System**

1. The NHTSA calculated and reported values through the two prior years.

INDOT calculates a rate for the prior year and projects rates for the current and succeeding years.

Suspected Serious Injury Count Issue:

In October 2014, Indiana's electronic police motor vehicle crash reporting system implemented a change that redefined an "Incapacitating injury." To replace a reporting police officer's subjective rating of injury level, the Indiana Traffic Records Coordinating Committee and Indiana State Police agreed to make the immediate transport of any driver, passenger, pedestrian, animal drawn vehicle operator, or bicyclist from the scene of the crash for medical treatment constituted an "Incapacitating injury." The effect was an increase in "Incapacitating injuries" as now people are counted who are transported out of an abundance of caution seeking a doctor's evaluation of their unknown level of injury.

Regulations promulgated under 23 CFR 1300 to support the administration of federal transportation funding included a requirement that states report Suspected Serious Injuries using the criteria established in the fourth edition of the Model Minimum Uniform

Crash Criteria (MMUCC). This linkage of an advisory document's definition to a federal regulation put Indiana's wider non-subjective definition of incapacitating (serious) injury out of compliance.

Specifically, the definition states, a suspected serious injury is an injury other than fatal which results in one or more of the following:

- Severe laceration resulting in exposure of underlying tissues/muscle/organs or resulting in significant loss of blood,
- Broken or distorted extremity (arm or leg),  
Crush injuries,
- Suspected skull, chest or abdominal injury other than bruises or minor lacerations,
- Significant burns (second and third degree burns over 10% or more of the body),
- Unconsciousness when taken from the crash scene, or  
Paralysis.

The Indiana State Police and its contractor maintaining the motor vehicle traffic crash report system are developing changes that will maintain Indiana's collection of the non-subjective "Incapacitating Injury" because of transport from the scene, while adding a data element to identify if the transport was due to one of the injury types specifically defined as a "Suspected Serious Injury" or for some other reason. This modification will put Indiana in compliance with the current federal law. Deployment of new Officer Reporting software (ARIES 6.0) is anticipated in 2019-2020. In order to allow for trend analysis, an estimated count of KABCO "A" (Suspected Serious Injuries) was developed after consultation with federal and state partners.

In this proxy for missing data, Indiana analyzed an injury count that remained consistent across all years, the total number of non-fatal injuries. The number of KABCO "A" level injuries "Incapacitating injuries" were evaluated to establish the percentage of non-fatal injuries they contributed. The annual average percent contribution of "A" injuries prior to the definition change the contribution was 7.1%. Weighting this value to account for recent increases in injury counts in the most recent three years, the value is adjusted to 7.2%.

Indiana uses that percentage of non-fatal injuries for each year to represent the number of "Suspected Serious Injuries." This percentage contribution is valid only when examining all crashes on all roads in Indiana. A value for any regional subset of the data will require its own historic analysis to establish the percentage contribution of "A" injuries to all non-fatal injuries in the subset.

In the case of *Non-Motorist A Injuries* as a percentage of *All Non-Motorist Non-Fatal Injuries* the statewide percent was found to average 13.0% of all Non-Fatal Injuries (Years 2004-2013). For *Non-Motorist Fatalities* as a percentage of *All Fatalities* the average is 10.5% (Years 2004-2015). Again, any regional subset of the data will require its own historic analysis to establish the percentage contribution.

The projections produced by this methodology represent a mathematical baseline before further adjustments to reflect consideration of non-highway influences that affect highway travel and traveler risk-taking. These influences would include, but are not limited to, economic change, technology proliferation, and weather.

## **Project Methodology**

**Fatality/Injury Count:** Indiana's electronic crash report data is reliable back to January 1, 2004, however 2009 was selected as the base year for projection of injury counts. It is a reasonable starting point as 2009 was the bottom of "the great recession" and represents the most recent low point for highway traffic crashes in Indiana. With the economic recovery, Indiana has experienced an increase in highway traffic and consequently increased motor vehicle crashes. It follows that projections of highway traffic safety performance acknowledge and reflect increased exposure.

Baseline projections are calculated using fatality and "A" injury counts (or estimations) and applying an equation to generate predictive values for the current and target years. This was accomplished by the software built into Microsoft Excel for applying a logarithmic trend line with a forward forecast of four years. The equation is of the form  $[y = A \cdot \ln(x) + B]$ . The resulting equation is then adjusted to more closely fit recent peak years by shifting the value of B to produce a matching value for the recorded peak.

**Fatality/Injury Rate:** The predicted annual counts for fatalities and "A" injuries are then evaluated with the projected traffic volumes for their respective future years to produce predicted injury rates per 100-million VMT.

**Vehicle Miles Traveled:** The predicted annual Vehicle Miles Traveled (VMT) growth rate for each of the next five years is estimated to be 1.20% from the FHWA approved VMT in 2015. INDOT's Technical Planning Support & Programming Division arrived at this figure by averaging the last 5 years of Annual Growth Rates for each of five factor groups and then averaging those to arrive at 1.20%. The contributing Annual Growth Rates are calculated from the data collected at Indiana's 100+ Continuous Data Collection Sites around the State across a variety of Functional Classes.

**Non-Motorists Fatalities and Suspected Serious Injury's:** For the purposes of counting non-motorist deaths and serious injuries, in addition to persons classified as pedestrians or pedal-



cyclists, persons classified as animal drawn vehicle operators are included in the calculation. This is due to the significant number of crashes involving animal drawn vehicles across Indiana. Current and target year Non-Motorist Fatalities are projected logarithmically as above. Non-motorist "A" injuries are projected as 13% of all non-fatal non-motorist "A" injuries.

Adjustment for other factors: Since the recent recession, traffic crash studies have been conducted to research the influence of employment on crash frequency and severity. Since 2006, the INDOT Office of Traffic Safety has monitored the influence on traffic crashes from changes in employment.

INDOT estimates seven fatalities annually may be influenced by every .1% change in annual unemployment. Recent economic forecasts indicate an additional decrease in annual unemployment of .1% during the next two year period can be reasonably anticipated in Indiana. Each year the unemployment rate will be checked for comparison to Indiana's historic high monthly employment level of 2.9% recorded during September and October 2000 (2.9% unemployment). Consequently, the fatality count projections include an additional seven fatalities each year in anticipation of an improving economic climate influencing greater risk-taking and unfortunately increased severe crash outcomes.

The adjustment for unemployment percentage is the only factor used for target projections that is not within the traditional engineering, education, enforcement, and emergency response areas of influence.

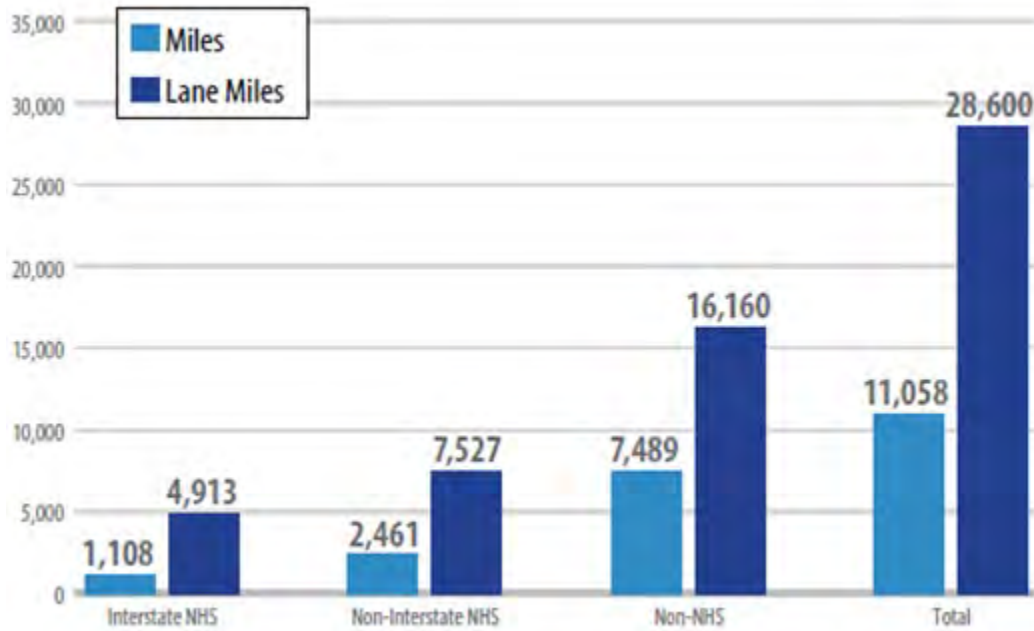
## **Pavement - Selection of Projects**

INDOT owns 11,058 miles, representing 28,600 lane-miles, of pavement in Indiana, as shown in Figure 4. The pavement on roadways owned by INDOT consists of both concrete and asphalt, as shown in Figure 5. There are 37 additional miles, representing 126 lane-miles, of NHS pavement owned by local government entities, as shown in Figure 6.

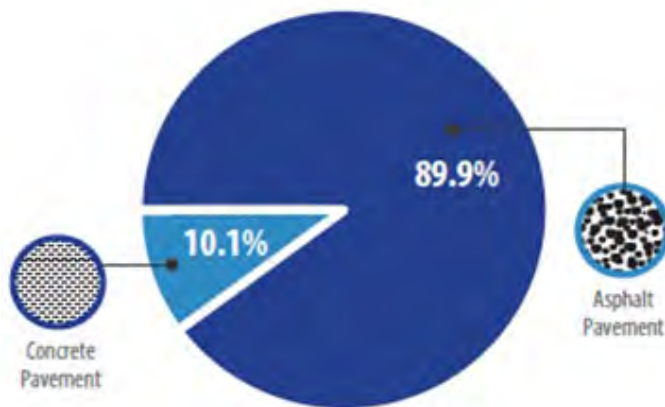
INDOT inspects all state highways and local NHS roads once a year with an outside contractor. This inspection determines the current pavement condition. Once INDOT receives this data it analyzes the condition of the road to determine pavement condition relative to INDOT's targets. Once we have the new data INDOT utilizes its pavement modeling system to analyze the network to determine the next program year of projects based upon the current business rules. Once the list is developed for the amount of proposed funding the list is sent out to the field engineers. The field engineers review the list and field check the candidates either providing confirmation or added value information for the proposed treatment and year. The field engineers also at this time submit other project needs that were not in the model. During this verification of the program the district staff will coordinate with the other asset managers and when possible with the local agencies. Once this review is completed and the projects are

selected INDOT updates the model to verify that the selected projects still meets the short and long term goals for the agency. Once this analysis is completed INDOT reviews the business rules and makes any updates that are required.

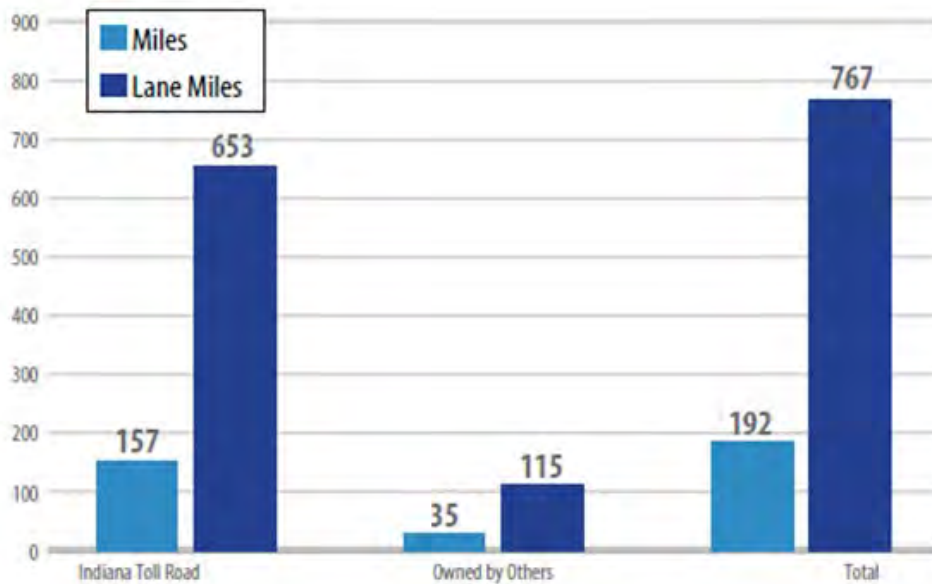
**Figure 4: Inventory of Pavement Owned by INDOT**



**Figure 5: Pavement Type of Indiana Roads**



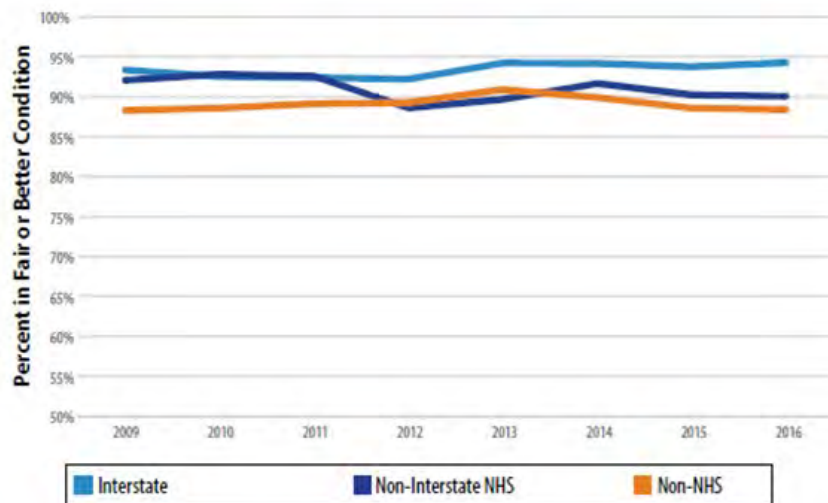
**Figure 6: Inventory of NHS Pavement Not Owned by INDOT**



## Current Pavement Conditions

The condition of INDOT’s interstate pavement has improved slightly between 2009 and 2016 to 94 percent in fair or better condition, as shown in Figure 7. Meanwhile, the condition of the non-interstate NHS declined between 2009 and 2012, from 92 percent to 89 percent in fair or better condition, and has remained fairly steady since 2012 at 90 percent in fair or better condition. Non-NHS pavement owned by INDOT has remained at 88 percent in fair or better condition from 2009 to 2016, with a slight improvement in 2013 to 91 percent.

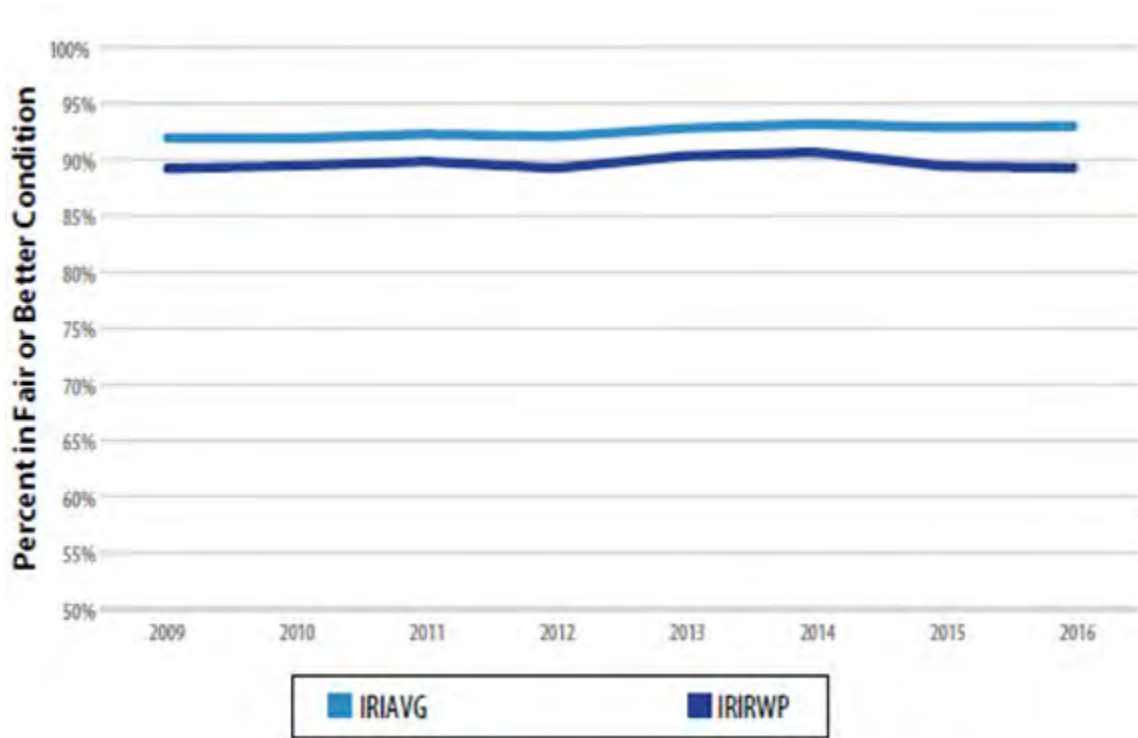
**Figure 7: Pavement Conditions History**



INDOT also breaks down the IRI measurement by the average IRI and the IRI of the RWP. IRI measures the roughness of roadway pavement in order to track how poor pavement affects roadway users. Figure 8 shows the percent of miles of all INDOT roads that are in fair or better condition based on the average IRI and the IRI RWP from 2009 to 2016.

In terms of average IRI, the conditions have improved slightly since 2009, while the conditions of IRI RWP have remained fairly constant over time.

Figure 8: Condition of Pavement, IRI AVG and IRI RWP



INDOT has set a condition target for all pavement to determine how well pavement is being maintained. INDOT follows two steps for adopting condition measures and targets:

1. planning processes that include a formal public comment period; and
2. an internal review and approval by a designated asset management group. When adopting or modifying condition measures and targets, INDOT carefully considers existing commitments, relative priorities, and trade-offs among assets. During the planning process, INDOT determined that different condition targets for urban and rural pavement is not appropriate.

Following this process, INDOT has set a ten-year pavement condition target of 96.1 percent of its interstate NHS pavement and 93.1 percent of its non-Interstate NHS pavement in fair or better condition by 2028.

**Table 8: INDOT has set a ten-year pavement condition**

<b>INDOT Statewide Performance Target for the Percentage of Pavements of the Interstate System in Good Condition</b>	
The 4-year target for the statewide percentage of pavements of the Interstate System in Good condition that INDOT has established for the 2018-2021 Performance Period. [23 CFR 490.107(b)(1)(ii)(A)]	50%
<b>Statewide Performance Target for the Percentage of Pavements of the Interstate System in Poor Condition</b>	
The 4-year target for the statewide percentage of pavements of the Interstate System in Poor condition that INDOT has established for the 2018-2021 Performance Period. [23 CFR 490.107(b)(1)(ii)(A)]	0.8
<b>Statewide Performance Target for the Percentage of Pavements of the Non-Interstate NHS in Good Condition.</b>	
The baseline statewide percentage of pavements of the Non-Interstate NHS in Good condition. [23 CFR 490.107(b)(1)(ii)(B)] For the first performance period, FHWA has calculated this value using IRI only (or PSR values for road sections where speed is less than 40 mph). [23 CFR 490.313(e)]	68.3
The 2-year target for the statewide percentage of pavements of the Non-Interstate NHS in Good condition that INDOT has established for the 2018-2021 Performance Period. [23 CFR 490.107(b)(1)(ii)(A)]	78.7
The 4-year target for the statewide percentage of pavements of the Non-Interstate NHS in Good condition that INDOT has established for the 2018-2021 Performance Period. [23 CFR 490.107(b)(1)(ii)(A)]	0.8
<b>Statewide Performance Target for the Percentage of Pavements of the Non-Interstate NHS in Poor Condition.</b>	
The baseline statewide percentage of pavements of the Non-Interstate NHS in Poor condition. [23 CFR 490.107(b)(1)(ii)(B)] For the first performance period, FHWA has calculated this value using IRI, only (or PSR values for road sections where speed is less than 40 mph). [23 CFR 490.313(e)]	5.3
The 2-year target for the statewide percentage of pavements of the Non-Interstate NHS in Poor condition that INDOT has established for the 2018-2021 Performance Period. [23 CFR 490.107(b)(1)(ii)(A)]	3.1
The 4-year target for the statewide percentage of pavements of the Non-Interstate NHS in Poor condition that INDOT has established for the 2018-2021 Performance Period. [23 CFR 490.107(b)(1)(ii)(A)]	3.1%

## Bridge – Selection of Projects

INDOT owns and maintains 5,747 bridges in the state of Indiana (see Table 6). There are an additional 268 bridges in Indiana on the NHS, including ITR bridges, bridges led by other state agencies, local bridges, and one privately owned bridge (see Table 7). INDOT oversees the inspection of both State and local bridges every two years per the National Bridge Inspection standards. Data is stored in BIAS and provided to FHWA once a year. INDOT uses the data to evaluate the condition of the bridges both State and local on the NHS and State off the NHS relative to the goals of agency. INDOT utilizes its bridge modeling system (dTIMS) to analyze the system to recommend projects for the next program year based on the current business rules and condition goals. Once the draft list is developed, it is reviewed by the district bridge asset engineers. The district bridge asset engineers review the list to either confirm the proposed treatments and years or modify them. The district bridge asset engineers may also submit other project needs that were not in the model. During this verification of the proposed program, the district bridge asset engineers will coordinate with the other asset managers and when possible with the local agencies. Once this review is completed and the projects are selected for the available funding, INDOT updates the model to verify that the selected projects still meet the short and long term goals for the agency. Once the projects are selected for a given program year, INDOT reviews the business rules and makes any updates that are required.

**Table 6: Bridge Inventory, Owned by INDOT**

Highway System	Number of Bridges	Deck Area (Square Feet)
Interstate NHS	1,427	18,318,566
Non-Interstate NHS	1,326	12,654,093
Non-NHS	2,969	20,969,024
Border Bridges <sup>5</sup>	25*	3,294,283
<b>Total</b>	<b>5,747</b>	<b>55,235,966</b>

\*INDOT is the lead state for 18 border bridges. Other states are the lead for the seven other border bridges.

**Table 7: Bridge Inventory, NHS Bridges Owned by Others**

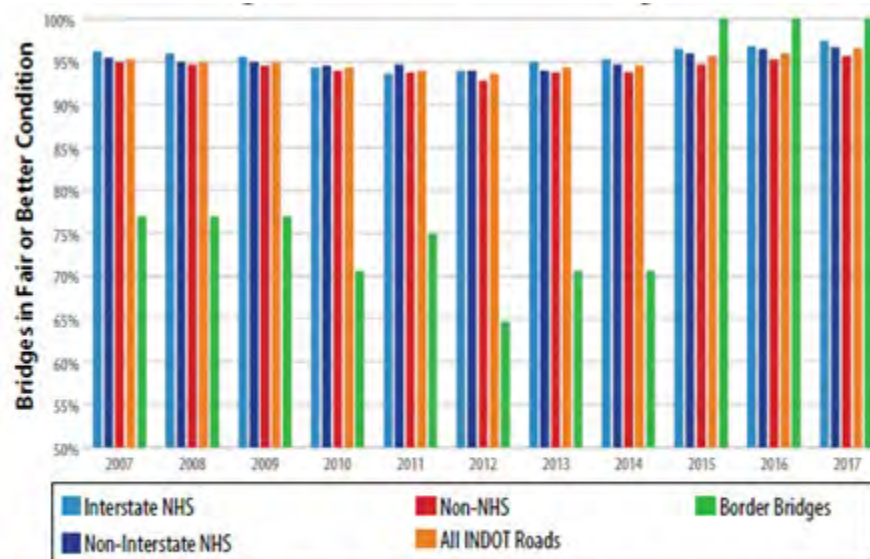
Highway System	Number of Bridges	Deck Area (Square Feet)
Indiana Toll Road	241	3,208,207
Other State Agencies	13	157,540
Local	13	128,331
Private	1	17,441
<b>Total</b>	<b>268</b>	<b>3,511,519</b>

## Current INDOT Bridge Conditions

INDOT assesses the condition of bridges in the following categories: Interstate NHS, non-Interstate NHS, non-NHS, all INDOT roads,<sup>7</sup> and border bridges. Figure 9 shows the condition of INDOT's bridges. Overall, 97 percent of INDOT's bridges were in fair or better condition in 2017.

Over the past 10 years, INDOT's bridges have remained in a consistently well maintained condition. The largest improvement in condition lies with the border bridges, which have seen significant improvement in condition since 2014, from 71 percent in fair or better condition to a full 100 percent in fair or better condition.

**Figure 9: Condition of INDOT Bridges**



\* The condition ratings for 2007 to 2017 were developed using INDOT's system which is based on the condition of bridge elements (deck, superstructure, substructure). Starting in 2018, INDOT is transitioning to the FHWA bridge condition ratings system based on condition by deck area percentage. Using the FHWA system, 97.3 percent of INDOT's bridges are in fair or better condition in 2018.

INDOT evaluates the current condition of its assets against the condition targets it sets to determine if any performance gaps exist. INDOT maintains two steps for adopting condition measures<sup>8</sup> and targets:

1. Planning processes that include a formal public comment period; and
2. An internal review and approval by the PMG. When adopting or modifying condition measures and targets, INDOT carefully considers existing commitments, relative priorities, and trade-offs among all resources.



During the planning process, INDOT determined that different condition targets for urban and rural bridges are not appropriate.

After completing the process, INDOT set a ten-year condition target of 96.1 percent of its bridges in fair or better condition by 2028. The target was based on the NHS established in 2018 and may change as INDOT updates the NHS routes.

**Table 8: INDOT Statewide Performance Target for Bridges on the NHS Classified as in Good Condition**

The baseline statewide percentage of deck area of bridges on the NHS classified as in Good condition. [23 CFR 490.107(b)(1)(ii)(B)]	50.0
The 2-year target for the statewide percentage of deck area of bridges on the NHS classified as in Good condition that INDOT has established for the 2018-2021 Performance Period. [23 CFR 490.107(b)(1)(ii)(A)]	48.3
The 4-year target for the statewide percentage of deck area of bridges on the NHS classified as in Good condition that INDOT has established for the 2018-2021 Performance Period. [23 CFR 490.107(b)(1)(ii)(A)]	47.2
<b>INDOT Statewide Performance Target for Bridges on the NHS Classified as in Poor Condition</b>	
THE Baseline statewide percentage of deck area of bridges on the NHS classified as in Poor condition. [23 CFR 490.107(b)(1)(ii)(B)]	2.3
The 2-year target for the statewide percentage of deck area of bridges on the NHS classified as in Poor condition that INDOT has established for the 2018-2021 Performance Period. [23 CFR 490.107(b)(1)(ii)(A)]	2.6
The 4-year target for the statewide percentage of deck area of bridges on the NHS classified as in Poor condition that INDOT has established for the 2018-2021 Performance Period. [23 CFR 490.107(b)(1)(ii)(A)]	3.1

## Introduction to the Methodology for INDOT PM-3 Determination and Reporting

For coordination and documentation purposes, this procedure document has been written to outline the methodology involved in determining Indiana’s National Performance Management Measures to assess system performance, freight movement, and the CMAQ program, otherwise known as PM-3. Per 23 CFR Part 490, Subparts E, F, G, and H, the six performance measures are:

- 1) Subpart E, System Performance: % of Person-Miles Traveled on Interstate that are Reliable (LOTTR Interstate);
- 2) Subpart E, System Performance: % of Person-Miles Traveled on Non-Interstate that

- are Reliable (LOTTR Non-Interstate);
- 3) Subpart F, Freight: Truck Travel Time Reliability (TTTR);
- 4) Subpart G, CMAQ Traffic Congestion: Peak Hour Excessive Delay (PHED);
- 5) Subpart G, CMAQ Traffic Congestion: % of Non-Single Occupancy Vehicle (Non-SOV) Travel;
- 6) Subpart H, CMAQ On-Road Mobile Source Emissions: Emission Reductions.

The first four measures (LOTTR, TTTR, and PHED) rely on travel time data derived from the National Performance Management Research Data Set (NPMRDS), whereas percent of non-SOV travel and emission reductions are based on the ACS survey and CMAQ Public Access System, respectively. The initial cycle for PM-3 completed in 2018 produced these baseline conditions (generally 2017) and two-year (2018-2019) and four-year (2018-2021) targets:

**Table 9: Summary of Performance Measures and Targets**

<b>Performance Measure</b>	<b>Baseline</b>	<b>2-Year</b>	<b>4-Year</b>
Percent of the Person-Miles Traveled on the Interstate That Are Reliable	93.8%	90.5%	92.8%
Percent of the Person-Miles Traveled on the Non-Interstate NHS That Are Reliable			89.8%
Truck Travel Time Reliability (TTTR) Index	1.23	1.27	1.30
Annual Hours of Peak Hour Excessive Delay Per Capita: Urbanized Area 1			15.4
Annual Hours of Peak Hour Excessive Delay Per Capita: Urbanized Area 2			5.7
Percent of Non-Single Occupancy Vehicle (Non-SOV) Travel: Urbanized Area 1	30.6%	31.4%	31.9%
Percent of Non-Single Occupancy Vehicle (Non-SOV) Travel: Urbanized Area 2	16.3%	16.3%	16.3%
Total Emission Reductions: PM2.5 (daily kg)	179.165	20.000	30.000
Total Emission Reductions: NOx (daily kg)	4576.370	1600.000	2200.000
Total Emission Reductions: VOC (daily kg)	2641.019	1600.000	2600.000
Total Emission Reductions: PM10 (daily kg)	4.068	0.300	0.500
Total Emission Reductions: CO (daily kg)	13939.447	200.000	400.000

## Freight

Indiana's State Freight Plan was recently updated for 2018 and serves as the basis for identifying truck freight bottlenecks. The 2018 State Freight Plan document was uploaded to the PMF.

The baseline truck travel time reliability (TTTR) index, for the Interstate routes, was calculated using baseline calendar year 2017 NPMRDS travel time data. The TTTR index for the 2-year and 4-year targets utilized INDOT's planned construction projects for 2017 and the future years. This information was used to understand the impact these projects have on truck reliability on the Interstate system in Indiana. This was accomplished by determining an exposure factor in day-miles. The projects in 2017 were used for a baseline exposure and the ratio of the future year exposure compared to the base year exposure was used to adjust the reliable percent of person-miles traveled to create Indiana's 2-year and 4-year targets.

TTTR Calculation Example (Interstate only):

Step 1: Calculate the **50th and 95th** percentile travel times for the following time periods for each TMC: 6 a.m. - 10 a.m., weekdays; 10 a.m. - 4 p.m., weekdays; 4 p.m. - 8 p.m., weekdays; 6 a.m. - 8 p.m., weekends; 8 p.m. - 6 a.m., all days.

Step 2: Calculate **TTTR measure** for each time period for each TMC by:  $TTTR = 95^{th} \text{ Percentile} / 50^{th} \text{ Percentile}$ . Then for each TMC, determine the time period with the maximum TTTR.

Step 3: Calculate the **TTTR index** using the following equation:

$$TTTR \text{ Index} = \frac{\sum \text{All segment length weighted TTTR}}{\sum \text{All Segment Lengths}}$$

Where: Segment length weighted TTTR = Segment Length X Max TTTR

This is completed for the full extent of the Interstate system.

## Peak Hour Excessive Delay (PHED)

The State of Indiana currently has two urbanized areas (Chicago, IL-IN and Indianapolis, IN) that are required to establish targets and report progress for PHED. In coordination with INDOT, the agencies that established the unified 4-year PHED target were the Illinois Department of Transportation (IDOT), Northwestern Indiana Regional Planning Commission (NIRPC), and the Chicago Metropolitan Agency for Planning (CMAP) for the Chicago area; and the Indianapolis Metropolitan Planning Organization (IMPO) for the Indianapolis urbanized area.

For the Chicago area, NIRPC and CMAP led the effort in establishing the Peak Hour Excessive Delay (PHED) four year target, in consultation with INDOT and IDOT. Trend line analysis of

recent historical data making use of the NPMRDS data set was applied to arrive at a rational 4-year target. The 4-year PHED target was set at 15.4.

For the Indianapolis area, INDOT and IMPO coordinated to determine the four year PHED target for the Indianapolis urban area. The baseline Peak Hour Excessive Delay (PHED) for the Indianapolis Urban Area was calculated using the calendar year 2017 travel time data from NPMRDS. The National Highway System (NHS) was recently updated for Indiana, though was not reflected in the NPMRDS NHS road network available in 2018 for 2017 performance. Therefore, the baseline NPMRDS network, hence travel time data, used the previous version of Indiana's NHS. The impacts of this significant change required extra steps to create a 4-year target to include the reduction in number and extent of TMC's on Indiana's updated NHS, as it applies to the final three years of the 4-year evaluation period.

PHED Calculation Example:

PHED (Peak Hour Excessive Delay): Amount of time spend in congested conditions by comparing a speed threshold that are lower than a normal delay threshold. Calculations are to be completed for: all vehicles; weekdays only; two peak periods, 6 a.m. - 10 a.m. and 3 p.m. - 7 p.m.

Step 1: Calculate the **Threshold Speed**: Threshold Speed is the greater of (0.6\*Posted Speed Limit for TMC) or 20 MPH

Step 2: Calculate the **Excessive Delay Threshold Travel Time (EDTTT)**:  $EDTTT \text{ (sec)} = (\text{TMC Length}/\text{Threshold Speed}) * 3600 \text{ (sec/hr)}$

Step 3: Calculate **Travel Time Segment Delay (RSD)**:  $RSD \text{ (Sec)} = \text{Measured Travel Time} - EDTTT$

Step 4: Calculate **Excessive Delay**:  $\text{Excessive Delay (hrs)} = (RSD/3600 \text{ (sec/hr)})$  when RSD is greater than or equal to zero. If RSD is less than zero then Excessive Delay is 0.

Step 5: Calculate **Total Excessive Delay (Each TMC)**:  $\text{Total Excessive Delay (Person-Hours)} = \text{Excessive Delay} * 15 \text{ Minute Volume} * \text{Average Vehicle Occupancy (AVO)}$  [where  $AVO = (\%cars * AVOCars) + (\%buses * AVObuses) + (\%trucks * AVOTrucks)$ ]

15 Minute Volume Calculation Procedure:

**Step A:** Determine AADT to use for 15 minute volume calculation. If the facility type of the TMC equals 1 (ramp or one-way road), then use the provided AADT for that TMC. If the facility type does not equal 1 (two-way facility), the divide the provided AADT by 2.

- AADT

**Step B:** Multiply **Step A** by the seasonal adjustment factor for the given month utilizing 2016 factors

- $(AADT) * \text{Seasonal Adjustment Factor for month and classification of roadway}$

**Step C:** Multiply **Step B** by the day of the week factor for the given month and day of the NPMRDS data

- $(AADT) \times \text{Seasonal Adjustment Factor for month and classification of roadway} \times \text{day of the week factor for given day of the week in the given month from NPMRDS}$

**Step D:** Multiply **Step C** by the hourly distribution factor provided by Traffic Statistics to convert daily volumes into hourly volumes

$(AADT) \times \text{Seasonal Adjustment Factor for month and classification of roadway} \times \text{day of the week factor} \times \text{hourly distribution factor for given hour}$  **Step E:** Divide **Step D** by 4 to get 15 minute volumes.

- $[(AADT) \times \text{Seasonal Adjustment Factor (per month and functional classification of roadway)} \times \text{day of the week factor (per month, day, and functional classification)} \times \text{hourly distribution factor (per functional classification)}] / 4$

Step 6: Calculate **PHED**:  $PHED = \text{Sum of Excessive Delays (per urban area)} / \text{population of urban area}$

## Non-SOV Travel

The State of Indiana currently has two urbanized areas (Chicago, IL-IN and Indianapolis, IN) that are required to establish targets and report progress for non-SOV travel. In coordination with INDOT, the agencies that established the unified non-SOV target for the urbanized areas were the Illinois Department of Transportation (IDOT), Chicago Metropolitan Agency for Planning (CMAP) and the Northwestern Indiana Regional Planning Commission (NIRPC) for the Chicago area; and the Indianapolis Metropolitan Planning Organization (IMPO) for the Indianapolis area. The data collection method for the percent of non-SOV travel for both areas was the American Community Survey (ACS).

For the Chicago area, the basis for the two year and four year targets established for the 2018-2021 performance period for the percent of non-SOV travel involved INDOT and IDOT coordination with the two MPOs (CMAP and NIRPC). CMAP has an aggressive 2050 plan to double transit ridership by 2050; both CMAP and NIRPC felt comfortable at setting aggressive goals to increase non-SOV travel based on past performance of the area that has seen a nearly 0.2% per year increase in non-SOV travel, and the CMAP 2050 plan strategies. Those values were initially inadvertently based on a performance period 2019-2022. The final established targets of 31.4 and 31.9 are correctly based on the performance period 2018-2021.

For the Indianapolis area, regarding the basis for the 2-year and 4-year targets established for the 2018-2021 performance period for the percent of non-SOV travel, INDOT and the IMPO

agreed the non-SOV travel should remain constant based on historical comparison of data from 2012-2016 that shows this percentage being stagnant.

## **Emissions**

Currently, the State of Indiana has areas designated as non-attainment or maintenance for PM10 (of which both NOx and VOC are a significant contributor to PM10 emissions); non-attainment or maintenance for CO; and non-attainment or maintenance for ozone. Three MPOs in Indiana are currently required to submit a CMAQ performance plan to INDOT: Indianapolis MPO (IMPO); Northwest Indiana Regional Planning Commission (NIRPC); and Ohio-Kentucky-Indiana Regional Council of Governments (OKI). The performance plans as shown in the next section were uploaded to the PMF.

The performance measure established in the January 18, 2017, final rule for the purpose of carrying out the CMAQ Program and to use to assess on-road mobile source emissions is "Total Emissions Reduction," which is the 2-year and 4-year cumulative reported emission reductions, for all projects funded by CMAQ funds, of each criteria pollutant and applicable precursors (PM2.5, PM10, CO, VOC, and NOx) under the CMAQ program for which the area is designated nonattainment or maintenance. The measure applies to areas designated as nonattainment or maintenance for ozone, carbon monoxide or particulate matter. For INDOT, this is the 24-hour PM 10, PM 2.5 (1997), Ozone (2008) and CO.

The data used to calculate the Total Emission Reduction measure came from the Indiana reporting table that was entered into the CMAQ Public Access System which includes the applicable nonattainment or maintenance area; the applicable MPO; and the emissions reduction estimated for each CMAQ funded project for each of the applicable criteria pollutants and their precursors for which the area is nonattainment or maintenance.

## **Methodology Used to Set the INDOT CMAQ Emissions Targets**

INDOT formed a CMAQ performance measure task group to coordinate efforts between INDOT and the MPOs in setting the INDOT CMAQ targets. The task group included three representatives from INDOT's Technical Planning and Programming; a representative from the Indianapolis and Northwestern Indiana MPOs, the two larger MPOs with over 1 million in population subject to the rule; and two representative members from the Indiana MPO Council (Fort Wayne and Evansville). A representative from the Indiana Division of the FHWA also participated in the task group. During the INDOT CMAQ target setting process, the group first met on a weekly basis and later, less frequently as the data collection and analysis was refined.

As noted, the data source used to calculate the Total Emission Reduction measure comes from the Indiana reporting table extracted from the CMAQ Public Access System. This table includes the applicable nonattainment or maintenance area; the applicable MPO; and the emissions

reduction estimated for each CMAQ funded project for each of the applicable criteria pollutants and their precursors for which the area is nonattainment or maintenance. The baseline Report Period is October 1, 2013 - September 30, 2017. The targets are based on the cumulative emission reductions for a period of time in kg using 2013 to 2017 data and the 2018 to 2023 projections. Those federal fiscal year 2018 to 2023 projections were estimated using programmed CMAQ projects from MPO TIPs and the State STIP. The task group was then able to focus on the pollutants applicable to the Indiana MPOs that had been designated as non-attainment and maintenance for PM2.5, PM10, CO, VOC, and NOx.

Using the data, calculations were completed for the annual mean, the 2-year mean and the 2014 to 2017 reporting period and for the projected emission reductions. The group then applied the annual, the two year means and the projections as a guide in establishing the 2-year and 4-year targets.

#### Calculation of Total Emissions Reduction Measure

The Total Emission Reductions performance measure was calculated by INDOT and MPOs to carry out CMAQ on-road mobile source emissions performance-related requirements. The Total Emission

Reductions measure for each of the criteria pollutant or applicable precursor for all projects reported to the CMAQ Public Access System are then calculated to the nearest one thousandths, as follows:

*Total Emission Reduction<sub>p</sub>*

$$= \sum_{i=1}^T \text{Daily Kilograms of Emission Reductions}_{p,i}$$

Where:

i = applicable projects reported in the CMAQ Public Access System for the first 2 Federal fiscal years of a performance period and for the entire performance period, as described in in § 490.105(e)(4)(i)(B);

p = criteria pollutant or applicable precursor: PM2.5, PM10, CO, VOC, or NOx;

Daily Kilograms of Emission Reductions p, i = total daily kilograms, to the nearest one thousandths, of reduced emissions for a criteria pollutant or an applicable precursor “p” in the in the first year the project is obligated;

T = total number of applicable projects reported to the CMAQ Public Access System for the first 2 Federal fiscal years of a performance period and for the entire performance period, as described in § 490.105(e)(4)(i)(B); and

Total Emission Reduction<sub>pp</sub>= cumulative reductions in emissions over 2 and 4 Federal fiscal years, total daily kilograms, to the nearest one thousandths, of reduced emissions for criteria pollutant or precursor “p.”

The FY 2020 - 2024 STIP includes projects on Interstates and non-Interstates that are intended to improve PM<sub>3</sub> performance during the life span of the TIP and contribute towards making progress to reach the established targets. Projects listed in the STIP that will positively impact performance include interchange improvements, intersection improvements, integrated/intelligent technologies, passing lanes, and roadway widening.





# INDIANA DEPARTMENT OF TRANSPORTATION

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**Eric Holcomb, Governor**  
**Michael Smith, Commissioner**

## INDIANA DEPARTMENT OF TRANSPORTATION PLANNING PROCESS CERTIFICATION

The Indiana Department of Transportation hereby certifies that the transportation planning process is being carried out in accordance with all applicable requirements of:

- (1) 23 U.S.C. 134 and 135, 49 U.S.C. 5303 and 5304, and this part;
- (2) Title VI of the Civil Rights Act of 1964, as amended (42 U.S.C. 2000d-1) and 49 CFR part 21;
- (3) 49 U.S.C. 5332, prohibiting discrimination on the basis of race, color, creed, national origin, sex, or age in employment or business opportunity;
- (4) Section 1101(b) of the FAST Act (Pub. L. 114-357) and 49 CFR part 26 regarding the involvement of disadvantaged business enterprises in DOT funded projects;
- (5) 23 CFR part 230, regarding implementation of an equal employment opportunity program on Federal and Federal-aid highway construction contracts;
- (6) The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) and 49 CFR parts 27, 37, and 38;
- (7) In States containing nonattainment and maintenance areas, sections 174 and 176(c) and (d) of the Clean Air Act, as amended (42 U.S.C. 7504, 7506(c) and (d)) and 40 CFR part 93;
- (8) The Older Americans Act, as amended (42 U.S.C. 6101), prohibiting discrimination on the basis of age in programs or activities receiving Federal financial assistance;
- (9) 23 U.S.C. 324, regarding the prohibition of discrimination based on gender; and
- (10) Section 504 of the Rehabilitation Act of 1973 (29 U.S.C. 794) and 49 CFR part 27 regarding discrimination against individuals with disabilities.

**Michael Smith, Commissioner**  
Indiana Department of Transportation

Date