

Performance-Based Planning and Programming (PBPP)

Background

The IIJA/ BIL continues the requirements established in MAP-21 and FAST Act for state DOTs and MPOs to establish and use a performance-based approach in transportation decision making. This includes tracking performance measures, setting data-driven targets for each measure, and selecting projects to help meet those targets. The IIJA/BIL also requires that the TIP include a description of its anticipated effect toward achieving the established performance targets and linking investment priorities to those performance targets.

Transportation Performance Management (TPM) is a strategic approach that uses data to make investment and policy decisions to achieve national performance goals. 23 USC 150(b) outlines the national performance goal areas for the federal-aid program. This statute requires the FHWA to establish specific performance measures for the system that address these national goal areas. The regulations for the national performance management measures are found in 23 CFR 490. The goal of PBPP is to ensure targeted investment of federal transportation funds by increasing accountability and transparency and providing for better investment decisions that focus on key outcomes related to seven national goal areas:

- **Safety:** to achieve a significant reduction in traffic fatalities and serious injuries on all public roads
- Infrastructure Condition; to maintain the highway infrastructure asset system in a state of good repair;
- **Congestion Reduction:** to achieve a significant reduction in congestion on the NHS;
- **System Reliability:** to improve the efficiency of the surface transportation system;
- **Freight Movement and Economic Vitality:** to improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development;
- **Environmental Sustainability:** to enhance the performance of the transportation system while protecting and enhancing the natural environment; and
- **Reduced Project Delivery Delays:** to reduce project costs, promote jobs and the economy, and expedite the movement of people and goods by accelerating project completion through eliminating delays in the project development and delivery process, including reducing regulatory burdens and improving agencies' work practices.

Regulations required by the FHWA have established final rules on performance measures that address the seven goals, accordingly:

- fatalities and serious injuries, both number and rate per vehicle miles traveled, on all public roads;
- pavement condition on the Interstate system and on the remainder of the NHS;
- bridge condition on the NHS;
- performance (system reliability) of the Interstate system and non-Interstate NHS;
- freight movement on the Interstate system;
- traffic congestion; and
- on-road mobile source emissions.

The FHWA has established three performance measure regulations for roadway safety (PM1), bridge and pavement condition (PM2), and system performance (PM3). The FTA has established performance measures for Transit Asset Management (TAM) and Transit Safety. MPOs may either choose to support the respective state DOT and transit operator targets and the agencies' efforts to achieve the targets or develop their own regional targets. DVRPC has memoranda of agreements with various pertinent planning partners, including state DOTs, transit operators, and other MPOs for each of the performance measure areas. The agreements outline how the planning partners will select and report performance targets, and the reporting of performance. For additional information or to view the latest TPM updates, visit www.dvrpc.org/TPM.

Highway Safety Performance Management Measures Rule (PM1)

Highway safety was the first national goal identified in the FAST Act and had the earliest deadline for addressing progress toward meeting targets in the TIP. In March 2016, the FHWA Highway Safety Improvement Program and Safety Performance Management Measures Rule (Safety PM Rule) was finalized and published in the *Federal Register*. The rule requires state DOTs and MPOs to set annual targets for five safety-related performance measures with the understanding that reaching zero fatalities on all public roads will require time and significant effort. A *target* is defined in 23 CFR 490.101 as a quantifiable level of performance or condition, expressed as a value for the measure, to be achieved within a time period required by the FHWA. The federal safety performance measures are consecutive five-year rolling averages for:

- number of fatalities: the total number of persons suffering fatal injuries in a motor vehicle crash during a calendar year;
- rate of fatalities per 100 million vehicle miles traveled (VMT): the ratio of total number of fatalities to the number of VMT (in 100 million VMT) in a calendar year;
- number of suspected serious injuries: the total number of persons suffering at least one suspected serious injury in a motor vehicle crash during a calendar year;
- rate of suspected serious injuries: the ratio of total number of suspected serious injuries to the number of VMT (in 100 million VMT) in a calendar year; and
- number of non-motorized fatalities and non-motorized suspected serious injuries (combined): the combined total number of non-motorized fatalities and non-motorized suspected serious injuries involving a motor vehicle during a calendar year.

State DOTs report baseline values, targets, and progress toward meeting the targets to the FHWA in an annual safety report. MPOs may either establish quantitative targets for their metropolitan planning area or agree to adopt the statewide targets. The FHWA requires DOTs and MPOs to establish safety targets on an annual basis.

DVRPC Regional Safety Targets and Goals

In January of 2022, the DVRPC Board adopted regional safety targets marking the end of a year and a half of engagement with DVRPC's RTC. During this time, staff discussed findings from their research into the regional target-setting processes of five peer MPOs and met individually with state DOT and FHWA partners seeking their guidance and support of our effort, and to promote transparency. The RTC considered two regional safety targets scenarios based on DVRPC's Regional Vision Zero 2050 goal. Regional Vision Zero provides the context for more meaningful and substantive strategies to improve safety systemwide.

If an MPO adopts regional targets, they must adopt targets that cover the entire MPO region. The adopted regional safety targets represent fatal and suspected serious injury data for the combined nine-county bi-state DVRPC region as required by the FHWA. DVRPC agrees to plan and program projects that contribute

toward meeting or exceeding the regional safety targets. The DVRPC regional safety targets are shown in Table 14: for reference.

Table 13: 2018–2022 DVRPC Regional Safety Targets

Performance Measure	Regional Baseline (2016–2020)	Regional Target (2018–2022)
Fatalities	407.2	387.2
Rate of Fatalities Per 100 mil VMT	1.050	0.940
Suspected Serious Injuries	1382.8	1302.8
Suspected Serious Injuries Per 100 mil VMT	3.557	3.162
Non-Motorized Fatalities and Suspected Serious Injuries	378.0	359.7

Source: DVRPC, 2022

The DVRPC non-linear regional safety targets are analyzed by the Performance Measure Baseline from 2016 to 2020 and the respective categories’ targets from [2018 to 2022](#). These targets were approved by the DVRPC Board in January 2022.

PennDOT Statewide Highway Safety Targets and Goals

PennDOT published its most recent Strategic Highway Safety Plan (SHSP) in early 2017. The 2017 SHSP was developed in conjunction with over 45 stakeholders including federal, state, and local agencies; private-sector organizations; and Pennsylvania’s MPO/RPO, coordinating together to address the four Es of the safety discipline (Engineering, Enforcement, Education, and Emergency Response). This document adopted a goal to support the national vision for highway safety: Toward Zero Deaths: A National Strategy on Highway Safety.

The goals outlined in PennDOT’s 2017 SHSP were used to help define targets for the Safety PM Rule. Specifically, the 2017 SHSP set a goal of reducing fatalities and serious injuries on PennDOT roadways by 2 percent per year. Table 14 details PennDOT’s statewide safety targets for calendar year 2020.

PennDOT’s SHSP serves as a blueprint to reduce fatalities and serious injuries on Pennsylvania roadways and targets 18 Safety Focus Areas that have the most influence on improving highway safety throughout the state. Within the SHSP, PennDOT identifies three key emphasis areas to improve safety-impaired driving, lane departure crashes, and pedestrian safety.

Table 14: PennDOT 2022 Statewide Safety Targets

Performance Measure	Five-Year Rolling Averages	
	Baseline	Target
	2016–2020	2018–2022
Number of Fatalities	1,140.6	1,113.7
Fatality Rate	1.157	1.205
Number of Serious Injuries	4,445.6	4,490.8
Serious Injury Rate	4.510	4.860
Number of Non-motorized Fatalities and Serious Injuries	761.2	730.1

Source: PennDOT, March 2022

An analysis of Pennsylvania’s historic safety trends was utilized as the basis for PennDOT and MPO/RPO coordination on the state’s safety targets. The targets listed above are based on a 2 percent annual reduction for fatalities and maintaining levels for suspected serious injuries, which was derived from the actions listed in the SHSP, crash data analysis, and the desire to support the national initiative Toward Zero Deaths.

Table 15: PennDOT’s SHSP Focus Areas

2022 SHSP Safety Focus Areas			
Lane Departure Crashes	Speed and Aggressive Driving	Seat Belt Usage	Impaired Driving
Intersection Safety	Mature Driver Safety	Local Road Safety	Motorcycle Safety
Pedestrian Safety	Bicycle Safety	Commercial Vehicle Safety	Young and Inexperienced Drivers
Distracted Driving	Traffic Records Data	Work Zone Safety	Transportation Systems Management and Operations
Emergency Medical Services	Vehicle-Train Crashes		

Source: PennDOT, 2022

Pursuant to 23 CFR 490.211(c)(2), a state DOT has met or made significant progress toward meeting its safety performance targets when at least four of the five safety performance targets established under 23 CFR 490.209(a) have been met, or the actual outcome is better than the baseline performance for the year prior to the establishment of the target. For Pennsylvania’s 2020 targets, the FHWA determined in March 2022 that Pennsylvania did not meet the statewide targets and is subject to the provisions of 23 U.S.C. § 148

(i). This requires PennDOT to submit an implementation plan that identifies gaps; develops strategies, action steps and best practices; and includes a financial and performance review of all HSIP-funded projects. In addition, PennDOT is required to obligate in Federal Fiscal Year (FFY) 2023 an amount equal to the FFY2019 HSIP apportionment.

Progress toward Highway Safety Targets

The DVRPC FY2023 TIP for Pennsylvania was developed to ensure progress toward target achievement. The following steps have been taken at the statewide and regional levels to ensure that projects selected for HSIP funding in Pennsylvania help to achieve a significant reduction of traffic fatalities and serious injuries on all public roads to support achieving safety targets:

- Pennsylvania sets aside HSIP funds per FFY to advance projects that are evaluated and ranked based on Benefit/Cost analysis, Highway Safety Manual (HSM) analysis, fatal and injury crashes, application of systemic improvements, improvements on local roads, and deliverability. This program is referred to as the Statewide HSIP Set-Aside Program (sHSIP), and applications for funding are solicited across the commonwealth. DVRPC and PennDOT District 6 staff work together to identify and develop projects to seek this funding. Those that have been awarded funding through this program are identified as "Statewide" in Table 16.
- In addition to advancing projects awarded through the sHSIP, the DVRPC region is allocated \$24.528M in FY2023, \$25.394M in FY2024, \$26.276M in FY2025, and \$27.176M in FY2026 and every year after of HSIP funds as part of the state's Financial Guidance after the passage of the IJJA/BIL. DVRPC and PennDOT District 6 staff work together with county planning staff to develop and identify safety projects to utilize these additional HSIP funds. Potential projects are evaluated based on Benefit/Cost and HSM analysis, in the same way described above for the sHSIP. Table 16: provides Cost/Benefit analysis for the FY2023 awards for the sHSIP.
- At the statewide and regional levels, PennDOT works to implement strategies identified in the 2022 SHSP through data-driven safety analysis, including low-cost systemic safety improvements.
- PennDOT Central Office opened the HSIP funding site on SharePoint in January 2017, and it is still being utilized. The HSIP funding site provides a single point of communication for all HSIP project eligibility and funding requests. Project applications are reviewed through an approval workflow involving District and Central Office safety and planning staff, and all MPOs and RPOs are also able to coordinate and communicate through the SharePoint system.
- Projects are being planned and completed that were associated with the Intersection Safety Implementation Plan and Roadway Departure Safety Implementation Plan.
- Pennsylvania is using the PA Regionalized Safety Performance Functions (SPFs) developed for the statewide network of about 20,000 locations. This approach uses the HSM's analysis method of Excess Expected Average Crash Frequency with Empirical Bayes adjustments, also known as Potential for Safety Improvement (PSI). This method uses the calculated expected crashes for a location and subtract the predicted crashes for that same location to produce an excess (or PSI) value. The new regionalized SPFs have been added to a Pennsylvania specific HSM analytical tool.

The expectation is that through a continued focus on implementing safety improvements, PennDOT's and DVRPC's safety performance measure targets will reduce the numbers of fatalities, serious injuries, and non-motorized fatalities in Pennsylvania. The DVRPC FY2023 TIP for Pennsylvania includes projects totaling over \$80.97 million for selected projects utilizing federal HSIP funds.

Additionally, DVRPC has established a set of criteria used to evaluate new projects that are added to the TIP. The criteria were developed with New Jersey and Pennsylvania members of a working subcommittee of the DVRPC RTC and were designed to align directly with the multimodal goals of the Long-Range Plan and to

reflect the increasingly multimodal nature of projects in the TIP. After defining the criteria, the working subcommittee weighted them, with higher weights equaling higher priorities for the DVRPC region. See more in Appendix D:

Safety was rated as the highest-priority for project evaluation. Each non-HSIP project is evaluated for how it impacts safety-critical elements for high-crash road locations, transit projects, or incorporates one or more FHWA-proven safety countermeasures. Many other TIP projects funded with non-HSIP funds will provide safety benefits to the roadway system. Guiderail and vegetation maintenance, as well as bridge improvement projects, are all expected to provide nominal safety improvements that may help to bring fatality and serious injury crashes down.

Demonstrating the region's commitment to the newly adopted regional safety targets, nearly half of the 12 total non-bridge projects focus explicitly on safety improvements. These include three roundabouts, one trail, and one complete streets project. All of the candidates added to the TIP scored well in the safety criteria of the TIP-LRP Project Benefit Evaluation Criteria analysis. All of these projects were funded with sources other than HSIP.

Table 16: Projects Utilizing Federal HSIP Funds

County	Project	Description	HSM Benefit/Cost	Funding Status
Bucks	Roundabout on Easton Rd. at New Britain Rd./Sauerman Rd. (MPMS #111024)	Roundabout installation at Easton Rd. and New Britain Rd., as well as Easton Rd. and Sauerman Rd.	1.28	Ongoing Statewide
	Route 113 and Minsi Trail Rd. Roundabout (MPMS #115418)	Roundabout at Souderton Rd. and Minsi Trail Rd.	5.08	Ongoing Regional
	Buckingham Rd and York Rd. (PA 263) Roundabout (MPMS #115419)	Roundabout at Buckingham Rd. and York Rd.	1.31	
	Penndel Borough Intersection Improvements (MPMS #115420)	Road diet; add left-turn lanes, upgrade pavement markings, high-visibility crosswalks, signals	2.56	
Chester	SR 896 Safety Improvement (MPMS #85949)	Increase the lane and shoulder width; install signage, raised pavement markers, rumble strips	N/A ¹	Ongoing Regional
	West Chester Pike Safety Improvements (MPMS #115422)	Install chevrons, curve warning, retroreflective back plates, of right-in/right-out access	9.46	
	Route 23 Corridor Safety Improvements (MPMS #115423)	Install retroreflective back plates, pedestrian countdown timers and pushbuttons, new signal; eliminate passing lane	17.13	
	US 322 West Chester Bypass Safety Improvements (MPMS #115424)	Remove passing lane; extend acceleration/deceleration lanes; install bike shoulders, centerline rumble strips, left-turn lanes, wrong-way countermeasures	3.93	
	High Street Pedestrian Improvements (MPMS #115425)	Install retroreflective back plates, pedestrian countdown timers, signals and lighting	7.51	
Delaware	MacDade Blvd. Corridor from Fairview to Ashland (MPMS #110951)	Road diet; addition of turn lanes; modernization of signals along corridor with fiber optic interconnection	6.59	Ongoing Statewide
	Chichester Ave. Corridor Safety Improvements (MPMS #111022)	Traffic signal installation; modify left-turn signal phases	1.55	

(cont.)

¹ This project was initiated before the current HSM Benefit/Cost analysis procedures were established for Pennsylvania's HSIP funding.

Table 16: Projects Utilizing Federal HSIP Funds (cont.)

County	Project	Description	HSM Benefit/Cost	Funding Status
Delaware	Lansdowne Ave. Corridor Safety Improvements (MPMS #111167)	Road diet; two-way left-turn lanes; left-turn lanes at 8 intersections; modify left-turn phasing; dynamic signal warning flashers; actuated advance warning dilemma zone protection system; modernize signals along corridor including fiber optic interconnection	5.72	Ongoing Regional
	Smithbridge Road Corridor (MPMS #107642)	Roundabout installation	N/A ²	
	Haverford Rd. Corridor Safety Improvements (MPMS #115427)	Installation of road diet, left-turn lanes, actuated advanced warning dilemma zone protection system	8.54	
	Lansdown Ave Corridor Safety Improvements (MPMS #115427)	Installation of retroreflective back plates, pedestrian countdown timers, additional lighting, and raised and high-visibility crosswalks	15.23	
Montgomery	Roundabout at Old Skippack Rd. and Schwenksville Rd.	Roundabout installation at Old Skippack Rd. and Schwenksville Rd.	3.27	Ongoing Statewide
	Main St. Corridor Safety Improvements (MPMS #110971)	Turn lane and signal modifications along corridor; relocate roadside fixed objects along corridor	2.1	
	Bethlehem Pike Safety Improvements (MPMS #114944)	Install partial road diet, left-turn lanes, pedestrian countdown timers and retroreflective back plates	15.16	
	Lancaster Ave and Remington Rd. Intersection Improvements (MPMS #114948)	Add left-turn lanes, install pedestrian countdown timers, add ADA ramps, upgrade existing mast arm and add additional primary signal head	5.27	Ongoing Regional
	Sumneytown Pike Intersection Improvements (MPSM #115428)	Install left-turn lanes, remove skew angle of road, install intersection lighting	3.33	
	Belmont Ave and St. Asaphs Rd. Roundabout (MPMS #115429)	Installation of a roundabout	2.00	

² This project was initiated before the current HSM Benefit/Cost analysis procedures were established for Pennsylvania's HSIP funding.

Table 16: Projects Utilizing Federal HSIP Funds (cont.)

County	Project	Description	HSM Benefit/Cost	Funding Status
Philadelphia	Frankford Ave. Signal Improvements (MPMS #106993)	Improve signing and pavement markings, improve traffic signal equipment including pedestrian countdowns, traffic calming measures	6.93	Ongoing Statewide
	Roosevelt Blvd. IHSDM Study (MPSM #114942)	Interactive Highway Safety Design Model Study of Roosevelt Blvd. at two different locations that represent whole corridor	N/A ³	Ongoing Regional
	Castor Ave. Corridor Safety Improvements (MPMS #115430)	Road diet; modify left-turn signal phasing; left-turn lane at 13 intersections	9.27	
	Broad St Corridor Safety Improvements) MPMS #115430)	Replacement of two-way left-turn lane with raised concrete medians	26.70	
	Verree Rd. Corridor Safety Improvements (MPSM #115431)	Conversion of signals from pedestal-mounted to mast arm, addition of pedestrian countdown timers and push buttons, coordination of arterial signals	19.86	
	Welsh Rd. Corridor Safety Improvements (MPMS #115433)	Installation of road diet, left-turn lanes, pedestrian countdown timers, coordination of signals, and installation of retroreflective back plates	12.29	
	Frankford Ave. Corridor Safety Improvements (MPMS #115434)	Conversion of signals from pedestal-mounted to mast arm, addition of pedestrian countdown timers, installation of retroreflective back plates, upgrade signal cabinet, coordination of arterial signals	14.44	
	63 rd St Corridor Safety Improvements (MPMS #115435)	Make pavement marking visible, update left-turn phasing and vehicle and pedestrian timings, install single-lane roundabout	8.60	
	Washington Lane Corridor Safety Improvements (MPMS #115440)	Installation of retroreflective back plates, pedestrian countdown timers, signal coordination; convert signals from pedestal to mast-arm; install curb bump outs, raised crosswalk, and flashing beacons	14.35	

(cont.)

³ This is the HSM analysis for the proposed alternatives and will be part of decision matrix to compare alternatives.

Table 16: Projects Utilizing Federal HSIP Funds (cont.)

County	Project	Description	HSM Benefit/Cost	Funding Status
Philadelphia	Vine St. Corridor Safety Improvements (MPMS #115442)	Installation of road diet, curb protected bike lane, remove on-street parking, and update signal equipment	1.76	Ongoing Regional
	Wyoming Ave. Corridor Safety Improvements (MPMS #115444)	Convert signals from pedestal-mounted to mast arm, provide flashing beacons at unsignalized intersections	9.78	
	5 th St Corridor Safety Improvements (MPMS #115445)	Convert all signals from pedestal-mounted to mast arm and install pedestrian countdown timers	17.44	
Various	Systemic Improvements - Lane Departure (MPMS #117793)	Identify locations where low-cost safety countermeasures can be constructed to reduce the number and severity of crashes		New Statewide
	Systemic Improvements - Vulnerable Users (MPMS #117796)	Implement roadway context appropriate traffic calming strategies with specific focus on speed management to address non-motorized roadway user safety in urban and urban-core areas		

Source: DVRPC, 2022

Infrastructure (Pavement and Bridge) Performance Management Measures Rule (PM2)

The FHWA rule for the National Performance Management Measures; Assessing Pavement and Bridge Condition for the National Highway Performance Program was published in the *Federal Register* (82 FR 5886) on January 18, 2017, and became effective on February 17, 2017. It established performance measures for all state DOTs to use to carry out the NHPP and to assess the condition of pavements on the Interstate system; pavements on the NHS (excluding the Interstate system); and bridges carrying the NHS, which include on- and off-ramps connected to the NHS. This rule established six measures related to the condition of the infrastructure on the NHS. The measures are commonly known as PM2. The current regulations are found at 23 CFR 490 Subpart C and Subpart D. Targets are established for these measures as part of a four-year performance period; the first was 2018 to 2021. This TIP includes projects that will impact the second four-year performance period of 2022 to 2025.

The NHPP is a core federal-aid highway program that provides support for the condition and performance of the NHS and the construction of new facilities on the NHS. The NHPP also ensures that investments of federal-aid funds in highway construction are directed to support progress toward the achievement of performance targets as established in a state's TAMP for the NHS. The Infrastructure Performance Management Measures Rule requires the state DOT to report and manage performance of the NHS, regardless of ownership or maintenance responsibility, for the full extent of the Interstate and non-Interstate NHS. This final rule establishes regulations for the new performance aspects of the NHPP that address measures, targets, and reporting. PennDOT has developed asset management systems for bridges in their Bridge Asset Management System (BAMS) and pavement in their Pavement Asset Management System

(PAMS) in order to achieve and sustain a state of good repair over the life-cycle of transportation assets at the minimum practicable cost. With the passing of the IIJA/BIL, states are required to manage the NHS to the LLCC and document this in their TAMPs. LLCC is a process designed to maximize the life of an asset at the lowest cost through a risk-based prioritization of preservation, rehabilitation, and reconstruction.

PennDOT provided an overview of the Bridge Asset Management and Pavement Asset Management systems to MPO staff, including DVRPC staff, on November 30, 2021. DVRPC is working closely with staff from PennDOT Central Office and PennDOT District 6-0 to understand the data provided by these systems and begin using them to identify and program projects in the TIP, as well as to adjust the scopes of current TIP projects to better align with the recommendations of the asset management systems, as appropriate.

Statewide Pavement and Bridge Performance Measure Targets

The pavement and bridge performance measures include:

- percentage of Interstate pavements in good condition;
- percentage of Interstate pavements in poor condition;
- percentage of non-Interstate NHS pavements in good condition;
- percentage of non-Interstate NHS pavements in poor condition;
- percentage of NHS bridges by deck area classified in good condition; and
- percentage of NHS bridges by deck area classified in poor condition.

The 2022–2025 Statewide Pavement and Bridge Performance Measure Targets are due October 2022. Pennsylvania’s pavement and bridge targets will be established by October 2022 through extensive coordination with a TAMP steering committee and workshops with MPOs/RPOs and the FHWA’s Pennsylvania Division. The targets will be consistent with PennDOT’s asset management objectives of maintaining the system at the desired state of good repair, managing to LLCC, and achieving national and state transportation goals.⁴ Targets are expected to be calculated based on general system degradation (deterioration curves) offset by improvements expected from delivery of the projects in the TIP, along with planned state-funded maintenance projects.

State two-year and four-year targets (the desired state of good repair) were established. Like the Highway Safety Performance Measure, MPOs must establish targets by either agreeing to support the state targets or establishing their own quantifiable targets no later than 180 days after a state DOT establishes (or amends) its targets. On October 25, 2018, the DVRPC Board agreed to support PennDOT’s statewide Pavement and Bridge Infrastructure Performance targets and PennDOT’s efforts at achieving those targets shown in Table 17: and Table 18: below. Note that two-year targets (FY18–FY19) for Interstate pavement are not required for the first performance period (hence “n/a”). DVRPC will be revisiting the targets for PM2 in the fall of 2022 as part of the initial four-year performance period review and establishment of the second four-year performance period.

Pavement Performance Targets

The Infrastructure Performance Management Measures Rule requires the state DOT to report and manage performance of the NHS, regardless of ownership or maintenance responsibility, for the full extent of the Interstate and non-Interstate NHS.

⁴ For more information on LLCC: www.penndot.gov/ProjectAndPrograms/Asset-Management/Documents/Lowest-Life-Cycle-Cost-Infographic.pdf

Federal rulemaking 23 U.S.C. 119 requires that all distress component information be collected for one-tenth-mile increments. Pavement condition is measured by four distress components (International Roughness Index, Cracking, Rutting, and Faulting), which are then translated to good, fair, or poor condition scores per FHWA criteria and then broken out into separate values for the Interstate and non-Interstate NHS.

- **International Roughness Index (IRI):** quantifies how rough the bituminous and concrete pavement is by measuring the longitudinal profile of a traveled wheel track and generating a standardized roughness value in inches per mile;
- **Cracking:** measures the percentage of bituminous and concrete pavement surface that is cracked;
- **Rutting:** measures the depth of ruts (surface depression) in bituminous pavement in inches; and
- **Faulting:** quantifies the difference in elevation across transverse concrete pavement joints in inches.

Determining pavement condition requires rigorous data collection. In the past, all PennDOT data was collected for each roadway segment, which is approximately one-half-mile in length. Federal rulemaking 23 U.S.C. 119 now requires that all distress component information be collected for one-tenth-mile increments. PennDOT and its partners have adjusted their pavement data collection to meet FHWA standards. Data collection at the one-tenth-mile increment level began in 2017 for cracking, rutting, and faulting and will be used for this submission of the TAMP.

Table 17: State Pavement Infrastructure Performance Targets

Pavement Infrastructure	Condition	Baseline	Two-Year Target	Four-Year Target
Interstate Pavement Lane Miles	Good	67.2%	n/a	60.00%
	Poor	0.4%	n/a	2.00%
Non-Interstate NHS Pavement Lane Miles,	Good	36.8%	35.00%	33.00%
	Poor	2.3%	4.0%	5.0%

Source: PennDOT, 2022. The TPM website pavement infrastructure data reflects the October 2020 interim (two-year) report that the state DOTs submitted to the FHWA. The next four-year report update is tentatively expected in the fall of 2022

PennDOT’s pavement condition targets for NHS Interstate roadways are within the federal standard of no more than 5 percent of NHS Interstate pavements being rated in poor condition. PennDOT’s pavement condition targets (see Table 17:), are consistent with its asset management objectives of maintaining the system at the desired state of good repair, managing to LLCC, and achieving national and state transportation goals.

Although the two-year and four-year targets assume pavement condition worsening, PennDOT and DVRPC are committed to a long-term goal of improving pavement conditions and achieving a sustainable state of good repair. PennDOT defines its desired state of good repair as meeting the FHWA minimum condition thresholds for pavements and bridges: no more than 5 percent of the NHS Interstate pavements are rated in poor condition and no more than 10 percent of total NHS bridge deck area shall be rated as poor, per federal requirement. The ability to achieve these condition thresholds is dependent on adequate funding. If the threshold is not met, restrictions are placed on PennDOT’s federal funding—specifically, NHPP and STP funds. The FHWA has not established a minimum condition for NHS non-Interstate roadways but requires the state DOT to establish performance targets.

Bridge Performance Targets

The FHWA final rulemaking also established performance measures for all mainline NHS bridges regardless of ownership or maintenance responsibility, including bridges on ramps connecting to the NHS and NHS bridges that span a state border. The FHWA’s performance measures aim to assess bridge condition by the percentage of NHS bridges rated in good and poor condition by deck area on the NHS.

Separate bridge structure condition ratings are collected for deck, superstructure, and substructure components during regular inspections using the National Bridge Inventory (NBI) Standards. For culvert structures, only one condition rating is collected (the culvert rating). A rating of 9 to 0 on the FHWA condition scale is assigned to each component. Based on its score, a component is given a good, fair, or poor condition score rating.

A structure’s overall condition rating is determined by the lowest rating of its deck, superstructure, substructure, and/or culvert. If any of the components of a structure qualify as poor, the structure is deemed poor. 23 CFR 490.411(a) requires that no more than 10 percent of a state’s total NHS bridges by deck area be in poor condition. It is important to note that poor does not correlate to the safety rating of the bridge. The bridge condition performance measures are calculated by summing the deck area of bridges in “good” and “poor” condition and dividing by the total deck area of all NHS bridges.

As with the pavement condition measures, DVRPC relied upon PennDOT for calculation of bridge condition metrics and supports PennDOT’s statewide targets (the desired state of good repair) in Table 18:.

Table 18: State NHS Bridge Infrastructure Performance Targets

Bridge Infrastructure	Condition	Baseline	Two-Year Target	Four-Year Target
NHS Bridge Deck Area	Good	23.7%	25.8%	26.0%
	Poor	5.1%	5.6%	6.0%

Source: DVRPC, 2022

PennDOT’s bridge condition targets are consistent with its asset management objectives of maintaining the system at the desired state of good repair, managing to LLCC, and achieving national and state transportation goals.

Coordination on Bridge and Pavement Performance Targets

A TAMP Steering Committee was formed in January 2017. The Committee comprised representation from PennDOT Executive Management, the FHWA, and the Pennsylvania Turnpike Commission, as well as PennDOT’s Engineering Districts, Asset Management Division, Center for Program Development and Management, Bureau of Planning and Research, and Highway Safety and Traffic Operations Division. The purpose was to manage and coordinate the development, submission, and implementation of the TAMP, and the pavement and bridge condition performance measures. The TAMP Steering Committee met on January 4, 2017; February 6, 2017; September 21, 2017; October 31, 2017; November 13, 2017; December 21, 2017; and April 16, 2018.

A workshop was conducted on October 12, 2017, with PennDOT, planning partners, and FHWA Pennsylvania Division staff related to fully integrating an asset management approach into decision making. A workshop

was conducted on January 11, 2018, with PennDOT and FHWA Pennsylvania Division staff to identify future steps and requirements related to the TPM rulemaking. PennDOT provided status updates on the development of performance measure data, tools, and methodologies to the planning partners. On October 18, 2017, PennDOT provided an overview of the performance measures and general approaches for target setting at the planning partners Fall Conference in State College. On a March 20, 2018, conference call, PennDOT provided a status update on the development of baseline measures and targets. PennDOT conducted a webinar on May 9, 2018, to review the state DOT targets with the planning partners. PennDOT has worked to develop the Pennsylvania Department of Transportation MAP-21 and FAST Act Performance Management Road Map to provide planning partners with a resource on the performance measure requirements and calculations.

Progress toward Pavement and Bridge Performance Targets

DVRPC is dedicated to system preservation for pavement and bridges. The DVRPC Long-Range Plan places an increased emphasis and analysis related to transportation system preservation needs and funding, which in turn informs the fiscally constrained list of projects included in the Long-Range Plan and TIP. In the DVRPC Pennsylvania subregion, the Plan identified \$34.207 billion needed for pavement and bridge preservation projects.⁵ Of this total need, \$963.506 million is programmed in the four-year FY2023 TIP for system preservation, under the regional TIP. This does not include the majority of the I-95 reconstruction, which is listed on the statewide IMP. DVRPC is expected to update the TIP-LRP Project Benefit Evaluation Criteria in FY2023, and the new federal and state regulations will be reflected in the updated criteria.

Per Table 49 in the DVRPC-Board-adopted *Connections 2050 Plan for Greater Philadelphia: Process and Analysis Manual* (DVRPC Publication Number 21028), system preservation receives the most funding of all roadway project categories. Of the \$23.5 billion allocated to roadway improvements in the Pennsylvania state subregion, 55 percent or \$12.9 billion is allocated to bridge preservation, followed by 21.5 percent or \$5.1 billion for pavement preservation. Tables 20 and 22 in the *Process and Analysis Manual* list the funding needs by plan period to maintain the existing system of roadways and bridges.

Facility and Asset Condition is the second-highest-ranked criterion in DVRPC's TIP-LRP Project Benefit Evaluation Criteria, accounting for 22 percent of the investment recommendation. Projects score well by bringing a facility or asset into a state of good repair, extending the useful life of a facility or asset, or providing reduced operating/maintenance costs. More information about the TIP-LRP Project Benefit Evaluation Criteria can be found in Appendix D:

PennDOT and DVRPC work together to develop and manage a regional TIP that supports progress toward the achievement of the current statewide pavement/bridge objectives and the targets that will be established for the 2022–2025 performance period. PennDOT is transitioning to the new TAMP, which is expected to be finalized in the summer of 2022. The tools and methodologies are continually evaluated to prioritize state of good repair approaches that preserve transportation system assets.

Pennsylvania's pavement and bridge projects provided in the FY2023 TIP were selected through an evaluation of PennDOT's Asset Management Systems in accordance with the TAMP. The projects are consistent with PennDOT's asset management objectives of maintaining the system at the desired state of good repair, managing to LLCC, and achieving national and state transportation goals. After the 2022–2025 performance targets are set, PennDOT will provide feedback on statewide and MPO/RPO-specific progress toward target

⁵ See Tables 20 and 22 of the DVRPC *Connections 2050 Plan for Greater Philadelphia; Process and Analysis Manual*: www.dvrpc.org/Products/21028.

achievement. The progress helps each region understand the impacts of their past bridge and pavement investments and can guide future planning goals and strategy assessments.

Of the 36 bridge and 12 highway projects that have been added to the TIP, \$256.368 million is going toward brand-new bridge projects, while \$91.541 million is going to address new highway-funded projects. Of the 12 highway projects that were selected for funding, one project with an estimated cost of \$8.75 million is fully dedicated to reconstruction, while other projects that were selected address safety and operational improvements that may include some pavement reconstruction. Totals of \$203.650 million in highway funds and \$100.225 million in bridge funding are focused on reconstructing highway and bridge structures that were pushed out of the 12-year plan during the FY2021 TIP update due to inadequate funding. The FY2023 TIP for Pennsylvania programmed \$275.235 million in SPIKE Discretionary NHPP and STP funds to be spent on bridge and pavement improvements.

Table 19: Key Bridge and Pavement Projects in the Region

County	MPMS	Project	Primary Improvement Focus
Bucks	93445	Route 1 Improvement-North (Section RC2)	Highway and Bridge Reconstruction
Chester	14698	US 422, Reconstruction (M2B) SR:0422	Highway Reconstruction
Delaware	104343	US 322 over CSX	Bridge Replacement
Montgomery	16738	US 422 Expressway Section M1B	Highway and Bridge Reconstruction
Philadelphia	69828	Market Street Bridges (3) Over Schuylkill River and CSX Railroad (MSB)	Bridge Rehabilitation/ Replacement

Source: DVRPC, 2022

Table 20: Anticipated Pavement and Bridge Deck to Be Preserved or Improved

	FY23–FY34
Anticipated Bridge Deck Area to be Preserved or Improved (included IMP)	10,823,666 square feet
Anticipated Miles of Pavement to be Preserved or Improved*	610.44 miles

Source: PennDOT, 2022

*Note: It is anticipated that the current PennDOT five-year resurfacing plan (FY22–FY26) will repave 1,059 miles of roadway.

System (NHS, Freight, CMAQ) Performance Management Measures Rule (PM3)

The FHWA final rule for 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 was published in the *Federal Register* (82 FR 5970) on January 18, 2017, and became effective on May 20, 2017.

This final rule is the third in a series of three related rulemakings that together establish a set of performance measures for state DOTs and MPOs to use as required by the IIJA/BIL. The measures in this third final rule will be used by state DOTs and MPOs to assess the performance of the Interstate and non-Interstate NHS for the purpose of carrying out the NHPP; to assess freight movement on the Interstate system; and to assess traffic congestion and on-road mobile source emissions for the purpose of carrying out the CMAQ Program. These system performance measures are collectively referred to as PM3 measures. System Performance Management Measures include the following listed below that are divided into three categories: Travel Time Reliability, CMAQ Congestion, and CMAQ Emissions Reduction. Each category has its own measures:

Travel Time Reliability (TTR)

- percentage person-miles traveled (PMT) on the Interstate that are reliable;
- percentage of PMT on the non-Interstate NHS that are reliable; and
- Interstate System Truck Travel Time Reliability Index.

CMAQ Congestion

- Annual Hours of Peak-Hour Excessive Delay (PHED) per capita; and
- percentage of non-Single Occupant Vehicle (SOV) travel.

CMAQ Emissions Reduction

- on-road mobile source emissions reduction for CMAQ-funded projects.

State two-year and four-year targets are established for these measures as part of a four-year performance period with the first period from 2018 to 2021. The four-year targets can be adjusted as part of the two-year interim review. This TIP includes projects that will impact future performance periods based on when projects are constructed or completed. Like safety performance measures and infrastructure performance measures, MPOs must establish targets by either agreeing to support the state targets or establishing their own quantifiable targets no later than 180 days after a state DOT establishes (or amends) its targets. This analysis is for the first performance period (2018–2021), in that the baselines and targets for the second performance period are currently underway and are anticipated to be completed in fall 2022. If the MPOs establish their own performance measure targets, they should coordinate with PennDOT on the selection of the targets in accordance with 23 U.S.C. 134(h)(2)(B)(i)(II) to ensure consistency, to the maximum extent practicable.

The DVRPC agreed to support PennDOT’s initial four-year targets, as well as their efforts to achieve those targets on October 23, 2018. On January 28, 2021, the DVRPC Board agreed to support PennDOT’s four-year target adjustments for Travel Time Reliability TTR, Freight Reliability, and CMAQ Emissions (for CO), as well as PennDOT’s efforts at achieving those targets for the first performance period shown in Table 22:. New statewide targets for the second performance period (2022–2025) are expected in fall 2022.

TTR Targets

Reliability refers to the variability of travel times on road segments experienced by travelers. The more variability in travel time, the less reliable the trip. Traffic congestion occurs when the amount of traffic far exceeds the physical capacity of the system, generally measured by the number of travel lanes on the roadway, the number of intersections, access points, and numerous other factors. Reliability is used in reference to the level of consistency in the transportation service provided by a roadway. For example, a roadway can be heavily congested, but if the amount and time of day when congestion occurs on it is consistent, it is considered reliable. The USDOT established performance measures pertaining to reliability because empirical evidence exists to suggest that the traveling public values reliability more than straight travel times. Traffic Congestion and Reliability: Linking Solutions to Problems is available on the FHWA website at ops.fhwa.dot.gov/congestion_report_04/chapter2.htm.

The first major performance area under system performance is TTR. The measures for TTR are the percentage of PMT on the Interstate on the NHS with reliable travel times, and the percentage of PMT on the non-Interstate NHS with reliable travel times. Travel times in this measure are derived from the National Performance Management Research Data Set (NPMRDS v2), based on archived probe-based traffic data, and traffic volumes from the Highway Performance Monitoring System. The measures are calculated using the UMD CATT Lab RITIS Probe Data Analytics software platform and generated by roadway segment using the Level of TTR metric, defined as the ratio of the longer travel times (80th percentile) to a “normal” travel time (50th percentile). Any value equal to or less than 1.50 is considered reliable. The percentage of PMT that are reliable for the region is the ratio of the reliable segments TTR multiplied by segment traffic volumes to all segments TTR multiplied by traffic volumes.

For the baseline of the first performance period, due to potential tool enhancements, limited historic information, and the need for additional research to understand the variances and factors influencing each of the performance measures, PennDOT led efforts collaboratively with the MPOs and other planning partners to keep the future two-year and four-year TTR Targets for Interstate and non-Interstate the same as the 2017 baseline values (See Table 23). For the two-year interim review in the mid-performance period, the 2019 actual performance met the two-year target, and PennDOT collaboratively with the planning partners decided to adjust the four-year target for percentage of PMT on the Interstate that are reliable from 89.8 percent to 89.5 percent.

DVRPC is monitoring the reliability of travel and is collaboratively working with PennDOT on setting two- and four-year percentage PMT reliability targets for the second performance period (2022–2025).

Table 21: State TTR Targets

NHS System	Baseline	Two-Year Target	2019 Actual	Four-Year Target
PMT on Interstate with Reliable Travel Times (%)	89.8%	89.8%	89.9%	89.8%**
PMT on Non-Interstate NHS with Reliable Travel Times (%)	87.4%	n/a*	88.5%	87.4%

*Target not required.

**Four-year target was adjusted for percentage PMT on the Interstate that are reliable at the mid-term reporting period.

Source: DVRPC, 2022

Freight/Truck Travel Time Reliability Targets

The national system performance measure for freight is the Truck Travel Time Reliability (TTTR) Index and is required for Interstate highways on the NHS only. Like TTR, this measure is derived from the NPMRDS v2 data and calculated using the UMD CATT Lab RITIS Probe Data Analytics software platform. It is expressed as an index, unlike the TTR measure, which is based on a percentage reliability threshold that determines whether a segment is reliable. TTTR is the ratio between the “congested” (95th percentile) and “average” (50th percentile) truck travel times. This metric is averaged for all Interstate road segments in the state, weighted by distance, resulting in the TTTR Index for the state.

Table 22: State Freight Performance Targets on the NHS Interstate Highway System

Freight	Baseline	Two-Year Target	2019 Actual	Four-Year Target
Truck Travel Time Reliability	1.35%	1.34%	1.36%*	1.40%**

*Target not achieved.

**Four-year target was adjusted for the TTTR at the mid-term reporting period.

Source: DVRPC, 2020

For the two-year interim review, the 2019 target was not achieved and PennDOT, collaboratively with the planning partners, decided to adjust the four-year target for the TTTR Index from 1.34 to 1.40. As a result of PennDOT not meeting the target, they were required to investigate why they did not meet the target and what actions they would take in the future to meet it.

As for the TTTR measures, DVRPC is monitoring the TTTR and is collaboratively working with PennDOT on setting two- and four-year targets for the second performance period (2022–2025).

Coordination on TTR and Freight/TTTR Targets

The very first state two-year and four-year targets were due May 20, 2018, and were reported to the FHWA in the 2017 baseline report that was due in October 2018. To satisfy coordination requirements [23 CFR

490.105(e)(2)], PennDOT coordinated with planning partners in the development of the measures and selection of targets to ensure consistency, to the maximum extent practicable. PennDOT then coordinated to adjust the four-year target for the TTR and TTTR, in collaboration with the planning partners. Specific coordination efforts are highlighted below.

A Mid-Performance Period Progress Report virtual meeting was conducted on September 16, 2020, by PennDOT to go over the Mid-Performance Period Program Report that was eventually submitted to the FHWA on September 30, 2020. This report contained the following: (1) the actual performance derived from the latest data collected through the mid-point of the performance period; (2) a discussion of PennDOT's progress toward achieving each established two-year target; (3) a discussion on progress of PennDOT's efforts in addressing congestion at truck freight bottlenecks within the state; (4) adjustments to the four-year targets for select performance measures with a discussion of the basis for the adjustment and how the revised targets support expectations in the long-range statewide transportation plan and the TAMP; and (5) MPO CMAQ performance plans for the Southwestern Pennsylvania Commission (SPC), DVRPC, and Lancaster County MPOs. The FHWA makes a formal determination of significant progress in the achievement of two- and four-year targets. If significant progress is not made, states will be required to document actions to achieve targets in future performance periods. The Mid-Performance Period Progress Report offers an opportunity for PennDOT and its planning partners to review and adjust the four-year targets for the PM3 performance measures, as well as the PM2 performance measures. All bridge, pavement, reliability, freight, and CMAQ congestion and emissions targets were assessed in coordination between PennDOT and Pennsylvania's MPO/RPOs. The CMAQ congestion targets were reviewed by all relevant state DOT and MPO partners for each Urbanized Area (e.g., Philadelphia and Pittsburgh areas).

PennDOT has adjusted the PM3 targets as summarized in Table 23:. The adjusted statewide targets were provided in PennDOT's Mid-Performance Period Progress Report to the FHWA. The September 16, 2020, virtual meetings included a discussion on the target setting process and requested comments on the proposed adjustments to the PM3 target values by the MPO/RPOs. No MPO/RPOs indicated concerns regarding adjustments to the reliability, freight, or CMAQ emissions targets.

Progress toward TTR and Freight/TTTR Targets

DVRPC is committed to improving reliability on roadways within its region in Pennsylvania, as well as working with its county, city, and transit partners, and PennDOT staff to develop projects that will improve TTR and help meet state targets. The CMP is a key part of DVRPC's commitment to improving TTR. DVRPC facilitates a CMP Planning Advisory Committee that is part of an overall, systematic, and ongoing process to determine where traffic congestion exists, identify causes, prioritize congested locations according to congestion and other CMP objective measures, and to help develop strategies to reduce congestion and improve reliability. The goals of the Long-Range Plan provide guidelines for developing DVRPC CMP objectives. These objectives include:

- minimizing growth in recurring congestion and improving mobility;
- improving TTR;
- improving accessibility, including providing transit where it is most needed;
- maintaining the existing core transportation network;
- improving safety;
- maintaining goods movement;
- improving security and maintaining transportation preparedness for major events;

- integrating federal PM3 system performance, freight, and CMAQ performance measures;
- supporting DVRPC Long-Range Plan land use and other principles;
- advancing equity and fostering diversity; and
- ensuring that all transportation investments support DVRPC Long-Range Plan principles.

Table 23: PennDOT PM3 Targets

Measure	Original Target	Adjusted Target	Basis for Adjustment
Interstate Reliability (TTR)	89.8%	89.5%	In the baseline report, PennDOT’s target was developed to maintain the status quo for operations. Based on a review of the first three years of data, there are yearly variations in the reliability measure. PennDOT has identified impacts of construction projects on reliability while work zone traffic restrictions are in effect. PennDOT’s 2021 STIP has an increased focus on Interstate highways, which will result in more construction projects. Major projects that will be underway in 2021 include the I-83 widening in Harrisburg, I-95 reconstruction in Delaware and Philadelphia counties, the Southern Beltway interchange with I-79 near Pittsburgh, and I-81 reconstruction near Carlisle. Smaller projects like bridge rehabilitations also impact reliability when long-term lane closures are required. The target adjustment reflects a desire to maintain the status quo as planned in the baseline report while taking into account year-to-year variability with a multitude of construction scenarios. Other congestion management techniques to improve reliability will need to be planned and are beyond the timeframe of the four-year target for this performance period.
Freight Reliability (TTTR)	1.34	1.40	The impacts of construction work zones on the freight reliability measure could not be mitigated prior to the 2021 construction season. PennDOT will continue to monitor data to develop appropriate mitigation strategies to improve freight reliability in future performance periods. The four-year target is intended to account for anticipated construction projects that will impact 2021 performance and unknown freight impacts due to the Coronavirus Disease 2019 (COVID-19) pandemic.
CMAQ CO Emissions	1,135.40	250.00	The DVRPC region is now in attainment for CO and no longer requires a target. As such, the statewide number is adjusted only to reflect the Southwestern Pennsylvania Commission area.

Source: PennDOT, 2022

PM3 performance measures are mapped by roadway segment where data is available and used to inform the CMP process. Reliability, as measured by the PTI, is a key component of the Congestion and Reliability criterion in DVRPC’s TIP-LRP Project Benefit Evaluation Criteria. Projects score based on location in a CMP congested corridor, implementing a CMP strategy appropriate for that corridor, or being located on a road

with a high PTI; or transit facility with a low on-time performance. This criterion accounts for 11 percent of the project-level investment decision recommendation for new candidates.

DVRPC tracks travel trends by CMP corridor using the PTI measure, which is a measure of roadway reliability defined as the ratio of the 95th percentile peak-hour travel time to the free-flow travel time (uncongested travel time) to better understand which CMP corridors are more or less reliable than others. This measure considers non-recurring congestion impacts on travel due to traffic events, such as crashes, disabled vehicles, construction, and adverse weather. This information is averaged by week and month and compared by month year-over-year to identify changes in reliability and help inform the process of developing strategies to improve travel times on the transportation network.

DVRPC proactively seeks to include freight as a primary planning factor through its Long-Range Plan, TIP development, and the conduct of technical studies. Truck counts are a component of the Multimodal Use criterion in DVRPC's TIP-LRP Project Benefit Evaluation Criteria. Projects score based on the total number of person trips (driver trips + passenger trips + transit trips + bike trips + pedestrian trips) and daily trucks using the facility or asset, and overall benefit to multimodal trip making. This criterion accounts for 9 percent of the project-level investment decision recommendations for new candidates. One of DVRPC's goals is to serve the region's freight stakeholders and maintain the Greater Philadelphia region as a premier freight transportation gateway. At the forefront of DVRPC's freight planning program is the Delaware Valley Goods Movement Task Force, a broad-based freight advisory committee that provides a forum for the private- and public-sector freight community to include its unique perspectives on regional plans and specific projects.

In the FY2023 DVRPC TIP for Pennsylvania, the following projects are programmed within a DVRPC designated Freight Center that supports freight TTR:

- Bridgewater Road Extension (MPMS #79329);
- PA 291 Drainage Improvements (MPMS #99668);
- I-95: Delaware Avenue Extension (BS5) (MPMS #103563);
- I-95 Reconstruction (17821, 47811, 47812, 47813, 79686, 79827, 79828, 79904, 79905, 79908, 79910, 79912, 103557, 103558, 103559, 103560, 103561, 103562); and
- I-95 Bridge Rehabilitation: Island Ave-Phila Navy Yard (MPMS #115805).

The FAST Act established, and the IIJA/BIL continues, the National Highway Freight Program (NFP) to improve the efficient movement of freight on the NHFN. NFP's eligibility criteria require that a project contribute to the efficient movement of freight and be identified in the state's freight investment plan. States may use up to 10 percent of NFP funding each year for public or private freight rail, water facilities (including ports), and/or intermodal facilities. There are only 10 projects in the entire state of Pennsylvania that are programmed with federal NFP funds, and five of them are located in the DVRPC region:

- **I-95: I-476/I-95 Interchange (MPMS #102276)** provides for lane modifications between the I-95 NB/I-476 NB interchange and the entrance of the MacDade Boulevard ramp on northbound I-476. Pavement reconstruction, resurfacing, and restriping of the I-95/I-476 northbound segment in Delaware County, including new sign installments, will accommodate these modifications.
- **I-95 Northbound: Race-Shackamaxon (GR5) (MPMS #79828)** provides for the reconstruction, rehabilitation, and widening of I-95 northbound between Race Street and Shackamaxon Street, and the reconstruction of the northern Vine Street interchange ramp connection with I-95. This project includes rehabilitation, deck replacement, demolition, and replacement of eight bridges.

- **I-95: Betsy Ross Section Ramps A&B (BR2) (MPMS #79904)** provides for the construction for the replacements of both Ramp A and Ramp B structures in the Betsy Ross Interchange, including approach roadway work in the City of Philadelphia.
- **I-95 Southbound: Ann Street to Wheatsheaf Lane (AF4) (MPMS #103558)** provides for the reconstruction of I-95 from Clearfield Street to Wheatsheaf Lane, including reconstruction of the southbound on-ramp and southbound off-ramp at Allegheny Avenue.
- **I-95: Betsy Ross Mainline Southbound (BR4) (MPMS #103559)** provides funding for southbound mainline construction from Wheatsheaf Lane to SR 0095 north of Margaret Street. This contract will also remove the southbound collector/distributor and ramp that connects Aramingo Avenue, Harbison Avenue, Tacony Street, and Bridge Street to I-95 southbound and the Betsy Ross Bridge.

This list will be updated pending the Primary Highway Freight System meeting.

Finally, there are also several grant programs (outside of DVRPC) administered by the state and federal governments specifically targeting freight. PennDOT's Rail Freight Assistance Program (RFAP), and Rail Transportation Alternatives Program (RTAP) provide assistance with investment in rail freight infrastructure. USDOT's Rebuilding American Infrastructure with Sustainability and Equity (RAISE) discretionary grant program (formerly known as BUILD and TIGER), National Infrastructure Project Assistance Program and INFRA grant program (formerly known as the Fostering Advancements in Shipping and Transportation for the Long-term Achievement of National Efficiencies, or FASTLANE program) provides for major investments in roads, rail, transit, and port infrastructure.

CMAQ Congestion Targets

The CMAQ is a federal program that funds projects that reduce congestion and improve air quality. The CMAQ Congestion and Emissions Reduction Targets are specifically intended to reduce congestion, directly related to attributes of CMAQ-funded projects, and unlike other federally required performance measures described in this chapter, specifically apply to Urbanized Areas with a population over one million in a non-attainment or maintenance area. The Philadelphia PA-NJ-DE-MD Urbanized Area includes a population of more than 5.54 million, per the U.S. Census ACS 2020 five-year estimate, and is part of a non-attainment and maintenance area.

CMAQ Congestion has two measures for the applicable Urbanized Area, which are:

- **Annual Hours of Peak Hour Excessive Delay (PHED) per Capita on the NHS:** The PHED measure is derived from the NPMRDS v2 travel time data, traffic volumes and vehicle mix (cars, buses, and trucks) from the Highway Performance Monitoring System, and vehicle occupancies and time-of-day travel distributions from national survey data and established estimation formulas. The population used to normalize the annual hours was acquired from the U.S. Census ACS 2020 five-year estimates.

The measure indicates traffic delay experienced by travelers throughout an entire year on roadways, specifically during peak periods. The morning peak is defined as weekdays from 6:00 AM to 10:00 AM, and partner agencies agreed on the afternoon peak period from 3:00 PM to 7:00 PM, rather than the 4:00 PM to 8:00 PM alternative. Excessive delay means the extra amount of time spent in congested conditions defined by speed thresholds that are lower than a normal delay. The speed threshold is 20 miles per hour, or 60 percent of the posted speed limit travel time, whatever is greater. The "excessive" part of the PHED name indicates that some level of congestion is recognized as not possible or desirable to eliminate and thus not counted. For example, some congestion can accompany economic activity in thriving places. The "per capita" implies that the total delay is shared by all residents. Some trips can be avoided or shifted to non-vehicular modes out of the peak period, which would reduce the measure. For the first performance period (2018–

2021) only a four-year target is required. This measure sums up the delay experienced by travelers throughout an entire year on NHS roads, specifically during peak periods. The actual rule containing all the details is found in 23 CFR 490.707(a).

- **Percentage of non-SOV travel:** Non-SOV travel may include travel via carpool, van, public transportation, commuter rail, walking or bicycling, as well as telecommuting. The actual rule containing all the details is found in 23 CFR 490.707(b).

For the first four-year performance period of the PHED per capita measure, only a four-year target is required, while both two- and four-year targets are required for the Percentage of Non-SOV measure, and the four-year targets can be adjusted as part of a two-year interim review. The CMAQ Congestion Performance targets were established by PennDOT and its partners through the UZA Coordination Group and supported by the DVRPC Board (see Table 24:).

Table 24: CMAQ Congestion Measures Targets on the NHS

DVRPC Urbanized Areas	CMAQ Congestion Measures	Baseline	Two-Year Target	Two-Year Performance	Four-Year Target
Philadelphia PA-NJ-DE-MD Urbanized Area	Non-SOV Travel	27.9% ¹	28.0%	28.2%	28.1%
	PHED per Capita	16.8 Hours per Capita	n/a	14.6 Hours per Capita	17.2 Hours per Capita

Source: DVRPC, 2022

Note: Baseline for non-SOV Travel is based on 2014–2018 ACS. PHED per Capita Four-Year Target assumes a growth of +0.6 percent per year. See also DVRPC’s CMAQ Interim Performance Plan for 2018–2019 (Publication #TM21003).

Coordination on CMAQ Congestion Targets

Pursuant to the IIJA/BIL, and prior FAST Act and MAP-21 bills, and the ensuing requirements of 23 CFR Part 490, the National Performance Management Measures Final Rule, all state DOTs and MPOs that contain, within their respective boundaries, any portion of the NHS network within the Urbanized Area with a population over one million must establish a single unified target for the two CMAQ congestion measures. DVRPC staff collaborated with multiple agencies in developing and agreeing on realistic targets for each of the two measures for the baseline of the first performance period. For the two-year interim review in the first performance period, DVRPC, collaboratively with the other agencies, decided not to adjust the four-year targets.

Meetings were held by DVRPC for the Philadelphia PA-NJ-DE-MD Urbanized Area to coordinate and discuss adjusting four-year targets for the PHED and non-SOV travel measures as part of the two-year review of the interim performance first performance period. Meetings were held on March 12 and June 11, 2020, and agency representation included PennDOT, New Jersey Department of Transportation (NJDOT), Delaware Department of Transportation, Maryland Department of Transportation, FHWA, and DVRPC, Northern Jersey Transportation Planning Authority, South Jersey Transportation Planning Organization, Wilmington Area Planning Council, and Lancaster County Transportation Coordinating Committee MPOs.

The agencies agreed not to adjust the four-year targets due to uncertainties with COVID-19 impacts on travel trends and uncertainties with the PHED measure with some data changes occurring, including updates to the NPMRDS v2 segments to more accurately represent the NHS coverage.

On September 24, 2020, the DVRPC Board adopted the CMAQ Interim Performance Plan (2018–2021).

CMAQ Emissions Reduction Targets

DVRPC coordinated efforts with PennDOT and other MPOs in the state to develop cumulative On-Road Mobile Source Emissions two-year and four-year reduction targets as kilograms per day. MPO regional targets in Table 25: were used to develop PennDOT’s statewide on-road mobile emissions reductions targets displayed in Table 26:. Page 15 of DVRPC’s *Congestion Mitigation and Air Quality Mid-Performance Period Progress Report (2018–2019)* (Publication #[TM21003](#)) describes the process in developing the regional targets.

Table 25: DVRPC Pennsylvania Region CMAQ On-Road Emissions Reductions Targets (in Daily Kilograms)

CMAQ Emissions Reduction	Two-Year Target (2018-2019)	two-Year Performance	Four-Year Target (2020-2021)
VOC	37.61	142.8	69.31
NO _x	23.42	652.4	42.50
PM _{2.5}	1.08	24.21	2.06
CO	282.74	n/a	n/a

Source: DVRPC, 2022

Table 26: PennDOT Statewide CMAQ On-Road Emissions Reductions Targets (in Daily Kilograms)

CMAQ Emissions Reduction	Two-Year Target	Four-Year Target
VOC	109.46	201.73
NO _x	337.70	612.82
PM _{2.5}	10.76	20.49
PM ₁₀	9.54	0.0
CO	567.70	250.0

Source: DVRPC, 2022

Coordination on CMAQ Emissions Reduction Targets

DVRPC has coordinated emissions reduction target setting with both PennDOT and NJDOT to establish emissions reduction targets from CMAQ-funded projects in the relevant portions of the DVRPC planning areas. Each state has developed state-level emissions reductions targets that account for emissions reductions at the MPO level. On September 24, 2020, the DVRPC Board agreed to support PennDOT’s and NJDOT’s statewide CMAQ emissions reduction targets and PennDOT’s efforts at achieving those targets mentioned above, as well as adopt the MPO regional targets, and approve DVRPC to submit the CMAQ Interim Performance Plan for 2018–2019 (Publication #[TM21003](#)) to PennDOT for submission to the FHWA.

Progress toward CMAQ Congestion and Emissions Reduction Targets

There are numerous projects in the TIP that will help the MPO and state meet two-and four-year targets for traffic congestion and on-road mobile source emissions. Table 9 in DVRPC’s *Congestion Mitigation and Air Quality Mid-Performance Period Progress Report (2018–2019)* (Publication #[TM21003](#)) identifies all TIP projects in the Pennsylvania portion of the DVRPC region from FY2018 to FY2019. The next CMAQ Performance Plan will be published in fall 2022.

DVRPC will continue to promote and develop projects and programs with air quality benefits to its counties and planning partners. As part of DVRPC’s CMP, DVRPC facilitates a CMP Planning Advisory Committee and generates a list of the top 10 bottleneck locations for state, county and local roadways.

Much of the congestion within the DVRPC region occurs on state-owned and maintained highways, which are part of the NHS. Therefore, PennDOT has invested a significant amount of resources in congestion relief programs statewide. Progress is being made toward meeting the congestion relief and on-road mobile emissions reductions targets. At the time of this publication, the DVRPC has been working with stakeholders on selecting projects for DVRPC’s new Travel Options Program, which funds innovative transportation demand management projects to provide better access to more travel options across the region and welcomes capital projects, operating projects, and education and marketing campaigns. These projects will be funded with STBGP funding.

Over \$505 million of federal CMAQ funding is programmed in the FY2023 TIP, including setting aside almost \$300 million, from FY2025 to FY2034, for the flexing of CMAQ funds to SEPTA for Trolley Modernization, Bus Revolution, Rail Fleet Replacements and the King of Prussia Rail projects. This program strengthens the region’s access to transportation infrastructure that is in good repair and produces lower emissions.

Table 27: SPIKE Funding Projects That Help Support Achieving PM3 Targets in DVRPC Pennsylvania Subregion

County	MPMS #	Project	Spike Amount	Primary Improvement Focus
Chester	107551	SR30/SR10 to Business 30 Interchange Improvements	\$40 million	Turning lanes
Chester	107553	SR30 & Airport Rd Interchange Improvements	\$30 million	Intersection reconfiguration
Chester	107554	US30 & PA82 Interchange Improvements	\$30 Million	Intersection reconfiguration

Source: DVRPC, 2022

Besides the individual CMAQ-funded projects, there are several continuing programs that utilize CMAQ funding to reduce emissions (as well as congestion), throughout the state. These projects and programs are listed below.

Air Quality Action Supplemental Services (MPMS #17928)—This program funds supplemental services performed by contractors in the implementation of the Air Quality Action program. Types of services may include design and production of education and outreach materials and advertising, printing, and placement of advertising on television, online, radio, and in newspapers. Advertisements educate the public about ozone and PM_{2.5} pollution and encourage actions to reduce activities that contribute to air pollution, especially on days that are forecast as unhealthy for people susceptible to ozone and PM_{2.5} pollution. Funding is provided in the amount of \$125,000 in FY2023 and \$125,000 in FY2024.

Table 28: Key Congestion-Relief Projects in DVRPC Pennsylvania Subregion

County	Project	Primary Improvement Focus
Delaware	64791 Kedron Avenue at Franklin	Updating signalization and improving intersection turn lanes for safety and transit concerns
	107642 Smithbridge Road Corridor	Construction of an eight-foot multiuse trail connecting residential neighborhoods school district campus, intersection improvements, and a roundabout
Montgomery	16334 PA 73, Church Road Intersection and Signal Improvements	Additional turn lanes
	102273 Ridge/Germantown Intersection Realignment - Phase 1, Perkiomen	Intersection realignment project will replace the intersection of Germantown Pike, Ridge Pike, and River Road—which currently sits near the Ridge Pike Bridge over Perkiomen Creek
	111005 Conshohocken Garage (I-76 ICM)	Regional Rail station “smart” parking garage with over 500 spaces for commuters to reduce congestion
	114172 Dreshertown Rd CC Trl Ext (Competitive CMAQ)	Trail through Fort Washington Office Park
Philadelphia	17697 Island Avenue Signal Upgrade	Upgrading and interconnecting the signal controls at six intersections, including incidental stormwater improvements, incorporating preference for SEPTA Route 36; narrowing the roadway to accommodate pedestrians; and simplifying three intersections
	98207 I-95 Congestion Management	Provide for Congestion Management Activities related to the reconstruction of I-95 through Bucks, Delaware, and Philadelphia counties. This is to further the ongoing congestion mitigation as the construction activity increases on the corridor

Note: Competitive CMAQ projects are listed in Chapter 8:

Source: DVRPC, 2022

Retrofit for Bike Lanes and Shoulders (MPMS #63406)—The purpose of this project is to install bicycle facilities as part of roadway resurfacing projects, including installation, maintenance, and replacement of striping and damaged and missing signs. Funding is provided annually in the amount of \$300,000 in FY2023 and \$300,000 in FY2024.

Signal Retiming Program (MPMS #84457)—This signal retiming program provides for the evaluation of existing signals along an identified corridor, with the goal of improving traffic operations along said corridor through revised signal timing plans. CMAQ funding is provided in the amount of \$350,000 in both FY2023 and FY2025.

CMAQ Flex for SEPTA Projects of Significance Line Item (MPMS #118015)— This project is a placeholder for CMAQ funds to be flexed to SEPTA in order to support the Trolley Modernization, KOP Rail Extension, Bus Revolution, and Rail Fleet Replacements projects. A total of \$299.8 million in CMAQ funding is expected to be flexed between FY2025 and FY2034.

Transit Asset Management Performance Measures

Transit Asset Management Rule

Under the provisions of the Transit Asset Transportation Performance Management rulemaking, transit operators are required to set performance targets for their transit asset portfolio. MPOs are then required to set their own targets, or adopt the transit operator targets, for the transit asset portfolio in their region, beginning in calendar year 2017, based on measures mandated by the rule. The performance measures were selected by the FTA and include average revenue fleet age; average non-revenue fleet age; percentage of the track system under a performance restriction, and percentage of facilities that are below a condition rating of 3 on the Transit Economic Requirements Model (TERM) scale. Transit agencies are required to upload their performance targets, as well as a supporting narrative, in their annual National Transit Database (NTD) submission, and report progress against these targets. They are also required to develop a TAM Plan.

The regulations required by the FTA have established a strategic and systematic process of operating, maintaining, and improving public capital assets effectively through their life-cycle. The performance management requirements are a minimum standard for transit operators and involve measuring and monitoring the following:

- transit rolling stock;
- transit equipment;
- transit infrastructure; and
- transit facilities.

Transit Asset Management Targets and Goals

Measure 1: Average Revenue Fleet Age

The agencies' vehicle engineering departments provide useful life benchmarks (ULB) for their respective fleets. A number of planned procurements will allow SEPTA to reduce the average age of the rail vehicle fleet in future reporting years. The majority of SEPTA's buses are within their ULBs. However, it should be noted that a significant number of the light rail and commuter rail vehicles are beyond their ULBs. This does not mean that the vehicles are unsafe; however, additional maintenance may be required to allow these fleets to maintain service quality and performance. In the FY2023 TIP, SEPTA will replace the light rail and vintage trolley fleets as part of the Trolley Modernization project. SEPTA will also replace the Market-Frankford Subway Elevated (MFSE) line vehicle fleet. Both of these vehicle procurements are included in the Projects of Significance program (MPMS #115472).

Table 29: Transit Asset Management Measure 1

Percentage of Revenue Vehicles That Have Met or Exceeded Their Useful Life Benchmark				
NTD Category	ULB (Years)	FY2021 Targets	FY2021 Performance	FY2022 Targets
SEPTA				
Articulated Bus	14 (12 for electric)	0%	0%	0%
Bus	14	15%	10.7 %	10%
Heavy Rail Passenger Vehicle	35 (MFSE); 30 (NHSL); 40 (BSS)	0%	0%	0%
Light Rail Vehicle	45 (Updated in FY2021)	0%	0%	0%
Commuter Rail Locomotive	30	0%	0%	0%
Commuter Rail Passenger Coach	39	0%	0%	0%
Commuter Rail, Self-Propelled	39	66%	66%	66%
Cutaway Car	10	0%	0%	0%
Trolley Bus	18	0%	0%	0%
Vintage Trolley/ Streetcar	58	100%	100%	100%

Source: DVRPC, 2022

Measure 2: Average Age of Non-Revenue Fleet

The agencies maintain a diverse portfolio of support vehicles, including fleets of police cars, utility vans, and rail maintenance vehicles. The performance targets are developed by comparing the age of the vehicles to their ULB. A number of ongoing procurements have allowed SEPTA to reduce the average age of the automobile and van fleets.

SEPTA utility vehicles support transit and railroad operations, and include the following types of equipment: utility vehicles for transit and paratransit supervisors and SEPTA police officers. Utility vehicles are used for inspection, maintenance, and construction of infrastructure. These vehicles include trucks, cranes, high rail vehicles, and maintenance-of-way equipment. Transporter vehicles are used in garages and shops, including revenue trucks, forklifts for material handling, pick-up trucks for material movement between depots and shops, and for snow removal. Service vehicles are used for vehicle maintenance, including wreckers, tow tractors, man lifts, and pick-up trucks. Miscellaneous equipment, such as generators, compressors, trailers, floor scrubbers, and welding units, are also used.

Table 30: Transit Asset Management Measure 2

Percentage of Support Vehicles That Have Met or Exceeded Their Useful Life Benchmark			
NTD Category	FY2021 Target	FY2021 Performance	FY2022 Target
SEPTA			
Automobiles	50%	41.2%	50%
Other Rubber Tired Vehicles	25%	41.9%	45%
Steel Wheel Vehicles	55%	48.9%	50%

Source: DVRPC, 2022

Measure 3: Percentage of Track Segments with Performance Restrictions

The FTA requires transit agencies to report the percentage of the right-of-way that is operating under performance restriction on the first Wednesday of each month at 9:00 AM. This number is to be averaged at the end of the year. Performance targets are based on infrastructure condition and speed restriction reports, and include provisions for planned maintenance work throughout the year. For FY2021, approximately 4.0 percent (Commuter Rail), 2.1 percent (Heavy Rail), and 0.7 percent (Streetcar Rail) of SEPTA’s track were in slow zone restrictions over the year. It is estimated that approximately, 10 percent, 5 percent, and 3 percent, respectively, of their track will be in slow zone restrictions over FY2022 as SEPTA is performing several projects that will harden the guideway against extreme weather events, including stabilization of cut rock slopes, dewatering systems for underground rail lines, and upgrading the signal system.

Table 31: Transit Asset Management Measure 3

Percentage of Track Segments with Performance Restrictions (by Mode)			
NTD Mode	FY2021 Target	FY2021 Performance	FY2022 Target
SEPTA			
Commuter Rail	10%	4%	10%
Heavy Rail	10%	2.1%	5%
Streetcar Rail	5%	0.7%	3%

Source: DVRPC, 2022

Measure 4: Average Condition of Facilities

The FTA requires transit agencies to evaluate all transit facilities on the TERM scale (5.0 = new, 1.0 = poor; assets below a rating of 3.0 are not in a state of good repair.) Facilities are to be evaluated every four years based on the inspections performed by the agency’s asset management groups. SEPTA’s and DRPA’s facilities are generally in a state of good repair.

Table 32: Transit Asset Management Measure 4

Percentage of Facilities Rated Below 3.0 on the TERM Scale			
NTD Category	FY2021 Target	FY2021 Performance	FY2022 Target
SEPTA			
Passenger Facilities	5%	1%	3%
Administrative/ Maintenance Facilities	5%	4%	5%

Source: DVRPC, 2022

Coordination on Transit Asset Management Target Setting

Besides the Tier 1 transit agencies (SEPTA and DRPA/PATCO), DVRPC also coordinates with the region’s Tier 2 transit agencies (smaller transit operators with fewer than 100 vehicles). The Pennsylvania TAM Group Plan fulfills the PBPP requirement and encourages communication between transit agencies and their respective MPOs and RPOs. In accordance with the plan, the following actions take place that fulfill the PBPP requirement:

- PennDOT provides asset performance reports to transit agencies by August 31 of each year that measure performance against established targets for the previous FY.
- Transit agencies review the content for accuracy and confirm with PennDOT that information related to transportation asset performance has been received and is accurate.
- Transit agencies share performance data with their respective planning partner by the end of each calendar year, or earlier as decided between the partners.

- New performance goals for the upcoming FY are established no later than September 15 of each year and communicated to transit agencies covered under the group plan.
- Transit agencies continue regular coordination regarding the local TIP and other planning initiatives of the local planning partner.

All transit agencies are required to utilize Pennsylvania’s transit Capital Planning Tool (CPT) as part of their capital planning process and integrate it into their TAM process. The CPT is an asset management and capital planning application that works as the central repository for all Pennsylvania transit asset and performance management activities.

Consistent with available resources and in coordination with the PennDOT BPT, transit agencies are responsible for submitting projects consistent with the CPT for the development of the transit portion of the program. This ensures that projects identified on the TIP are consistent with the TAM approach and respective TAM plans. PennDOT CPDM will update this project information in MPMS and share it with the MPOs/RPOs, PennDOT BPT, and the transit agencies.

MPOs have 180 days after the transit agencies set their targets to decide to either adopt the transit operators’ targets or develop their own metropolitan targets. DVRPC has taken formal action to adopt the same set of targets as SEPTA and DRPA/PATCO. DVRPC has also worked with SEPTA, DRPA/PATCO, and PennDOT to develop a set of written procedures that outline the coordination process for TAM. SEPTA and DRPA/PATCO operate on different FYs: SEPTA’s FY is July 1 through June 30, while DRPA/PATCO’s FY is January 1 through December 31.

Progress toward Transit Asset Management Targets

The Transit Asset Transportation Performance Management Rule requires MPOs to describe how the region’s TIP will help to achieve the TAM targets. The DVRPC FY2023 TIP for Pennsylvania was developed to ensure progress toward target achievement. The following steps have been taken by the transit operators to ensure that projects selected for TIP funding help to achieve the TAM targets. Overall, SEPTA has programmed almost 90 percent of their FY2023 TIP funding for preservation and maintenance of their system.

To meet the targets for Measure 1: Percentage of Revenue Vehicles That Have Met or Exceeded Their Useful Life Benchmark, SEPTA released a contract to replace 220 buses in fall 2021, with an option to purchase an additional 120 buses. SEPTA recognizes that additional investment is needed in the rail fleets, maintenance facilities, and infrastructure to bring them to a current vehicle standard. Due to their condition, replacement of the MFSE cars is of the highest priority and is fully funded in this program. SEPTA also continues to work to secure funding to replace the 231 Silverliner IV commuter rail vehicles, which were purchased between 1973 and 1976. Partial funding has been allocated in this program to initiate this procurement. SEPTA is in the early phases of a “Trolley Modernization” program, which includes the procurement of new light rail vehicles, along with associated infrastructure and maintenance facility upgrades. MFSE cars and trolley vehicle replacements are included in the “Projects of Significance” in SEPTA’s FY2023 Capital Budget.

In addition to daily inspections and routine maintenance, all revenue vehicles receive preventative maintenance on a regular basis through SEPTA’s vehicle overhaul (VOH) program. The VOH program is particularly important for rail fleets, where most vehicles are approaching or have aged beyond their ULB.

SEPTA is planning for a full transition to zero-emission buses (ZEBs) by the year 2040. The Zero Emission Bus Master Plan will lay the groundwork for the bus fleet of the future. SEPTA has completed the first phase of analysis that examines the feasibility of procuring battery electric buses and installing charging infrastructure

to support the fleet. The next phase of the plan will evaluate fuel cell electric buses and the necessary fueling infrastructure to support them. To ensure the reliability and continuity of bus operations while the ZEB Master Plan and transition plan is finalized, the Authority contracted with New Flyer to purchase 220 hybrid buses with an option for 100 additional buses to provide flexibility to transition to a zero-emission bus procurement sooner if technology is available. This bus procurement will allow SEPTA to retire the last of the all-diesel fleet, which is now more than 15 years old (purchased in 2005). Future bus purchases will be guided by the ZEB Playbook and the results of Bus Revolution.

To meet targets that were set for Measure 2: Percentage of Support Vehicles That Have Met or Exceeded Their Useful Life Benchmark, SEPTA programs on average \$10.9 million annually in their Utility Fleet Renewal Program—Non-Revenue Vehicles program. These vehicles include automobiles for transit supervisors and operator support personnel; utility vehicles for the inspection, maintenance, and construction of operating facilities, overhead power systems, signal systems, and track; and service vehicles and equipment for use in garages, shops, and operations support functions. In order to have adequate and reliable utility vehicles, SEPTA has developed a program to periodically renew this fleet on a vehicle-by-vehicle basis contingent upon the vehicle's age, condition, and usage within the Authority.

To meet targets that were set for Measure 3: Percentage of Track Segments with Performance Restrictions (by Mode), SEPTA evaluated the scope of planned maintenance work when establishing the performance targets for 2022. SEPTA will continue the cyclical replacement of railroad tie timbers and overhead contact wire. Tie work is generally performed between the hours of 9:00 AM and 3:00 PM; therefore, maintenance projects will continue to cause performance restrictions. In the case of a condition that requires a speed restriction, SEPTA deploys crews to fix the issue as soon as possible. SEPTA's Resiliency Program is performing several projects that will harden the infrastructure against extreme weather events, such as stabilization of four slopes on the Main Line and one slope on the Manayunk/Norristown Line, installation of new pumps on the Broad Street Subway, flood mitigation at Jenkintown and Sharon Hill Stations, and emergency power for the signal system.

For the last measure, Measure 4, Average Condition of Facilities, SEPTA's 2023–2034 Capital Budget includes provisions of \$934.4 million and \$250.6 million for maintenance and passenger facilities, respectively. Representative projects include Ardmore Transportation Center, Conshohocken Station, and 30th Street Station. SEPTA continues to design improvements for City Hall Station and has started to design improvements for Fairmount Station, which were rated to be in poor condition. Construction for these stations is scheduled to begin in 2023 and 2025, respectively. SEPTA has programmed \$347 million and \$136 million for Transit & Regional Rail Station and Maintenance & Transportation Facilities improvements over the next four years, respectively. These investments will help bring various stations, bus and rail maintenance shops, facilities maintenance shops, and office buildings to a state of good repair. Additionally, starting in 2027, SEPTA will spend \$45.2 million per year of TIP funding on their Federal Preventative Maintenance Program, which includes repair of buildings, grounds, and equipment (including, but not limited to, the overhaul of vehicles), fare collection, equipment and structures, and maintenance of general administration buildings. Due to the influx of federal dollars from the Coronavirus Response and Relief Supplemental Appropriations Act (CRRSAA) and the American Rescue Plan (ARPA), SEPTA has been able to shift funding around and does not need to program funding in Federal Preventative Maintenance for FY2023-FY2026, as funding has already been obligated and placed into a grant for those four years.

Transit Safety Rule

The FTA issued a final rule on PTASP, effective July 19, 2019. The PTASP final rule (49 C.F.R. Part 673) is meant to enhance safety by creating a framework for transit agencies to manage safety risks in their organization. It requires recipients of FTA funding to develop and implement safety plans that support the implementation of Safety Management Systems. At this time, recipients that only receive Section 5311 (Formula Grants for Rural Areas) or Section 5310 (Enhanced Mobility of Seniors and Individuals with Disabilities Program) are exempt from the PTASP requirement.

Transit agencies are required to develop Transit Agency Safety Plans that establish performance targets based on the four measures included in the FTA's National Transit Public Safety Plan (NTPSP). The four measures are Fatalities, Injuries, Safety Events, and System Reliability. Transit agencies are required to report their targets and performance to the state DOT and the agency's MPO in order to prioritize funding to improve transit safety performance.

Fatalities

The transit safety performance measure requires that transit providers set annual targets for the number of fatalities that occur on each mode of transit that the agency operates, excluding deaths that result from trespassing, suicide, or natural causes. The NTPSP defines the modes as rail, fixed guideway bus service, and non-fixed route bus service. Fatalities are required to be calculated for both the total number of fatalities and the fatality rate per vehicle revenue mile. Specific targets are set for total fatalities across the transit agency's system and the rate of fatalities per vehicle revenue mile operated by the transit agency.

Injuries

The PTASP requires that transit agencies set annual targets for the number of injuries that occur on each mode of transit that the agency operates. Injuries are defined as "harm to person that requires immediate medical attention away from the scene." Injuries are required to be calculated for both the total number of injuries and the injury rate per vehicle revenue mile for each of the modes that the agency operates. Specific targets are set for total injuries across the transit agency's system and the rate of injuries per vehicle revenue mile operated by the transit agency.

Safety Events

Transit providers are required to set annual targets for the number and rate of safety events that occur across the transit agency's system. A *safety event* is defined by the FTA as a "collision, derailment, fire, hazardous material spill, or evacuation." Safety events are required to be calculated for both the total number of events and the event rate per vehicle revenue mile for each of the modes that the agency operates. Specific targets are set for total safety events across the transit agency's system and the rate of safety events per vehicle revenue mile operated by the transit agency.

System Reliability

Transit providers are required to set annual targets for the agency's system reliability for each mode of transit that the agency operates. The system reliability performance measure accounts for major mechanical failings of a vehicle that prevent the vehicle from starting or completing a scheduled trip. Mechanical failings and interrupted trips can create hazardous conditions for the transit operators and passengers, depending on the location of the service interruption and if passengers are required to deboard in unsafe locations. Specific

targets are set for the miles traveled between major mechanical failures calculated for each mode that the transit agency operates.

These indicators are reported to the FTA through the NTD. Internally, SEPTA tracks these indicators on an FY basis and publishes a monthly report evaluating performance against established targets. SEPTA's FY starts July 1 and DRPA/PATCO's FY starts January 1.

Summary of FY2022 Performance indicators

Table 33: Measure 1—Fatalities

Transit Safety Rule—Fatalities and Injuries				
NTD Category	FY2021 Target	FY2021 Actual	Number of Fatalities	FY2022 Targets
SEPTA Fatalities per 100,000 miles				
Fatalities	0.0173	0.0358	27	0.0263

Source: SEPTA, 2022

Table 34: Measure 2—Injuries

SEPTA Passenger Injuries per 100,000 miles				
Bus	5.53	2.62	1,143	3.88
Trolley Bus	5.75	2.27	19	4.46
Heavy Rail (MFL)	0.79	0.37	33	0.54
Heavy Rail (BSL)	0.40	0.35	23	0.36
Heavy Rail (NHSL)	3.48	0.68	6	1.58
Light Rail	6.48	3.16	82	4.58
Commuter Rail	0.69**	0.16	21	0.47
SEPTA Lost Time Injuries—normalized by 200,000 work hours				
	3.28	5.24	439	4.26

Source: SEPTA, 2022

Table 35: Measure 3—Safety Events: Vehicular Accidents

Transit Safety Rule—Safety Events				
NTD Category	FY2021 Target	FY2021 Actual	Number of Vehicular Accidents	FY2022 Targets
SEPTA Vehicle Accidents per 100,000 miles				
Bus	8.18	6.08	2,653	6.77
Trolley Bus	9.51	5.37	45	7.11
Heavy Rail (MFL)	0.09	0.07	6	0.10
Heavy Rail (BSL)	0.07	0.06	4	0.08
Heavy Rail (NHSL)	2.30	1.94	17	2.04
Light Rail	8.38	8.94	232	8.33
Commuter Rail	0.07	0.09	11	0.08

Source: SEPTA, 2022

Table 36: Measure 3—Safety Events: Station Accidents

Transit Safety Rule—Safety Events				
NTD Category	FY2021 Target	FY2021 Actual	Number of Accidents	FY2022 Targets
SEPTA Station Accidents per 100,000 miles				
Heavy Rail (MFL)	1.59	2.77	46	2.80
Heavy Rail (BSL)	0.56	1.09	12	0.96
Heavy Rail (NHSL)	0.72	0.93	1	0.86
Light Rail	1.01	0.00	0	0.58
Commuter Rail	0.95	0.73	5	0.79

Source: SEPTA, 2022

System Safety Events

The FTA and NTD define *safety events* as “a collision, derailment, fire, hazardous material spill, act of nature (Act of God), evacuation, or Other Safety Occurrence Not Otherwise Classified (OSONOC) occurring on transit right-of-way, in a transit revenue facility, in a transit maintenance facility, or involving a transit revenue vehicle and meeting established NTD thresholds.”

Table 37: Measure 3—Safety Events

NTD Mode	FY2021 Target	FY2021 Actual	FY2022 Target
BU: Bus	595	396	471
TB: Trolley Bus	13	13	11
HR: Heavy Rail	132	143	128
SR: Light Rail Vehicle	104	101	91
CR: Commuter Rail	3	6	3

Source: SEPTA, 2022

Table 38: Measure 4—System Reliability

NTD Mode	FY2021 Target	FY2021 Actual	Number of Failures	FY2022 Target
HR: Heavy Rail (MFL)	85,000	121,827	49	85,000
HR: Heavy Rail (BSL)	130,000	139,280	32	130,000
HR: Heavy Rail (NHSL)	35,000	28,224	20	35,000
SR: Light Rail Vehicle (City Trolley)	8,000	19,154	84	8,000
SR: Light Rail Vehicle (MSHL)	20,000	22,707	12	20,000
CR: Commuter Rail	30,000	No Data*	No Data*	30,000

Source: SEPTA, 2022

Note: System Reliability targets are set by the Operations Department.

*Due to a malware attack that impacted SEPTA’s Vehicle Maintenance Information System and access to network files, SEPTA commuter rail operations staff was not able to accurately track mean distance between failures (MDBF) for FY2021. The systems are back online, and SEPTA is tracking FY2022 MDBF for all modes.

Capital Mitigation Measures

SEPTA has developed and implemented various safety programs, rules, and standard operating procedures. In addition to these administrative controls, SEPTA develops engineering controls or eliminates these risks by investing capital funds in various projects. The projects will maintain SEPTA's state of good repair and reduce risks, improve safety, and help achieve safety performance target goals. Under SEPTA's FY2022 Capital Program, the Authority is committing \$50 million toward Communication and Signal System Improvements, \$52 million toward Infrastructure Safety Renewal Programs, \$18.49 million toward Safety and Security Improvements, \$159.72 million toward vehicle acquisition and overhauls, and \$31.9 million toward projects of significance early action phases for Bus Network Redesign (Bus Revolution), Trolley Modernization, and rail vehicle acquisition projects. The following highlights several projects that will be implemented to help address each of the targets. For specific details on each of the referenced programs/projects, refer to SEPTA's Capital Program Report.

Fatalities/Injuries and Safety Events

To reduce the number of fatalities, injuries, and safety events, SEPTA is implementing the following projects that will help reduce rail vehicle collisions, grade crossing events, trespassing, and pedestrian safety in and around their operating environments.

Stations, Loops and Parking Improvements (MPMS #77183, Transit and Regional Rail Station Program and MPMS #90497, Infrastructure Safety Renewal Program): The program provides for the construction, reconstruction, or rehabilitation of transit and Regional Rail stations and terminals, bus/trolley loop facilities, transportation centers, bicycle facilities, and parking expansions and improvements. In FY2022, SEPTA is scheduled to progress the following projects.

- Ardmore Transportation Center (MPMS #73214);
- Conshohocken Station & Parking;
- 11th Street Station;
- A Rail Transit Global Wayfinding and Signage Project;
- Replacing and Adding New ADA Bridge Plates for Regional Rail and Transit Stations;
- Chestnut Hill East ADA Improvements;
- Swarthmore Station Design;
- Willow Grove Station Phase 1;
- Center City Concourse Phase 2 and 4; and
- Somerset Station Edge of Platform Safety Rail Pilot.

Due to reduced ridership resulting from the COVID-19 pandemic, SEPTA is re-evaluating its parking needs and will finalize additional projects based on that evaluation.

Signal System Safety Renewal Program (MPMS #102571, Communications, Signals, and Technology Program): SEPTA will be modernizing various signal systems throughout their system, including a positive train control system on the Media-Sharon Hill Line (MSHL), modernizing their Broad Street Line signal system, advancing an Automatic Train Control signal design for the MFSE, and advancing a Communications Based Train Control signal design for the Subway/Surface Line. Interlockings were reconfigured at Bryn Mawr and Wynwood on the Norristown High Speed Line (NHSL) to enhance train movements. These signal system enhancements will provide the improved technology to reduce, if not eliminate, train incidents due to overspeed, close separation, and signal run-throughs.

Track and Right-of-Way Safety Renewal Program (MPMS #102565, Track Improvement Program): This program focuses on the renewal and replacement of track, switches, and special work, including yard and shop areas, track surfacing, culverts, bridges, and retaining walls. In FY2022 SEPTA will be working on the following sections of right-of-way:

- MFL Bridge St Yard;
- NHSL Ties and Continuous Welded Rail (CWR);
- Route 101/102 Yard Track;
- Route 101/102 – Hilltop Road;
- Route 102 – Spruce Street (adding second track);
- Route 102 – Broad Street (adding second track);
- Route 102 – Walnut Street (adding second track);
- City Street Track Replacement at 41st and Filbert, Curve Renewal at 59th and Callowhill, Tangent Track Renewal from Callowhill to Girard, Callowhill from 58th to 60th and Girard, including curve. The Street Track will also include Route 15, Tangent Track Renewal on Girard Avenue from 26th to 33rd, and from 34th to 38th; and
- Regional Rail – Bishop Avenue.

Elevator Escalator Improvements (MPMS #107011, Safety and Security Improvements): SEPTA has a program to modernize and upgrade escalators and elevators throughout the system to maintain safe transport and ADA compliance for customers. In FY2022, SEPTA will be working on the design phase of the following units:

Replacement of five escalators. One escalator at each station:

1. BSS Olney Station;
2. BSS C.B. Moore Station;
3. BSS City Hall Station;
4. MFSE Spring Garden Station; and
5. MSFE 13th Street Station.

Overhaul/Modernization of eight elevators. Two elevators at each station:

1. MFSE Tioga Station;
2. MFSE Girard Station;;
3. MFSE Erie-Torresdale Station; and
4. MFSE 69th Street Station.

SEPTA is currently in construction for improvements to the MFSE Allegheny elevators. MFSE Somerset elevators have been completed. The next elevator improvement project will be at MFSE Huntingdon Station.

SEPTA’s Grade Crossing Enhancement Program (MPMS #107011, Safety and Security Improvements): This program incorporates upgrades to various grade crossings to help mitigate grade crossing events involving private, over-the-road vehicles and pedestrians. In FY2022, SEPTA completed the installation of quad gates at Ford Street on the Norristown Line and bids were awarded for Oak Street; Main Street; and 2nd, 3rd, Walnut, and Beaver Streets. SEPTA is also submitting a grant that would fund improvements at Bellevue and Woodbourne on the West Trenton Line and Union Avenue on the Media Line.

Fern Rock Transportation Center Security upgrades (MPMS #107011, Safety and Security Improvements): This project will address trespassing issues and security improvements around the Fern Rock Transportation Center. The work includes a grade-separated pedestrian crossover, platform repairs, and elevator upgrades on the railroad platform, as well as security fencing, lighting, and closed-circuit television (CCTV) upgrades to the Fern Rock Subway rail yard.

System Wide Security: Through the U.S. Department of Homeland Security, the Transit Security Grant Program provides funds to operators of public transportation systems to protect critical surface transportation assets and the traveling public from acts of terrorism, and to increase the resilience of transit infrastructure. From this grant program, SEPTA has funded CCTV cameras on vehicles; multijurisdictional counter-terrorism emergency simulation drills on various transit modes; directing of SEPTA Transit Police Patrols in strategically designated areas during periods of elevated alert using specially trained anti-terrorism teams; hazardous material identification kits for Special Operations and Response Teams (SORT); purchase of explosive detection devices, intrusion detection and surveillance equipment, and bulletproof vests; SORT and K-9 patrol teams; upgraded mobile communications and Control Center monitoring equipment; installation of video surveillance cameras at transit facilities; implementation of a radio interoperability system; maintenance of a computer-aided dispatch and records management system for the Philadelphia region; and perimeter fencing and security cameras at SEPTA’s Fern Rock facility.

Revenue Fleet Collision Avoidance Technology Pilots: Collision avoidance system technology is evolving, and there are systems now available to the public transit industry that can help reduce the human factor component to vehicle accidents. SEPTA is testing two separate collision avoidance systems. One pilot project will retrofit four light rail trolleys with a collision avoidance system and one pilot project will retrofit two buses. The results of these pilot programs will help SEPTA determine if the available technology is effective and reliable enough to pursue on a fleetwide basis.

System Reliability

To ensure safe, efficient, and reliable service to riders, it is paramount that system infrastructure and revenue fleet equipment remain reliable and minimize failures that can cause SEPTA to suspend or significantly delay service. The following programs will be implemented to help maintain system reliability:

Track and Right-of-Way Renewal Program Track and Right-of-Way Safety Renewal Program (MPMS #102565, Track Improvement Program): This program focuses on the renewal and replacement of track switches and special work, including yard and shop areas, track surfacing, culverts, bridges, and retaining walls. In FY2022, SEPTA will be working on the following sections of right-of-way.

- CTD MFL Bridge St Yard – Two Storage Tracks;
- STD NHSL Ties and CWR;
- STD Route 101/102 Yard Track;
- STD Route 102 – Grade Crossing Renewal at Chestnut Street (MP 4.59);

- STD Route 102 – Grade Crossing Renewal at Bartram Avenue (MP 4.65);
- STD Route 101 – Grade Crossing Renewal at Rosemont Street (MP 2.24); and
- CTD Embedded track replacement at 41st and Filbert, Tangent Track renewal on 42nd Street from Spruce to Woodland, and 40th Street from Market to Spruce. The Street Track will also include Route 13, Chester Avenue, from Cobbs Creek Avenue to Church Lane.
 - RRD – NOR Grade Crossing Renewal at School House Lane (MP 5.90); and
 - RRD – NOR Grade Crossing Renewal at Main Street (MP 17.75).

Vehicle Acquisitions and Overhauls (MPMS #60638, Regional Rail Car and Locomotive Acquisitions; MPMS #90512, SEPTA Bus Purchase Program; MPMS #60582, Vehicle Overhaul Program): Under this program, SEPTA’s vehicle fleets are overhauled on a planned schedule to maintain a quality, reliable fleet throughout the vehicles’ service life. The program also provides for the replacement of vehicles and equipment that have exceeded their useful life and for fleet expansion to meet present and projected increases in ridership demands. The vehicle acquisition includes the purchase of 220 new 40-foot Hybrid Buses and 45 Multi-Level Regional Rail Cars. In FY2022 SEPTA will overhaul the following number of vehicles in the respective fleets:

- Bus – 60-foot articulated (44); 40-foot vehicles (28);
- BSL – 23 cars;
- MFL – 28 cars;
- NHSL – 5 cars;
- SE LRVs – 15 trolleys;
- DE LRVs – 19 trolleys;
- PCC II – 4 trolleys;
- SL IV – 30 cars; and
- SL V – 12 cars.

In addition to these VOH fleet numbers, the rail fleet conducts subcomponent overhauls for additional cars in the fleet. These subcomponents include, but are not limited to, HVAC systems, traction motors, control boxes, software upgrades, and pantographs.

Rail Vehicle Replacement Program (MPMS #60638, Regional Rail Car and Locomotive Acquisitions): This project provides initial investments necessary to begin procuring replacements for the following rail vehicle fleets:

- Silverliner IV Regional Rail cars; and
- MFSE railcars (including vehicle specifications), signal system and infrastructure improvements to enhance operational efficiency. This program also includes MFSE rail line enhancements to allow SEPTA to perform analysis and conceptual design of strategic rail service improvement initiatives in advance of new rail vehicles.

Trolley Modernization (MPMS #115472, Projects of Significance): The goals of the Trolley Modernization program are: a system in full compliance with the ADA; a safe and improved customer experience; and providing faster, higher-capacity service. Specific activities to be addressed include property acquisition for the new trolley car facility/facilities; bridge enhancements to support the new trolley cars; the Trolley Tunnel State of Good Repair Program; coordination with utilities and the City of Philadelphia; development of modern trolley station design standards and identification of locations, based on public input and community engagement; Preliminary Engineering and program management for the overall project; and acquisition of ADA Accessible trolleys.

Rehabilitation of Power Systems and Substations (MPMS #60651, Substations and Power Improvements):

This program provides for the design, rehabilitation, and construction of electric traction substations, power systems, and associated components, including catenary and support structures, feeders, transmission lines, and localized and centralized control facilities. The program also includes the procurement of long lead equipment, such as auto transformers and circuit breakers that are required for the substation construction projects. In FY2022 SEPTA will be working on the following power systems:

- 30th Street West Catenary Replacement;
- Trolley Tunnel Overhead Replacement;
- Lansdale Substation;
- Hatboro Substation;
- 12th St Switching Station; and
- Portal Switching Station.

Wheel Truing Machine Rebuilds (MPMS #102569, Maintenance and Transportation Facilities): This program includes reconditioning and rebuilding wheel truing machines that have exceeded their useful life. This critical equipment maintains the rail fleet wheels, keeping the fleet safe and available for service. When rail wheels cannot be trued, the fleet may need to be held out of service and not available for revenue service.

Sharon Hill Line Flood Mitigation Project (MPMS #107011, Safety and Security Improvements): This project will provide relief from flooding on the Route 102 Sharon Hill Trolley Line by constructing a pumped drainage system where the trolley crosses under a freight railroad bridge at milepost 5.30 in Delaware County. This frequently flooded underpass forces SEPTA to rely on a bus substitution program to detour service around the high-water area more than a dozen times each year.

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