MOBILITYPLAN 2050

Appendix E

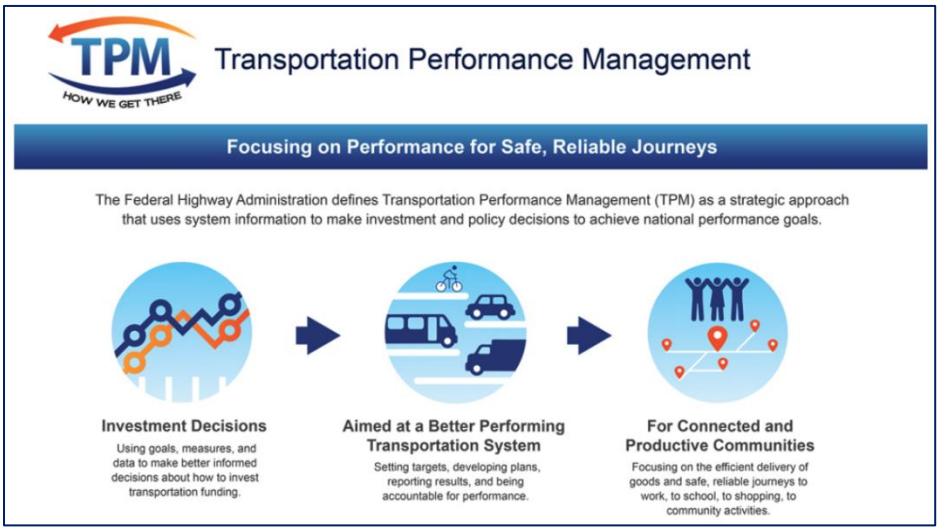
System Performance

Contents

Introduction

OVERVIEW OF TRANSPORTATION PERFORMANCE MANAGEMENT

Transportation Performance Management (TPM) was introduced in Federal legislation that was passed in 2012 as a new requirement to incorporate a performance-based approach into the transportation planning process. The federal transportation bill known as Moving Ahead for Progress in 21st Century Act (MAP-21) required state Departments of Transportation, MPOs, and transit authorities to set coordinated targets, report on a required set of performance measures, and prioritize projects using a coordinated performance-based planning process. These performance tracking requirements were continued in subsequent transportation bills including the most recent one known as the Infrastructure Investment and Jobs Act (IIJA), also known as the Bipartisan Infrastructure Law (BIL).



TPM is specifically tied to the seven national performance goals for the Federal-aid Highway Program as established by Congress:

1. ***Safety:*** To achieve reduction in fatalities and serious injuries on all public roads.
2. ***Infrastructure Condition:*** To maintain highway infrastructure assets in state of good repair.
3. ***Congestion Reduction:*** To achieve reduction in congestion on the National Highway System.
4. ***System Reliability:*** To improve the efficiency of the surface transportation system.
5. ***Freight Movement and Economic Vitality:*** To improve freight networks, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development.
6. ***Environmental Sustainability:*** To enhance the performance of the transportation system while protecting and enhancing the environment.
7. ***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.

In addition to the performance measures established for the Federal-aid Highway Program, the Federal Transit Administration (FTA) has established performance measures in the areas of:

1. ***Transit Asset Management (TAM):*** The purpose of this performance measure area is to help achieve and maintain a state of good repair (SGR) for the nation's public transportation assets.
2. ***Public Transportation Agency Safety Plans (PTASP):*** Transit operators are required to develop and adopt a Public Transportation Agency Safety Plan (PTASP), which must include safety performance targets.

The following tables summarizes all of the applicable FHWA & FTA Performance Measures and current target value (note, **red text** indicates a TPO local target and **blue text** indicates a TDOT statewide target:

FHWA PM's	Performance Measure	Federal Aid Funding Program	Baseline (2019-2023) or 2021	Target (2021-2025) or 2025
PM 1: Safety For All Public Roads (Set Annually, 5-yr avg)	Number of Fatalities	Highway Safety Improvement Program (HSIP)	**101.4**	**110.2**
	Fatality Rate per 100M VMT		**1.087**	**1.157**
	Number of Serious Injuries		**518.0**	**483.0**
	Serious Injury Rate per 100M VMT		**5.573**	**5.074**
	Number of Non-Motorized fatalities and serious injuries		**49.8**	**45.8**
PM2: Infrastructure Condition For National Highway System (4-Year Performance Period)	% of interstate pavement in good condition	National Highway Performance Program (NHPP)	70.8%	58.0%
	% of interstate pavement in poor condition		0.2%	1.0%
	% of non-interstate NHS pavement in **good** condition		40.3%	36.0%
	% of non-interstate NHS pavement in **poor** condition		4.1%	6.0%
	% of NHS bridges classified in **good** condition		32.5%	32.0%
	% of NHS bridges classified in **poor** condition		5.0%	6.0%
PM3: NHS & Freight Travel Time Reliability (4-Year Performance Period)	% of reliable person-miles traveled on the Interstate	National Highway Performance Program (NHPP) and National Highway Freight Program (NHFP)	92.1%	87.0%
	% of reliable person-miles traveled on the non-Interstate NHS system		93.4%	87.0%
	Truck Travel Time Reliability Index (TTTR)		1.32	1.55
PM3: Traffic Congestion & Emissions Reductions (4-Year Performance Period)	Peak Hour Excessive Delay per Capita	Congestion Mitigation & Air Quality Improvement Program (CMAQ)	**10.1**	**12.0**
	% Non-Signal Occupancy Vehicle		**17.8%**	**21.0%**
	Emission Reductions: PM2.5		10.480	0.009
	Emission Reductions: NOx		226.196	27.808
	Emission Reductions: VOC		54.772	30.854

FTA PM's	Performance Measure	Federal Aid Funding Program	Backlog %	Target
Transit Asset Management Plan (State of Good Repair)	Bus & Trolley	FTA Section 5307 Funds	24.0%	<10%
	Cutaway Van		38.8%	<10%
	Transit Van		23.5%	<10%
	Minivan		22.6%	<10%

	Agency	Vehicle Type	Fatality Rate	Injury Rate	Safety Event Rate
Public Transportation Agency Safety Plan (Includes Safety Targets)	KAT	Bus	0.00	0.16	0.32
		Demand	0.16	0.16	0.32
	CAC	Demand	0.00	0.10	0.10
	ETHRA	Bus	0.69	0.00	0.69
		Demand	0.00	0.03	0.28

TARGET SETTING OPTIONS

According to the USDOT, all state DOT's and transit agencies must set targets for the established performance measures within one year of respective final rule implementation, and all MPOs including the Knoxville Regional TPO must either: 1) establish their own quantifiable targets for their metropolitan planning area, or 2) support the statewide/regional targets as established by the state DOT or transit agency, no later than 180 days after the state adopts its targets. The TPO has typically chosen to support the TDOT statewide targets except for the most recent set of PM1 Safety Targets, for which local targets were adopted by the TPO Executive Board on 2/26/2025. The TPO will be exploring the adoption of local targets for the FHWA PM2 and PM3 areas for the next 4-year Performance Period where determined to be appropriate.

ASSESSMENT OF SIGNIFICANT PROGRESS

The assessment of significant progress for the Federal-aid Highway Program is conducted by FHWA at the state level wherein the FHWA determines whether TDOT has met or made significant progress towards meeting the adopted targets. FHWA does not directly assess the TPO's progress towards meeting targets; however, both FHWA and FTA will review TPO performance relative to targets as part of periodic transportation planning reviews, including MPO certification reviews, and reviews of adopted MTPs and TIPs.

Performance Progress Report by Target Area

PM1 – SAFETY

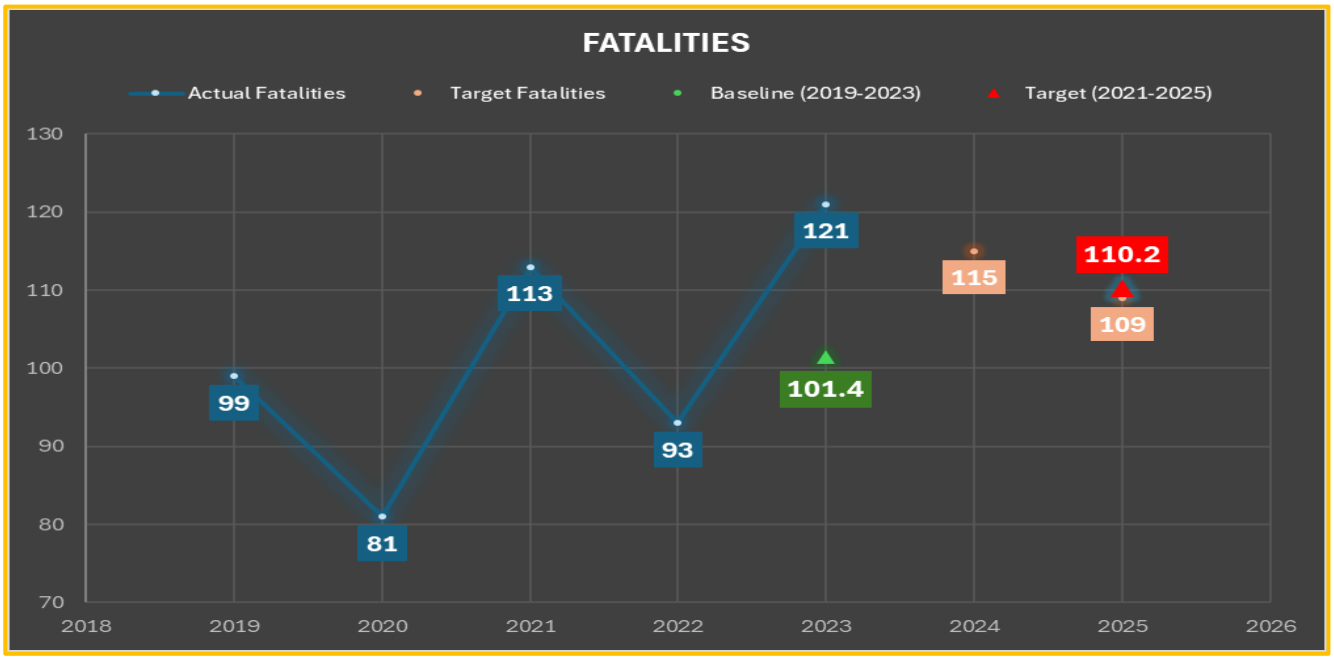
The Safety PM Final Rule establishes five performance measures (based on five-year rolling averages) to include:

1. **Number of Fatalities**
2. **Rate of Fatalities per 100 million Vehicle Miles Traveled (VMT)**
3. **Number of Serious Injuries**
4. **Rate of Serious Injuries per 100 million VMT**
5. **Number of Non-motorized Fatalities and Non-motorized Serious Injuries**

Traditionally, the TPO has been supporting the TDOT statewide safety targets, however the TPO adopted a **Regional Roadway Safety Action Plan** in June 2023 that established a formal goal to reduce fatalities and serious injuries by two-thirds by the year 2045, which translates to a 5% annual reduction from 2024 – 2045. The TPO staff therefore proposed that the Executive Board consider adopt our own TPO regional PM1 Safety Targets based on the new commitment for the 2021 – 2025 Annual Safety Target period.

TPO Fatality Trends – Number and Rate

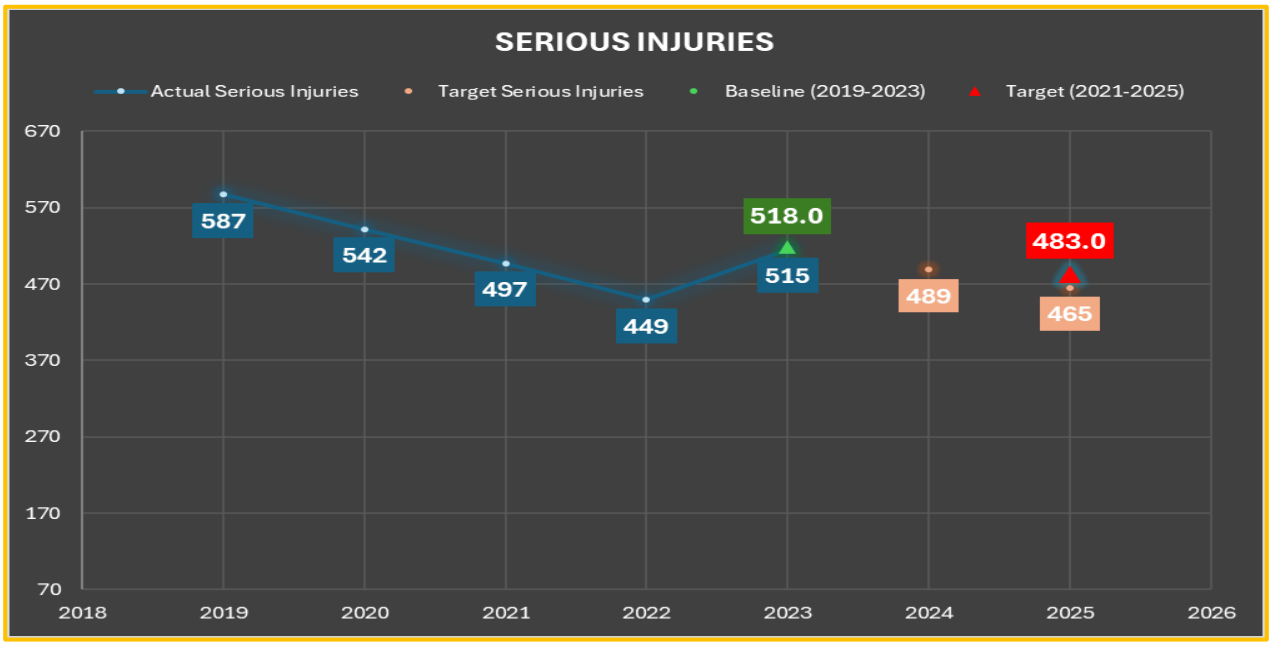
The following figure shows the actual number of fatalities each year within the TPO Planning Area for the baseline period from 2019 – 2023. The year 2023 had the highest number of fatalities and it now serves as the baseline/starting year for implementing target reductions moving forward based on the goal stated in the TPO Regional Roadway Safety Action Plan. A 5% reduction factor was applied to the 2023 value to generate target numbers for both 2024 and 2025 which comprise part of the target period 5-year rolling average between 2021 – 2025. The somewhat low values in the baseline, especially for year 2020, means that the target will likely be higher than the baseline for the next few annual target-setting reporting periods.



In terms of the Fatality Rate (fatalities per 100 million Vehicle Miles Traveled), a similar trendline as the total number of fatalities is observed although it should be noted that the current 5-year Baseline Average used in target-setting from 2019 – 2023 is significantly lower for the TPO Region at 1.087 fatalities per 100 million VMT than the Tennessee Statewide Average of 1.541.

TPO Serious Injury Trends – Number and Rate

The figure below shows the actual number of Serious Injuries within the TPO Planning Area each year for the baseline period from 2019 – 2023. Similar to the fatalities measure, the year 2023 had the highest number of serious injuries and it now serves as the baseline/starting year for implementing target reductions moving forward of 5% reduction per year. Unlike with the Fatality numbers however, the



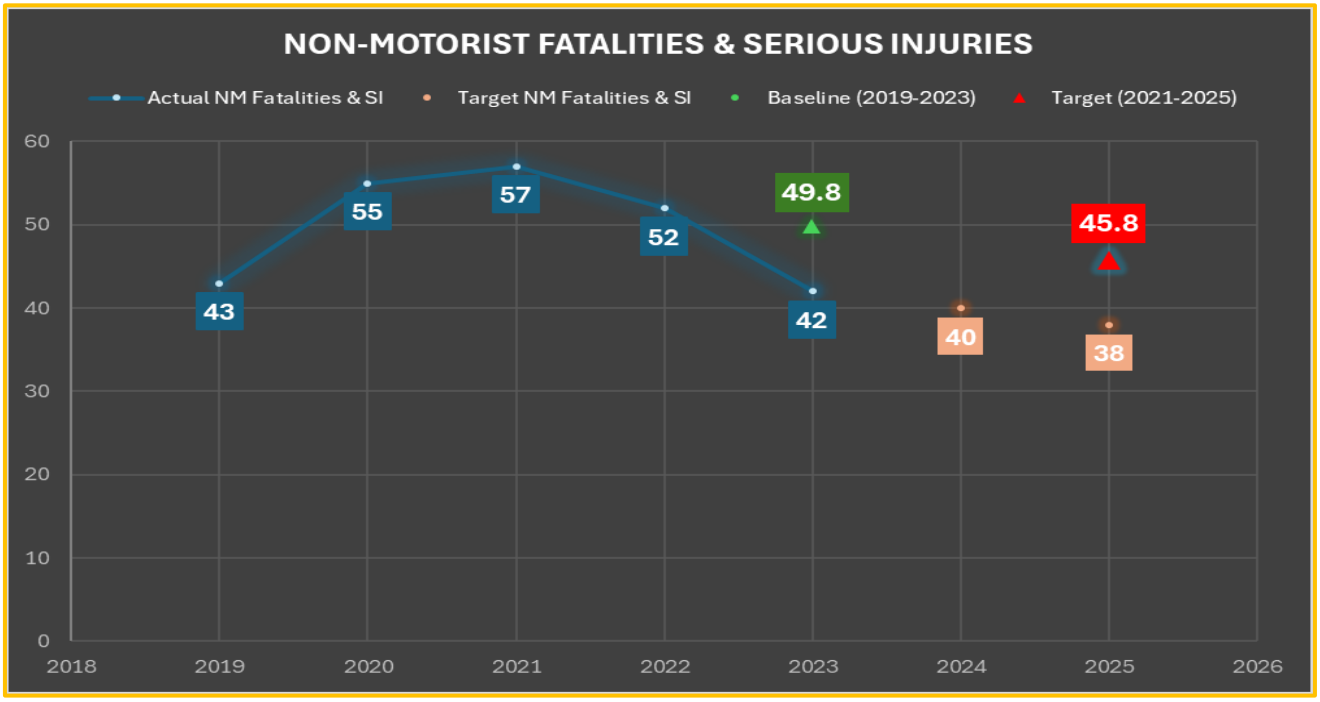
Serious Injuries have been experiencing an overall declining trendline and the 2021 – 2025 5-Year Target is projected to be less than the 2019 – 2023 Baseline value.

TPO Non-Motorist Fatalities and Serious Injuries Trends

This measure is a subset of both Measure 1 and Measure 3 to focus in on the Non-Motorist involved crash victims, also known as "Vulnerable Road Users". The measure is calculated as the sum of both Serious Injuries and Fatalities, so it is helpful to look at the breakdown of those separately as shown in the chart below.

Performance Measure	2019	2020	2021	2022	2023	2024 (Projected)	2025 (Projected)
Number of Non-motorist Fatalities	13	15	19	14	17		
Number of Non-motorist Serious Injuries	30	40	38	38	25		
Number of Non-motorist Fatal + SI	43	55	57	52	42	40	38

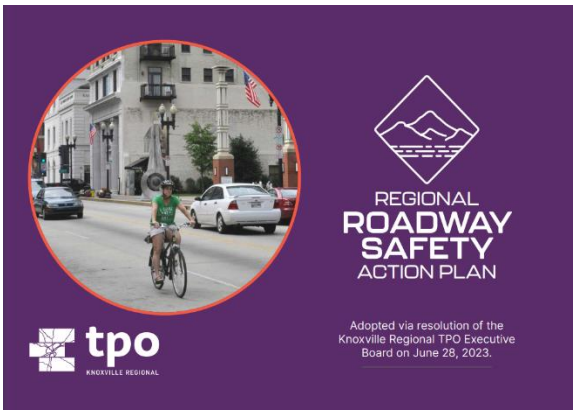
The figure below shows the actual number of Non-Motorist Fatality and Serious Injury victims within the TPO Planning Area each year for the baseline period from 2019 – 2023. Unlike both previous measures, the year 2023 had the lowest number of fatalities plus serious injuries and it now serves as the baseline/starting year for implementing target reductions moving forward of 5% reduction per year.



Summary of PM1 Projects and Initiatives since Mobility Plan 2045

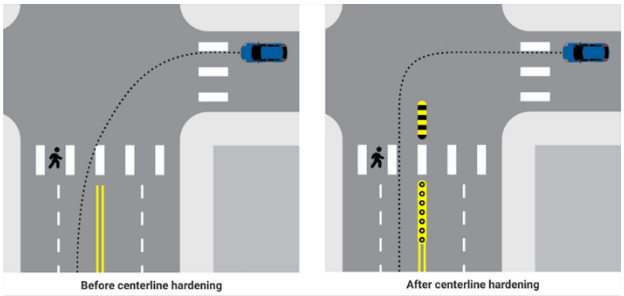
The Knoxville TPO along with its partner agencies and stakeholders, including TDOT, continue to emphasize transportation safety for all users as one of the primary factors influencing project selection and development. There have been several notable initiatives since the adoption of the previous MTP known as Mobility Plan 2045 including:

- Adoption of a Regional Roadway Safety Action Plan in June 2023
- City of Knoxville Vision Zero Commitment and Action Plan in June 2023
- Continuation of TPO's 6-month interdisciplinary fatal crash review meetings
- FHWA Safe Streets and Roads for All (SS4A) Supplemental Safety Plan Grant for Anderson County
- SS4A Planning Grant Awards for multiple agencies
- SS4A Implementation Grant Awards for City of Knoxville of more than $25 Million



The City of Knoxville, which is the single largest jurisdiction within the Knoxville TPO Planning Area, has especially increased its emphasis on transportation safety with a formal commitment to Vision Zero (VZ). The Knoxville VZ process has included the establishment of a formal section within its engineering department and designation of a dedicated Vision Zero Coordinator staff position who acts as a champion for identifying safety issues and potential projects, both long-term as well as "quick-fix" opportunities that are low-cost and easier to implement than traditional road projects.

One example of a quick-fix safety improvement that was made by the City of Knoxville is at an intersection of two city streets adjacent to a high school used by a large number of students who walk to school from nearby neighborhoods. A student was unfortunately struck by a motorist who turned across the crosswalk. In order to slow traffic down and not allow cars to "short cut" across the intersection, the City installed plastic/rubber curbing known as centerline hardening (see figure below).



SAFE STREETS AND ROADS FOR ALL (SS4A)

The establishment of the FHWA Safe Streets and Roads for All (SS4A) discretionary grant program under IIJA has opened several new opportunities for safety planning and project funding that was not available when the Mobility Plan 2045 was adopted. The TPO's Regional Roadway Safety Action Plan was developed to be SS4A "compliant" in order to allow the Region to submit applications for Implementation Grant funding. The City of Knoxville's Vision Zero Action Plan was essentially a subset of the larger regional plan that was developed in concert with but independent from the regional effort. The City of Knoxville leveraged its plan to successfully obtain SS4A Implementation Grant funds in both 2023 and 2024. The safety improvement projects are under development with construction expected to be underway and potentially completed by the next update of the Mobility Plan in 2029.

HIGHWAY SAFETY IMPROVEMENT PROGRAM (HSIP)

The PM1 measures are most directly tied to the Federal-Aid Highway formula funding program known as the Highway Safety Improvement Program (HSIP). The HSIP funds are administered by TDOT who are responsible for ensuring that they are used to make progress towards the goals that are established in the Tennessee Strategic Highway Safety Plan (SHSP). The **SHSP** was recently updated to cover the 5-Year Period from 2025-2029 and for the first time it incorporated a special **Vulnerable Road User Safety Assessment** that is used to identify set-aside HSIP funding for Pedestrian Road Safety Initiative (PRSI) projects. The SHSP identifies "Emphasis Areas" that direct priories for use of the HSIP funding.

TDOT prepares an **HSIP annual report** each year that summarizes safety projects and initiatives included in the HSIP program that they administer statewide along with specific qualifying criteria. Some examples of separate initiatives that are part of TDOT's safety program include:

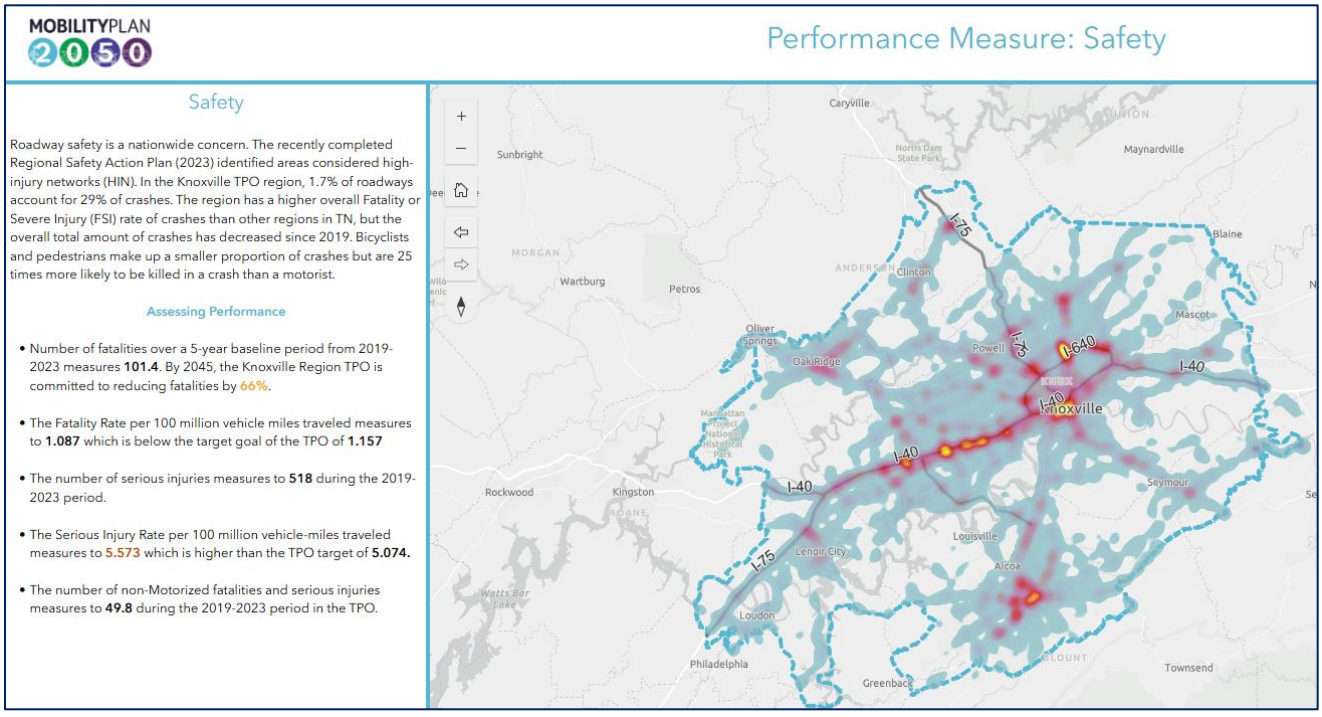
- Road Safety Audits
- Ramp Queue Program
- Pedestrian Road Safety Initiative (PRSI)
- PRSI – ADA Improvements
- Spot Safety Program
- Pedestrian Accessibility Ramps – Resurfacing Program
- Resurfacing Program
- Local Road Safety Initiative (LRSI)

In terms of HSIP-funded projects that have been implemented in the TPO Region since the Mobility Plan 2045 was adopted in early 2021, TDOT has focused primarily on leveraging safety improvements along with the multitude of roadway resurfacing projects that have occurred. In particular, most resurfacing projects incorporate pedestrian ADA improvements such as curb ramps. Additionally, the resurfacing program utilizes a checklist for safety countermeasures which can be implemented in the process of resurfacing. The total amount of HSIP funding that was authorized for Construction within the TPO Planning Area for fiscal years 2021-2024 was **$27,045,394.** Some of the most significant, and highest cost, projects are as follows:

- **Chapman Highway** (SR-71) from south of Simpson Rd to Hendron Chapel Rd – installation of center turn lane in undivided 4-lane section ($8,118,000)
- **I-640 Interchanges at Millertown Pike and Washington Pike** – Ramp Queue Safety ($4,076,100)
- **FY 2023 Curb Ramp Upgrades** ($2,646,900)
- **FY 2022 Curb Ramp Upgrades** ($1,333,866)
- **Various Interstates in Knox & Blount counties** – High Friction Surface Treatment and Pavement Markings ($1,249,200)
- **Rutledge Pike (SR-1) at Intersections of Mine Road and Shipetown Road/Roberts Road** – Install Traffic Signals ($640,270)

PM1 (Safety) – Conclusion & Next Steps

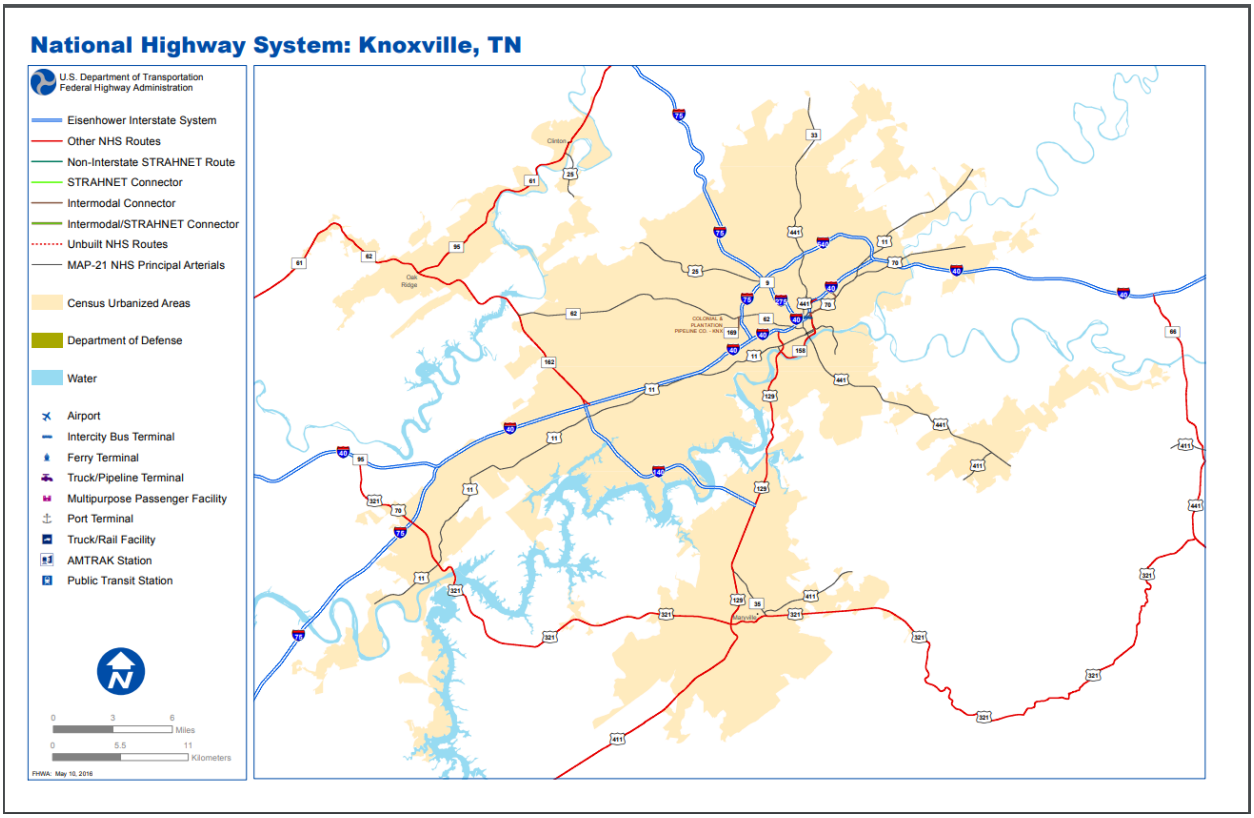
The TPO and its planning partners have made significant progress in the area of transportation safety as it pertains to increasing planning efforts and emphasis on safety initiatives, particularly due to the increased focus coming from the federal level such as the SS4A program and promotion of the "Safe System Approach". Much work remains to be done, however, to realize the outcomes that are desired from these initiatives as there are still far too many lives cut short or forever altered by traffic crashes. The TPO looks forward to working with all of its partners to achieve further improvements and reduction of traffic fatalities and serious injuries. As part of the ongoing maintenance of the new Mobility Plan 2050, the TPO will host an online Safety "Dashboard" to help track progress in meeting the Local Safety Targets as shown in the screenshot below.



PM2 – PAVEMENT AND BRIDGE CONDITIONS ON THE NHS

Background

This measure is specific to the pavement and bridge condition along roadways that are designated on the National Highway System (NHS), the vast majority of which are owned and maintained by the Tennessee Department of Transportation (TDOT). The TPO has decided to support the statewide targets for these measures since there are less than 30 lane-miles of locally-owned NHS routes which contain only 5 total bridges. TDOT develops its own statewide asset management process to determine appropriate funding allocations to address maintenance of pavements and bridges across the entire state and the TPO does not have direct input on where those funds are spent. The map below shows the NHS-designated roadway system in the Knoxville-region and subsequent sections provide information on current bridge and pavement condition targets as well as the Knoxville-specific conditions.



Pavement Conditions and Targets

The FHWA performance measure areas related to NHS pavement condition are broken out into four total categories related to the percentage of lane-miles rated as either “Good” or “Poor” for both the Interstate system and other Non-Interstate NHS routes as follows:

- Percentage (%) of pavements of the Interstate System in **Good** condition
- Percentage (%) of pavements of the Interstate System in **Poor** condition
- Percentage (%) of pavements of the non-Interstate NHS in **Good** condition
- Percentage (%) of pavements of the non-Interstate NHS in **Poor** condition

Pavement ratings are comprised of different metrics including: International Roughness Index (IRI), Cracking, Rutting and Faulting. TDOT contracts with companies that drive vehicles equipped with specialized equipment to automatically record this data in order to inventory conditions regularly. TDOT is subsequently able to use software programs that allow them to model expected deterioration over time in order to estimate the future pavement conditions against various funding scenarios.

The following table shows the current amount of total statewide mileage of NHS routes by Interstate and Non-Interstate along with the current 2022-2025 four-year Performance Period targets established by TDOT and supported by the TPO:

Performance Measure	Lane-Miles	Baseline (2021)	Target (2025)
% of **Interstate** pavement in **Good** condition	5,813	70.8%	58.0%
% of **Interstate** pavement in **Poor** condition		0.2%	1.0%
% of **Non-Interstate** NHS pavement in **Good** condition	13,385	40.3%	36.0%
% of **Non-Interstate** NHS pavement in **Poor** condition		4.1%	6.0%

TDOT provides MPOs with the pavement ratings of NHS routes within each of their planning area's every other year for tracking purposes. The Knoxville TPO mileages and ratings for the 2021 and 2023 periods are shown in the table below, which also includes the small number of local (non-TDOT maintained) road mileage that is designated as an NHS route:

Road System	Lane-Miles	% Good		% Poor	
		2021	2023	2021	2023
TPO Interstates	529.3	65.6%	77.1%	0.9%	0.8%
TPO Non-Interstate NHS State Routes	859.0	41.3%	44.5%	1.2%	2.0%
TPO Non-Interstate NHS Local Routes	20.6	14.3%	11.6%	2.5%	14.4%

Bridge Conditions and Targets

The FHWA performance measure areas related to NHS bridge conditions are broken out into two total categories related to the percentage of bridges rated as either "Good" or "Poor" for all NHS routes (Interstate and Non-Interstate) as follows:

- Percentage (%) of NHS Bridges by Deck Area in **Good** condition
- Percentage (%) of NHS Bridges by Deck Area in **Poor** condition

Bridge conditions are measured based on three different aspects: Deck, Superstructure and Substructure. If any of those three items are rated as "Poor" then the entire bridge is considered as being in poor condition for purposes of the FHWA Performance Measures. The size of the bridge comes into play as well as its rating is weighted by the total deck area and factored into the total for the statewide value.

There are 4,211 NHS Bridges in TN with an average age approximately 48 years and since in general a bridge will transition from Good to Fair at around 20 years of age and from Fair to Poor at around 65 years it will be critical to maintain and increase funding for bridge projects to be able to keep them in a state of good repair. The below table shows the TDOT Statewide baseline and targets for bridge condition:

Performance Measure	Baseline (2021)	Target (2025)
% of NHS Bridges by Deck Area in **Good** condition	32.5%	32.0%
% of NHS Bridges by Deck Area in **Poor** condition	5.0%	6.0%

As noted previously, there are only five total bridges on NHS "Local" routes. The following table includes the most recent condition data from 2024 for those NHS Local bridges as well as all other TDOT-owned NHS bridges within the TPO Planning Area:

Road System	Bridge Count	% Good	% Poor
TPO Interstates	181	58.7%	2.1%
TPO Non-Interstate NHS State Routes	174	55.0%	0.3%
TPO Non-Interstate NHS Local Routes	5	63.5%	0.0%

Summary of PM2 Projects and Initiatives since Mobility Plan 2045

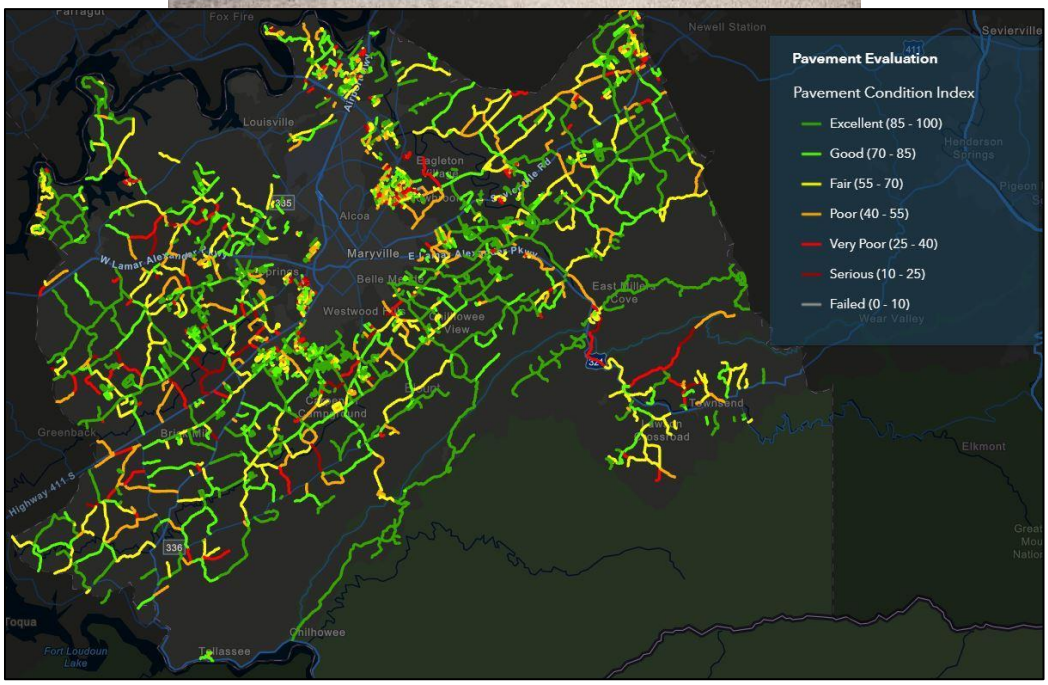
Of all the FHWA performance measure areas, the PM2 measures can be the most easily and directly correlated between funding amount and resulting condition level. TDOT has often communicated that they have a "fix it first" mentality and have focused additional funding to asset management received through the Transportation Modernization Act passed by the Tennessee State Legislature in 2024. As the Interstate system reaches the critical age of 60+ years old there will be several bridges that will have reached their original design life so increased funding will be critical moving forward.

This performance measure is tied directly to the National Highway Performance Program (NHPP) Federal-Aid formula funds. TDOT uses those funds for resurfacing and bridge maintenance/replacement projects programmed in groupings in the TPO Mobility Plan and TIP. The total amount of NHPP funding that was authorized for construction on resurfacing projects within the TPO Planning Area for fiscal years 2021-2024 was **$91,510,808** and the amount authorized for construction on bridge repair projects on the NHS was **$14,683,320.** Some of the most significant projects are as follows:

- **I-640 from I-275 / I-75 to I-40 East** – this project included major reconstruction of the concrete pavement and completed resurfacing of the entire I-640 loop ($19,466,442)
- **I-140 from I-40 to Blount County Line** – Resurfacing ($8,437,149)
- **Kingston Pike (SR-1) from Loudon County Line to I-140** - Resurfacing ($2,806,880)
- **I-275, Bridge over I-275/Elm Street/Bernard Avenue** – Bridge Replacement ($14,683,320)

PM2 (Pavement and Bridge Conditions on the NHS) – Conclusion & Next Steps

Pavements and bridges represent the most valuable assets that are owned by state and local governments and it is critical that timely maintenance is performed along with preservation techniques to keep good pavements and bridges good. While the local agencies within the TPO maintain a small fraction of the NHS roadway mileage, we are all directly affected by pavement and bridge conditions. Although it is not directly related to the NHS performance measure, it is worth noting that eight of the member TPO agencies are participating in a Regional Pavement Management System project that is now in its second iteration of pavement data collection. Below are depictions of the contractor's specially equipped van for collecting pavement data from multiple sensors and the resulting display of the pavement conditions for one of the participating agencies, Blount County Highway Department.



PM3 – SYSTEM PERFORMANCE

Background

This Performance Measure Area is the broadest of all of the FHWA measures and covers multiple aspects of transportation performance including:

- Measures to Assess Performance of the National Highway System – Travel Time Reliability (NHPP)
- Measures to Assess Freight Movement on the Interstate System – Truck Travel Time Reliability (NHFP)
- Measures to Assess the CMAQ Program – Traffic Congestion, Peak Hour Excessive Delay & Percent Non-Single Occupancy Vehicle Travel
- Measure to Assess the CMAQ Program – On-Road Mobile Source Emissions

Similar to the PM2 measures, the PM3 measures are set based on a 4-Year Performance Period, with this now being the 2nd Performance Period since the initiation of FHWA TPM covering the years 2022-2025.

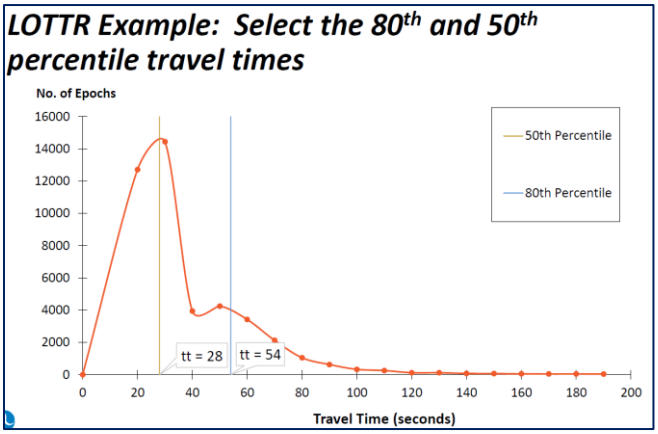
NHS Level of Travel Time Reliability (LOTTR) Measures and Targets

The FHWA performance measure areas related to Travel Time Reliability are broken out into two categories covering all Directional Mainline National Highway System (NHS) Roadways:

- Percent of Person miles Traveled on the Interstate that are Reliable
- Percent of Person miles Traveled on Non-Interstate NHS that are Reliable

Travel Time Reliability can be defined as the consistency or dependability of travel times from day to day or across different times of the day. It was selected as a performance measure by FHWA since while it is related to traffic congestion, it is a mechanism to better describe the day-to-day experience of travelers and the importance of being able to reliably predict travel time, such as to an important appointment.

The calculation of Travel Time Reliability is very mathematically intensive and relies on large amounts of archived travel time data. The graph to the right shows the concept of travel time reliability, which is calculated as the 80th percentile travel time divided by the 50th percentile travel time, known as Level of Travel Time Reliability (LOTTR). This computation is made for four different time periods during the day and if any one is greater than 1.50 then the entire segment is considered to be "Unreliable".



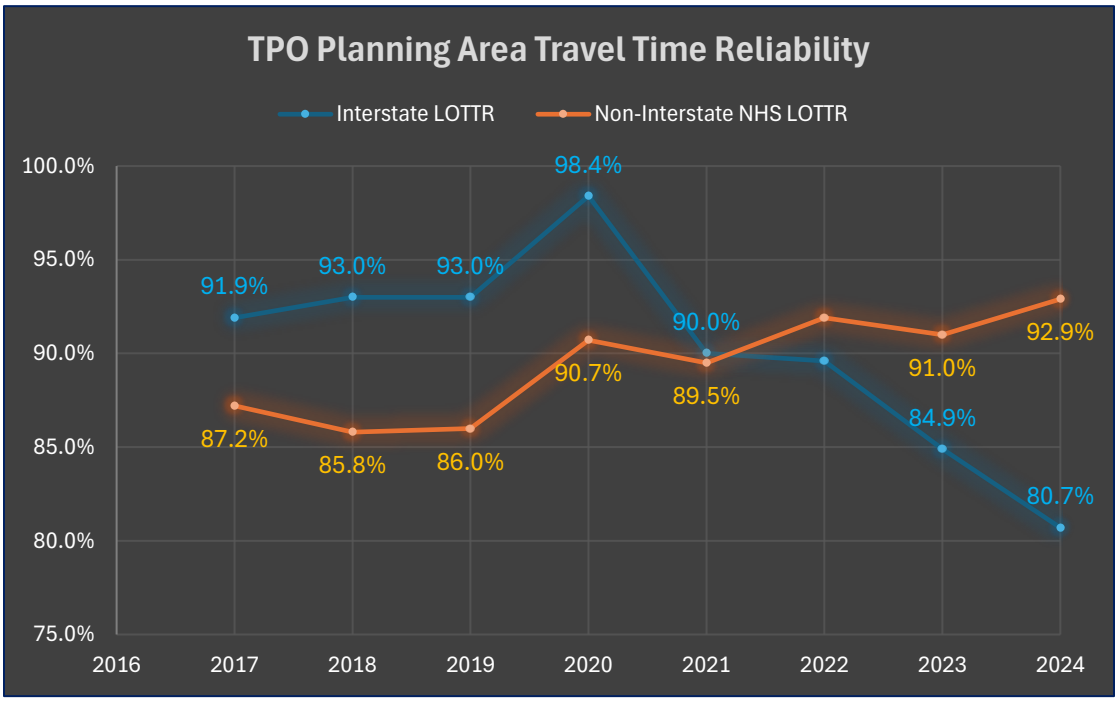
The TPO decided to support the TDOT statewide targets for both Travel Time Reliability measures, primarily due to the National Highway Performance Program federal-aid formula funds being solely controlled by TDOT. The TPO works with TDOT to prioritize projects for NHPP funding but recognizes that TDOT must determine projects on a statewide basis for this funding. The TPO is however able to access

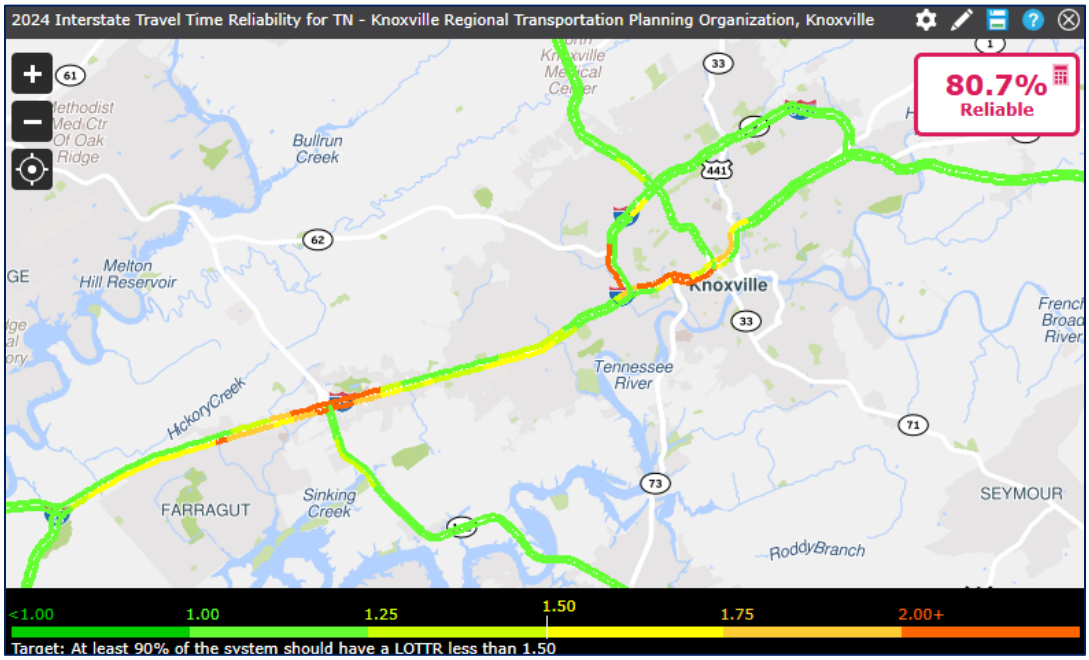
the “big data” tools through the Regional Integrated Transportation Information System (RITIS) to allow for determination of local trends and identify the most unreliable segments of the NHS roadways in the TPO area.

The following table shows the current Travel Time Reliability targets with the 4-year Targets having been adjusted at the midpoint based on worse than anticipated reliability when originally set:

Performance Measure	Baseline (2021)	Target (2025)
Percent of Person Miles Traveled on the **Interstate** That are Reliable	92.1%	87.0%
Percent of Person Miles Traveled on the **Non-Interstate NHS** That are Reliable	93.4%	87.0%

When looking at the local data for the TPO Planning Area, it is apparent that the trends are going in the wrong direction for the Interstate Travel Time Reliability, which has been noticeable to travelers with the return of traffic following the Covid Pandemic. Alternatively, however, the Non-Interstate NHS Travel Time Reliability has improved over the past couple of years. Below are a chart showing the trends since 2017 for both roadway systems and a figure from the RITIS system that shows a color-coded map of the most unreliable segments on Interstates in the TPO:





Interstate Truck Travel Time Reliability (TTTR) Measures and Targets

The FHWA performance measure area related to Freight Travel Time Reliability has one category covering all Directional Interstate Roadways:

- Truck Travel Time Reliability (TTTR) Index

Truck Travel Time Reliability is a very similar metric as the previous one for LOTTR but is tailored specifically to freight movement that is shipped by trucks. Since many manufacturers and shippers are using a strategy known as Just-in-time delivery, the ability to reliably predict travel time for trucks is especially critical.

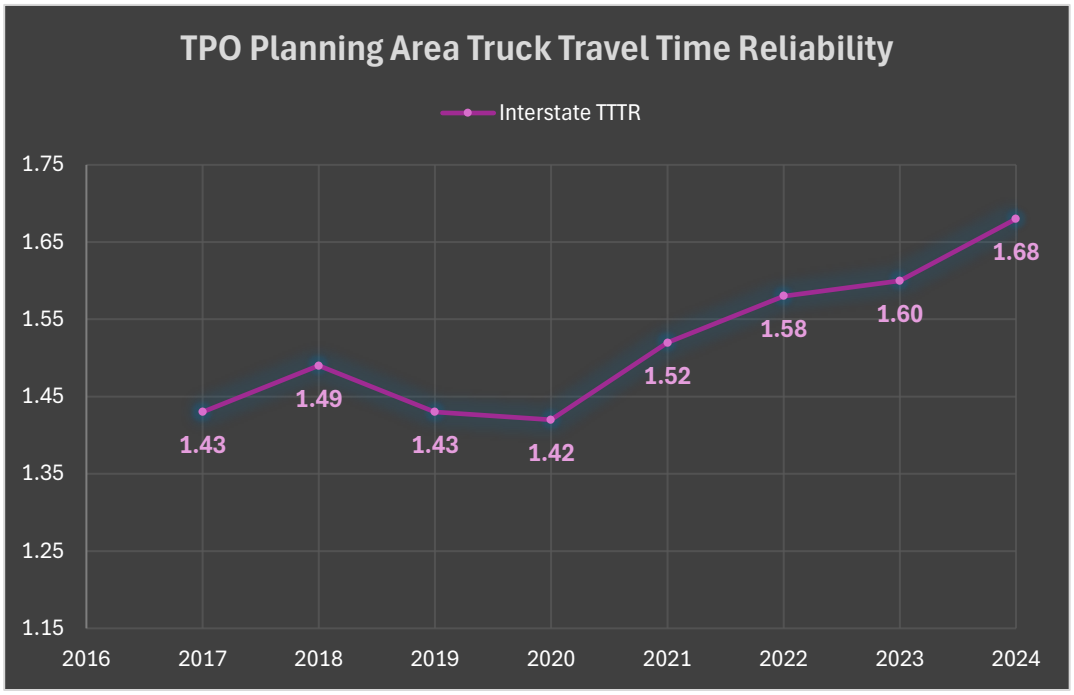
The calculation of TTTR is somewhat similar to LOTTR – it is the ratio of the 95th percentile travel time divided by the 50th percentile travel time for trucks. There are five total time periods that are analyzed for TTTR including the weekday morning, midday and evening peaks along with overnight and weekends from 6 a.m. to 8 p.m. The maximum TTTR ratio from those time periods for each roadway segment is taken and aggregated together for the entire network, weighted by segment length, to derive an overall TTTR ratio. Whereas for the LOTTR a higher value indicates more reliability, it is the opposite for TTTR where a higher value means it is less reliable.

As with the LOTTR performance measure, the TPO has been supporting the TDOT statewide targets rather than developing local targets. This performance target is tied directly to the federal aid formula funding program known as the National Highway Freight Program (NHFP) that are controlled by TDOT. To date there have been no projects funded with this source of funds in the TPO Region.

The following table shows the current Truck Travel Time Reliability targets with the 4-year Targets having been adjusted at the midpoint based on worse than anticipated reliability when originally set:

Performance Measure	Baseline (2021)	Target (2025)
Truck Travel Time Reliability Index for Interstates	1.32	1.55

The TTTR values for the Interstates in the Knoxville Region are available through the online big data RITIS platform mentioned previously and displayed in the graph below. The trend for TTTR on Knoxville Interstates since the year 2017 is exhibiting significant growth from its lowest value of 1.42 in 2020 during the height of the Covid Pandemic to a value of 1.68 in the most recent year of 2024 that is available. These values are much higher than the statewide TTTR and reflects the extremely high volume of trucks through Knoxville where major Interstates 40 and 75 converge for a 17-mile corridor.



CMAQ Program – Traffic Congestion Measures and Targets

The FHWA performance measure areas related to the Traffic Congestion portion of the Congestion Mitigation and Air Quality Improvement (CMAQ) program are broken out into two categories covering the Census-designated Urbanized Area for the Knoxville Region as follows:

- Annual Hours of Peak Hour Excessive Delay per Capita (PHED)
- Percent of Non-Single Occupancy Vehicle Travel (% Non-SOV)

These measures, also known as "Subpart G" PM's, are only required for urbanized areas with a population greater than 200,000 and include an Air Quality Nonattainment/Maintenance Area. Like the other PM2 and PM3 measures this one is based on a 4-year Performance Period of which this is the 2nd one covering 2022 – 2025. This Performance Measure is somewhat unique from the other ones which are evaluated on a statewide basis since it is specific to just the geographic area of the Census-designated Knoxville

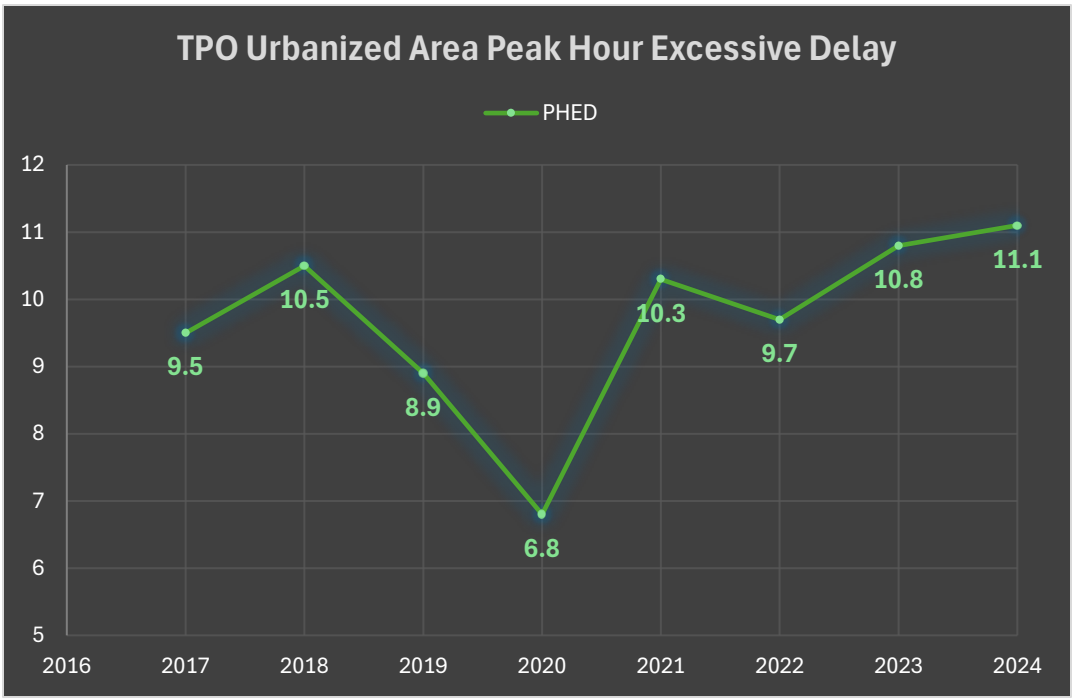
Urbanized Area. Targets for these measures are developed collaboratively between TDOT and TPO staff and each entity adopts the same target value.

The following table shows the current CMAQ Traffic Congestion targets and reflecting the recent midpoint adjustment of the 4-year Targets:

Performance Measure	Baseline (2021)	Target (2025)
Annual Hours of Peak Hour Excessive Delay (PHED) per Capita	10.3	12.0
% of Non-Single Occupancy Vehicle (Non-SOV) Travel	17.8%	21.0%

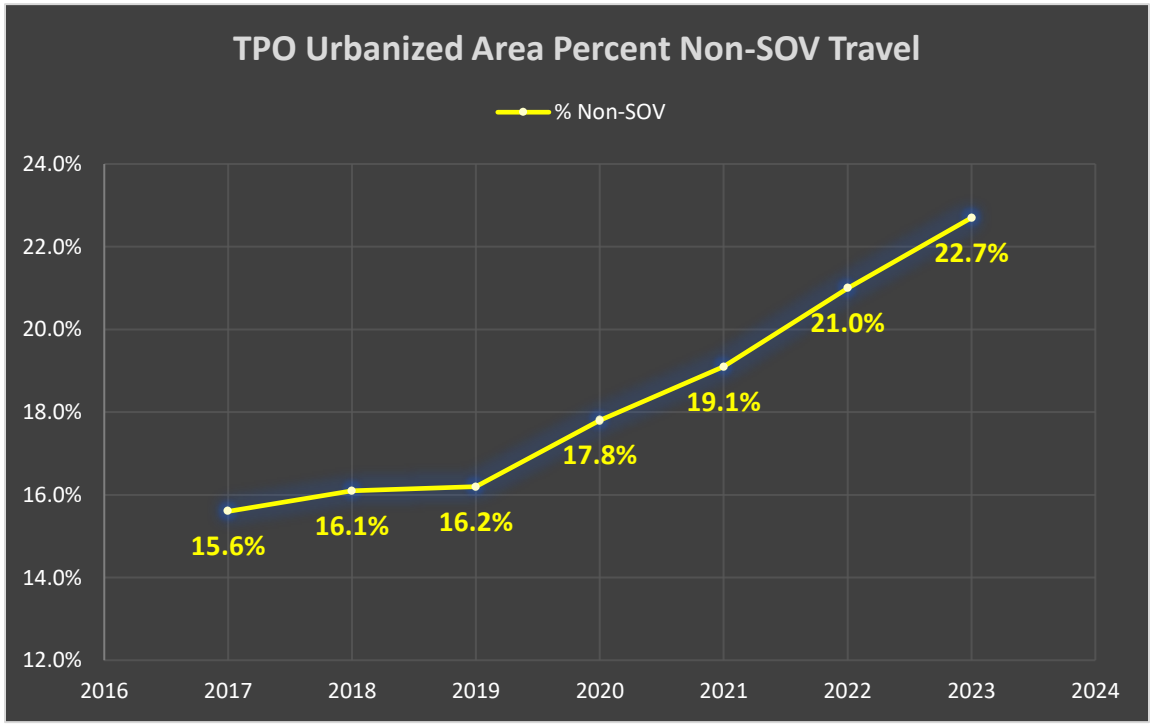
PEAK HOUR EXCESSIVE DELAY (PHED)

For the Peak Hour Excessive Delay (PHED) measure, the same RITIS data platform is used to determine the total hours of delay based on the archived travel time data for the subject area. PHED is calculated as the amount of travel that occurs at 60% of the posted speed limit on the NHS roadway system that has been discussed previously in this report. For example, if a road has a posted speed limit of 60 mph then any travel that occurs at speeds less than 36 mph would contribute to this measure. As with the reliability measures, there has been an increasing (worsening) trend for this measure since the Covid period of 2020. The original 4-year target was set at 10.8 hours but was adjusted to be 12.0 hours at the midpoint re-evaluation. The graph below shows the trend since 2017 with the highest delay being experienced in the most recent available year of 2024:



PERCENT NON-SINGLE OCCUPANCY VEHICLE TRAVEL (% NON-SOV)

For the Percent Non-SOV Travel measure, data provided from the U.S. Census American Community Survey (ACS) program is used to track the mode of travel for work commutes. This measure has increased significantly in response to the Covid-era shift towards working from home and its effect on the percent of commuters that go to work via a single occupant vehicle. In response to the increase of percent Non-SOV travel, the TPO and TDOT decided to adjust the original 4-year target significantly from the original value of 16.7% to become 21.0% for 2025. The graph below shows the trend from 2017 to the year with most recent data available, which is the 2023 5-Year ACS:



CMAQ Program – On-Road Mobile Source Emissions Measures and Targets

For the On-road Mobile Source Emissions measure, data from the FHWA's CMAQ Public Access System is compiled on actual projected emissions reductions from CMAQ projects that have been implemented in the Knoxville Region for the pollutants which the area is subject to either a Nonattainment or Maintenance designation by EPA. In the case of the Knoxville Region, it has been formerly designated as a Nonattainment Area for both the Ozone and PM2.5 National Ambient Air Quality Standards (NAAQS) set by EPA. Therefore, the specific pollutants that the TPO is subject to are Oxides of Nitrogen (NOx) and Volatile Organic Compounds (VOC) which contribute to Ozone pollution as well as Direct PM2.5 emissions. Since the Memphis area is also designated as an Ozone Maintenance Area its VOC and NOx emissions are added to the Knoxville ones to compute a statewide target value.

Since TDOT currently has authority for project selection under the CMAQ program the TPO has supported the statewide targets for the current 4-year Performance Period from 2022-2025. Unlike other PM2 & PM3 measures, the emissions targets represent a cumulative value of the emission reductions predicted for each of the individual years of the performance period.

The table below shows the current 4-Year Performance Period targets that were adjusted at the midpoint:

Performance Measure	Baseline (2018 – 2021)	Target (2022-2025)
Total Emission Reductions (kg/day): PM2.5	10.480	0.009
Total Emission Reductions (kg/day): NOx	226.196	27.808
Total Emission Reductions (kg/day): VOC	54.772	30.854

This performance area can be subject to much more variability than any of the other measures due to the randomness in which and how many projects are selected for CMAQ funding and there is not a discernable trend that lends itself to graphing as with the other PM3 measures.

Summary of PM3 Projects and Initiatives since Mobility Plan 2045

The PM3 measures cover a wide range as discussed throughout this section and are tied to multiple Federal-Aid funding programs including: National Highway Performance Program (NHPP), National Highway Freight Program (NHFP) and Congestion Mitigation and Air Quality Improvement Program (CMAQ). As noted previously, there have yet to be any projects funded from the NHFP funding source in the Knoxville Region, but several projects have been implemented since the last Mobility Plan using NHPP and CMAQ.

NHPP PROJECTS FOR TRAVEL TIME RELIABILITY & FREIGHT RELIABILITY

The projects that impact travel time reliability measures often relate to roadway capacity improvements to reduce overall congestion but can also involve operations/ITS projects such as improved signal timing or incident management to keep traffic moving as efficiently as possible. The total amount of NHPP funding that was authorized for construction on projects that address travel time and freight reliability within the TPO Planning Area for fiscal years 2021-2024 is estimated at: **$360,000,000**. Some of the most significant projects are as follows:

- **US-129/SR-115 Relocated Alcoa Highway, Stage 1 from Tyson Blvd to Existing SR-115 at Singleton Station Rd** – this is the first phase of a major 4-lane freeway-style roadway on new alignment near the McGhee Tyson Airport in Blount County. ($186,326,644)
- **US-129/SR-115 Alcoa Highway from Woodson Dr to Cherokee Trail** – this is a major reconstruction project widening from 4 to 6 lanes and converting to full access control ($159,843,904)
- **I-140 ITS Expansion from MM2 to SR-115** – Addition of Cameras and Message Boards for Incident Response and Traveler Information ($5,292,900)
- **Continued Operation of TDOT Incident Response (HELP Trucks)** – Ongoing funding of HELP Truck Program ($3,800,000)

CMAQ PROJECTS FOR TRAFFIC CONGESTION AND EMISSIONS REDUCTIONS

The CMAQ funding has very specific eligibility requirements in that the projects it is used for must be able to demonstrate an emissions reduction related to the EPA criteria pollutants that the area is subject to. Traditionally these funds have been used for traffic operations and signal improvements in the Knoxville Region as a source of major stopped delay for vehicles and associated emissions from idling. The TPO has also received CMAQ funding across multiple years to manage a Travel Demand Management program known as Smart Trips that seeks to promote Non-SOV travel. The total amount of CMAQ funding that was authorized for construction on projects within the TPO Planning Area for fiscal years 2021-2024 is estimated at: **$12,000,000**. Some of the most significant projects are as follows:

- **Knox County Advanced Traffic Management System Phase 1** – this is the first phase of planned traffic signal hardware improvements in unincorporated Knox County. ($1,684,683)
- **Lenoir City Intelligent Transportation System: Signal System** – this is another traffic signal upgrade project for the jurisdiction of Lenoir City ($1,617,828)
- **Farragut Advanced Traffic Management System (ATMS) Phase 1 –** this is a citywide traffic signal system upgrade that includes central operating software and communications to increase efficiency on congested corridors.
- **TPO Smart Trips Program** – Travel Demand Management Program to reduce Non-SOV trips ($65,600)

PM3 (System Performance) – Conclusion & Next Steps

The Knoxville TPO Region is facing several challenges to maintaining desirable travel times and overall reliability of the roadway system as population and traffic has been steadily increasing over the past few years. It will be important to identify the most critical segments of the transportation system to utilize the limited amount of funding given the rapidly increasing costs associated with roadway construction. TDOT has recently embarked on a major study of the I-40/75 Corridor in west Knox County which sees the highest average daily traffic volumes in the entire state of Tennessee. These segments are shown to have the greatest impacts to the Travel Time Reliability, Freight Reliability and Peak Hour Excessive Delay in the Region using the RITIS data platform. This study along with other large transportation investments that are programmed in the TDOT 10-Year Plan will help the Region address these PM3 targets.

TRANSIT PERFORMANCE MEASURES

Background

The Knoxville TPO is served by three federally-funded transit providers, including one fixed-route transit system operated by Knoxville Area Transit (KAT) and two demand-response transit providers: Knox County Community Action Committee (CAC) and East Tennessee Human Resources Agency (ETHRA). The FTA has established performance measures in two major areas: Transit Asset Management and Safety for which targets are established by each transit agency.

Transit Asset Management

Transit Asset Management (TAM) is a strategic approach to managing transit assets such as bus and van useful life and replacement schedules. An assessment of State of Good Repair (SGR) is performed to gauge the condition of each asset to ensure it is able to operate at full level of performance & does not pose unacceptable risk. Each vehicle/asset is assigned Useful Life Benchmarks as the expected life cycle to plan for each of the assets. The age of vehicles is a primary metric in this evaluation but is just one guide.

The TPO target for rolling stock/equipment at 10% or less – or – a goal of at least 90% being classified in a state of good repair. Refer to the table below for each transit agency information related to the most recently established TAM targets:

Knoxville Regional TPO
Transit Asset Management (TAM) Plan
FFY 2025 Targets

Asset Class/Definition	Useful Life Benchmark (Years)	Agency	Total Assets	2025 # of Assets in Good Repair	2025 # of Assets in SGR Backlog	2025 % of Assets in SGR Backlog	2025 Target
Rolling Stock – All Revenue Vehicles – Percent of revenue vehicles that have met or exceeded their Useful Life Benchmark							
Bus	14	KAT	75	57	18	24.00	<10.0%
Cutaway	5	KAT, CAC, ETHRA, NP	121	74	47	38.84	<10.0%
Ford Transit Van	7	KAT, CAC, NP	34	26	8	23.53	<10.0%
Minivan	8	CAC, CACVAT, NP	31	24	7	22.58	<10.0%
Automobile	8	CAC, CACVAT, NP	4	0	4	100	<10.0%
Equipment – Non-Revenue Vehicles – Percent of non-revenue vehicles that have met or exceeded their Useful Life Benchmark							
Support Vehicle	8	KAT, CAC	21	15	6	28.57	<10.0%
Equipment – Over $50,000 – Percent of equipment with a condition rating below3.0 on the FTA's Transit Economic Requirements Model (TERM) scale							
Equipment	N/A	KAT	30	29	1	3.33	<10.0%
Facilities – All Buildings or Structures – Percent of facilities or structures with a condition rating below 3.0 on FTA's Transit Economic Requirements Model (TERM) scale							
Facilities	N/A	KAT	2	2	0	0.00	0.00%

KAT = Knoxville Area Transit, CAC = Knox County CAC Transit, CACVAT = CAC Volunteer Assisted Transportation Program, ETHRA = East Tennessee Human Resource Agency, NP = Non-Profit Organizations (5310 Funding). Only includes ETHRA vehicles that operate in the TPO's urban area.
SGR = State of Good Repair

It should be noted that the transit vehicle industry is still in recovery from COVID supply chain issues and rising inflation. Several agencies have new vehicles on order, which will bring these numbers closer in line with the specified targets.

Transit Safety Performance Targets

The Transit operators are required to develop and adopt a Public Transportation Agency Safety Plan (PTASP). These plans establish processes and procedures to support the implementation of Safety Management Systems. PTASPs must also include formal safety performance targets, which are broken out by provider and vehicle type. The safety targets consider the number and rate of: Fatalities, Injuries, Safety Events and Mechanical Failures. The tables below show the most recent adopted Transit Safety Targets for the TPO:

Knoxville Regional Transportation Planning Organization

Knoxville Urban Area - 2024-2025 Transit Safety Performance Targets

	Knoxville Area Transit (KAT) - 2024-2025 Safety Performance Targets							
	2024 Motor Bus Vehicle Revenue Miles		2,483,690	2024 Demand Response Vehicle Revenue Miles		565,208		
	Number of Fatalities	Rate of Fatalities per 100K VRM	Number of Injuries	Rate of Injuries Per 100K VRM	Number of Safety Events	Rate of Safety Events Per 100K VRM	Total Major Mechanical Failures	Miles between Major Mechanical Failures
MB	0	0	5	0.16	10	0.32	200	12,500
DR	0	0	5	0.16	10	0.32	25	25,000

	Knox County CAC Transit - 2024-2025 Safety Performance Targets							
				2024 Demand Response Vehicle Revenue Miles		983,960		
	Number of Fatalities	Rate of Fatalities per 100K VRM	Number of Injuries	Rate of Injuries Per 100K VRM	Number of Safety Events	Rate of Safety Events Per 100K VRM	Total Major Mechanical Failures	Miles between Major Mechanical Failures
DR	0	0	1	0.10	1	0.10	8	122,995

	ETHRA - 2024-2025 Safety Performance Targets							
	2024 Motor Bus Vehicle Revenue Miles		145,000	2024 Demand Response Vehicle Revenue Miles		3,200,000		
	Number of Fatalities	Rate of Fatalities per 100K VRM	Number of Injuries	Rate of Injuries Per 100K VRM	Number of Safety Events	Rate of Safety Events Per 100K VRM	Total Major Mechanical Failures	Miles between Major Mechanical Failures
MB	0	0	0	0.00	1	0.69	5	29,000
DR	0	0	1	0.03	9	0.28	22	145,455