February 2024

Beyond Mobility
Massachusetts 2050 Transportation Plan

Appendix D: System Performance Report

Draft Plan

Table of Contents

List of Tables

List of Figures

1.0 Introduction

Pursuant to the Moving Ahead for Progress in the 21st Century Act (MAP-21) Act enacted in 2012 and the Fixing America's Surface Transportation Act (FAST Act) enacted in 2015, State Departments of Transportation (DOT) and Metropolitan Planning Organizations (MPO) must apply a transportation performance management approach in carrying out their Federally-required transportation planning and programming activities. The process requires the establishment and use of a coordinated performance-based approach to transportation decision-making to support national goals for the Federal-aid highway and public transportation programs.

To help transportation agencies take the necessary steps toward achieving the national goals, the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) promulgated a series of rulemakings between 2016 and 2019 that established performance measures for the Federal-aid highway and transit programs. The Federal performance measure rules fall into three broad categories: safety (highway and transit); infrastructure condition (highway and transit); and system performance (highway only).

It should be noted that the highway requirements pertain to the National Highway System (NHS), the majority of which is under MassDOT ownership. These targets are set directly by the DOT and MPOs. By contrast, the transit requirements are primarily set by transit operators with technical assistance and coordination from MassDOT and the MPOs. These operators include the Massachusetts Bay Transportation Authority (MBTA) and 15 Regional Transit Authorities (RTAs).

Under Federal rulemakings, MassDOT must include a description of Federal transportation performance measures and targets and a system performance report in its long range transportation plan. The system performance report evaluates the condition and performance of the transportation system with respect to the Federal performance targets, including progress achieved by MassDOT in meeting those targets. Future system performance reports must also compare current performance with system performance recorded in previous reports. **To satisfy this requirement, MassDOT developed this System Performance Report as a product of *Beyond Mobility*, the Massachusetts 2050 Transportation Plan.**

2.0 Safety

2.1 Highway Safety

Effective April 14, 2016, the FHWA established the highway safety performance measures[1] to carry out the Highway Safety Improvement Program (HSIP). These safety performance measures include the following:

- Number of fatalities.
- Rate of fatalities per 100 million vehicle miles traveled (VMT).
- Number of serious injuries.
- Rate of serious injuries per 100 million vehicle miles traveled.
- Number of combined non-motorized fatalities and non-motorized serious injuries.

The Commonwealth of Massachusetts' top priority is ensuring the safety of all roadway users: whether they are driving a vehicle, truck, or motorcycle; riding as a passenger; taking transit; walking; bicycling; or using any other mobility device. One life lost or seriously altered on the Commonwealth's roadways is one too many. Massachusetts is committed to the goal of zero roadway fatalities and serious injuries.

To achieve zero roadway fatalities and serious injuries, Massachusetts is adopting a **Safe System Approach**, a U.S. Department of Transportation endorsed framework for addressing roadway safety holistically as a system. As defined in MassDOT's Strategic Highway Safety Plan (SHSP)[2], the Safe System Approach works by anticipating human mistakes and keeping impact energy on the human body at tolerable levels.

Critical to the success of the SHSP and safety-related initiatives is identifying and mitigating risks in the transportation system to prevent serious crashes, rather than waiting for crashes to occur and reacting afterward. Implementing this approach requires shared responsibility across agencies and communities. Everyone is accountable and has a role to play, including those who plan, program, design, construct, maintain and utilize the roads, as well as those who create, enforce, and adjudicate laws. While road users share some of the responsibility, and must follow the rules of the road system, it is unacceptable to assign users complete responsibility for their safety on a system they do not plan, design, construct, operate, and maintain.

Highway Safety Targets

Per FHWA guidance, the calendar year (CY) 2024 target setting process began with a trend line projection based on the most recent available data. This year, MassDOT also developed a 2022-

1 23 CFR Part 490, Subpart B.
2 https://www.mass.gov/service-details/strategic-highway-safety-plan.

2026 target to be consistent with the Highway Safety Office and National Highway Traffic Safety Administration (NHTSA). These targets are shown in Table 2.1.

Table 2.1 Targets for Highway Safety, 2022–2026

Performance Measure	Current (2022)	2024 Target	2026 Target
Number of Fatalities	378	377	362
Rate of Fatalities per 100 Million VMT	0.62	0.61	0.54
Number of Serious Injuries	2,708	2,708	2,603
Rate of Serious Injuries per 100 Million VMT	4.42	4.36	3.91
Number of Combined Non-Motorized Fatalities and Non-Motorized Serious Injuries	480	445	435

Total Fatalities

Due to higher rates of speeding caused by decreased vehicle miles traveled VMT amid pandemic shutdowns in 2020 and the lingering impacts in 2021 and 2022, roadway fatalities increased relative to previous years. Furthermore, the Infrastructure Investment and Jobs Act (IIJA) requires "performance targets to demonstrate constant or improved performance," so Massachusetts is unable to use increasing targets.

Although the latest 2023 data suggests fatalities are trending towards pre-COVID levels, the data is incomplete and was not used when the target setting process began. Therefore, MassDOT developed the target for CY 2024 by projecting the 2023 and 2024 fatalities to be in line with pre-COVID data. As a result, year over year changes reflect a decrease of approximately 20 percent when comparing 2021 and 2022 to 2023 and 2024. However, the five-year averages from 2018-2022 to 2020-2024 see only a minor decrease from 378 to 377. If this trend continues, the 2022-2026 average will drop to 362, a reduction of four percent.

As always, MassDOT's overarching goal is zero deaths and this goal will be pursued by implementing strategies from the SHSP. The Massachusetts SHSP and Vulnerable Road User Safety Assessment were both updated and finalized in 2023. These strategies help provide details on how the state will drive down fatalities and serious injuries. Moreover, it should be restated that while MassDOT developed numeric targets, **the goal is zero** and MassDOT will continue to work toward that goal by implementing SHSP strategies.

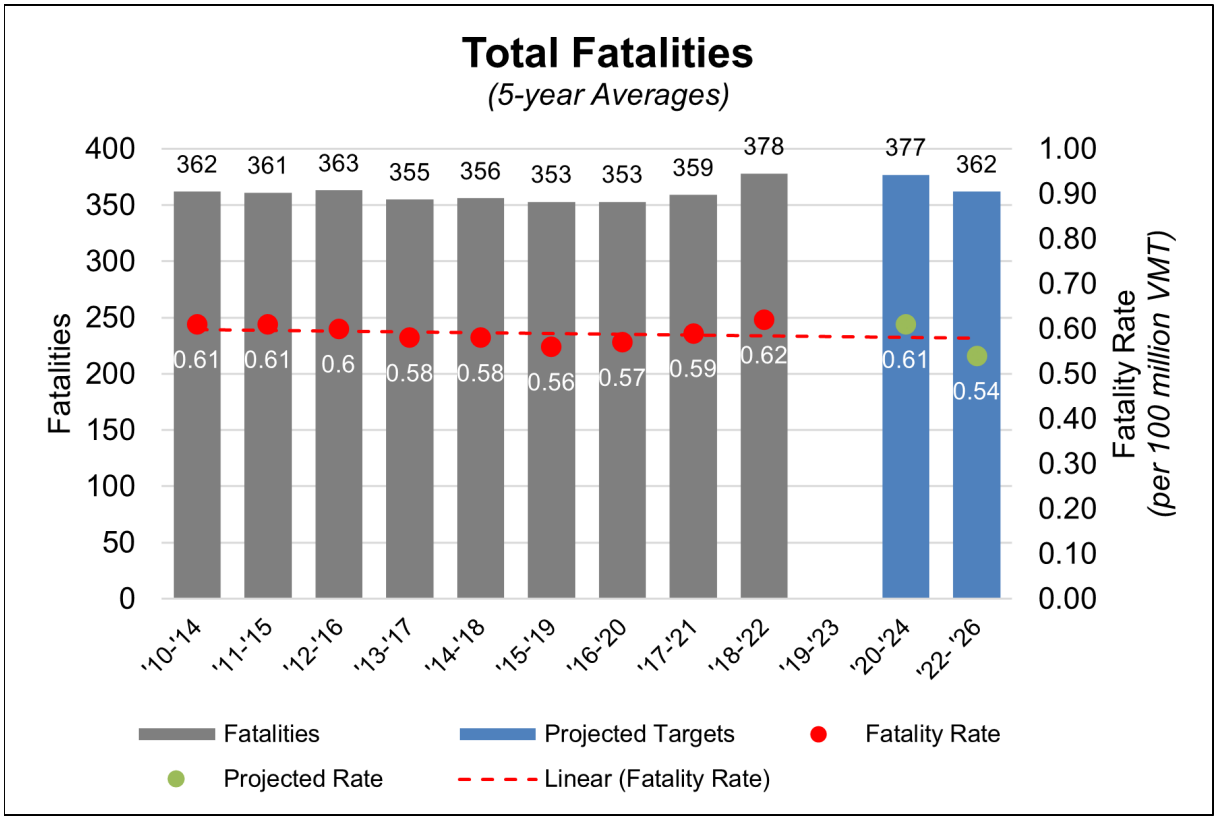
Fatality Rate

The annual fatality rate is the total number of fatalities divided by the annual vehicle miles traveled (in 100 millions) for a given year. This performance target represents the five-year average of the annual fatality rate. The fatality rate illustrates how many roadway deaths occurred per 100 million miles driven by vehicles in Massachusetts.

The COVID-19 pandemic greatly impacted VMT, causing fatality rates to spike in 2020 with significantly lower VMT and slightly higher fatalities. Data projections for 2023 indicate VMT will exceed pre-pandemic levels. Consequently, the five-year average fatality rate is expected to decrease from 0.62 fatalities per 100 million VMT for 2018-2022, to 0.61 fatalities per 100 million VMT in 2020-2024, a reduction of 1.63 percent. If this trend continues, MassDOT projects a decrease to 0.54 fatalities per 100 million VMT by 2026, a reduction of 12 percent.

Figure 1 shows the five-year rolling average fatalities and fatality rate between 2014 and 2022, alongside the targets for 2024 and 2026.

Figure 2.1 Fatalities, 2014–2022 with 2024 and 2026 Targets



Total Serious Injuries

The target setting process began with a trend line projection based on the most recent available data. The 2021 and 2022 serious injury data were not finalized in the statewide crash system during this process, so it is possible these figures will change once that data becomes final.

Due to higher rates of speeding caused by decreased VMT amid pandemic shutdowns in 2020 and the lingering impacts in 2021 and 2022, serious injuries increased relative to previous years. Although the latest 2023 data suggests serious injuries are trending towards pre-COVID levels, the data is incomplete and was not used when the target setting process began. Therefore, MassDOT developed the target for CY 2024 by projecting the 2023 and 2024 serious injuries to be in line with pre-COVID data. As a result, year over year changes reflect a decrease of approximately 10 percent

when comparing 2021 and 2022 to 2023 and 2024. However, the 5-year average from 2018-2022 to 2020-2024 remains the same at 2,708 serious injuries. If this trend continues, the 2022-2026 average will drop to 2,603, a 4 percent reduction.

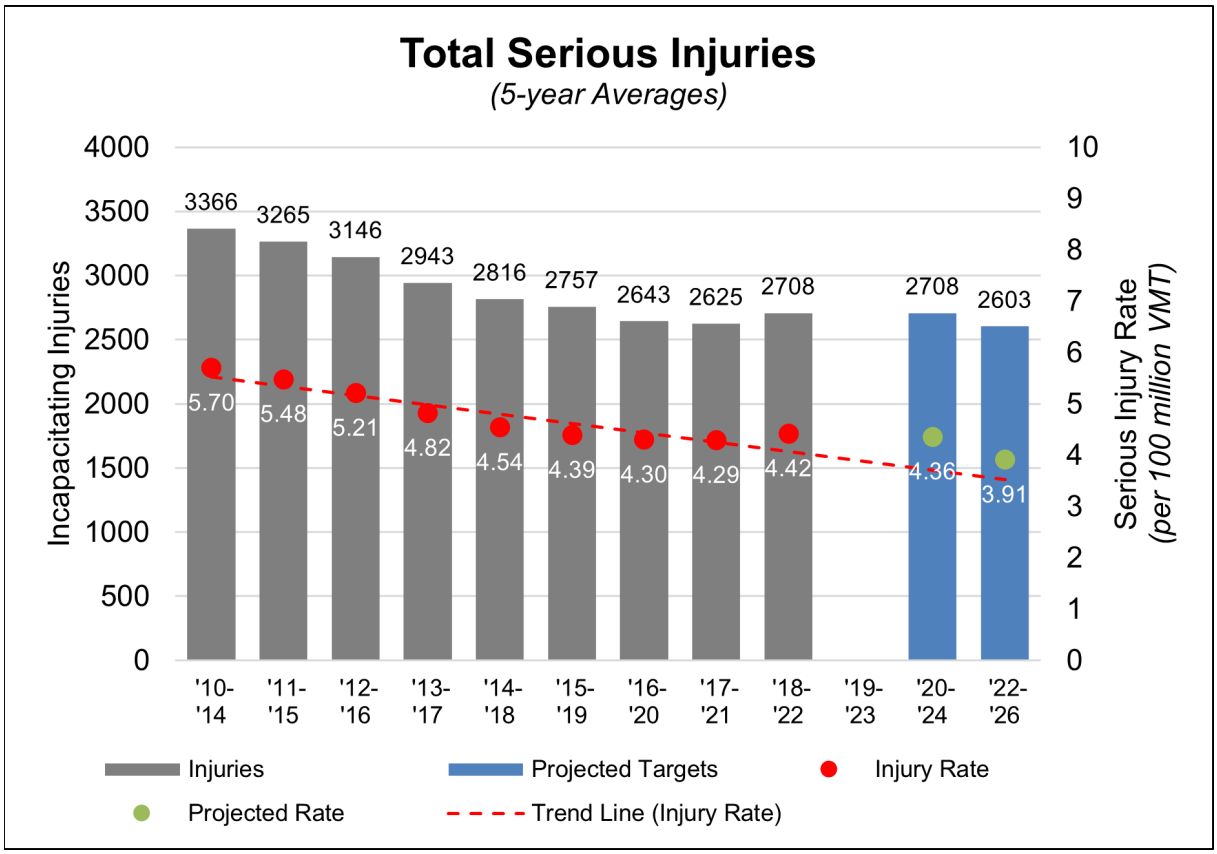
Serious Injury Rate

The serious injury rate is calculated in a similar way as the fatality rate five-year rolling average. The serious injury rate illustrates how many roadway serious injuries occurred per 100 million miles driven by vehicles in Massachusetts.

Similar to the fatality rate, serious injury rates were greatly impacted due to COVID. Following the methods above, the projection is now 4.36 serious injuries per 100 million VMT for 2020-2024. This reflects a 1.36 percent reduction compared to the 2018-2022 serious injuries rate of 4.42. If this trend continues, the 2022-2026 rate will drop to 3.91 serious injuries per 100 million VMT, an 11 percent reduction.

Figure 2 shows the five-year rolling averages for serious injuries and serious injury rate between 2014 and 2022, alongside the targets for 2024 and 2026.

Figure 2.2 Serious Injuries, 2014–2022 with 2024 and 2026 Targets



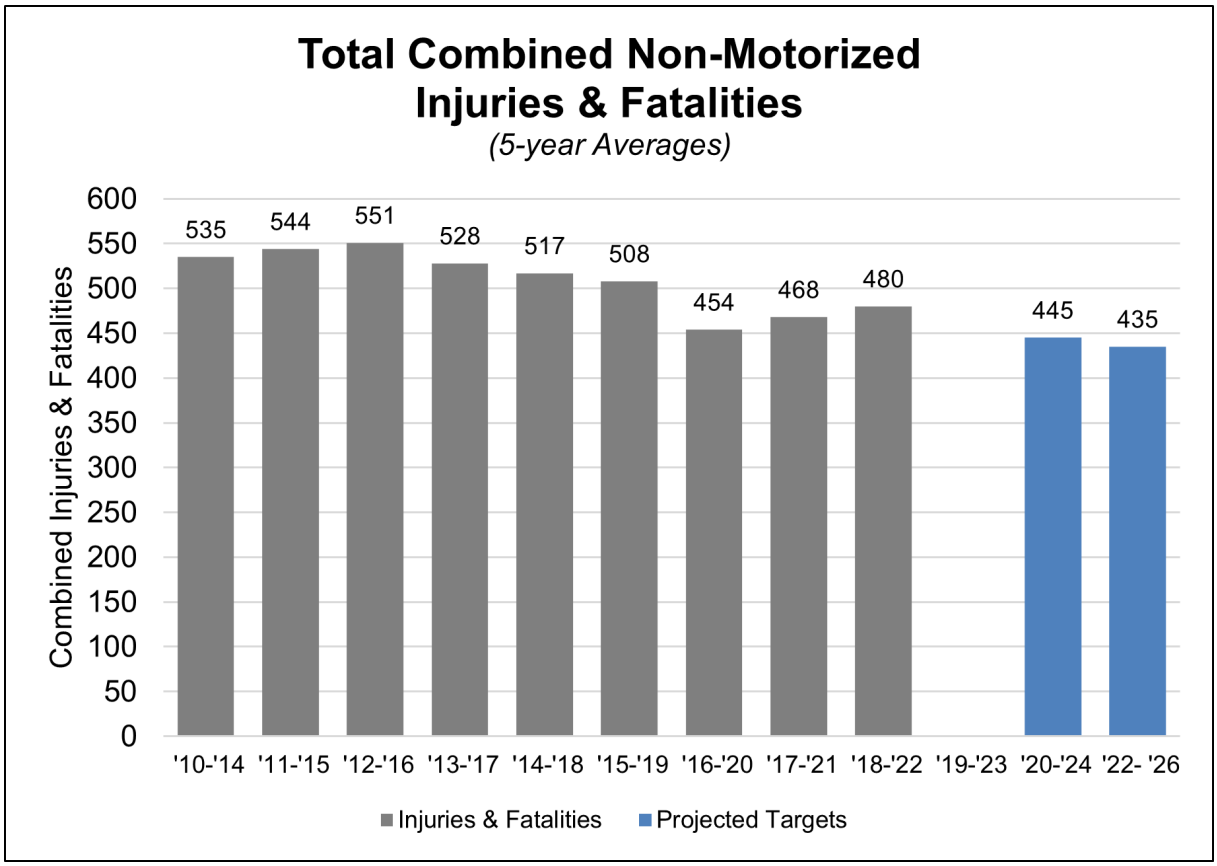
Non-Motorized Fatalities and Serious Injuries

The number of non-motorized fatalities and serious injuries is the combined total of roadway fatalities and serious injuries who were pedestrians, bicyclists, other cyclists, or persons on personal conveyances.

The number of non-motorized fatalities and serious injuries decreased during the start of the pandemic in 2020, followed by an increase in 2021 and further dramatic spike in 2022. Based on the state's emphasis on vulnerable road users, MassDOT anticipates the 2023 and 2024 numbers to match those from 2020. This results in a five-year average of non-motorist fatalities and serious injuries decreasing from 480 (2018-2022) to 445 (2020-2024), a 7.3 percent reduction. Looking ahead to 2026, the average combined non-motorist fatalities and serious injuries is expected to decrease to 435, a reduction of approximately nine percent.

Figure 3 shows the five-year rolling averages for total non-motorized fatalities and serious injuries between 2014 and 2022, alongside the targets for 2024 and 2026.

Figure 2.3 Non-Motorized Injuries and Fatalities, 2014-2022 with 2024 and 2026 Targets



A Final Note

The fatality and serious injury data contained here was developed to align with the data included in MassDOT's annual Highway Safety Improvement Program (HSIP) report. As such, historical data may be different from what was reported in prior years.

The targets were developed in coordination with the Executive Office of Public Safety and Security (EOPSS), the Highway Safety Division, and other sections within MassDOT. Although MassDOT emphasizes that the state's goal is zero fatalities and serious injuries, the state targets presented here are not "goals" but realistic targets considering the events of the last three years. The Secretary of Transportation and Highway Division Administrator for MassDOT approved the targets recognizing that MassDOT must demonstrate short term incremental steps in order to achieve the Commonwealth's goal.

Measuring Over Time: Pedestrian Crash Cluster Area per Population in REJ+ and non-REJ+ Communities

Beyond Mobility explored disparate impacts experienced by Environmental Justice and other vulnerable communities, using MassDOT's definition and data for Regional Environmental Justice "Plus" (REJ+). REJ+ communities include communities with higher concentrations of poverty, non-white households, people with limited English proficiency, households without access to a vehicle, people with disabilities, or people ages 65 years and older, in comparison to nearby communities. For an in-depth description of REJ+ communities, refer to *Beyond Mobility* Section 2.2 Needs Assessment.

Additionally, MassDOT has conducted a longitudinal analysis of the pedestrian crash cluster area per population[3] in REJ+ and non-REJ+ communities by using MassDOT's Top Five-Percent Pedestrian Crash Clusters. While the data is updated annually, each data set reflects a ten-year average. The analysis is based on the past five available data sets (2007-2016, 2008-2017, 2009-2018, 2010-2019, and 2011-2020). This analysis was done by assigning pedestrian crash cluster areas to either REJ+ or non-REJ+ block groups based on their location and then evaluating non-motorist crashes per one million population.

Table 2.2 and Figure 2.4 present the disparity between REJ+ and non-REJ+ communities as it relates to pedestrian crash cluster area per population. The difference in pedestrian crash cluster area between REJ+ and non-REJ+ communities has slightly increased over the past five years of datasets. MassDOT would like to see the disparity between REJ+ and non-REJ+ communities, as well as overall pedestrian crash cluster areas, decrease over time.

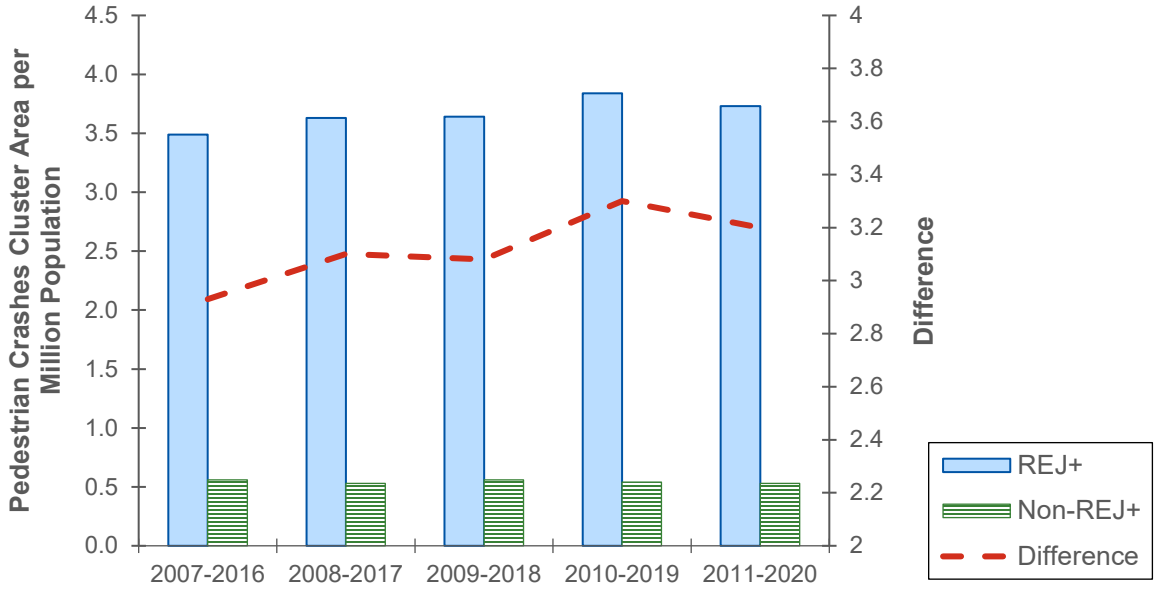
[3] Crash clusters are developed in GIS software using a cluster analysis methodology where multiple crashes are merged together based on proximity, and therefore vary by size. The top five percent of crash clusters are determined using crash severity weighting, with more weight given to fatal and serious injury crashes. Unit is crash cluster area (square miles) per one million population. https://www.mass.gov/doc/2017-top-crash-locations-report/download.

Table 2.2 Pedestrian Crash Cluster Area per Million Population in REJ+ and non-REJ+ Communities, 2016–2020 (Five-Year Average)

Years	REJ+	Non-REJ+	Difference
2007-2016	3.5	0.6	2.9
2008-2017	3.6	0.5	3.1
2009-2018	3.6	0.6	3.1
2010-2019	3.8	0.5	3.3
2011-2020	3.7	0.5	3.2

[a] *Difference of REJ+ minus non-REJ+*

Figure 2.4 Pedestrian Crash Cluster Area per Million Population in REJ+ and non-REJ+ Communities, 2016-2020 (Five-Year Average)



Measuring Over Time: Number of Non-Motorist Serious Injuries and Fatalities per Population in REJ+ and non-REJ+ Communities

A longitudinal analysis of fatal and serious injury non-motorist crashes using MassDOT's IMPACT portal for the years 2018 to 2022 was also performed by assigning non-motorist filtered crashes (pedestrian and bicyclist) to either REJ+ or non-REJ+ block groups based on their location, and then comparing non-motorist crashes per community 100,000 population.

Table 2.3 presents the disparity between REJ+ and non-REJ+ communities as it relates to non-motorist fatal and serious crashes per population. Figure 2.5 and Figure 2.6 illustrate these trends.

While there have been more fatal and serious crashes in REJ+ communities in each data year shown, the disparity between non-motorist fatal and serious injury crashes between REJ+ and non-REJ+ communities has slightly decreased over the past five years of data, with a slight increase in 2022. MassDOT would like to see the disparity between REJ+ and non-REJ+ communities, as well as overall non-motorist crashes, continue to decrease over time.

Table 2.3 Fatal and Serious Non-Motorist Crashes per 100,000 Population in REJ+ and non-REJ+ Communities, 2018–2022

	Pedestrian			Bicyclist		
Year	REJ+	Non-REJ+	Difference[1]	REJ+	Non-REJ+	Difference
2018	43	16	27	19	11	8
2019	43	16	26	20	12	8
2020	28	11	18	15	10	5
2021	31	13	18	15	11	4
2022	37	15	22	19	13	6

[1] *Difference of REJ+ minus non-REJ+*

Figure 2.5 Fatal and Serious Pedestrian Crashes per 100,000 Population in REJ+ and non-REJ+ Communities, 2018–2022

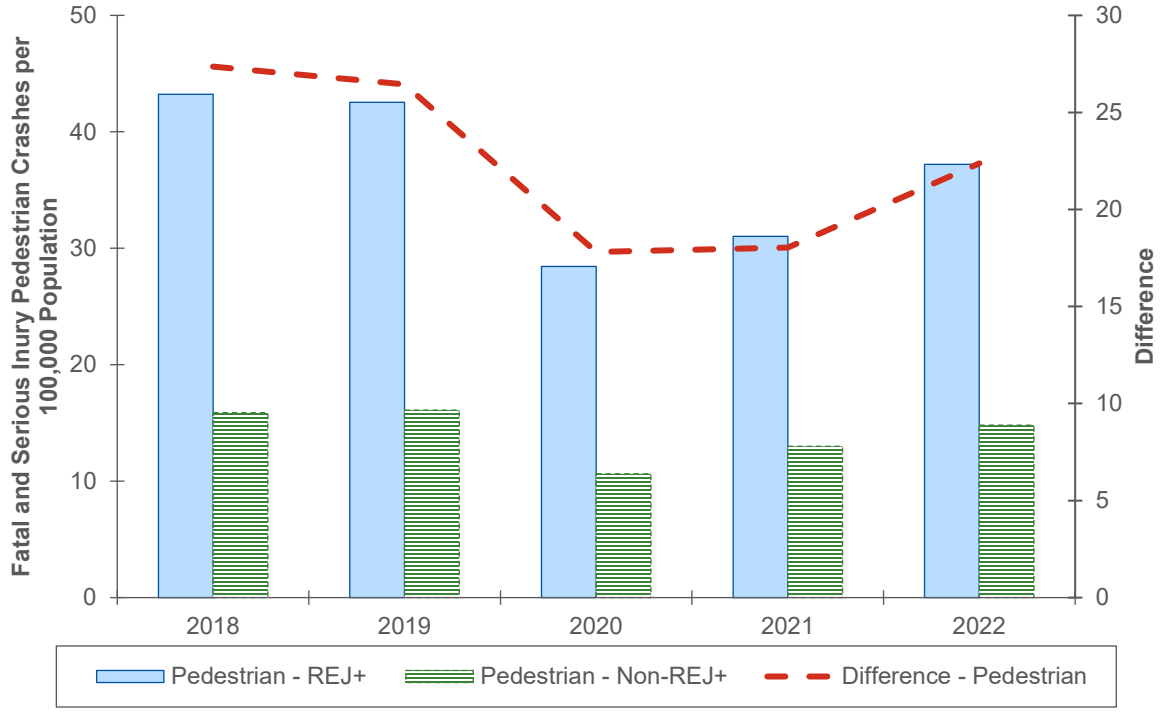
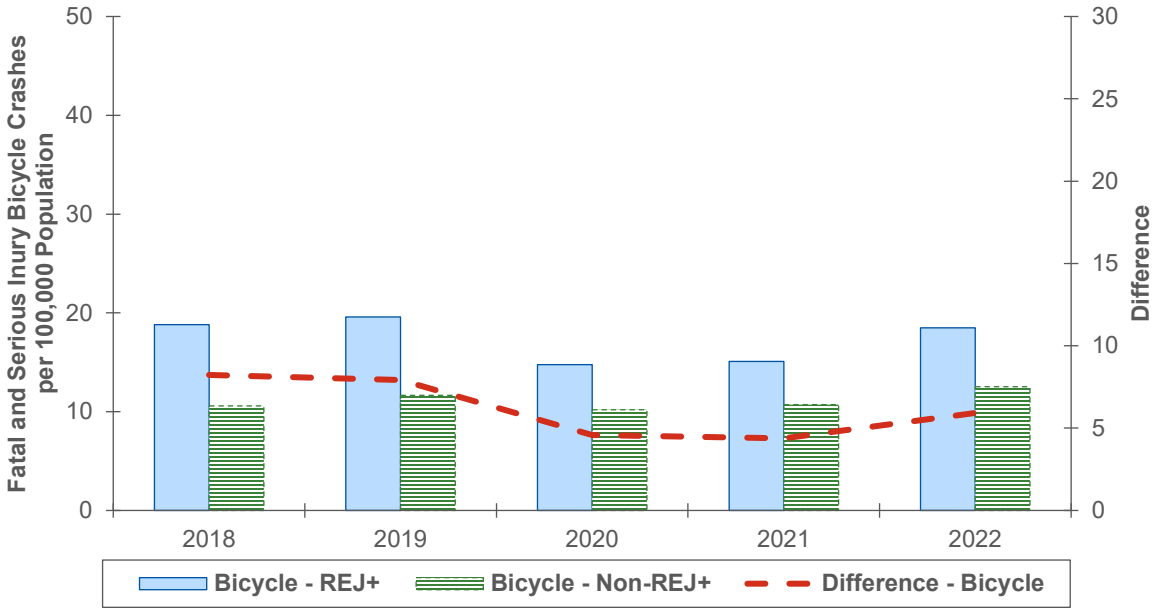


Figure 2.6 Fatal and Serious Bicyclist Crashes per 100,000 Population in REJ+ and non-REJ+ Communities, 2018-2022



MassDOT's Vulnerable Road User Assessment found that:[4]

- 50 percent of all fatal and serious injury pedestrian crashes occurred in a REJ+ community, and 38 percent of all fatal and serious injury bicycle crashes occurred in a REJ+ community.
- Crashes involving vulnerable road users (e.g., pedestrians, bicyclists, and other non-motorists) increased between 2020 and 2022.
- Pedestrian fatalities reached a new high in Massachusetts in 2022, with 101 people dying in a crash-related incident. Bicyclist fatalities were also high in 2022, but still lower than five of the recorded years since 2004, with 10 cyclists dying on the road in 2022, and 124 cyclists seriously injured.

The Assessment also found a correlation between crashes and transit proximity: 41 percent of pedestrian-involved crashes and 34 percent of bicyclist crashes occurred within 300 feet of bus stops statewide, and this statistic is even higher in Boston-area communities, where 45 percent of bicyclist crashes and 50 percent of pedestrian crashes happened within 300 feet of an MBTA bus stop. MassDOT has a goal of reducing crashes in proximity to transit.

Measuring Over Time: Number of Vehicular Fatal and Serious Injury Crashes per Population in REJ+ and non-REJ+ Communities

A longitudinal analysis of vehicular fatal and serious injury crashes using MassDOT's IMPACT portal for the years 2018 to 2022 was performed by assigning fatal and serious injury crashes to either

[4] https://storymaps.arcgis.com/stories/8b36ed2f1f3749b7ac085c0ca5b8efa7

REJ+ or non-REJ+ block groups based on their location and then compared crashes per community 100,000 population.

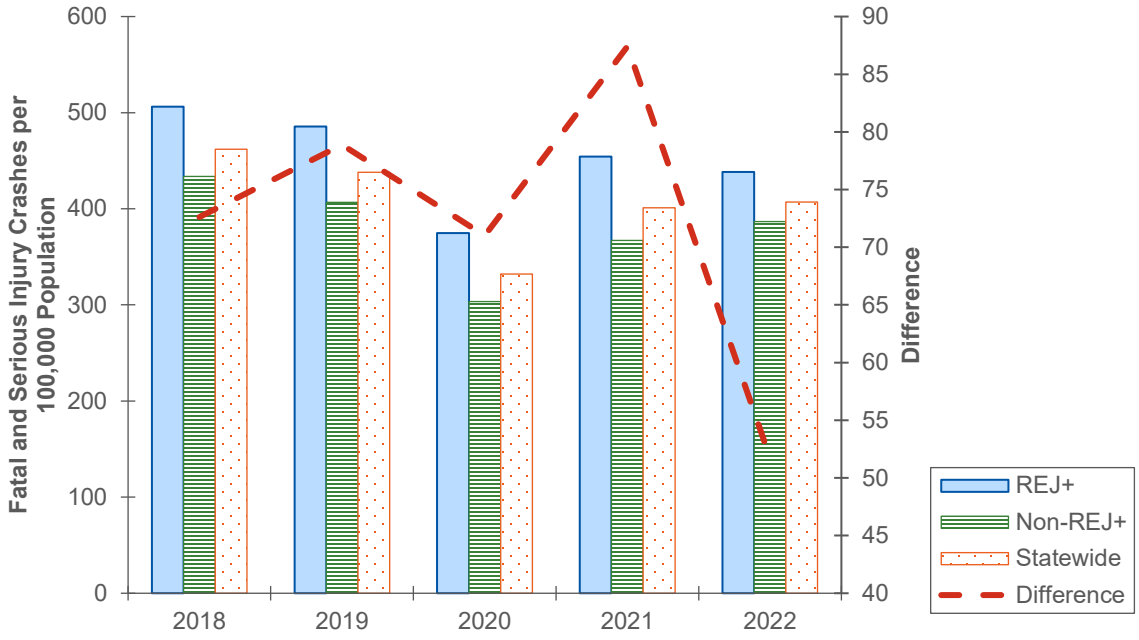
Table 2.4 and Figure 2.7 present the disparity between REJ+ and non-REJ+ communities as it relates to fatal and serious crashes per population. Overall, the fatal and serious injury crashes per population have decreased over the past five years of available data, as well as the gap between REJ+ and non-REJ+ communities. MassDOT would like to see fatal and serious injury crashes and the disparity between REJ+ and non-REJ+ communities continue to decrease over time.

Table 2.4 Fatal and Serious Vehicular Crashes per 100,000 Population in REJ+ and non-REJ+ Communities, 2018-2022

Years	REJ+	Non-REJ+	Difference[1]	Statewide
2018	506	433	73	462
2019	486	407	79	438
2020	375	304	71	332
2021	454	367	87	401
2022	438	387	52	407

[1] *Difference of REJ+ minus non-REJ+*

Figure 2.7 Fatal and Serious Vehicular Crashes per 100,000 Population in REJ+ and non-REJ+ Communities, 2018–2022



Measuring Over Time: Percent Difference in Roadway Risk Miles between REJ+ and non-REJ+ Communities

In addition to traditional crash-based screening, MassDOT also uses risk-based analysis. This analysis identifies locations with the highest risk of fatal and serious injury crashes for a number of emphasis areas of the Strategic Highway Safety Plan. An analysis of total roadway risk mile data was performed by assigning roadway risk segments to either REJ+ or non-REJ+ block groups based on their location. Then the percentages of total miles of roadway risk were compared per 100,000 population.

Figure 2.8 and Figure 2.9 present the disparity between REJ+ and non-REJ+ communities as it relates to miles of roadway risk and percentage of roadway risk miles per population for the current dataset. The miles of roadway risk per population remains consistent in REJ+ and non-REJ+ communities throughout the Commonwealth; however, a higher percentage of roadway miles are classified as high risk within REJ+ communities than non-REJ+ communities. The roadway risk segments are located throughout the state, with high concentrations within urban areas, such as Boston, Worcester, and Lowell, where there are also higher concentrations of REJ+ designated communities.

While the 2013-2017 data set is currently the only one available, more detailed analysis may be completed in the future as additional years of data become available. MassDOT would like to see the overall miles of roadway risk decrease over time, as well as see the disparity between REJ+ and non-REJ+ communities decrease over time.

Figure 2.8 Roadway Risk Miles per 100,000 Population in REJ+ and non-REJ+ Communities

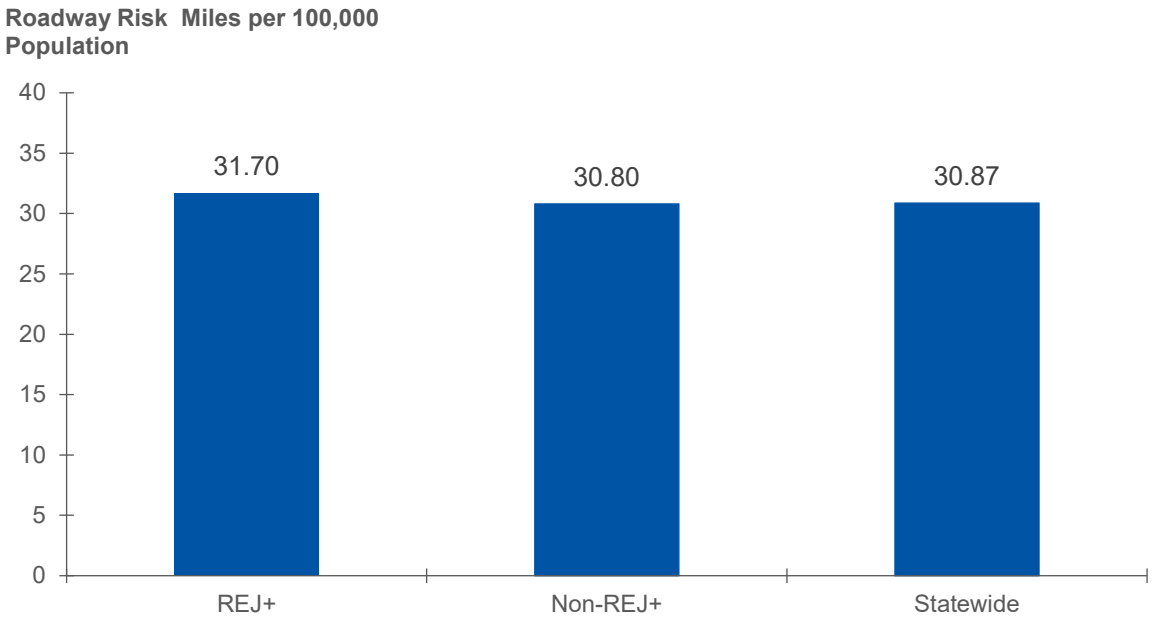
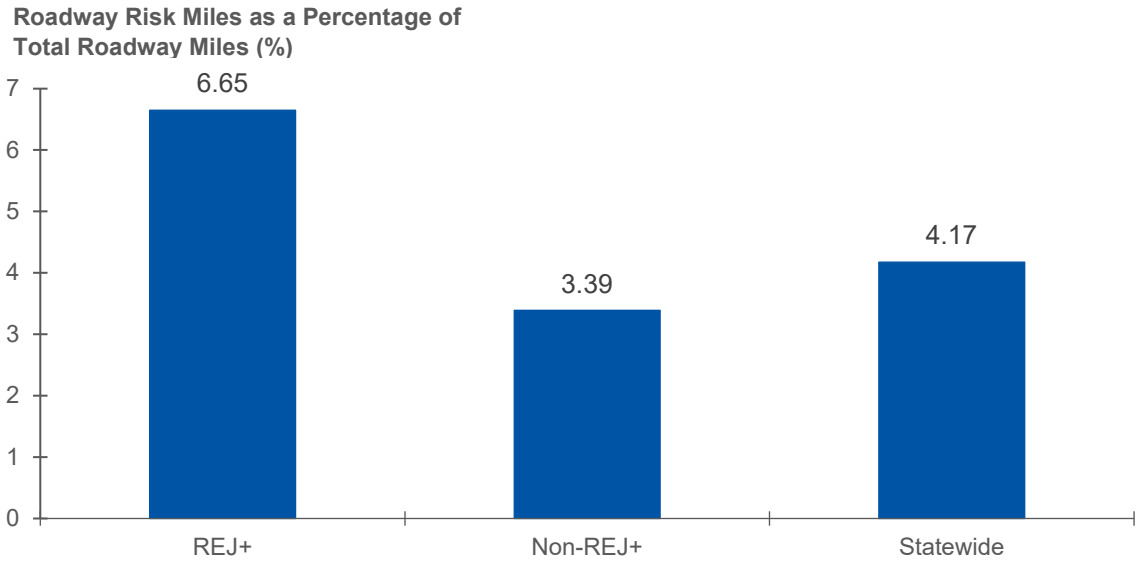


Figure 2.9 Roadway Risk Miles as a Percentage of Total Roadway Miles in REJ+ and non-REJ+ Communities



Measuring Over Time: Number of Fatalities on Principal or Minor Arterials

To contextualize progress toward addressing the problem statement that **Massachusetts traffic fatality rates have risen since 2019, despite lower vehicle miles traveled**, MassDOT has conducted an analysis of the number of fatalities on principal and minor arterial roadways for the years 2018 to 2022 using MassDOT's IMPACT portal and the state's authoritative Road Inventory File. As part of this analysis, fatal crashes were classified by the roadway facility they are located on, and then compared year over year.

Table 2.5 presents the number of fatal crashes that occurred on principal or minor arterials for the following three functional classifications: Rural or Urban Principal Arterial; Rural Minor Arterial or Urban Principal Arterial; and Urban Minor Arterial or Rural Major Collector. Over the past five years of available data, the total number of fatal crashes on these roadway classes has increased. MassDOT has a general goal of decreasing fatal collisions over time.

Table 2.5 Fatal Crashes on Arterial and Collector Roadways, 2018–2022

Years	Rural or Urban Principal Arterial Class[1] 2	Rural Minor Arterial or Urban Principal Arterial Class[1] 3	Urban Minor Arterial or Rural Major Collector Class[1] 5	Total
2018	35	65	103	203
2019	34	69	78	181
2020	36	73	97	206
2021	48	74	109	231
2022	60	73	116	249

[1] *Class is based on coding within MassDOT's Road Inventory Functional Classification.*

2.2 Transit Safety

49 CFR Section 673 requires Section 5307 recipient agencies to establish a *Public Transportation Agency Safety Plan* (PTASP), and mandates state DOTs to assist in the preparation of these plans for all small urban transit agencies. FTA established four performance measures to evaluate safety performance for transit agencies (for more detail on these measures, please refer to the National Transit Database (NTD) Safety and Security Policy Manual):[5]

- **Fatalities |** A reportable event that occurs at a transit revenue facility, maintenance facility, or rail yard, on transit right-of-way or infrastructure during a transit-related maintenance activity; or involves a transit revenue vehicle that results in a fatality. Fatalities that occur because of illnesses, drug overdoses, or other natural causes are not reportable. With one exception, RTAs' CY2021 performance was on target for fatalities.

- **Injuries |** A reportable event that occurs at a transit revenue facility, maintenance facility, or rail yard, on transit right-of-way or infrastructure during a transit-related maintenance activity; or involves a transit revenue vehicle that results in any damage or harm to persons that requires immediate medical attention away from the scene. Illnesses (e.g., seizure, heart attack) that require immediate medical attention away from the scene are not reportable. For the most part, RTAs' CY2021 performance was well below the target for reportable injuries.

- **Safety Events |** A collision, unsuppressed fire, hazardous materials spill, or natural disaster that occurs at a transit revenue facility, maintenance facility, or rail yard, on transit right-of-way or infrastructure during a transit-related maintenance activity; or involves a transit revenue vehicle that is inclusive of the following event types. For the most part, RTAs' CY2021 performance was well below the target for reportable safety events.

[5] https://www.transit.dot.gov/sites/fta.dot.gov/files/2022-02/2022%20Safety%20and%20Security%20Policy%20Manual%20Version%201.0_0.pdf.

- **Preventable Accidents per 100,000 Vehicle Revenue-Miles (VRM) |** The number of preventable crashes for every 100,000 revenue miles operated. A preventable accident is defined as a crash in which the transit personnel did not do everything reasonably expected to prevent the crash from occurring. For the most part, RTAs' FY2022 performance was well below the target for preventable incidents.

Table 2.6 provides the transit safety targets established by the MBTA and the RTAs. Note that these targets are updated annually. Figures 2.10 and 2.11 show the statewide RTA dashboard for safety measures on Fixed-Route and Demand Response modes, respectively.

Table 2.6 Targets for Transit Safety

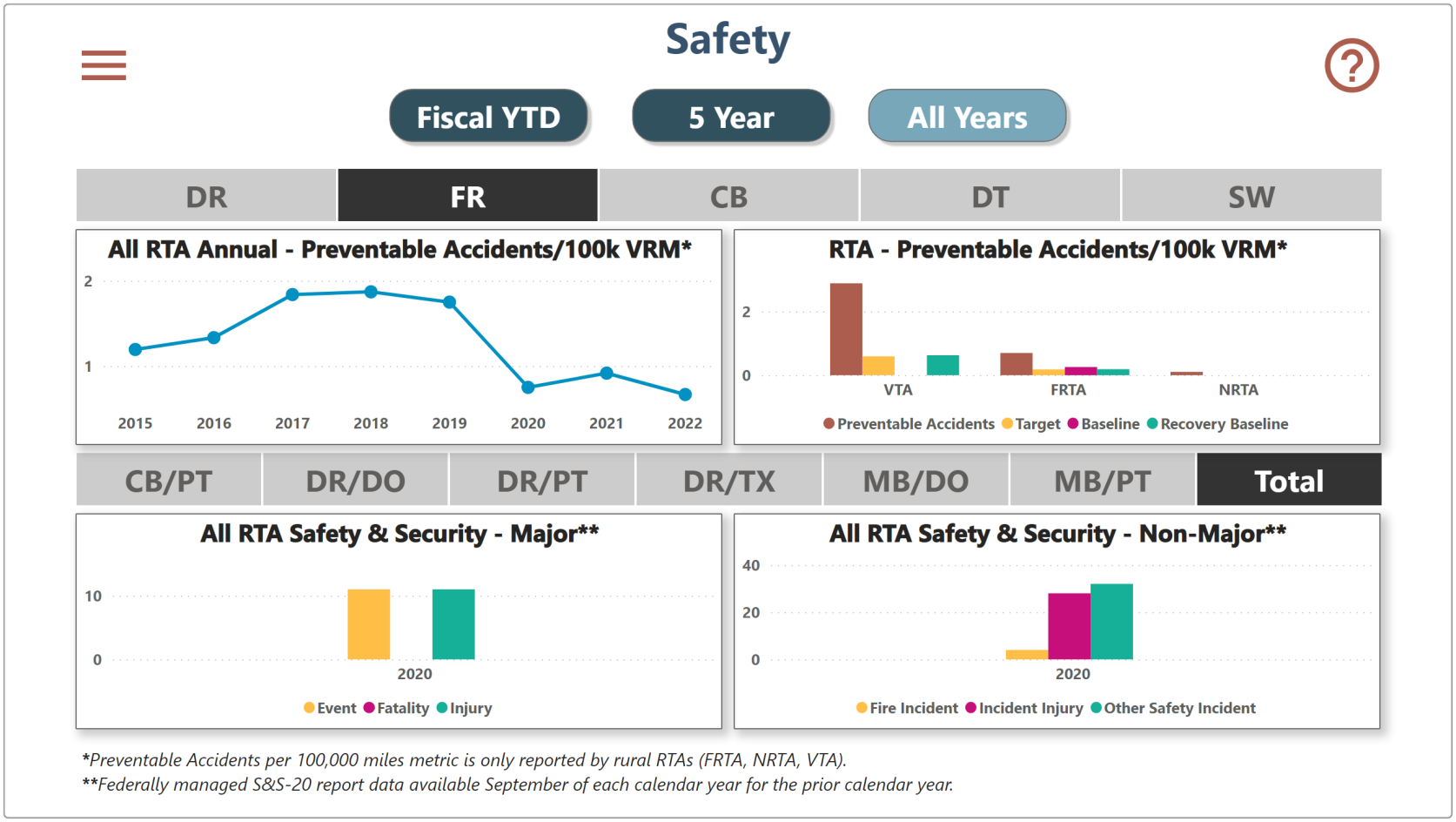
Agency Name (Year)	Mode	Fatalities (total)	Injuries (total)	Safety Events	Preventable Accidents per 100K VRM
MBTA (2023)	Heavy Rail	0.0	180.0	24.0	1.07
	Light Rail	0.0	79.0	27.0	4.94
	Bus	0.0	286.0	98.0	4.21
	The RIDE	0.0	27.0	20.0	1.74
BAT (2020)	Fixed-Route	0.0	10.0	6.0	4.6
	Demand Response	0.0	4.0	4.0	5.9
BRTA (2020)	Fixed-Route	0.0	4.0	3.0	3.2
	Demand Response	0.0	0.0	0.0	0.0
CATA (2023)	Fixed-Route	0.0	1.0	2.5	1.5
	Demand Response	0.0	1.0	2.5	1.0
CCRTA (2020)	Fixed-Route	0.0	8.0	16.0	1.2
	Demand Response (Paratransit)	0.0	4.0	8.0	0.2
	Demand Response (Taxi)	0.0	6.0	12.0	1.0
FRTA*	Fixed-Route	N/A	N/A	N/A	N/A
	Demand Response	N/A	N/A	N/A	N/A
GATRA (2020)	Fixed-Route	0.0	3.0	3.0	1.8
	Demand Response	0.0	2.0	2.0	1.3
LRTA (2021)	Fixed-Route	0.0	2.0	2.0	1.5
	Demand Response (Roadrunner)	0.0	1.0	1.0	2.4
	Demand Response (Council on Aging)	0.0	1.0	1.0	3.6
MART (2020)	Fixed-Route	0.0	5.0	5.0	7.5
	Demand Response	0.0	5.0	5.0	2.0

Agency Name (Year)	Mode	Fatalities (total)	Injuries (total)	Safety Events	Preventable Accidents per 100K VRM
MeVa (2019)	Fixed-Route	0.0	–	2.0	–
	Demand Response	0.0	–	2.0	–
MWRTA (2023)	Fixed-Route	0.0	12.0	15.0	1.25
	Demand Response	0.0	8.0	10.0	1.25
NRTA*	Fixed-Route	N/A	N/A	N/A	N/A
	Demand Response	N/A	N/A	N/A	N/A
PVTA	Fixed-Route	0.0	0.0	N/A	N/A
	Demand Response	0.0	0.0	N/A	N/A
SRTA (2022)	Fixed-Route	0.0	8.0	8.0	5.2
	Demand Response	0.0	1.0	1.0	1.9
VTA[1]	Fixed-Route	N/A	N/A	N/A	N/A
	Demand Response	N/A	N/A	N/A	N/A
WRTA (2020)	Fixed-Route	0.0	10.0	9.0	4.6
	Demand Response	0.0	1.0	1.0	0.8

[1] *FTA has deferred the requirement for the development of Public Transit Agency Safety Plans (PTASPs) for agencies that receive Federal funding only through the Enhanced Mobility of Seniors and Individuals with Disabilities Formula Program (Section 5310) and/or the Rural Area Formula Program (Section 5311).[6] Three RTAs in Massachusetts receive funds through Section 5311 only, and consequently they have not developed safety targets.*

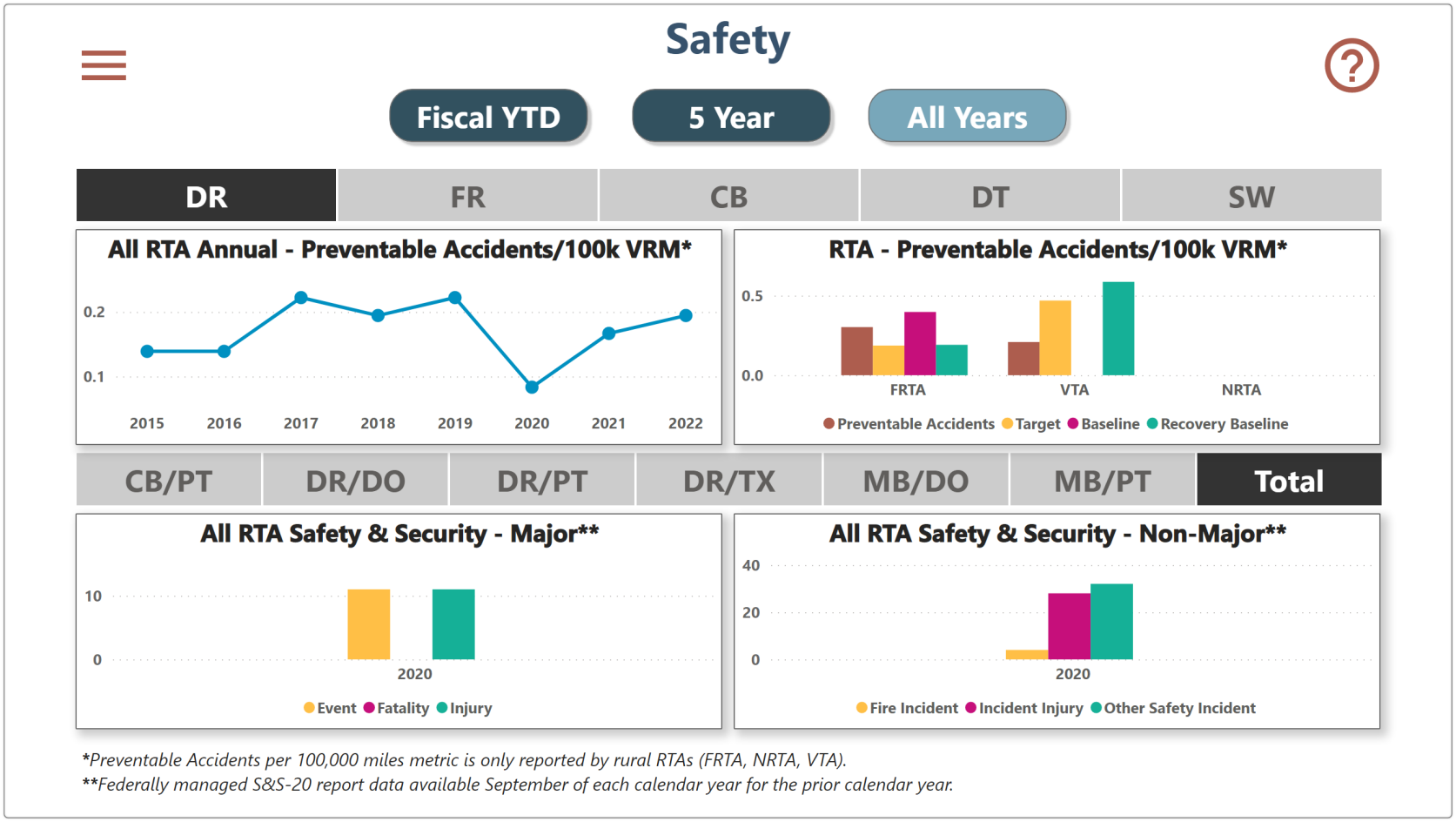
[6] https://www.transit.dot.gov/PTASP

Figure 2.10 RTA Performance Dashboard for Safety Measures on Fixed-Route, 2022



**Preventable Accidents per 100,000 miles metric is only reported by rural RTAs (FRTA, NRTA, VTA).*
***Federally managed S&S-20 report data available September of each calendar year for the prior calendar year.*

Figure 2.11 RTA Performance Dashboard for Safety Measures on Demand Response, 2022



**Preventable Accidents per 100,000 miles metric is only reported by rural RTAs (FRTA, NRTA, VTA).*
***Federally managed S&S-20 report data available September of each calendar year for the prior calendar year.*

3.0 Infrastructure Condition

3.1 Highway Infrastructure Condition

Effective May 20, 2017, FHWA established performance measures to assess pavement condition and bridge condition for the National Highway Performance Program.[7,8] This second FHWA performance measure rule (also known as "PM2") established six performance measures:

- Percent of Interstate pavements in good condition.
- Percent of Interstate pavements in poor condition.
- Percent of non-Interstate National Highway System (NHS) pavements in good condition.
- Percent of non-Interstate NHS pavements in poor condition.
- Percent of NHS bridges by deck area classified as in good condition.
- Percent of NHS bridges by deck area classified as in poor condition.

Condition of NHS Pavement

MassDOT manages just 13 percent of the Commonwealth's roads (9,600 out of 73,000 lane-miles), yet processes more than half of Massachusetts vehicle miles traveled. The MassDOT road network includes the Interstate system, freeways, and other major roadways that provide local, regional, and national connectivity.

MassDOT pavement is a significant Commonwealth asset. Pavement science and sustained investment ensure that the network remains safe and reliable at the least cost to the Commonwealth. The MassDOT Pavement Management Section operates a state-of-the-art vehicle that automatically collects pavement distress data, and informs a data-driven process to choose the "right treatment" at the "right time." Using current condition data, deterioration curves, and specialized software, MassDOT can interrogate various investment scenarios for consideration in the CIP.[9]

The Federal pavement condition measures are expressed as the percentage of both Interstate and non-Interstate NHS roads in good or poor condition according to an FHWA metric that incorporates International Roughness Index (IRI), several types of cracking, rutting, and raveling. Pavement in good condition suggests that no major investment is needed. Pavement in poor condition suggests major reconstruction investment is needed due to either ride quality or a structural deficiency.

7 23 CFR Part 490, Subpart C.
8 23 CFR Part 490, Subpart D.
9 2021 Performance & Asset Management Advisory Council Update, p. 2.

Condition of NHS Bridges

The definition of a bridge is a "structure of a span of 20 feet or greater"; there are approximately 5,260 examples meeting this criterion in Massachusetts. These are known as National Bridge Inventory (NBI) structures. MassDOT owns 3,494 of these structures, and also inspects the 1,646 municipally owned NBI structures. The sum of these two inventories, 5,140 structures, is the focus of the bridge program within the CIP. Of these, 2,298 structures are on the NHS.

Massachusetts bridges are 25 years older than the national average, which combined with unforgiving winters and traffic from an active and growing state, has resulted in a considerable repair backlog. Based on NBI data, Massachusetts ranks fourth worst in the nation for bridge condition on the NHS. Today's conditions reflect the $3 billion investment of the Accelerated Bridge Program (2008-2018), which rehabilitated or replaced nearly 300 bridges and forestalled a further decline of condition. However, a significant investment is needed to rehabilitate or replace legacy infrastructure and sufficiently fund maintenance and preservation.[10]

The bridge condition measures represent the percentage of bridges, by deck area, on the NHS that are in good condition or poor condition. The condition of each bridge is evaluated by assessing four primary bridge components: deck, superstructure, substructure, and culverts. FHWA created a metric rating threshold for each component to establish good, fair, or poor condition, as shown in Figure 3.1.

Figure 3.1 NBI Condition Rating Scale

Name	Score	Description
Good	9	Pristine condition.
	8	No problems noted.
	7	Insubstantial flaws.
Fair	6	Minor deterioration.
	5	Elements sound, some defects.
Poor	4	Advanced defects.
	3	Local failures, cracking begins.
	2	Support failure, closure possible.
	1	Elements moving, bridge closed.
	0	Out of service, beyond repair.

Every bridge on the NHS is evaluated using these component ratings. If the lowest rating of the four metrics is greater than or equal to seven, the structure is classified as good. If the lowest rating is less than or equal to four, the structure is classified as poor. If the lowest rating is five or six, it is classified as fair.

To determine the percent of bridges in good or poor condition, the sum of total deck area of good or poor NHS bridges is divided by the total deck area of bridges carrying the NHS. Deck area is

[10] 2021 Performance & Asset Management Advisory Council Update, p. 3.

computed using structure length and either deck width or approach roadway width. Good condition suggests that no major investment is needed. Bridges in poor condition are safe to drive on; however, they are nearing a point where substantial reconstruction or replacement is needed.

Highway Infrastructure Condition Targets

Table 3.1 presents performance for the PM2 measures for the 2021 baseline year, as well as the current two-year and four-year statewide targets established by MassDOT. All of the performance measures and targets provided in Table 3.1 are tracked in greater detail in MassDOT's 2022 *Transportation Asset Management Plan* (TAMP).[11]

Table 3.1 Targets for Highway Infrastructure Condition, 2021-2025

Performance Measure	Current (2021)	2-Year Target (2023)	4-Year Target (2025)
Bridges in Good Condition	16%	16%	16%
Bridges in Poor Condition	12.2%	12%	12%
Interstate Pavement in Good Condition	71.8%	70%	70%
Interstate Pavement in Poor Condition	0%	2%	2%
Non-Interstate Pavement in Good Condition	34%	30%	30%
Non-Interstate Pavement in Poor Condition	3%	5%	5%

3.2 Transit Asset Management

Under the TAM Final Rule, FTA established four performance measures to approximate the State of Good Repair (SGR) for four categories of capital assets. Calculating performance measures helps transit agencies to quantify the condition of their assets, which facilitates setting targets that support local funding prioritization.[12]

- **Rolling Stock |** Percentage of revenue vehicles (e.g., buses, vans, cars, railcars, locomotives, trolley cars and buses, and ferry boats) exceeding useful life benchmark (ULB). A ULB is defined as the expected lifecycle of a capital asset—or the acceptable period of use in service—for a particular transit provider's operating environment.

- **Equipment |** Percentage of non-revenue service vehicles (e.g., automobiles, trucks, or steel wheel vehicles used by supervisors or maintenance staff) exceeding ULB.

- **Facilities |** Percentage of facilities rated under 3.0 on the TERM scale. FTA uses the five-point Transit Economic Requirements Model (TERM) scale to rate the condition of all passenger

11 https://www.mass.gov/lists/massdot-asset-management.
12 https://www.transit.dot.gov/PerformanceManagement.

facilities used in revenue service as well as administrative and maintenance facilities for which the agency has a capital responsibility. A score of 0 is failure while 5 is new.

- **Infrastructure |** Percentage of track segments under performance restriction.

More detail on the MBTA's asset management practice can be found in the agency's *Transit Asset Management Plan*.[13] More detail on asset management performance for the RTAs can be found in the Annual Report on the Regional Transit Authority Performance Management Program, most recently published December 31, 2022.

Transit Asset Management Targets

Tables 3.2 through 3.4 provide the transit asset management targets established by the MBTA and the RTAs. Note that these targets are updated annually.

[13] https://cdn.mbta.com/sites/default/files/2022-11/2022-11-17-transit-asset-management-plan.pdf.

Table 3.2 Targets for Transit Asset Management—Revenue Vehicles, 2022

Agency Name	Bus	Cutaway	Minivan	Van	Over-the-Road Bus	Automobile	Articulated Bus
MBTA[1]	25.00%	N/A	N/A	19.00%	N/A	50%	30%
BAT	8.00%	25.00%	N/A	13.00%	N/A	N/A	N/A
BRTA	0.00%	30.00%	0.00%	N/A	N/A	N/A	N/A
CATA	40.00%	0.00%	N/A	N/A	N/A	N/A	N/A
CCRTA	0.00%	10.00%	0.00%	N/A	N/A	N/A	N/A
FRTA	0.00%	0.00%	N/A	0.00%	N/A	N/A	N/A
GATRA	24.00%	10.00%	N/A	34.00%	N/A	N/A	N/A
LRTA	5.00%	35.00%	0.00%	N/A	N/A	N/A	N/A
MVRTA	10.00%	20.00%	N/A	0.00%	N/A	N/A	N/A
MWRTA	17.00%	0.00%	N/A	N/A	33.00%	N/A	N/A
MART	N/A	25.00%	N/A	0.00%	N/A	0.00%	N/A
NRTA	0.00%	N/A	N/A	0.00%	N/A	N/A	N/A
PVTA	32.00%	39.00%	N/A	N/A	N/A	N/A	0.00%
SRTA	25.00%	25.00%	N/A	N/A	N/A	N/A	N/A
VTA	3.00%	0.00%	0.00%	0.00%	N/A	N/A	N/A
WRTA	22.64%	36.84%	100.00%	13.00%	N/A	N/A	N/A

[1] *MBTA Targets were set for 2021. RTA targets were set for 2022.*

Table 3.3 Targets for Transit Asset Management – Equipment and Facilities, 2022

Agency Name	Automobiles	Trucks and Other Rubber-Tired Vehicles	Passenger/Parking Facilities	Administrative/Maintenance Facilities
MBTA[1]	45.00%	27.00%	7.00%	45.00%
BAT	33.00%	37.50%	0.00%	0.00%
BRTA	100.00%	100.00%	0.00%	0.00%
CATA	N/A	100.00%	N/A	0.00%
CCRTA	0.00%	10.00%	0.00%	0.00%
FRTA	66.00%	85.00%	N/A	100.00%
GATRA	0.00%	14.00%	0.00%	0.00%
LRTA	33.33%	75.00%	0.00%	0.00%
MVRTA	N/A	17.00%	0.00%	0.00%
MWRTA	0.00%	8.33%	0.00%	0.00%
MART	N/A	50.00%	N/A	0.00%
NRTA	N/A	0.00%	N/A	0.00%
PVTA	100.00%	27.00%	0.00%	0.00%
SRTA	50.00%	50.00%	0.00%	0.00%
VTA	0.00%	N/A	0.00%	0.00%
WRTA	50.00%	75.00%	0.00%	0.00%

[1] *MBTA Targets were set for 2021. RTA targets were set for 2022.*

4.0 System Performance

4.1 Highway System Performance

Effective May 20, 2017, FHWA established measures to assess performance of the National Highway System, freight movement on the Interstate system[14], and the Congestion Mitigation and Air Quality Improvement (CMAQ) Program[15]. This third FHWA performance measure rule (PM3) established six performance measures, described below.

- **NHS Performance:**
  - Percent of person-miles traveled (PMT) on the Interstate system that are reliable.
  - Percent of PMT on the non-Interstate NHS that are reliable.
- **Freight Movement on the Interstate:**
  - Freight Reliability index derived from Truck Travel Time Reliability (TTTR).
- **Congestion Mitigation and Air Quality Improvement (CMAQ) Program:**
  - Annual hours of peak hour excessive delay per capita (PHED).
  - Percent of non-single occupant vehicle travel (Non-SOV).
  - Cumulative two-year and four-year reduction of on-road mobile source emissions for CMAQ funded projects (CMAQ Emission Reduction).

Reliability

Reliability in general represents how much extra time a traveler needs to plan for when making a trip. If it takes the traveler 30 minutes to make a trip on a typical day, but once per week it takes an hour, the traveler will need to plan 30 minutes extra into their trip to be guaranteed to make it in time. Level of Travel Time Reliability (LOTTR) represents the additional time needed to make a trip versus the normal travel time. In this case, the LOTTR would be 2.0, i.e., 60 minutes divided by 30 minutes.

The PM3 reliability measure for general travel is defined as the percent of PMT statewide that are "reliable" based on the results of the LOTTR calculation. LOTTR is the ratio of the 80th percentile travel time to the 50th percentile travel time over the course of a year. Average travel time data are collected every 15 minutes during all time periods other than 8 PM to 6 AM local time. A segment of the highway system is reliable if all the periods have an LOTTR that is less than 1.50. PMT for a

14 23 CFR Part 490, Subpart F.
15 23 CFR Part 490, Subparts G and H.

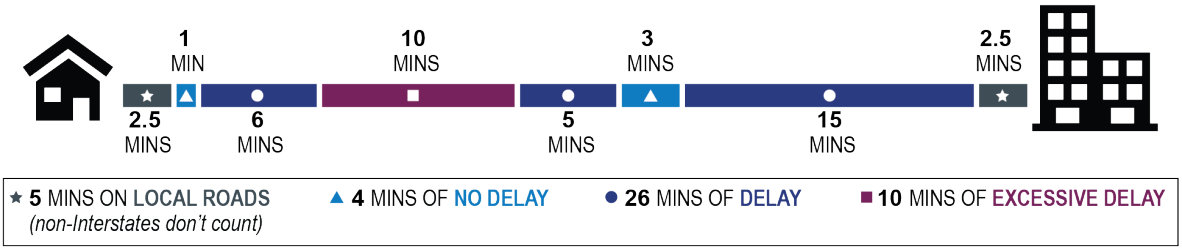
segment is computed by multiplying the Annual Average Daily Traffic (AADT) on a segment by vehicle occupancy and length.

TTTR is the ratio of the 95th percentile travel time to the 50th percentile travel time for trucks on a segment, or the longest travel time versus normal travel time. Freight Reliability is derived from TTTR for five time periods on Interstate segments: AM peak, midday, PM peak for weekdays, weekends, and overnight for all days. The measure is a weighted average of the Interstate system by length—a segment's highest value across the five periods is multiplied by the segment's length. The sum of all of these across the Interstate system is divided by the system's total length. The period with the worst TTTR will vary by segment. On less congested segments, the TTTR may occur overnight if trucks reduce speed in darkness.

Delay

Excessive delay means travel times that are longer than normal. More specifically, it means that travel times exceed a specific travel time threshold (the greater of either (a) 60 percent of posted limit or (b) 20 mph), as illustrated in Figure 4.1.

Figure 4.1 Excessive Delay Map for a Hypothetical Trip[16]



PHED quantifies the hours of delay resulting from traffic congestion on the NHS during morning and afternoon weekday peak travel times. Peak travel hours are defined as 6 AM to 10 AM on weekday mornings, and either 3 PM to 7 PM or 4 PM to 8 PM on weekday afternoons in 15-minute intervals. PHED is weighted by vehicle volumes and occupancy and is expressed as the annual hours of excessive delay during the peak hours on a per capita basis.

As an example: in a two-person household, Daniel drops off and picks up his toddler, Katy, at daycare on his drives to and from work.[17]

- Daniel and Katy represent two person-trips. Their trip each direction takes 36 minutes, of which six minutes are spent on local streets and 30 minutes are spent on a major highway with a 65-mph speed limit.

16 FHWA.
17 Adapted from NJTPA resource "Peak Hour Excessive Delay per Capita (PHED)." https://www.youtube.com/watch?v=mXTGteSlVU8.

- Of the 30 minutes of the trip on the major highway, 17 minutes are spent traveling at 65 mph or higher, eight are spent traveling at 40 mph or higher, and five are spent traveling at less than 39 mph (60 percent of the speed limit).

- Daniel and Katy experience five minutes of excessive delay per trip. Two trips per day and two people in the car gives their family unit 20 person-minutes per day. Following this routine 240 days per year gives them 80 person-hours per year, or 20 hours of PHED.

Applicability of the CMAQ Measures

The PHED and Non-SOV measures apply only within the boundaries of an urbanized area (UZA) that contains an NHS road, has a population of more than 250,000, and contains any part of a non-attainment or maintenance area for ozone, carbon monoxide, or particulate matter. States and MPOs with planning boundaries that are within any part of the applicable UZA must coordinate to set a single, unified four-year PHED target for the entire UZA, and single, unified two- and four-year targets for Non-SOV travel. The percentage of non-SOV travel is approximated using the U.S. Census Bureau's American Community Survey (ACS) Journey-to-Work data. This metric is based on the percentage of people commuting to work using a mode other than a single occupancy vehicle.

In Massachusetts, the PHED and Non-SOV measures apply to the Boston, Worcester, and Springfield UZAs. The majority of Massachusetts MPOs fall into one of these UZAs, and all three of them cross state lines – the Boston UZA is shared with New Hampshire and Rhode Island, while the Worcester and Springfield UZAs are shared with Connecticut. Memoranda of Understanding between MassDOT, New Hampshire DOT, Connecticut DOT, Rhode Island DOT, and MPOs overlapping the UZA on both sides of the border guide a collaborative process for setting a single set of targets for the UZA.[18,19,20]

Emissions reduction targets are measured as the sum total of all emissions reductions anticipated through CMAQ-funded projects in non-attainment or air quality maintenance areas (currently the cities of Lowell, Springfield, Waltham, and Worcester, and the town of Oak Bluffs) identified in the *Statewide Transportation Improvement Program* (STIP). This anticipated emissions reduction is calculated using the existing CMAQ processes.

18 https://www.ctps.org/data/calendar/pdfs/2020/MPO_0107_Providence_UZA_MOU.pdf.
19 https://www.ctps.org/data/calendar/pdfs/2020/MPO_0107_Worcester_UZA_MOU.pdf.
20 https://pvmpo.pvpc.org/wp-content/uploads/2021/10/2020-Springfield-MA-CT-UZA-MOU-Final.pdf.

Highway System Performance Targets

Table 4.1 presents performance for the PM3 measures for the 2021 baseline year, as well as the current two-year and four-year statewide targets established by MassDOT.

Table 4.1 Targets for Highway Infrastructure Condition, 2021-2025

Performance Measure	Current (2021)	2-Year Target (2023)	4-Year Target (2025)
Percent of Person-Miles on the Interstate System that are Reliable	84.2%	74.0%	76.0%
Percent of Person-Miles on the Non-Interstate NHS that are Reliable	87.2%	85.0%	87.0%
Freight Reliability Index Derived from Truck Travel Time Reliability	1.61	1.80	1.75
Annual Hours of Peak Hour Excessive Delay per Capita (PHED) – Boston UZA	18.0	24.0	22.0
Annual Hours of Peak Hour Excessive Delay per Capita (PHED) – Worcester UZA	6.2	6.5	6.0
Annual Hours of Peak Hour Excessive Delay per Capita (PHED) – Springfield UZA	6.8	7.0	5.0
Percent Non-SOV Travel – Boston UZA	36.9%	38.8%	39.8%
Percent Non-SOV Travel – Worcester UZA	21.5%	22.2%	22.2%
Percent Non-SOV Travel – Springfield UZA	23.4%	25.4%	26.1%
CMAQ PM2.5 Cumulative Emission Reductions	N/A	N/A	N/A
CMAQ NOx Cumulative Emission Reductions	0.490	0.000	0.000
CMAQ VOC Cumulative Emission Reductions	0.534	0.000	0.000
CMAQ PM10 Cumulative Emission Reductions	N/A	N/A	N/A
CMAQ CO Cumulative Emission Reductions	6.637	0.354	0.354

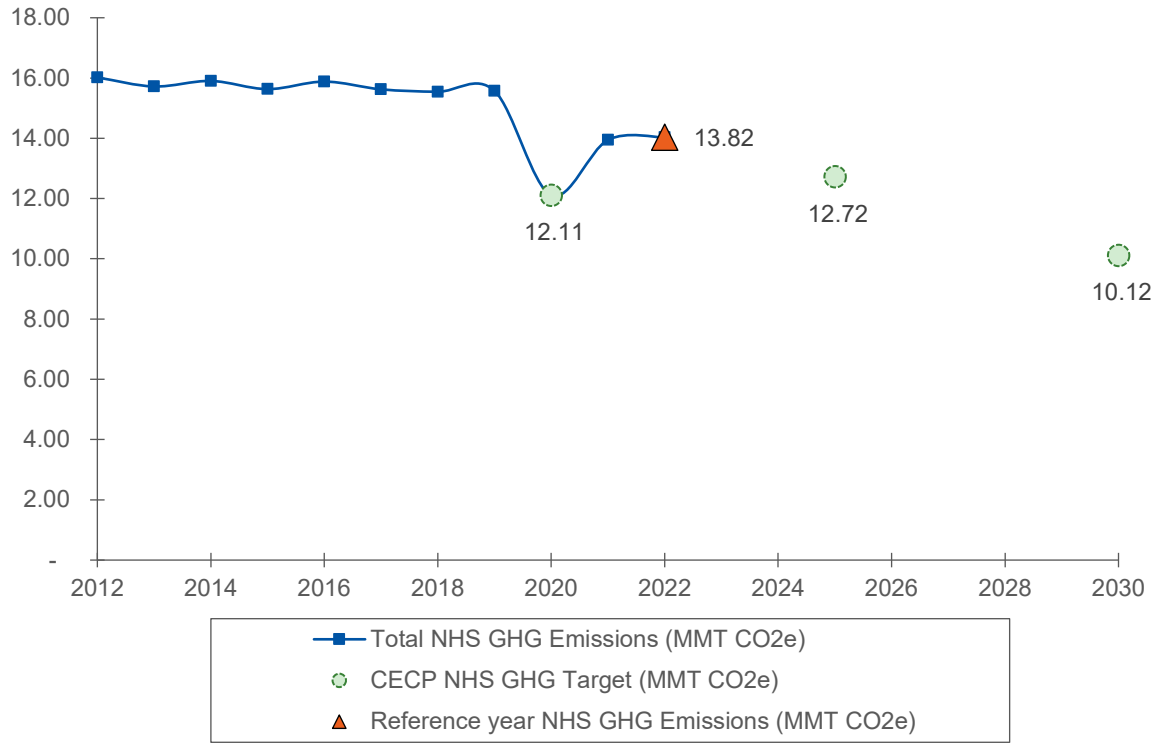
5.0 Greenhouse Gas (GHG) Emissions

To help address the climate crisis, in 2023, FHWA amended its regulations governing national performance management measures to require State DOTs and MPOs to establish declining carbon dioxide (CO2) targets and to establish a method for the measurement and reporting of greenhouse gas (GHG) emissions associated with transportation under the Highways title of the United States Code (U.S.C.).

MassDOT reported an initial four-year state target in the area of GHG emissions reduction to USDOT in February 2024 in response to this requirement. The reporting of this measure will follow an October 1 cycle beginning in 2026 to align with other national performance management reporting requirements.

Figure 5.1 below shows MassDOT's target of a 7.9 percent decrease in GHGs, as measured in MMT CO2e1 (1 million metric tons of carbon-dioxide equivalent) from the 2022 reference year to be consistent with state targets reported in Massachusetts' *Clean Energy and Climate Plan for 2025 and 2030.*

Figure 5.1 MassDOT's Four-Year GHG Emissions Reduction Target



6.0 Other Performance Measures

6.1 Measuring Over Time: Difference in Travel Times Between White and Non-White Commuters

A key Problem Statement under the Destination Connectivity Priority Area is that **people living in historically marginalized communities are burdened by connectivity inequities across transportation systems, limiting their access to opportunities.** In order to contextualize progress toward this goal, MassDOT has conducted a longitudinal analysis of the difference in travel time across all modes between white and non-white commuters using Census data from the years 2017 to 2021. These results were developed through the Census's Microdata Access Tool (MDAT), which leverages microdata and cross tabulation to create customized data tables. Using MDAT, commuting time could be grouped by survey respondents who identified as "White, non-Hispanic" and those who did not.

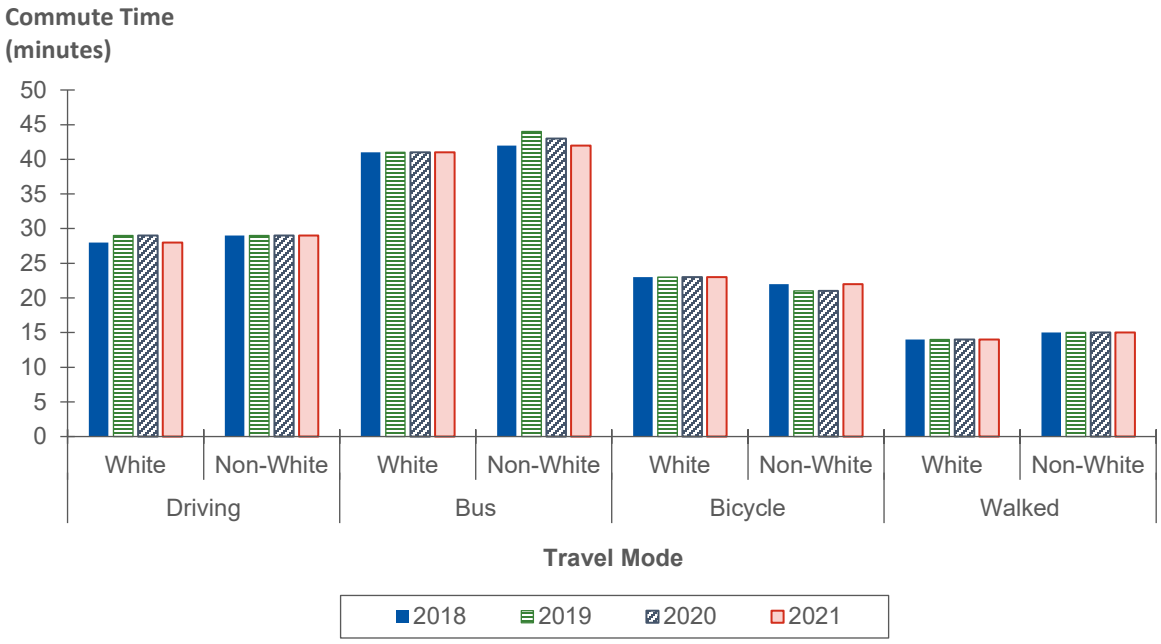
Table 6.1 presents the difference in average commute time on a per-trip basis between white and non-white residents over time (in minutes). Figure 6.1 presents the average commuting time itself in these categories. Although these travel time differences appear small, the 'penalty' assumed by non-white commuters accumulates over time; 2021 data suggests that the annual travel time 'penalty' for non-white commuters traveling via car, bus, or on foot is equivalent to over eight 'lost' hours per year. MassDOT would like to see there be no disparities in commuting time across demographic groups.

Table 6.1 Difference in Commuting Time Between White and Non-White Residents, 2018-2021 (minutes)

Mode	2018	2019	2020	2021
Driving	1	0	0	1
Bus	1	3	2	1
Bicycle	-1	-2	-2	-1
Walking	1	1	1	1

Note: Positive values indicate time penalty for Non-white commuters. Negative value indicates time savings for non-white commuters.

Figure 6.1 Difference in Commuting Time Between White and Non-White Residents, 2018-2021



6.2 Measuring Over Time: Percent of Residents Who Drive Alone to Work

Another key Problem Statement in the Destination Connectivity Priority Area is that **though reduced car travel is a desired and crucial step toward decarbonization, Massachusetts community members find it difficult to get around using other modes including transit.** In order to contextualize progress toward addressing this issue, MassDOT has conducted a longitudinal analysis of the percent of residents who drive alone to work using Census data for the past five American Community Survey (ACS) datasets.[21] The analysis was conducted for three Urbanized Areas (UZAs) within Massachusetts (Boston-Cambridge-Newton, Worcester, and Springfield) as well as for statewide to understand general regional trends. The percentage of residents who drive alone to work was calculated by comparing the total number of residents who drive alone to the total working age population in the geographic region.

Table 6.2 presents the percent of residents who drive to work for the UZAs and statewide regions. This percentage has remained relatively stable over the past five available datasets. MassDOT has a goal of decreasing this percentage over time. The table also indicates that residents in the Worcester and Springfield urban areas have a higher percentage of residents that drive alone to work. This could indicate that there are fewer desirable options for multimodal access compared to Boston urban area residents.

[21] ACS averages are for 2013–2017, 2014–2018, 2015–2019, and 2016–2020.

Table 6.2 Percent of Residents Driving Alone to Work by Urbanized Area, 2013-2020

ACS 5-Year Period	Boston	Springfield	Worcester	Statewide
2013-2017	70.8%	83.0%	85.2%	74.3%
2014-2018	70.4%	83.1%	85.1%	73.9%
2015-2019	70.1%	83.2%	85.0%	73.7%
2016-2020	70.6%	83.6%	84.7%	74.1%

Note: Based on the population of working age residents (aged 15-64), not total population.

6.3 Data Sources for Longitudinal Analysis

Table 6.3 lists data sources used in longitudinal analysis throughout the document.

Table 6.3 Data Sources Used in Longitudinal Analysis

Data	Source	Used In
Massachusetts Urban Areas	MassGIS	All
Massachusetts State Boundary	MassGIS	All
REJ+ (with and without Dominant Factor)	GeoDOT	All
Census 2020 Block Groups	MassGIS	All
Census 2020 Population	Census	All
MassDOT Crash Inventory (Fatal/Serious Crashes & Pedestrian/Bicycle Crashes)	GeoDOT	Safety
HSIP Crash Clusters (Pedestrian)	GeoDOT	Safety
Roadway Risk (Total Risk)	GeoDOT	Safety
Roadway Functional Classification	Road Inventory - GeoDOT	Safety
Means of Transportation to Work	Census Table B08301	Connectivity & Accessibility
Average Commuting Time by Race	Census Table S0802	Connectivity & Accessibility
MBTA 2008-2009 Systemwide Passenger Survey	MBTA	Travel Experience
MBTA 2015-2017 Systemwide Passenger Survey	MBTA	Travel Experience
MBTA 2022 Systemwide Passenger Survey	MBTA	Travel Experience

Thank you