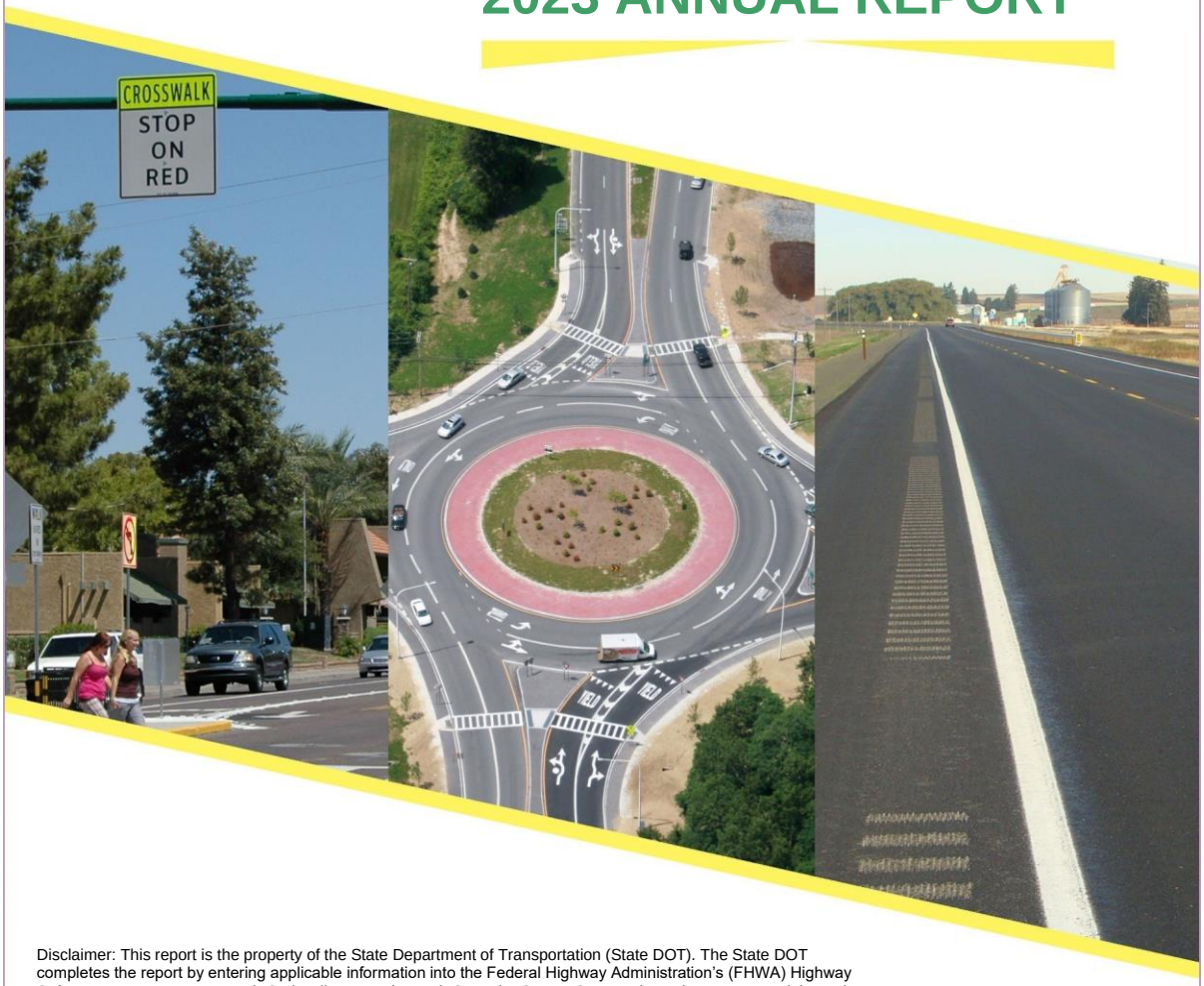
MASSACHUSETTS

HIGHWAY SAFETY IMPROVEMENT PROGRAM

2023 ANNUAL REPORT



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Protection of Data from Discovery Admission into Evidence

23 U.S.C. 148(h)(4) states “Notwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected for any purpose relating to this section[HSIP], shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location identified or addressed in the reports, surveys, schedules, lists, or other data.”

23 U.S.C. 407 states “Notwithstanding any other provision of law, reports, surveys, schedules, lists, or data compiled or collected for the purpose of identifying, evaluating, or planning the safety enhancement of potential accident sites, hazardous roadway conditions, or railway-highway crossings, pursuant to sections 130, 144, and 148 of this title or for the purpose of developing any highway safety construction improvement project which may be implemented utilizing Federal-aid highway funds shall not be subject to discovery or admitted into evidence in a Federal or State court proceeding or considered for other purposes in any action for damages arising from any occurrence at a location mentioned or addressed in such reports, surveys, schedules, lists, or data.”

Executive Summary

A Massachusetts HSIP Task Force was established in 2009 to develop guidelines for HSIP-eligible projects and programs. The Task Force consisted of FHWA, MassDOT Highway, MassDOT Planning and MARPA (Massachusetts Association of Regional Planning Agencies)/MPOs. Criteria for HSIP projects were defined. But the role of the Task Force was not to select individual projects and programs. The Task Force had met annually or as needed (and not since COVID). In 2019, the Task Force was updated to include additional member in an effort to help move HSIP projects to advertise in a timely manner. MassDOT District Project Development Engineers were added and additional MPO members. The guidelines for HSIP projects were updated (in draft) to emphasize systemic projects and projects combined with other project types to broaden the impacts of the HSIP program. This should help to reinvigorate the HSIP Task Force so that the project selection for HSIP can be more fluid and nimble and responsive to the needs of SHSP strategies and ensure project readiness and ability of projects to be advertised in a timely manner. This became easier with the development of the IMPACT Safety Analysis Module which enables users to visualize, query and export information on the top crash-based and top risk-based locations (https://apps.impact.dot.state.ma.us/sat/landing). This was initial developed in spring of 2021 and is being updated. This will necessitate an update to the HSIP guidance (due in late fall 2023). Also, to help strengthen the program, a STIP Manager was added in 2021 to help plan and program HSIP projects. Finally, although not required, an HSIP Implementation Plan was developed in 2021 to help guide HSIP project selection and programming.

Introduction

The Highway Safety Improvement Program (HSIP) is a core Federal-aid program with the purpose of achieving a significant reduction in fatalities and serious injuries on all public roads. As per 23 U.S.C. 148(h) and 23 CFR 924.15, States are required to report annually on the progress being made to advance HSIP implementation and evaluation efforts. The format of this report is consistent with the HSIP Reporting Guidance dated December 29, 2016 and consists of five sections: program structure, progress in implementing highway safety improvement projects, progress in achieving safety outcomes and performance targets, effectiveness of the improvements and compliance assessment.

Program Structure

Program Administration

Describe the general structure of the HSIP in the State.

A Massachusetts HSIP Task Force was initially established in 2009 to develop guidelines for HSIP-eligible projects and programs. The Task Forces role was to develop HSIP guidelines not to select individual projects. At the time, the Task Force consisted of FHWA, MassDOT Highway, MassDOT Planning and MARPA (Massachusetts Association of Regional Planning Agencies)/MPOs. It was determined that an HSIP eligible project was defined as one that contains a hot spot crash location (a cluster in which the total number of "equivalent property damage only" crashes in the cluster is within the top 5% of all clusters in a specific region), systemic fixes or any strategy, activity or project on a public road that is consistent with the data-driven State Strategic Highway Safety Plan (SHSP) and corrects or improves a hazardous road location or feature or addresses a highway safety problem.

The equivalent property damage only (EPDO) calculations were changed in 2018 to reflect the FHWA methodology for crash costs. Rather than the previous system of 10 points for a fatal crash, 5 points for an injury crash and 1 point for a property damage only crash, the new EPDO calculations are based on weighted average costs of crashes. So as not to be chasing fatal crashes only, the combined weighting of fatal and injury crashes is 21 times that of a property damage only crash. This new weighting was used in hot spot selection. This is described in a previous Top Crash Locations Report. https://www.mass.gov/doc/2017-top-crash-locations-report/download . To view the HSIP eligible clusters, go to: https://gis.massdot.state.ma.us/topcrashlocations/ . Recently developed in 2021, MassDOT has been using crash predictive methods and developed Safety Performance Functions for various types of collector and arterial roadways. This was then input into a new IMPACT network screening tool so that users can query, visualize, and export data for the Top 5% of segments (segments with the greatest difference between expected and predicted crashes). This is available in the Massachusetts crash data portal, IMPACT. https://apps.impact.dot.state.ma.us/sat/HotSpotNetworkScreening . The models are in the process of being updated and we anticipate having them available before the end of the 2023 calendar year. Furthermore, MassDOT is moving to a more proactive systemic approach and has developed risk model for many of the emphasis areas within our SHSP. These models, and their detailed reports explaining the derivation of the models, were recently added to IMPACT in late summer 2021 and can be found at https://apps.impact.dot.state.ma.us/sat/NetworkEmphasisArea . These models (and top crash based models) are in the process of begin updated and will be available by the end of 2023 calendar year. Although HSIP guidelines have not yet been updated, Top risk locations will be eligible for systemic HSIP projects. We anticipate reconvening the HSIP Task Force by the end of calendar year 2023 and developing new HSIP guidelines. The SHSP was completed in December 2022. (Massachusetts 2023 Strategic Highway Safety Plan (SHSP))

MassDOT Federal Aid Programming and Reimbursement Office and MassDOT Planning allocate the Federal funds into various categories for the Statewide Transportation Improvement Program (STIP), including Statewide HSIP funds and HSIP funds for each of the regions under "Intersection Improvements" and "Safety Improvements". HSIP projects are selected based on the HSIP guidelines, the MPO processes, priority and readiness (regardless of roadway jurisdiction). Once an HSIP project (hot spot) has been identified, an early requirement is a Road Safety Audit which helps to guide the recommended improvements. In an attempt to enhance the HSP programming, a Program Manager was brought onboard to assist with this in 2021. The impacts of this are being evaluated.

Where is HSIP staff located within the State DOT?

Engineering

Even though the "HSIP staff" is within MassDOT's Traffic and Safety Engineering, assistance is provided from the Districts, Assest Management, Planning, Federal Aid and other sections.

How are HSIP funds allocated in a State?

- Formula via MPOs
- Other-combination

Describe how local and tribal roads are addressed as part of HSIP.

Working with the 13 Regional Planning Agencies (RPAs) and the 13 Metropolitan Planning Organizations (MPOs) that encompass the entire geographic area of the Commonwealth of Massachusetts, HSIP funds are allocated not only to projects that are eligible within the statewide Highway Safety Improvements Program but also to eligible projects programmed by the MPOs, which may include local roads and tribal roads. Because most of the project proponents in the Commonwealth are municipalities, these projects are locally initiated, driven, and coordinated with MassDOT through the project initiation and development process. There is close coordination between our Traffic Safety division staff and MPO/RPA staff on the sharing of data and identifying crash cluster locations and prioritizing safety improvements to assist local entities and the MPOs in making sound safety investment decisions. Providing the IMPACT crash data portal to the locals, with a safety analysis module and other tools, assists them to advance projects based on data driven processes.(https://apps.impact.dot.state.ma.us/cdp/home). Furthermore, In 2022 , with IIJA funds available to locals for Safe Street for All program, MassDOT updated the IMPACT tool to provide a data package to assist the locals to apply for grants without having to perform major data analytics on their own and we assisted some communities with their application by funding the consultants and providing resources and assistance. The success of this last year means that this will continue this year.

Identify which internal partners (e.g., State departments of transportation (DOTs) Bureaus, Divisions) are involved with HSIP planning.

- Design
- Districts/Regions
- Maintenance
- Operations
- Planning
- Traffic Engineering/Safety

Describe coordination with internal partners.

Previously, the HSIP Task Force consists of seven members: 2 FHWA representatives (one from Massachusetts Division Office in Planning and one from the Massachusetts Division Office in Safety), 2 representatives from MassDOT Highway Division (Chief Engineer and Safety Engineer), one from MassDOT Office of Transportation Planning and two representatives from the Regional Planning Agencies (RPAs), the technical arm of the Metropolitan Planning Organizations (MPOs). The initial role of the Task Force was to establish HSIP guidelines based on input and feedback from others. The continuing role of the Task Force is to meet annually or as needed, ("meetings" could be via email or in person) to review and update the HSIP guidelines. The HSIP Task Force does not select the individual projects / programs. However, in 2019, the Task Force was expanded to include additional members from MassDOT's Project Development Engineers and additional MPOs as a means to move projects along more quickly and to be more nimble and responsive to safety needs. Based on a number of changes since 2019, the Task Force will reconvene next year (upon completion of the SHSP) and draft up updated guidelines.

Program and project selection occurs both in MassDOT HQ, MassDOT District and at the regional MPO level. Once projects are selected, the MassDOT Planning Office allocates the funding type to the STIP categories so that the full pot of HSIP funds are programmed.

For hot spot locations, Road Safety Audits are required and there is participation from a variety of disciplines both internal and external to MassDOT. MassDOT personnel include: MassDOT Safety and MassDOT District personnel as well as needed from MassDOT Highway Design, MassDOT Project Management, Complete Streets Engineer and others.

Identify which external partners are involved with HSIP planning.

- Academia/University
- FHWA
- Governors Highway Safety Office
- Law Enforcement Agency
- Local Government Agency
- Regional Planning Organizations (e.g. MPOs, RPOs, COGs)
- Other-SHSP Emphasis area team members
- Other-Advocacy groups
- Other-Public Health

Describe coordination with external partners.

All HSIP projects must be based on strategies identified in the SHSP which, in the past, has been developed with the assistance from our internal and external partners. The SHSP was updated in December 2022 (and Action Plans are being developed). During the SHSP development process, participation from over 200 individuals from more than 25 agencies (including all of those external partners mentioned in the response to Question 9) and entities were involved. Strategies identified in the SHSP are those that can be used for the HSIP eligible projects (although we have just begun the details of the SHSP strategies through the Action Plan development). Furthermore, all HSIP-eligible spot improvement projects require Road Safety Audits which ensures coordination with external partners. Project selection has a significant amount of external input through the MPO public process. Some specific programs are based on an Ad Hoc basis, as needed, and typically involve participation from external sources. As an example, based on EDC FoRRRwD, we worked on a fatal and serious injury rural lane departure reduction program. Most of the locations identified are municipally owned. We have worked with locals to gauge interest and participation and are continuing to do so as we expand this program. As a first step in this program, MassDOT purchased and provided speed feedback trailers (through non-HSIP funds) to 10 rural local communities after using a data driven process to identify the

communities with the greatest need. We then worked with the local communities on training and supplying materials to further reduce lane departure crashes. This is being expanded and is including additional materials based on prove countermeasures.

Describe other aspects of HSIP Administration on which the State would like to elaborate.

While Massachusetts continues to struggle with systemic projects due to ROW issues (We still do not have a way of doing quick hit / short term and low cost systemic types of projects without obtaining survey), FHWA approved a process to allow for materials procurement. This has been a huge improvement because we are able to get materials (signs, speed feedback bords, etc) into the hands of the locals for them to be able to install quickly.) As a result, we are already on our 3rd materials procurement project and local communities are getting what they need. This program has been very well received and will continue while we are in the process of effectiveness evaluation.

Program Methodology

Does the State have an HSIP manual or similar that clearly describes HSIP planning, implementation and evaluation processes?

No

We used to have a guidance document but things have changed so much, as we move towards a more rigorous Safety Management Process, that a manual or guidance document has not yet been completed. Once the network screening models are updated and our Implementation Plan and VRU Assessment are complete, an HSIP manual is on the list to tackle next.

Select the programs that are administered under the HSIP.

- HSIP (no subprograms)

Our STIP has "Intersection" and "Safety" for HSIP funding but that is changing as we integrate safety into all types of projects. Many of the projects / programs contain countermeasures to address the list contained in this question but there are no set asides. (There will be for VRU starting this coming year). Pedestrian safety is addressed in a number of ways in MA. HSIP funds are only a small percentage of the funds used on pedestrian safety. Likewise, for bicyclist safety. In fact, many of the programs identified in the list are also addressed by HSIP but not as a separate category. (Only starting in 2023 is VRU a separate category).

Program: HSIP (no subprograms)

Date of Program Methodology:9/30/2019

What is the justification for this program?

- Addresses SHSP priority or emphasis area
- Other-Based on crash-based (EPDO and exceeding predicted) and risk-based network screening locations

What is the funding approach for this program?

Competes with all projects

What data types were used in the program methodology?

Crashes	Exposure	Roadway
• Other-intersections EPDO (FI = 21 and O = 1)	• Traffic • Other-risk-based models also use other exposure factors	• Median width • Horizontal curvature • Functional classification

What project identification methodology was used for this program?

- Equivalent property damage only (EPDO Crash frequency)
- Excess expected crash frequency with the EB adjustment
- Other-risk-based models

Are local roads (non-state owned and operated) included or addressed in this program?

Yes

Are local road projects identified using the same methodology as state roads?

Yes

How are projects under this program advanced for implementation?

- Other-eligibility and readiness

Select the processes used to prioritize projects for implementation. For the methods selected, indicate the relative importance of each process in project prioritization. Enter either the weights or numerical rankings. If weights are entered, the sum must equal 100. If ranks are entered, indicate ties by giving both processes the same rank and skip the next highest rank (as an example: 1, 2, 2, 4).

Relative Weight in Scoring

Other-readiness:100
Total Relative Weight:100

Crash-based network screening is available on IMPACT, the public facing portal (https://apps.impact.dot.state.ma.us/sat/HotSpotNetworkScreening) and is being updated. Likewise, the risk-based network screening is also available on IMPACT. (https://apps.impact.dot.state.ma.us/sat/NetworkEmphasisArea). The guidelines for HSIP can be found here. Highway Safety Improvement Program (HSIP) Project Selection Criteria (mass.gov) . We do also have the risk-based network screening tools for the emphasis area crash types and those can be used to identify needs and countermeasures but not used to select project type.

Until 2023, HSIP was a general funding pot which had designated funds for HSIP eligible projects but, starting in 2023 has designated VRU funds so that projects of the VRU type are specifically identified.

What percentage of HSIP funds address systemic improvements?

43.5

HSIP funds are used to address which of the following systemic improvements?

- Install/Improve Signing

The projects listed as systemic for this year are more systematic in that they involve upgrading the signage (which is done on a cycle so that all guide signs are updated and retroreflectivity is maintained.

What process is used to identify potential countermeasures?

- Crash data analysis
- Data-driven safety analysis tools (HSM, CMF Clearinghouse, SafetyAnalyst, usRAP)
- Engineering Study
- Road Safety Assessment
- Stakeholder input

Does the State HSIP consider connected vehicles and ITS technologies?

Yes

Describe how the State HSIP considers connected vehicles and ITS technologies.

MassDOT definitely considers connected vehicles and ITS technologies as part of the safety solution. We recently implemented a pilot project for Wrong Way Vehicle Detection systems at 17 key interchange ramps around Massachusetts. It is a statewide pilot program for detection and notification of vehicles entering the freeway ramps the wrong direction. This system will hopefully drastically reduce wrong way incidents at our highest occurring ramp locations. The project uses advanced technology to identify wrong way vehicles in real time and send alerts to our HOC and Mass State Police. Although the system just became operational in late winter of 2023, i8t has already proven effective and considerations are underway to expand the program. We are considering adding additional locations. This project used HSIP funding. The Route 9 Connected Corridor project is under construction and will add connected vehicle technology and adaptive control at 37 intersections along Route 9 from Worcester, MA to Wellesley, MA. This project was part of the SPaT challenge and used CMAQ funding. In Phase II, this will allow advance notice for motorists driving along the corridor of signal timing and phasing and pedestrian detection in crosswalks. The Connected Corridor will also allow snow and ice vehicles to extend signal phasing to help with operational progression along the corridor (i.e. not having the stop at each intersection if activated). MassDOT has been implementing smart work zone technologies since 2009 and has been awarded a USDOT Grant for the purpose of working cooperatively with other states, vendors and FHWA to have defined field device and traffic data added to the standardized WZ data feed specification, extending the static work zone information to include dynamic real time information. MassDOT utilizes SWZ applications to provide real time feedback to drivers regarding travel times and congestion information, incidents, temporary closures and other information that will enhance the safety of road users and workers. MassDOT recently advertised Districts 1 and 2 Signal Safety project that will provide connected vehicle technology capabilities on all signals in D1 and D2. This is being expanded to include additional districts as budget permits. (We have also integrated safety countermeasures into this project such as backplates and pedestrian countdown timers). In 2017, MassDOT worked with WAZE to install beacons in our tunnel system to aid driver navigation where GPS is lost. (Although no Federal funds were used for this). The batteries are at life expectancy and a replacement project is planned for summer 2022. MassDOT was actively involved in the EDC Use of Crowdsourcing in Operations and last year we piloted an interactive dashboard with FHWA and its contractor's assistance. There are aspects of this that will help with Safety as well but, HSIP funds were not used for this. MassDOT contracted with RITIS/INRIX and Streetlight to make use of travel time, speed and volume data to supplement our permanent count station program and can be used on our projects and in Planning features (but not using HSIP funds). We continue to look forward to other technologies that will enhance safety and reduce fatalities and injuries on the public roadways.

Does the State use the Highway Safety Manual to support HSIP efforts?

Yes

Please describe how the State uses the HSM to support HSIP efforts.

In general, IMPACT (https://apps.impact.dot.state.ma.us/cdp/home) is our public-facing crash data portal which is designed to encourage public safety initiatives and awareness specific to crash information. Within IMPACT one can engage with crash related data through easy to understand pre-built reports, dashboards, tools and visualizations or one can conduct self-driven analysis this is all part of the safety management process identified in Part B of the HSM and is used for inputs into Part C of the HSM.

MassDOT uses both the predictive methodology and the empirical-Bayes method described in the Highway Safety Manual to support administrating the HSIP. In 2020, MassDOT completed the network screening process to consider the difference between expected and predicted crashes using HSM methodologies and Massachusetts-specific safety performance functions. Furthermore, a systemic risk-based network screening was also developed for nearly all of the emphasis areas in the SHSP. (Interestingly enough, many of the risk based models incorporated equity into the risk factors based on statistically significant information.) These models (both crash based and risk based) are visualized in a public-facing tool so any user (internal or external) can easily query, visualize, and export the Top 5% crash segments (https://apps.impact.dot.state.ma.us/sat/landing). We have recently begun updating all the models and will have that completed in 2022.

During RSAs (especially for HSIP projects), MassDOT uses HSM methodologies so expected crash frequency can be used for discussion, diagnosis, and countermeasure selection.

MassDOT also uses HSM methodologies to evaluate HSIP projects at the site-, project-, and countermeasure level. The empirical-Bayes method is used to estimate the number of crashes expected in the after period had no change occurred to compare with what was observed in the after period. We use our Alternatives Analysis Guide which captures HSM methodologies. MassDOT Safety Alternatives Analysis Guide . However, we struggle because most projects are not straightforward facility types that have SPFs, therefore, we still perform a lot of qualitative analyses.

Project Implementation

Funds Programmed

Reporting period for HSIP funding.

Federal Fiscal Year

Enter the programmed and obligated funding for each applicable funding category.

FUNDING CATEGORY	PROGRAMMED	OBLIGATED	% OBLIGATED/PROGRAMMED
HSIP (23 U.S.C. 148)	$12,094,216	$12,837,590	106.15%
HRRR Special Rule (23 U.S.C. 148(g)(1))	$0	$0	0%
VRU Safety Special Rule (23 U.S.C. 148(g)(3))	$0	$0	0%
Penalty Funds (23 U.S.C. 154)	$0	$0	0%
Penalty Funds (23 U.S.C. 164)	$0	$0	0%
RHCP (for HSIP purposes) (23 U.S.C. 130(e)(2))	$0	$0	0%
Other Federal-aid Funds (i.e. STBG, NHPP)	$4,539,975	$5,229,534	115.19%
State and Local Funds	$2,478,795	$3,007,387	121.32%
Totals	$19,112,986	$21,074,511	110.26%

While VRU HSIP funds have not be designated until BIL/IIJA, pedestrian and bicyclist safety have been incorporated into most projects. So, the funding above does not reflect the spending on VRU, it includes this work within the general HSIP.

How much funding is programmed to local (non-state owned and operated) or tribal safety projects?

17%

How much funding is obligated to local or tribal safety projects?

16%

How much funding is programmed to non-infrastructure safety projects?

0%

How much funding is obligated to non-infrastructure safety projects?

0%

How much funding was transferred in to the HSIP from other core program areas during the reporting period under 23 U.S.C. 126?

0%

How much funding was transferred out of the HSIP to other core program areas during the reporting period under 23 U.S.C. 126?

0%

Discuss impediments to obligating HSIP funds and plans to overcome this challenge in the future.

There are two main impediments to obligating HSIP funds. One is project readiness. If a programmed project is not able to advertise (for any number of reasons), it is very difficult to just swap in another HSIP project because there are limited projects that already designed and ready to advertise. This could be because projects are rarely advanced in design unless they are already programmed on the STIP and even then, they are designed and reviewed to meet the advertising date. So, if a programmed project is not able to advertise, we are often left with a hole to try and fill in a replacement project.

The second major impediment to obligating HSIP funds is that we are struggling to develop low cost-short term systemic projects here in Massachusetts. We are not able to have local communities self-certify that project work all occurs within the public way. This must only be done with layout plans or survey. Therefore, any simple pavement marking and/or signage project (typically the low cost/short term type systemic projects) must include a survey which adds time and expense and precludes the short term / low cost projects.

Based on the above two factors, it sometimes makes it challenging for MassDOT to obligate funds. This is especially true in cases in which we have short notice such as for High Risk Rural Roads Projects when we are informed 18 months before they must be obligated that we fall within the rule and must obligate a certain amount of money. It is too short of a time frame to develop a project (including ROW, environmental processes, etc.) so we struggle with what can be done.

There are steps we have taken to resolve these issues. A Project Manager from the MassDOT Design Section will be providing assistance to push projects along. With regards to the difficulties we face for systemic project, MassDOT Traffic and Safety Engineering has been meeting with FHWA ROW Section and MassDOT ROW Section to try to resolve ROW issues with regards to low cost systemic projects. In the short term, we anticipate testing out systemic projects on MassDOT roadways only where layouts are available. This was done for a rural High Friction Surface Treatment project. Last year, MassDOT developed an HSIP Implementation Plan, this highlighted the project types that would be most effective to reducing our fatalities and injuries. By highlighting these types of projects (systemic), there should have been a greater urgency to resolve some issues. In addition to this, FHWA helped set up a peer exchange with several other states and their FHWA Division offices so they could showcase how they conduct systemic projects. This meeting happened in 2022 and the end result is we could not solve the ROW issue but FHWA encouraged MassDOT to develop materials contracts and provide the materials to locals for them to install. We are in the process of doing a number of materials procurement contracts.

General Listing of Projects

List the projects obligated using HSIP funds for the reporting period.

PROJECT NAME	IMPROVEMENT CATEGORY	SUBCATEGORY	OUTPUTS	OUTPUT TYPE	HSIP PROJECT COST($)	TOTAL PROJECT COST($)	FUNDING CATEGORY	LAND USE/AREA TYPE	FUNCTIONAL CLASSIFICATION	AADT	SPEED	OWNERSHIP	METHOD FOR SITE SELECTION	SHSP EMPHASIS AREA	SHSP STRATEGY
608443-LITTLETON-AYER	Intersection traffic control	Modify traffic signal – modernization/replacement	1	Intersections	$1199820	$4221857	HSIP (23 U.S.C. 148)	Urban	Principal Arterial-Other	14,460	50	State Highway Agency	Spot	Intersections	Reducing fatalities and injuries at intersections
608779-LANCASTER	Intersection traffic control	Modify control – new traffic signal	2	Intersections	$2188362	$5894642	HSIP (23 U.S.C. 148)	Urban	Principal Arterial-Other	20,625	30	City or Municipal Highway Agency	Spot	Intersections	Reducing fatalities and injuries at intersections
609056-HOLLAND TO STURBRIDGE	Roadway signs and traffic control	Sign sheeting - upgrade or replacement	7.39	Miles	$887214	$887214	HSIP (23 U.S.C. 148)	Rural	Principal Arterial-Interstate	52,977	65	State Highway Agency	Systemic	Older Drivers	Improving legibility and retroreflectivity of guide signs
609060-LYNNFIELD-PEABODY-DANVERS	Roadway signs and traffic control	Sign sheeting - upgrade or replacement	6.7	Miles	$741754	$741754	HSIP (23 U.S.C. 148)	Urban	Principal Arterial-Interstate	129,069	55	State Highway Agency	Systemic	Older Drivers	Improving legibility and retroreflectivity of guide signs
609062-WORCESTER-LEOMINSTER	Roadway signs and traffic control	Sign sheeting - upgrade or replacement	18.8	Miles	$4639066	$4639066	HSIP (23 U.S.C. 148)	Urban	Principal Arterial-Interstate	18,397	65	State Highway Agency	Systemic	Older Drivers	Improving legibility and retroreflectivity of guide signs
609314-ASHBY	Intersection traffic control	Modify control – Modern Roundabout	1	Intersections	$3334233	$3334233	HSIP (23 U.S.C. 148)	Urban	Minor Arterial	2,564	45	State Highway Agency	Spot	Intersections	Reducing fatalities and injuries at intersections
609392-ROWLEY	Intersection traffic control	Modify control – new traffic signal	1	Intersections	$1391745	$1391745	HSIP (23 U.S.C. 148)	Urban	Principal Arterial-Other	9,855	50	State Highway Agency	Spot	Intersections	Reducing fatalities and injuries at intersections

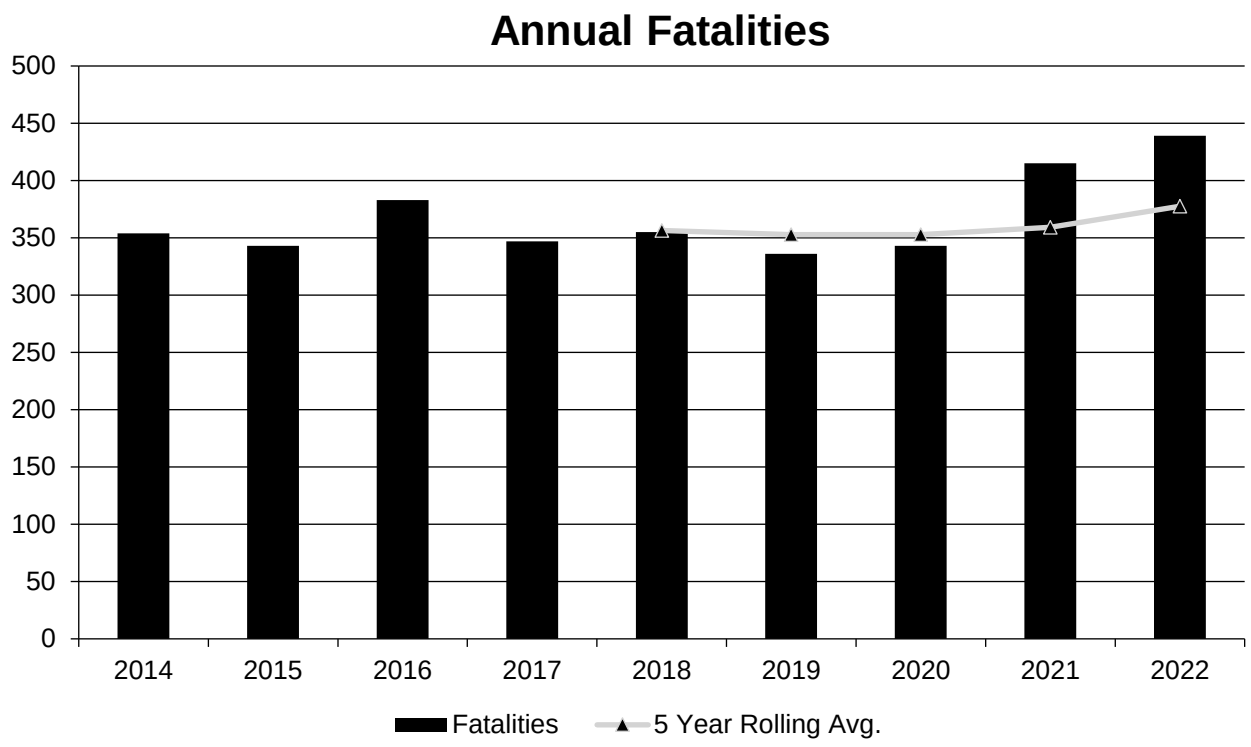
It should be noted that projects defined and listed as "intersection" projects also incorporate pedestrian and bicyclist safety into the project (as do other project types) without specifically calling out pedestrian and bicyclist safety. However, in the future, with BIL/IIJA and VRU, project listings will include VRU as a type.

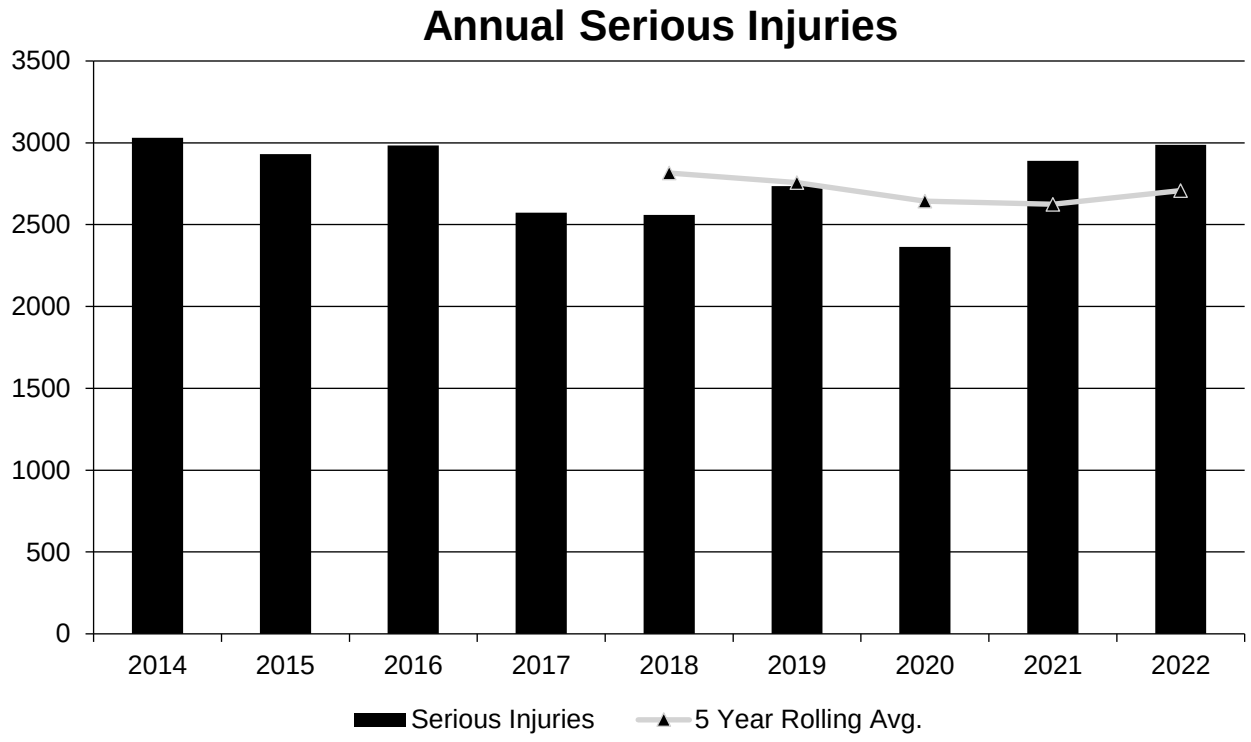
Safety Performance

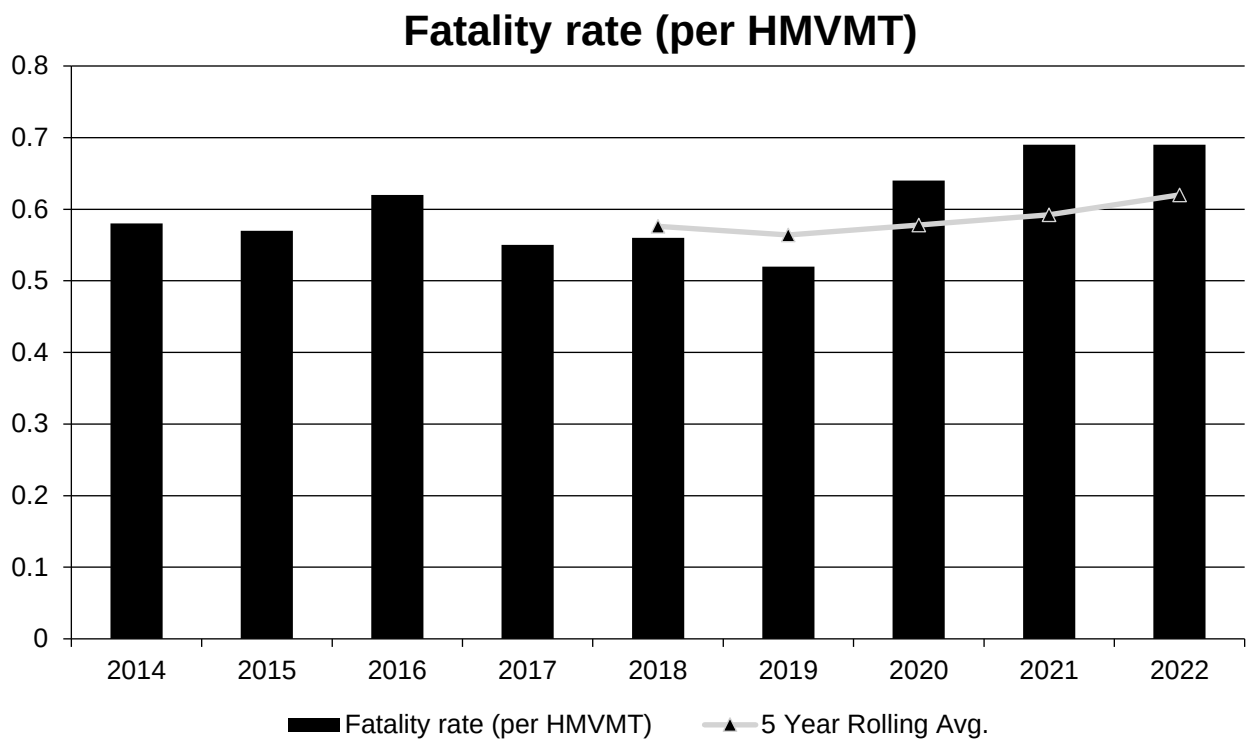
General Highway Safety Trends

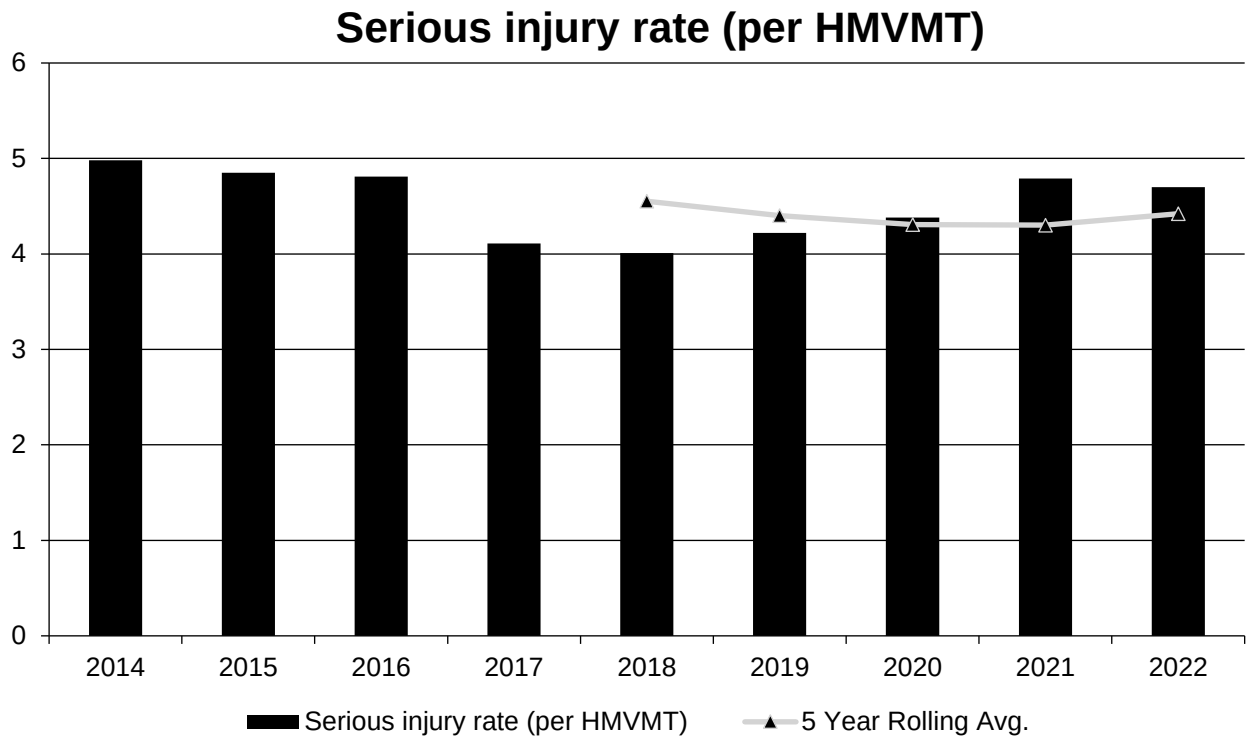
Present data showing the general highway safety trends in the State for the past five years.

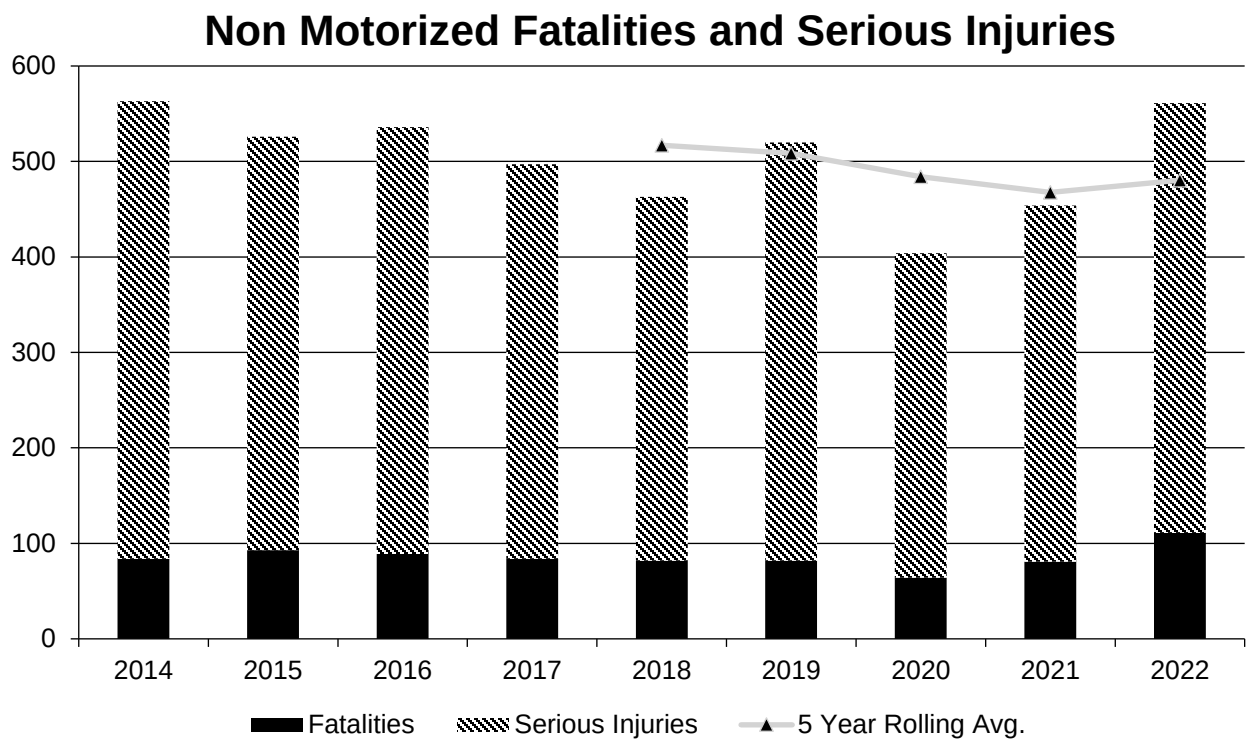
PERFORMANCE MEASURES	2014	2015	2016	2017	2018	2019	2020	2021	2022
Fatalities	354	343	383	347	355	336	343	415	439
Serious Injuries	3,031	2,931	2,983	2,573	2,560	2,736	2,365	2,890	2,987
Fatality rate (per HMVMT)	0.580	0.570	0.620	0.550	0.560	0.520	0.640	0.690	0.690
Serious injury rate (per HMVMT)	4.980	4.850	4.810	4.110	4.010	4.220	4.380	4.790	4.700
Number non-motorized fatalities	84	93	89	84	82	82	64	81	111
Number of non-motorized serious injuries	479	433	447	413	381	438	340	373	450


Annual Fatalities
500
450
400
350
300
250
200
150
100
50
0
2014
2015
2016
2017
2018
2019
2020
2021
2022
Fatalities
5 Year Rolling Avg.


Annual Serious Injuries
3500
3000
2500
2000
1500
1000
500
0
2014
2015
2016
2017
2018
2019
2020
2021
2022
Serious Injuries
5 Year Rolling Avg.


Fatality rate (per HMVMT)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2014
2015
2016
2017
2018
2019
2020
2021
2022
Fatality rate (per HMVMT)
5 Year Rolling Avg.


Serious injury rate (per HMVMT)
6
5
4
3
2
1
0
2014
2015
2016
2017
2018
2019
2020
2021
2022
Serious injury rate (per HMVMT)
5 Year Rolling Avg.



The serious injury information comes from IMPACT (queried on May 10) MassDOT: Crash Data Portal (state.ma.us) from the Crash Tabulation and Charting Tool. The fatality information comes from FARS for years 2019 and prior. However, 2020, 2021 and 2022 come from the Fatalities dashboard (data that is entered into FARS) as of May 10th. MassDOT: Crash Data Portal (state.ma.us) . Since 2021 and 2022 are not yet finalized in any of the datasets, the recorded number of people dying or seriously injured for the recent years may change.

Describe fatality data source.

Other
If Other Please describe

combination FARS website and FARS analysts in our State

The FARS website did not have the final fatality information as of the time of the report preparation. Therefore, the years 2021 and 2022 were based on the Fatalities dashboard MassDOT: Crash Data Portal (state.ma.us) which is some of the same information that is gathered for FARS analysts use.

To the maximum extent possible, present this data by functional classification and ownership.

Year 2022

Functional Classification	Number of Fatalities (5-yr avg)	Number of Serious Injuries (5-yr avg)	Fatality Rate (per HMVMT) (5-yr avg)	Serious Injury Rate (per HMVMT) (5-yr avg)
Rural Principal Arterial (RPA) - Interstate	2.2	6.6	0.28	0.81
Rural Principal Arterial (RPA) - Other Freeways and Expressways	1	1.6	0.97	1.47
Rural Principal Arterial (RPA) - Other	3.8	4.4	1.38	1.58
Rural Minor Arterial	6.4	17.6	1.38	3.86
Rural Minor Collector	3	12.8	2.45	10.58
Rural Major Collector	7	28.2	1.07	4.17
Rural Local Road or Street	4.2	26	0.7	4.87
Urban Principal Arterial (UPA) - Interstate	63.6	234.8	0.4	1.46
Urban Principal Arterial (UPA) - Other Freeways and Expressways	18.2	111.8	0.29	1.8
Urban Principal Arterial (UPA) - Other	97.6	767	0.81	6.31
Urban Minor Arterial	97.2	809.6	0.82	6.83
Urban Minor Collector	0	0	0	0
Urban Major Collector	34.4	283.2	0.81	6.65
Urban Local Road or Street	37	339.8	0.45	4.15

Year 2022

Roadways	Number of Fatalities (5-yr avg)	Number of Serious Injuries (5-yr avg)	Fatality Rate (per HMVMT) (5-yr avg)	Serious Injury Rate (per HMVMT) (5-yr avg)
State Highway Agency	173.6	853.4	0.54	2.63
County Highway Agency	0	0	0	
Town or Township Highway Agency	0	0	0	0
City or Municipal Highway Agency	0	0	0	0
State Park, Forest, or Reservation Agency	0.2	1.2	0.24	1.42
Local Park, Forest or Reservation Agency	0	0	0	0
Other State Agency	7.4	37.8	0.82	4.17
Other Local Agency	0	0	0	0
Private (Other than Railroad)	0	0.4	0	1.64
Railroad	0	0	0	0
State Toll Authority	0	0	0	0
Local Toll Authority	0	0	0	0
Other Public Instrumentality (e.g. Airport, School, University)	0.2	0.2	0.59	0.51
Indian Tribe Nation	0	0	0	0
Municipal (City or town)	181.4	1,695.8	0.67	6.28
Federal-Army/Navy/Airforce	0	0.4	0	0.97
Unaccepted	4.6	44.4	0.39	3.78

VMT numbers for 2022 and beyond reflect a combination of: regional COVID-19 "recovery" trends, rates of change in projected traffic from the statewide travel demand model, and different regional growth rates of population, households and employment in MassDOT's latest round of socioeconomic projections. Final VMT numbers broken down by jurisdiction for 2022 are not currently available due to HPMS delays so we broke down the total VMT values by the same percentages with which the data was broken down by for 2021. Crash

data by functional classification is based on what is in the statewide crash system and may differ from what is contained in FARS. The statewide crash system has not yet finalized 2021 and 2022 so the data are subject to change.

Safety Performance Targets

Safety Performance Targets

Calendar Year 2024 Targets *

Number of Fatalities:377.0

Describe the basis for established target, including how it supports SHSP goals.

Per FHWA guidance, the MassDOT target setting process began with a trend line projection based on the most recent available data to develop safety targets for the 2024 five year rolling average (2020-2024). New, for this year, we are also developing a 2022-2026 target to be consistent with the Highway safety Office and NHTSA. The 2021 and 2022 fatalities were not finalized on the NHTSA FARS website when MassDOT began this process so the Massachusetts fatality data analyst provided the team with the 2021, 2022 and 2023 fatalities to date.

Due to COVID, the shutdowns in 2020 and the lingering impacts in 2021 and 2022, the MA 2020, 2021 and 2022 fatalities were not following a downward trend. Furthermore, the Infrastructure Investment and Jobs Act (IIJA) now requires "performance targets that demonstrate constant or improved performance" so Massachusetts is unable to use the increasing "targets".

Therefore, MassDOT took this opportunity to restate the ultimate goal of 0 fatalities and serious injuries on our roadways, but to also reflect a short-term target that would move the state in that direction.

As of now, 2023 is trending more towards the pre-COVID fatalities. Therefore, we assumed the 2023 and 2024 fatalities would be in line with pre-COVID data. As a result, when looking at annual year over year changes, this reflects a drop of approximately 20% when comparing 2021 and 2022 compared to 2023 and 2024. However, **when comparing the 5-year rolling average fatalities from 2018-2022 of 378 fatalities, the five-year rolling average for fatalities for 2020-2024 is projected to be 377.** If this continues through 2026, our five-year rolling average for 2022-2026 will drop to 362 (a 4% drop).

The Massachusetts updated SHSP, using a Safe System framework, was recently completed in December 2022. The Commonwealth is beginning work on the Action Plan and on the Vulnerable Road User Assessment to provide the details on how we will drive down the fatalities and serious injuries in MA.

This target was developed in coordination with the Executive Office of Public Safety and Security – Highway Safety Division (EOPSS/HSD) as they are required to submit targets to NHTSA and reviewed by senior leadership. Moreover, it should be restated that while MassDOT developed numeric targets, the goal is 0 and MassDOT will continue to work toward that goal by implementing SHSP strategies.

Number of Serious Injuries:2708.0

Describe the basis for established target, including how it supports SHSP goals.

Per FHWA guidance, the MassDOT target setting process began with a trend line projection based on the most recent available data to develop safety targets for the 2024 five year rolling average (2020-2024). New,

for this year, we are also developing a 2022-2026 target to be consistent with the Highway safety Office and NHTSA. The 2021 and 2022 serious injuries are not finalized in the statewide crash system so the Massachusetts serious injuries may change when the years are closed and data are finalized.

Due to COVID, the shutdowns in 2020 and the lingering impacts in 2021 and 2022, the MA 2020, 2021 and 2022 fatalities were not following a downward trend. Furthermore, the Infrastructure Investment and Jobs Act (IIJA) now requires "performance targets that demonstrate constant or improved performance" so Massachusetts is unable to use the increasing "targets".

Therefore, MassDOT took this opportunity to restate the ultimate goal of 0 fatalities and serious injuries on our roadways, but to also reflect a short-term target that would move the state in that direction.

As of now, 2023 is trending more towards the pre-COVID fatalities. Therefore, we assumed the 2023 and 2024 fatalities would be in line with pre-COVID data. As a result, when looking at annual year over year changes, this reflects a drop of approximately 10% when comparing 2021 and 2022 compared to 2023 and 2024. However, **when comparing the 5-year rolling average fatalities from 2018-2022 of 2,708 serious injuries, the five-year rolling average for serious injuries for 2020-2024 is projected to remain 2,708.** If this continues through 2026, our five-year rolling average for 2022-2026 will drop to 2,603 (a 4% drop).

The Massachusetts updated SHSP, using a Safe System framework, was recently completed in December 2022. The Commonwealth is beginning work on the Action Plan and on the Vulnerable Road User Assessment to provide the details on how we will drive down the fatalities and serious injuries in MA.

This target was developed in coordination with the Executive Office of Public Safety and Security – Highway Safety Division (EOPSS/HSD) as they are required to submit targets to NHTSA and reviewed by senior leadership. Moreover, it should be restated that while MassDOT developed numeric targets, the goal is 0 and MassDOT will continue to work toward that goal by implementing SHSP strategies.

Fatality Rate:0.610

Describe the basis for established target, including how it supports SHSP goals.

The fatality rate is simply math. So once the team has projections for fatalities and has projected VMTs, the fatality rate is simply the 5-year average of the annual fatality rates.

Like nearly every other state, COVID greatly impacted the state's VMTs so the state rates spiked in 2020 with significantly lower VMTs and slightly higher fatalities. However, Massachusetts VMTs have come back and annual projections in 2023 and beyond are that VMTs will be higher than pre-pandemic levels. The projection is now **0.61 fatalities per 100 million vehicle miles traveled for 2020-2024 (five-year rolling average) compared to .62 fatalities per 100 million vehicle miles traveled for 2018-2022 for which reflects a 1.63% drop in the fatality rate.** When looking to the 2026 five-year average (2022-2026), the fatality rate will drop to 0.54 fatalities per 100 million vehicle miles traveled, or approximately a 12% drop. The long-term goal is toward zero deaths, so the long-term fatality rate target is 0.0 fatalities per 100 million VMTs.

Serious Injury Rate:4.360

Describe the basis for established target, including how it supports SHSP goals.

The serious injury rate is simply math. So once MassDOT has projections for serious injuries and has projected VMTs, the serious injury rate is simply the 5-year average of the serious injury rate. Like nearly every other state, COVID greatly impacted the state's VMTs so Massachusetts rates spiked in 2020 with significantly lower VMTs which impacted the serious injury rates. However, Massachusetts VMTs have come back and

annual projections in 2023 and beyond are that VMTs will be higher than pre-pandemic levels. The projection is now **4.36 serious injuries per 100 million vehicle miles traveled for 20120-2024 (five-year rolling average) compared to 4.42 serious injuries per 100 million vehicle miles traveled for 2018-2022 for which reflects a 1.36% drop in the serious injury rate.** When looking to the 2026 five-year average (2022-2026), the serious rate will drop to 3.91 serious injuries per 100 million vehicle miles traveled, or approximately an 11% drop. The long-term goal is toward zero deaths and serious injuries, so the long-term serious injury rate target is 0.0 serious injuries per 100 million VMTs.

Total Number of Non-Motorized Fatalities and Serious Injuries:445.0

Describe the basis for established target, including how it supports SHSP goals.

As with all the other target setting measures, FHWA's guidance is to start with a trend line forecast and then consider external factors and planned implementation in order to set targets. However, the number of non-motorist fatalities and serious injuries dramatically dropped in 2020 (a more than 25% annual reduction from 2019 to 2020) at the beginning of COVID and then increased in the year 2021 and then spiked in 2022 to an all-time high in recent history. Based on the emphasis on vulnerable road users, we are anticipating a drop in the non-motorized deaths and serious injuries. As such, we anticipate the 2023 and 2024 annual numbers match the all-time low from 2020. This translates **to the 5-year average number of non-motorist fatalities and serious injuries going from 480 (2018-2022) down to 445 (2020-2024) which reflects a 7.3% reduction**. When looking to the 2026 five-year average (2022-2026), the non-motorist fatal and serious injuries will drop to 435, approximately a 9% drop. The long-term goal is toward zero deaths and serious injuries, so the long-term serious injury rate target is 0.0 serious injuries per 100 million VMTs.

Massachusetts is actively working on strategies to ameliorate non-motorist fatality and injuries, while promoting and encouraging walking and cycling. The 2023 Strategic Highway Safety Plan, the 2019 Statewide Pedestrian Plan and the 2019 Statewide Bicycle Plan identify new multi-disciplined and multi-agency strategies to implement in order to eliminate fatalities and serious injuries of people walking and bicycling and on personal conveyance. The Commonwealth of MA awarded grants directed to local communities to help increase walking and biking trips while improving safety and that will help to move the needle.

The new focus on Speed Management and a Safe System approach should also help to drive down the fatalities and serious injuries. To show that state efforts are paying off, Massachusetts was ranked # 1 in the 2022 Bicycle Friendly State Report Card by the *League of American Bicyclists* who gave Massachusetts a grade of "A" for Infrastructure & Funding, Education & Encouragement, and Policies & Programs. Furthermore, Massachusetts will be subject to the Vulnerable Road User Rule and is already making plans for further investment of funds. The Vulnerable Road User Assessment and resulting work of projects and programs will further help us reach the goal.

Describe efforts to coordinate with other stakeholders (e.g. MPOs, SHSO) to establish safety performance targets.

Starting in February/March, MassDOT began meeting with the Highway Safety Division (HSD) office of the Executive Office of Public Safety and Security to align targets. In April, the targets were presented to the MassDOT Secretary of Transportation and the MassDOT Highway Administrator. The resulting targets were confirmed with the HSD and subsequently mentioned to the MassDOT Office of Performance Management and Innovation as well as the transportation Program Managers of the regional Planning Agencies (the technical arm of the MPOs). After hearing no additional feedback, the "targets" were confirmed with HSD. While it was all agreed that these are short term "targets" to stabilize after the horrific trends during COVID, our long term goal remains at zero deaths serious injuries.

Does the State want to report additional optional targets?

No

Describe progress toward meeting the State's 2022 Safety Performance Targets (based on data available at the time of reporting). For each target, include a discussion of any reasons for differences in the actual outcomes and targets.

PERFORMANCE MEASURES	TARGETS	ACTUALS
Number of Fatalities	340.0	377.6
Number of Serious Injuries	2504.0	2707.6
Fatality Rate	0.560	0.620
Serious Injury Rate	4.110	4.420
Non-Motorized Fatalities and Serious Injuries	471.0	480.4

We did not meet any of our targets. Our targets included a reduction in fatalities, serious injuries, fatality rates, serious injury rates and non-motorists to match requirements that targets must be showing progress and to reflect that we are trying to move towards zero fatalities and serious injuries and were developed before COVID. Yet, our fatalities and serious injuries had increased from the onset of COVID. While many early explanations and theories citing the behavioral components although the work in HSIP has focused on infrastructure. Our VMTs dramatically decreased compared to our projections made pre-COVID so that impacted our rates as well. We have shifted into a more Safe System Approach that focuses on elements we can change. As an example, Statewide, we have shifted our focus away from reliance on just enforcement and are using a more comprehensive approach to speed management. Furthermore, in seeing the uptick in certain fatality types, MassDOT and others have pivoted our focus. An example of this is with the dramatic increase in motorcycle fatalities in 2021, the State (including MassDOT) stepped up education and awareness. Another example is with the increase in pedestrian fatalities, we have refocused on vulnerable users. In 2022, a State law was passed with components aimed at improving vulnerable user safety by addressing speed, vehicle design, safer passing around vulnerable users and improved data collection. Finally, while our previous implementation plan specifically called out increased use of systemic projects as an effective way to reduce fatalities and serious injuries, until recently this was still problematic because of the right-of-way issue. However, FHWA and MassDOT recently came to an agreement for a short-term workaround and we only recently began advancing systemic projects (through the use of material procurement contracts).

Applicability of Special Rules

Does the VRU Safety Special Rule apply to the State for this reporting period?

Yes

There are several State funding sources used to address pedestrian and bicyclist safety which is under a different program (although various sections within MassDOT work together). However, with the new VRU Safety Rule, HSIP-VRU projects have been identified starting in 2023. Those projects will be identified in next year's HSIP report. With the VRU assessment well underway, the reach will be broad to raise awareness to select projects and programs based on a data driven process. Furthermore, with the passage of Chapter 358 in MA, "An Act to Reduce Fatalities", there are several changes and enhancements as a direct result (although these will all be spelled out in the next year's report since work is all in Federal Year 2023 and beyond).

Does the HRRR special rule apply to the State for this reporting period?

No

If we compare the rural fatality rates of collectors and locals for 5-year average between 2022 (2018-2022) and 2020 (2016-2020), as shown in Question 32A, it does not appear that we meet the HRRR rule. However, MassDOT has taken an active role as part of EDC FoRRRwD to reduce run off road crashes on rural roadways, particularly on those municipally owned roadways with highest risk for run off road. In addition to the previous EDC work, in 2023, several projects are underway with rural communities to provide materials (signage, speed feedback boards, flexible reflective posts, etc) for installation by the community. This is using HSIP funds and will be reflected in next year's HSIP report.

Provide the number of older driver and pedestrian fatalities and serious injuries 65 years of age and older for the past seven years.

PERFORMANCE MEASURES	2016	2017	2018	2019	2020	2021	2022
Number of Older Driver and Pedestrian Fatalities	73	50	76	77	73	79	103
Number of Older Driver and Pedestrian Serious Injuries	296	265	272	295	225	276	312

Years 2021 and 2022 are not yet finalized and are subject to change

Evaluation

Program Effectiveness

How does the State measure effectiveness of the HSIP?

- Benefit/Cost Ratio
- Change in fatalities and serious injuries
- Economic Effectiveness (cost per crash reduced)

MassDOT measures the effectiveness of the HSIP using Benefit/Cost Ratio (BCR), change in fatalities and serious injuries, and cost per crash reduced. This year, MassDOT evaluated all projects which received HSIP funding that were completed in 2018, allowing them to compare three years of after data to three years of before data. Generally, the three-year before periods occurred between 2012 and 2016 (depending on project start date), and the three-year after period was 2019 through 2021. MassDOT calculated benefits for the projects by converting the annual reduction in crashes to crash costs, then aggregating the benefits observed in the first three years after completion over the anticipated service life of the project. All costs and benefits are reported in 2019 dollars. Additionally, benefits only represent safety benefits; operational, environmental, and other benefits are not included.

The 14 evaluated projects accounted for $11.1 million in HSIP funds and $26.4 million in total expenditures. Together, these projects are expected to return $878.8 million in safety benefits in their expected 20-year service lives. This produces a BCR of 79.4 for HSIP funds and 33.2 for all funds. These results are buoyed by 4 systemic projects included in this tranche of projects. The 4 systemic projects account for $3.0 million in HSIP (completely funded by HSIP) and return $840.8 million in safety benefits in their expected 20-year service lives, producing a BCR of 283.9.

In contrast, the Spot projects evaluated accounted for $8.1 million in HSIP funds, $23.5 million in total funds, and are expected to return $38.0 million in safety benefits, producing a BCR of 4.7 for the HSIP and 1.6 for total funds. Though these are less economically efficient than the systemic projects, it is still heartening that MassDOT is producing effective spot HSIP projects, as these are critical to a safety program.

A naive review of these projects also shows that, in the first three years after completion, MassDOT has produced a reduction in fatal and serious injury (KA) crashes. Across all project locations, there were 270 KA crashes in the before period, compared to just 224 in the after period, an average reduction of 15.3 crashes per year across all sites. When isolating for the systemic project locations, those sites experienced 251 KA crashes in the before period and 218 in the after period, an average reduction of 11 KA crashes per year across the systemic project locations. Finally, the spot project locations went from 19 KA crashes to 6 KA crashes, an average reduction of 4.3 KA crashes per year.

Along with BCR and fatalities and serious injuries, MassDOT also considers cost per crash reduction as a metric for their HSIP. Annually, the evaluated projects are expected to reduce 623 all severity crashes, 174 fatal and injury crashes, and 15.3 KA crashes per year. Considering the $11.1 million in HSIP funds applied, this implies that, for these projects, the MassDOT HSIP required $17,762 to reduce one all severity crash per year, $63,532 to reduce one fatal and injury crash per year, and $721,474 to reduce one KA crash per year. For the $26.4 million in total funds, the program required $42,465 to reduce one all severity crash, $151,886 to reduce one fatal and injury crash, and $1.7 million to reduce one KA crash.

While the reduction in KA crashes suggests HSIP effectiveness, this unfortunately occurs against a backdrop of increasing fatalities and serious injuries across Massachusetts. Fatalities and serious injuries have increased since 2020, likely due to a change in driving behaviors which arose across the Commonwealth.

MassDOT is continuing to evolve its HSIP, as well as working with its stakeholders, to counteract this recent rise in fatalities and serious injuries.

Based on the measures of effectiveness selected previously, describe the results of the State's program level evaluations.

MassDOT did not complete emphasis area program evaluations this year. Rather, MassDOT reviewed their HSIP projects which fell in their hot-spot and systemic programs. Using the results in Question 46, the following summarizes the performance of those programs.

MassDOT evaluated 14 HSIP projects, 4 of which fell into the Systemic program and 10 fell into the hot-spot program. The 4 systemic projects account for $3.0 million in HSIP (completely funded by HSIP) and return $840.8 million in safety benefits in their expected 20-year service lives, producing a BCR of 283.9. The systemic projects are expected to reduce 609 all severity crashes per year, 167 fatal and injury crashes per year, and 11 KA crashes per year. At a cost of $2,961,770 in HSIP funds, this implies systemic projects require $4,863 to reduce one all severity crash per year, $17,769 to reduce one fatal and injury crash per year, and $269,252 to reduce one KA crash per year.

The 10 Spot projects evaluated accounted for $8.1 million in HSIP funds, $23.5 million in total funds, and are expected to return $38.0 million in safety benefits, producing a BCR of 4.7 for the HSIP and 1.6 for total funds. On a per crash basis, Spot projects are expected to require $587,133 in HSIP funds and $1.7 in total funds to reduce one all severity crash per year, $1.1 million in HSIP funds and $3.2 million in total funds to reduce one fatal and injury crash per year, and $1.9 million in HSIP funds and $5.4 million in total funds to reduce one KA crash per year.

Generally, both programs appear to be effective, and MassDOT plans to expand the systemic program moving forward.

What other indicators of success does the State use to demonstrate effectiveness and success of the Highway Safety Improvement Program?

- # RSAs completed
- HSIP Obligations
- Increased awareness of safety and data-driven process
- More systemic programs

MassDOT considers several other success indicators for their HSIP. These include the number of RSAs completed, HSIP Obligations relative to spending authority, increased awareness of safety and data-driven processes, and increased systemic programs.

28 RSAs were conducted by MassDOT. This was a little tougher than previous years because several had to be virtual. However, all RSAs planned by MassDOT were accomplished.

HSIP Obligations - This year our HSIP obligations were less than our spending authority partially because some projects we had planned to develop had glitches with right-of-way and therefore were pulled. While this is a problem, it helps us to raise awareness to some issues. Subsequent to this, we had developed an Implementation Plan which will help us to push on project types (systemic) in which we have previously had a hard time advertising.

In recent years, MassDOT has implemented several safety and data-driven processes to guide decision making both within and outside of the HSIP. These include the publication of a Safety Alternatives Analysis Guide and companion tools, establishing an Intersection Control Evaluation (ICE) Policy, and build out of the IMPACT crash data and analysis tools. The ICE policy and analysis guide have allowed MassDOT to require safety data-driven decision making for many projects in Massachusetts which had previously not considered the potential safety impact of design and traffic decision, which previously had not taken those into consideration in a data-driven way. Additionally, the IMPACT tool has allowed MassDOT to encourage the consideration of high-risk locations for all projects, not just HSIP projects.

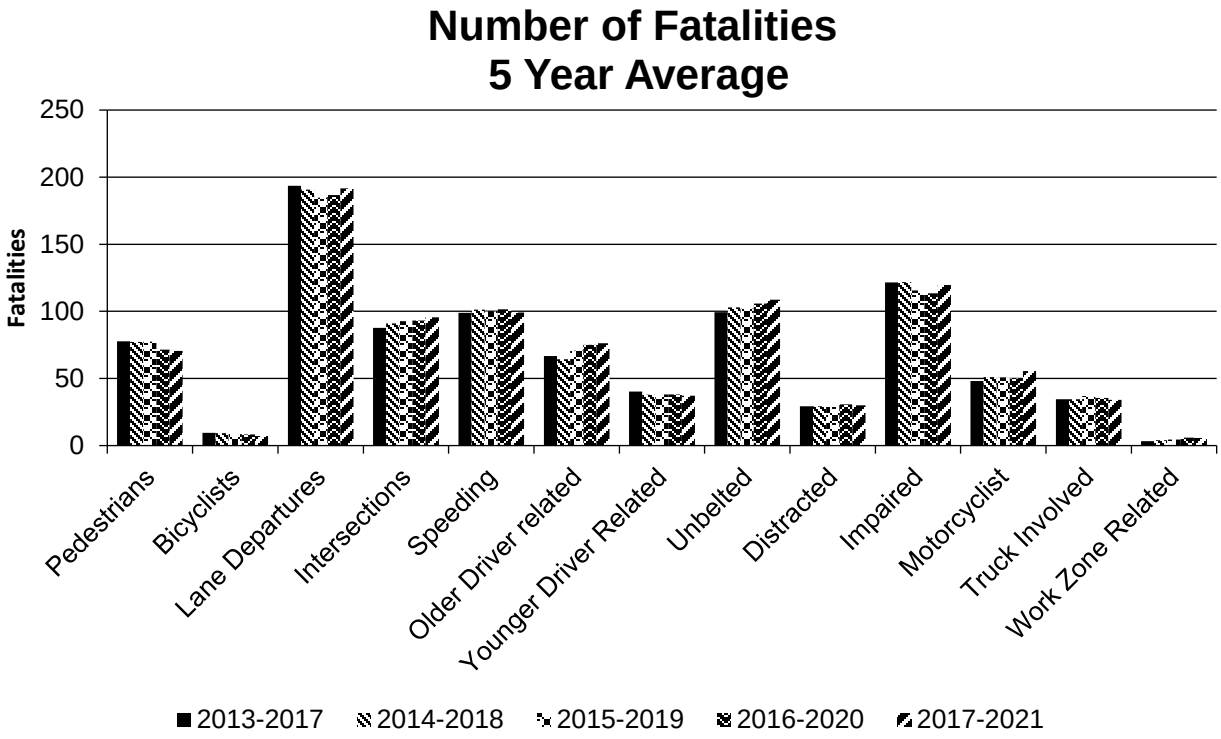
Finally, MassDOT has used the HSIP to program an increasing number of systemic projects. For instance, there are 3 systemic projects on the STIP for 2023 and 2024, whereas previously there would be 0 or 1. These systemic projects are driven by MassDOT's risk-based network screening maps in IMPACT. Helping this is MassDOT's adoption of a Material Procurement approach, in which MassDOT purchases safety countermeasure equipment for distribution to local agencies, who then take ownership of them and apply them at high-risk locations.

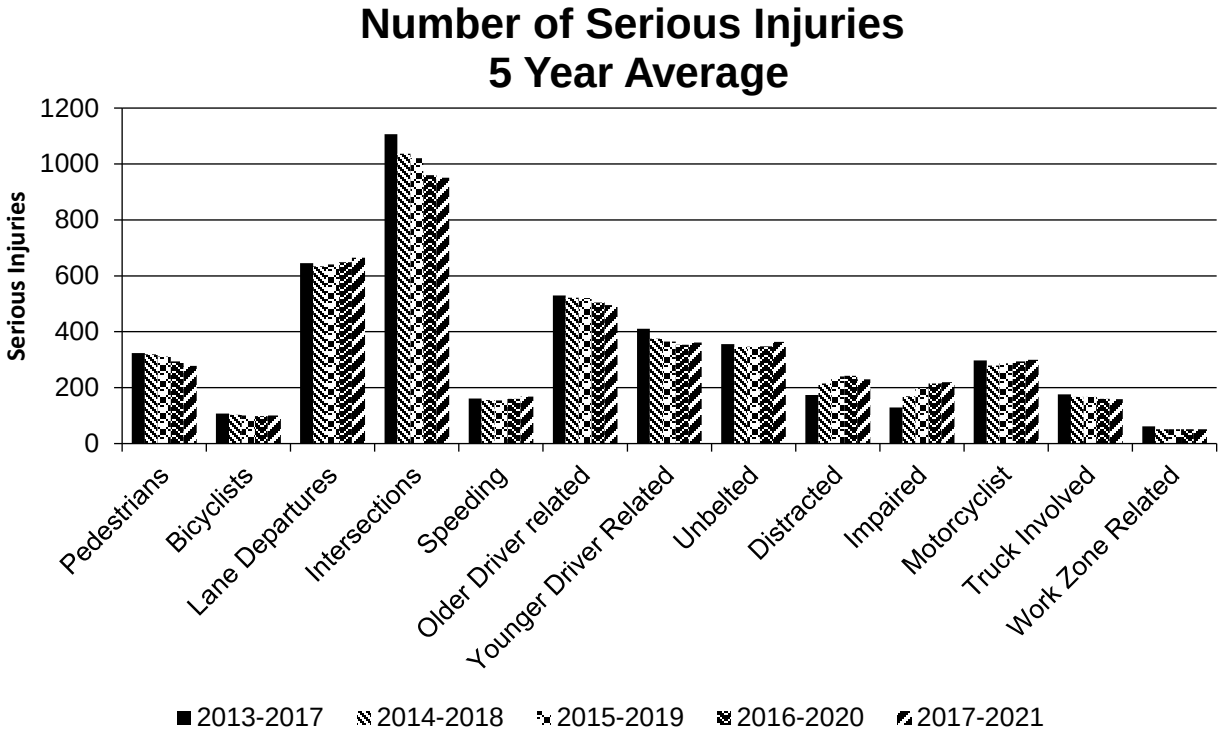
Effectiveness of Groupings or Similar Types of Improvements

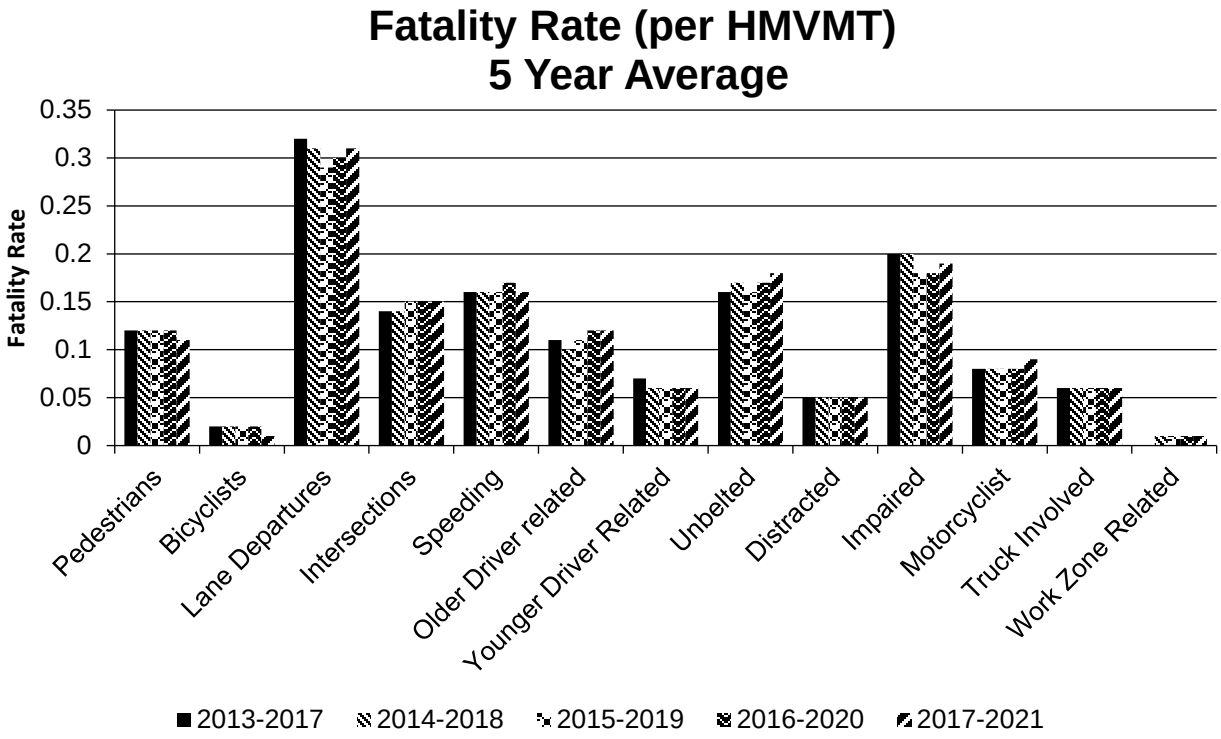
Present and describe trends in SHSP emphasis area performance measures.

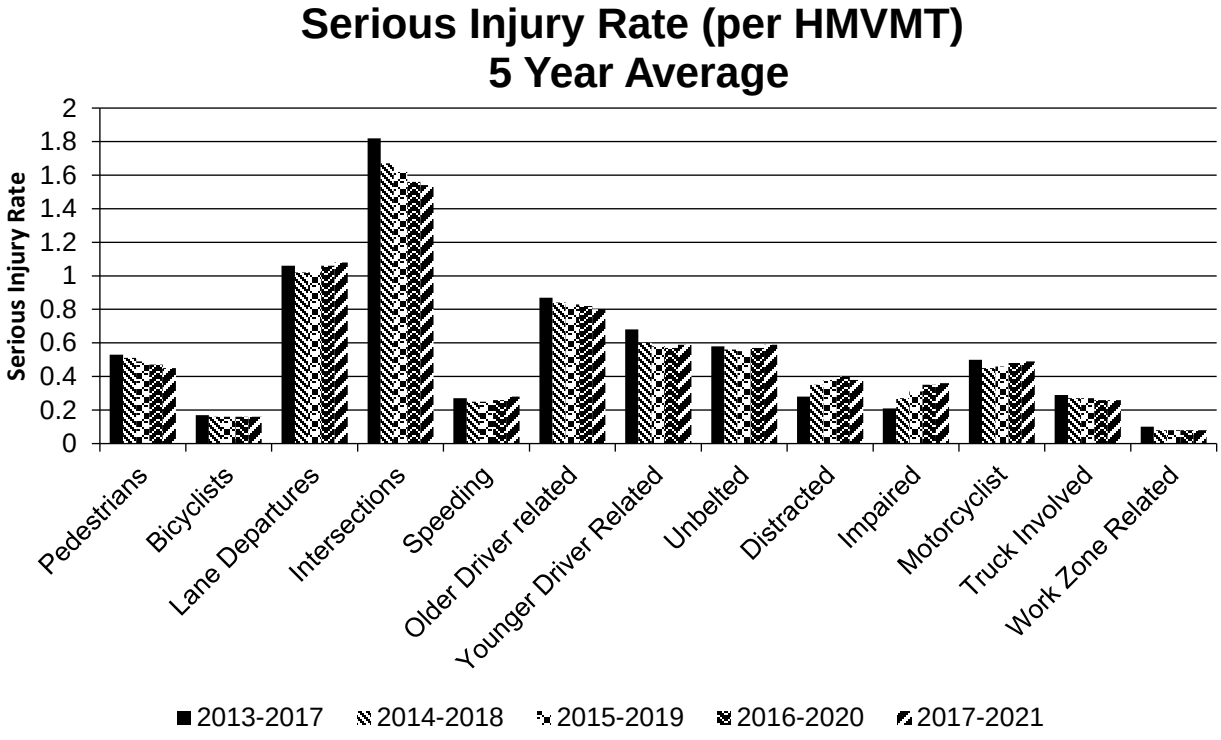
Year 2021

SHSP Emphasis Area	Targeted Crash Type	Number of Fatalities (5-yr avg)	Number of Serious Injuries (5-yr avg)	Fatality Rate (per HMVMT) (5-yr avg)	Serious Injury Rate (per HMVMT) (5-yr avg)
Pedestrians		70.6	278	0.11	0.45
Bicyclists		7.2	100.2	0.01	0.16
Lane Departures		191.6	664.2	0.31	1.08
Intersections		95.6	951.2	0.15	1.54
Speeding		99.2	167.8	0.16	0.28
Older Driver related		76.2	495.6	0.12	0.8
Younger Driver Related		37.2	361	0.06	0.59
Unbelted		108.8	363.4	0.18	0.59
Distracted		30	230.2	0.05	0.38
Impaired		119.6	219.2	0.19	0.36
Motorcyclist		55.6	299.2	0.09	0.49
Truck Involved		34	158.8	0.06	0.26
Work Zone Related		5.6	50.8	0.01	0.08


Number of Fatalities
5 Year Average
Fatalities
250
200
150
100
50
0
Pedestrians
Bicyclists
Lane Departures
Intersections
Speeding
Older Driver related
Younger Driver Related
Unbelted
Distracted
Impaired
Motorcyclist
Truck Involved
Work Zone Related
2013-2017
2014-2018
2015-2019
2016-2020
2017-2021


Number of Serious Injuries
5 Year Average
Serious Injuries
1200
1000
800
600
400
200
0
Pedestrians
Bicyclists
Lane Departures
Intersections
Speeding
Older Driver related
Younger Driver Related
Unbelted
Distracted
Impaired
Motorcyclist
Truck Involved
Work Zone Related
2013-2017
2014-2018
2015-2019
2016-2020
2017-2021





The fatality information comes from FARS and the serious injuries come from IMPACT. We could not go beyond 2021 because of the data are still draft. The rates were based on total statewide VMTs not VMTs by type since that is unavailable. Below are the criteria used for serious injuries:

Impaired Driving

  - Persons with “Non-fatal injury - Incapacitating” or “Suspected Serious Injury (A)” injuries involved in a crash where one or more drivers has the “Alcohol Suspected” flag reported as “Yes”.
- Intersection Related
  - Persons with “Non-fatal injury - Incapacitating” or “Suspected Serious Injury (A)” injuries involved in a crash where the Roadway Junction Type is reported to be “Four-way intersection”, “T-intersection”, “Y-intersection”, or “Five-point or more”.
- Lane Departure
  - Persons with “Non-fatal injury - Incapacitating” or “Suspected Serious Injury (A)” injuries involved in a crash where the first Sequence of Events for the crash is one of the following attributes: “Collision with curb”, “Collision with tree”, “Collision with utility pole”, “Collision with light pole or other post/support”, “Collision with guardrail”, “Collision with highway traffic sign post”, “Collision with fence”, “Collision with mail box”, “Collision with impact attenuator/crash cushion”, “Collision with bridge”, “Collision with other fixed object (wall, building, tunnel, etc.)”, or “Collision with unknown fixed object”.
- Occupant Protection
  - Persons with “Non-fatal injury - Incapacitating” or “Suspected Serious Injury (A)” injuries, and the “Person Type” field is either “Driver” or “Passenger”, and the “Protective System Use” field is “No”, and the “Vehicle Configuration” field for one or more of the vehicles involved in the crash includes “Passenger car” or “Light truck (van, mini-van, pick-up or sport utility)”.
- Speeding Related
  - Persons with “Non-fatal injury - Incapacitating” or “Suspected Serious Injury (A)” injuries involved in a crash in which one or more of the drivers is reported with a “Driver Contributing Circumstance” of “Exceeded authorized speed limit”.
- Young Driver
  - Persons with “Non-fatal injury - Incapacitating” or “Suspected Serious Injury (A)” injuries involved in a crash in which one or more of the drivers is between the ages of 15 and 20.
- Older Driver
  - Persons with “Non-fatal injury - Incapacitating” or “Suspected Serious Injury (A)” injuries involved in a crash in which one or more of the drivers is between the ages of 65 and 110.
- Pedestrian
  - Persons with “Non-fatal injury - Incapacitating” or “Suspected Serious Injury (A)” injuries involved in a crash where the Person Type is “Non-motorist” and the Non-motorist Type is “Pedestrian”.
- Bicycle
  - Persons with “Non-fatal injury - Incapacitating” or “Suspected Serious Injury (A)” injuries involved in a crash where the Person Type is “Non-motorist” and the Non-motorist Type is “Pedalcyclist (bicycle, tricycle, unicycle, pedal car)”.
- Motorcycle
  - Persons with “Non-fatal injury - Incapacitating” or “Suspected Serious Injury (A)” injuries involved in a crash in which one or more of the vehicles has a Vehicle Configuration Code of “Motorcycle”.
- Truck Involved
  - Persons with “Non-fatal injury - Incapacitating” or “Suspected Serious Injury (A)” injuries involved in a crash in which one or more of the vehicles has a Vehicle Configuration Code of “Bus (seats for 16 or more, including driver)”, “Bus (seats for 9-15 people, including driver)”, “Single-unit truck (2-axle, 6-tires)”, “Single-unit truck (3-or-more axles)”, “Truck/trailer”, “Truck tractor (bobtail)”, “Tractor/semi-trailer”, “Tractor/doubles”, “Tractor/triples”, or “Unknown heavy truck, cannot classify”
- Distracted Driving
  - Persons with “Non-fatal injury - Incapacitating” or “Suspected Serious Injury (A)” injuries involved in a crash in which one or more of the drivers is reported with a “Driver Distracted Type” of “Manually operating an electronic device”, “Talking on hands-free electronic device”,

“Talking on hand-held electronic device”, “Other activity, electronic device”, “Other activity (searching, eating, personal hygiene, etc.)”, “Passenger”, or “External distraction (outside the vehicle)”.

- Grade Crossing
  - Persons with “Non-fatal injury - Incapacitating” or “Suspected Serious Injury (A)” injuries involved in a crash in which the Roadway Junction Type is “Railway grade crossing”.
- Work Zone
  - Persons with “Non-fatal injury - Incapacitating” or “Suspected Serious Injury (A)” injuries involved in a crash in which the Work Zone Related flag is reported as “Yes”.
- Non-Motorist
  - Persons with “Non-fatal injury - Incapacitating” or “Suspected Serious Injury (A)” injuries involved in a crash where the Person Type is “Non-motorist” and the Non-motorist Type is “Pedestrian”, “Cyclist”, “Skater”, or “Other”.

Although 2022 was not yet completed, several emphasis areas data have been available. The 2018-2022 5-year average for the following fatalities are available (still as draft)

Pedestrians = 76

Bicyclist = 6.6

Motorcyclists = 58.8

Has the State completed any countermeasure effectiveness evaluations during the reporting period?

Yes

Please provide the following summary information for each countermeasure effectiveness evaluation.

CounterMeasures:	Flashing Yellow Arrow
Description:	Follow up evaluation on approach level CMFs
Target Crash Type:	Other (define)
Number of Installations:	
Number of Installations:	
Miles Treated:	
Years Before:	2
Years After:	2
Methodology:	Before/after using comparison group
Results:	All crash severity left turn crashes for approach level has CMF of 0.871 but several other crash types evaluated: Key findings, as described by Tainter et al. (2023), include: • The naïve before/after analysis yielded significant reductions in crashes for both 3-way and 4-way FYA intersections, primarily focused on the LTOT-related crash data sample. • The LT- and LTOT-related data yielded a

reduction in crashes resulting in injury and PDO, in addition to a reduction in severe crash types (head-on, angle, sideswipe). • Significant reductions in EPDO for both the LT- and LTOT-related samples of FYA crashes (95% confidence); however, there were significant increases in EPDO for both the LT- and LTOT-related sample of CG crashes (95% confidence). • The LT- and LTOT-related crash data samples resulted in BC ratios ranging from 18:1 to 2:1 and 21:1 to 3:1, respectively. • The LTOT-related sample yielded significant CMFs with 95% confidence regarding severe crash type reduction (head-on, angle, sideswipe) as well as injury crash reduction; however, the total crash (including PDO) reduction remained significant at 90% confidence. • In the infrastructure analysis, the No All-Red condition yielded the lowest EPDO rating, following by Greater than 3 seconds and Less than 3 seconds. • In evaluating the presence of Supplementary Signage, the Not Present condition led to an EPDO rating of 17.7 per approach, while the Present condition led to 21.6 per approach. • In evaluating the presence of conflicting pedestrian intervals, the Not Present condition yielded an EPDO rating of 19.5 per approach as compared to the Present condition of 24.6. Crash Type Crash Category Treatment Group, Before Treatment Group, After Comparison Group, Before Comparison Group, After CMF LT All Crashes 387 352 96 88 0.871 LT KABC Crashes 134 120 30 35 0.718 LT Severe Crash Types 363 321 85 80 0.915 LTOT All Crashes 318 265 61 64 0.767 LTOT KABC Crashes 116 102 24 33 0.592 LTOT Severe Crash Types 313 262 58 62 0.755

File Name: FYA_Summary March 2023.xlsx

Project Effectiveness

Provide the following information for previously implemented projects that the State evaluated this reporting period.

LOCATION	FUNCTIONAL CLASS	IMPROVEMENT CATEGORY	IMPROVEMENT TYPE	PDO BEFORE	PDO AFTER	FATALITY BEFORE	FATALITY AFTER	SERIOUS INJURY BEFORE	SERIOUS INJURY AFTER	ALL OTHER INJURY BEFORE	ALL OTHER INJURY AFTER	TOTAL BEFORE	TOTAL AFTER	EVALUATION RESULTS (BENEFIT/COST RATIO)
604035 - Hadley-Signal & Intersection Improvements At Route 9 (Russell Street) & Route 47 (Middle Street)	Urban Principal Arterial (UPA) - Other	Intersection traffic control	Modify traffic signal – modernization/replacement	11.00	21.00					1.00	4.00	12.00	25.00	-1.69
604699 - Sterling-Intersection Improvements At Route 12 And Chocksett Road	Urban Principal Arterial (UPA) - Other	Intersection traffic control	Modify control – Modern Roundabout	63.00	25.00			1.00		23.00	8.00	87.00	33.00	52.88
606207 - Spencer-Rehabilitation On Route 9 (Main Street), From High Street To Grove Street	Urban Principal Arterial (UPA) - Other	Roadway	Pavement surface - other	53.00	63.00				1.00	14.00	18.00	67.00	82.00	-2.2
607495 - District 5-Retroreflective Sign Upgrade On Secondary Roads	Urban Minor Arterial	Roadway signs and traffic control	Roadway signs (including post) - new or updated	3532.00	3340.00	10.00	5.00	105.00	84.00	1199.00	1080.00	4846.00	4509.00	211.9
607539 - Shelburne-Intersection Improvements @ Route 2 & Colrain/Shelburne Road	Rural Principal Arterial (RPA) - Other Freeways and Expressways	Intersection geometry	Intersection geometry - other	1.00	1.00			1.00		1.00	2.00	3.00	3.00	-0.56
607753 - Barnstable-Intersection & Signal Improvements At Sr 28 (Falmouth Road) At Strawberry Hill Road	Urban Principal Arterial (UPA) - Other	Intersection traffic control	Modify traffic signal – modernization/replacement	4.00	6.00					3.00	1.00	7.00	7.00	3.87
608025 - Brockton-Corridor Improvements On Route 123 (Belmont Street), Including Traffic Signals Upgrading At Manley Street And The V.A. Hospital	Urban Principal Arterial (UPA) - Other	Intersection traffic control	Modify traffic signal – modernization/replacement	68.00	39.00			7.00	1.00	33.00	30.00	108.00	70.00	-9.25

LOCATION	FUNCTIONAL CLASS	IMPROVEMENT CATEGORY	IMPROVEMENT TYPE	PDO BEFORE	PDO AFTER	FATALITY BEFORE	FATALITY AFTER	SERIOUS INJURY BEFORE	SERIOUS INJURY AFTER	ALL OTHER INJURY BEFORE	ALL OTHER INJURY AFTER	TOTAL BEFORE	TOTAL AFTER	EVALUATION RESULTS (BENEFIT/COST RATIO)
608169 - Dudley- Sign And Pavement Marking Installation And Upgrades And Related Work On Dresser Hill Road (Route 31), From State Line (Mm 0.0) To Tow	Urban Minor Arterial	Roadway signs and traffic control	Roadway signs (including post) - new or updated	12.00	21.00			1.00		8.00	6.00	21.00	27.00	16.68
608261 - Lawrence- Intersection Improvements At Marston Street And Ferry Street/Commonwealth Drive	Urban Minor Arterial	Intersection traffic control	Modify control – new traffic signal	29.00	13.00			2.00	1.00	17.00	4.00	48.00	18.00	48.2
608269 - District 4- District 6- Implementation Of Flashing Yellow Arrows	Rural Principal Arterial (RPA) - Other	Intersection traffic control	Modify traffic signal – add flashing yellow arrow	169.00	117.00			3.00	1.00	43.00	24.00	215.00	142.00	52.74
608398 - District 4- Retroreflective Sign Upgrades On Secondary Roads	Urban Minor Arterial	Roadway signs and traffic control	Roadway signs (including post) - new or updated	5249.00	4223.00	9.00	7.00	115.00	111.00	1585.00	1294.00	6958.00	5635.00	671.15
608539 - District 5- Pedestrian And Bicycle Facility Upgrades At Various Locations	Urban Minor Arterial	Pedestrians and bicyclists	Install new crosswalk	344.00	293.00	1.00		8.00	10.00	149.00	105.00	502.00	408.00	99.93
608542 - Winchendon- Resurfacing & Related Work On Route 140, From Teel Road To 430 Ft. South Of Route 12 (1.1 Miles)	Urban Principal Arterial (UPA) - Other	Roadway	Pavement surface - other	6.00	4.00					1.00	4.00	7.00	8.00	-11.78
608740 - Westport- Guardrail Installation On I-195	Urban Principal Arterial (UPA) - Interstate	Roadside	Barrier- metal	33.00	51.00	2.00		5.00	3.00	21.00	30.00	61.00	84.00	-16.96

Compliance Assessment

What date was the State's current SHSP approved by the Governor or designated State representative?

12/30/2022

What are the years being covered by the current SHSP?

From: 2016 To: 2020

When does the State anticipate completing it's next SHSP update?

2026

The HSP was completed in December 2022. However, due to a change in leadership, it was determined that the Action Plan should wait until the new leadership is in place. The Action Plan development will begin soon.

Provide the current status (percent complete) of MIRE fundamental data elements collection efforts using the table below.

*Based on Functional Classification (MIRE 1.0 Element Number) [MIRE 2.0 Element Number]

ROAD TYPE	*MIRE NAME (MIRE NO.)	NON LOCAL PAVED ROADS - SEGMENT		NON LOCAL PAVED ROADS - INTERSECTION		NON LOCAL PAVED ROADS - RAMPS		LOCAL PAVED ROADS		UNPAVED ROADS	
		STATE	NON-STATE	STATE	NON-STATE	STATE	NON-STATE	STATE	NON-STATE	STATE	NON-STATE
ROADWAY SEGMENT	Segment Identifier (12) [12]	1	1					1	1	1	1
	Route Number (8) [8]	1	1								
	Route/Street Name (9) [9]	0.9907	0.9941								
	Federal Aid/Route Type (21) [21]	0.9999	0.999								
	Rural/Urban Designation (20) [20]	1	1					1	1		
	Surface Type (23) [24]	0.9912	0.9911					1	1		
	Begin Point Segment Descriptor (10) [10]	1	1					1	1	1	1
	End Point Segment Descriptor (11) [11]	1	1					1	1	1	1
	Segment Length (13) [13]	1	1								
	Direction of Inventory (18) [18]	1	1								

ROAD TYPE	*MIRE NAME (MIRE NO.)	NON LOCAL PAVED ROADS - SEGMENT		NON LOCAL PAVED ROADS - INTERSECTION		NON LOCAL PAVED ROADS - RAMPS		LOCAL PAVED ROADS		UNPAVED ROADS	
		STATE	NON-STATE	STATE	NON-STATE	STATE	NON-STATE	STATE	NON-STATE	STATE	NON-STATE
	Functional Class (19) [19]	1	1					1	1	1	1
	Median Type (54) [55]	0.99	0.99								
	Access Control (22) [23]	0.9999	0.9974								
	One/Two Way Operations (91) [93]	0.9909	0.9914								
	Number of Through Lanes (31) [32]	1	1					1	1		
	Average Annual Daily Traffic (79) [81]	0.9991	0.9998					1	1		
	AADT Year (80) [82]	0.9991	0.9998								
	Type of Governmental Ownership (4) [4]	1	1					1	1	1	1
INTERSECTION	Unique Junction Identifier (120) [110]			1	1						
	Location Identifier for Road 1 Crossing Point (122) [112]			1	1						
	Location Identifier for Road 2 Crossing Point (123) [113]			1	1						
	Intersection/Junction Geometry (126) [116]			1	1						
	Intersection/Junction Traffic Control (131) [131]			0.541723171503481	0.723116638467844						
	AADT for Each Intersecting Road (79) [81]			0.999896336634012	0.999946245877989						
	AADT Year (80) [82]			0.999896336634012	0.999946245877989						
	Unique Approach Identifier (139) [129]			1	1						
INTERCHANGE/RAMP	Unique Interchange Identifier (178) [168]					1	1				

ROAD TYPE	*MIRE NAME (MIRE NO.)	NON LOCAL PAVED ROADS - SEGMENT		NON LOCAL PAVED ROADS - INTERSECTION		NON LOCAL PAVED ROADS - RAMPS		LOCAL PAVED ROADS		UNPAVED ROADS	
		STATE	NON-STATE	STATE	NON-STATE	STATE	NON-STATE	STATE	NON-STATE	STATE	NON-STATE
	Location Identifier for Roadway at Beginning of Ramp Terminal (197) [187]										
	Location Identifier for Roadway at Ending Ramp Terminal (201) [191]										
	Ramp Length (187) [177]					1	1				
	Roadway Type at Beginning of Ramp Terminal (195) [185]										
	Roadway Type at End Ramp Terminal (199) [189]										
	Interchange Type (182) [172]					0.5691	0.454				
	Ramp AADT (191) [181]					1	0.96				
	Year of Ramp AADT (192) [182]					1	0.96				
	Functional Class (19) [19]					1	1				
	Type of Governmental Ownership (4) [4]					1	1				
Totals (Average Percent Complete):		**1.00**	**1.00**	**0.94**	**0.97**	**0.60**	**0.58**	**1.00**	**1.00**	**1.00**	**1.00**

*Based on Functional Classification (MIRE 1.0 Element Number) [MIRE 2.0 Element Number]

Describe actions the State will take moving forward to meet the requirement to have complete access to the MIRE fundamental data elements on all public roads by September 30, 2026.

MassDOT, Geospatial Technology is working with various stakeholders to add new events to the Roads and Highways database. Projects currently under development are pedestrian data elements. These are to be gathered in an automated process utilizing an application developed by MIT. Database enhancements since the last update include the addition of Interchange Type (FDE 172) which is still being populated with data and improved data quality for Speed Limit (FDE 94). Intersection linework has been updated to meet current guidelines.

The following data elements need further research: 26, 27, 35, 47, 51, 60-69, 83, 87, 88, 97-99, 102, 105-107.

Data can be derived from elements 70-76 (driveway) due to Jurisdiction domain changes. These may need to be modified to meet MIRE standards.

Optional Attachments

Program Structure:

Project Implementation:

Safety Performance:

Evaluation:

FYA_Summary March 2023.xlsx
FYA2_March2023.pdf
Compliance Assessment:

Glossary

5 year rolling average: means the average of five individuals, consecutive annual points of data (e.g. annual fatality rate).

Emphasis area: means a highway safety priority in a State's SHSP, identified through a data-driven, collaborative process.

Highway safety improvement project: means strategies, activities and projects on a public road that are consistent with a State strategic highway safety plan and corrects or improves a hazardous road location or feature or addresses a highway safety problem.

HMVMT: means hundred million vehicle miles traveled.

Non-infrastructure projects: are projects that do not result in construction. Examples of non-infrastructure projects include road safety audits, transportation safety planning activities, improvements in the collection and analysis of data, education and outreach, and enforcement activities.

Older driver special rule: applies if traffic fatalities and serious injuries per capita for drivers and pedestrians over the age of 65 in a State increases during the most recent 2-year period for which data are available, as defined in the Older Driver and Pedestrian Special Rule Interim Guidance dated February 13, 2013.

Performance measure: means indicators that enable decision-makers and other stakeholders to monitor changes in system condition and performance against established visions, goals, and objectives.

Programmed funds: mean those funds that have been programmed in the Statewide Transportation Improvement Program (STIP) to be expended on highway safety improvement projects.

Roadway Functional Classification: means the process by which streets and highways are grouped into classes, or systems, according to the character of service they are intended to provide.

Strategic Highway Safety Plan (SHSP): means a comprehensive, multi-disciplinary plan, based on safety data developed by a State Department of Transportation in accordance with 23 U.S.C. 148.

Systematic: refers to an approach where an agency deploys countermeasures at all locations across a system.

Systemic safety improvement: means an improvement that is widely implemented based on high risk roadway features that are correlated with specific severe crash types.

Transfer: means, in accordance with provisions of 23 U.S.C. 126, a State may transfer from an apportionment under section 104(b) not to exceed 50 percent of the amount apportioned for the fiscal year to any other apportionment of the State under that section.