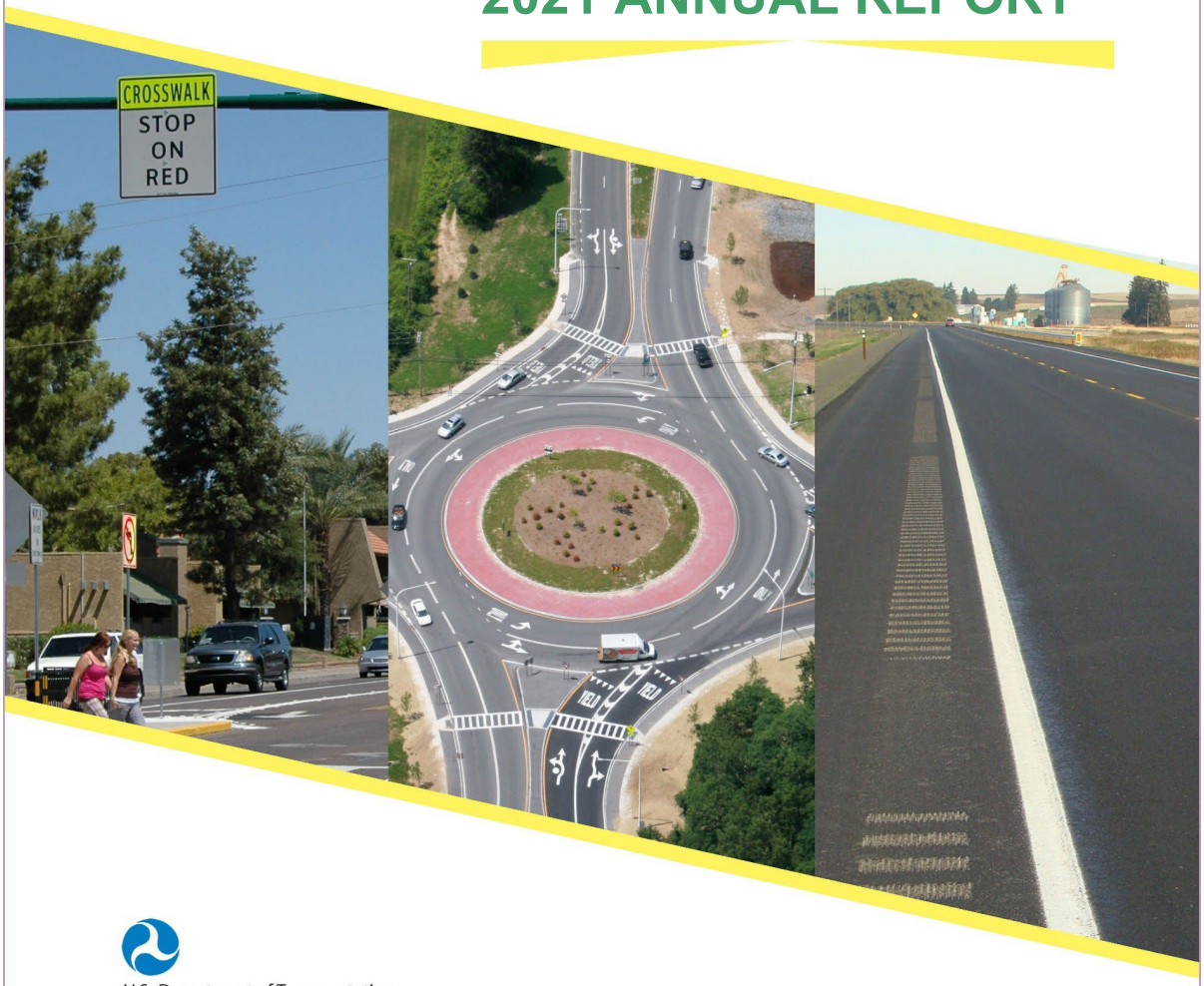
MASSACHUSETTS

HIGHWAY SAFETY IMPROVEMENT PROGRAM

2021 ANNUAL REPORT



U.S. Department of Transportation
Federal Highway Administration

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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. 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. 409 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. 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 was 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 finalized. This will necessitate an update to the HSIP guidance (due in fall 2021).

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 the 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 IMAPCT 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 While the guidelines have not yet been updated to reflect this but the Top 5% locations are also HSIP eligible. 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 . Although HSIP guidelines have not yet been updated, Top risk locations will be eligible for systemic HSIP projects.

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 late 2019, an expanded HSIP Task Force reconvened and slightly tweaked the HSIP Guidelines so that the project selection for HSIP can be more fluid and nimble and responsive to the needs of SHSP strategies. This is still a work in progress and the new information from network screening still needs to be added (due fall 2021).

Where is HSIP staff located within the State DOT?

Engineering

MassDOT does not have specific "HSIP staff". However, the people who design and develop HSIP guidelines and eligibility as well as review Safety aspects and conduct Road Safety Audits sit within Traffic and Safety Engineering at MassDOT.

How are HSIP funds allocated in a State?

- Formula via MPOs
- Other-combination

The MPOs collectively receive about 1/3 of the FHWA funds available to us each FFY (after ABP GANS payments), and the MARPA formula simply distributes that 1/3 by % for each region (Boston gets 43%, for example). HSIP is assigned for project eligibility across regional and statewide priorities as opposed to a required minimum by region.

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.

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.

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 works with the MassDOT Safety Group to allocate 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 has been developed with the assistance from our internal and external partners. The SHSP was updated and approved in December 2018 and involved participation from over 200 participants from more than 25 agencies (including all of those external partners mentioned in the response to Question 9) and entities and the strategies identified in the SHSP are those that can be used for the HSIP eligible projects. 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. As an example of this is when we were developing the pedestrian/bicyclist safety campaign (a Statewide HSIP program), we developed a committee consisting of Governors Highway Safety Office, Public Health, MPOs, advocacy groups, local police and community officials, etc. to assist with the specifics and to guide the program.

As stated earlier, there is an existing HSIP Task Force that develops the HSIP guidelines and identifies eligibility of HSIP projects (but does not select the specific projects).

Describe HSIP program administration practices that have changed since the last reporting period.

A new tool was built to assist MassDOT internal and external partners as well as the public to better view and understand HSIP eligible locations. This can be found through the network screening tools of IMPACT:

https://apps.impact.dot.state.ma.us/sat/landing However, it should be noted, that this was developed in spring 2021 and the HSIP guidelines have not yet been updated.

Program Methodology

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

Yes
On the MassDOT website are links to the HSIP Criteria that defines what is HSIP eligible. https://www.mass.gov/service-details/highway-safety-improvement-program . As stated earlier, this HSIP eligibility guide needs to be updated to reflect the new use of crash-based and risk-based network screening. However, since those models were recently completed and posted to IMAPCT, the guide has not yet been updated. This update will be completed in fall 2021.
Also, on that webpage is a link for MassDOT Safety: Alternatives Analysis Guide (SAAG) which details how to evaluate effectiveness of project alternatives. The guide also include MA-preferred CMFs. This SAAG is being updated and the version on the website is being updated as well.

Select the programs that are administered under the HSIP.

- HSIP (no subprograms)

We do not have specific "programs" administered under HSIP. We have guidelines where HSIP eligibility is determined. Previously, guidelines were based on strategies identified in the SHSP and EPDO for hot spot locations. But this is all changing because we developed risk based models and network screening which will be used in the future. We are also developing an HSIP Implementation Plan to help guide project/program selection.

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 EPDO and data for intrsecitons nad other hot spot clusters

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	• Median width • Horizontal curvature • Functional classification

What project identification methodology was used for this program?

- Crash rate
- Equivalent property damage only (EPDO Crash frequency)

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

Project readiness has been a difficulty for us. But we recently developed network screening, risk based analysis and SPFs along with the longstanding availability of hot spot intersection/bicyclist/pedestrian crash clusters based on EPDO. So it will be easier to integrate safety into other programmed projects and to develop projects/programs moving forward. To date, all HSP hot spot projects were required to have road safety audits conducted and the recommendations were integrated into the projects.

What percentage of HSIP funds address systemic improvements?

28.5

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

- Cable Median Barriers
- Wrong way driving treatments

Note that the calculation of systemic percentage is the total cost of the two systemic projects divided by the total costs of all projects that have HSIP components. But note that not all funding for the systemic projects or other projects relate to safety. Some aspects of the cost relate to other purposes and needs for the projects.

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 are in the process of implementing a pilot project for Wrong Way Vehicle Detection systems at 17 key interchange ramps around Massachusetts. The project will use advanced technology to identify wrong way vehicles in real time and send alerts to our HOC and Mass State Police. The pilot project is scheduled to become operational in mid 2022. This project used HSIP funding. MassDOT has also begun construction for the Route 9 Connected Corridor project that will add connected vehicle technology and adaptive control at 37 intersections along Route 9 from Worcester, MA to Wellesley, MA. Phase 1 of this project is expected to be completed in late 2021. This project used CMAQ funding. 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 is also currently scoping and designing the Districts 1 and 2 Signal Safety project that will provide connected vehicle technology capabilities on all signals in D1 and D2. This project will use HSIP funding but will be advertised in 2021. Previously, 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). MassDOT signed on for the EDC Use of Crowdsourcing in Operations. FHWA and the contractor have begun helping us to pilot this. 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.

MassDOT uses both the predictive methodology and the empirical-Bayes method described in the Highway Safety Manual to support administrating the HSIP. MassDOT just completed the network screening process to consider the difference between expected and predicted crashes using HSM methodologies and Massachusetts-specific safety performance functions. These models 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). Furthermore, a systemic risk-based network screening was also developed for nearly all of the emphasis areas in the SHSP. This, too, is available in the in the public-facing IMAPCT tool.

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.

Project Implementation

Funds Programmed

Reporting period for HSIP funding.

Federal Fiscal Year
The report describes projects funded in FFY 2020. The crash data and data related questions are by calendar year.

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

FUNDING CATEGORY	PROGRAMMED	OBLIGATED	% OBLIGATED/PROGRAMMED
HSIP (23 U.S.C. 148)	$28,094,694	$28,454,771	101.28%
HRRR Special Rule (23 U.S.C. 148(g)(1))	$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)	$56,253,545	$55,935,873	99.44%
State and Local Funds	$14,187,897	$17,552,402	123.71%
Totals	$98,536,136	$101,943,046	103.46%

This information was provided directly from FAPRO office via email on 5/20/2021

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

9%

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

9%
Two projects, Auburn and Chicopee, are local jurisdiction projects

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

0%

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

0%
We would really like the ability to focus on all of the "Es" and have the flexibility to include as an integrated program with HSIP funding.

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 (for pedestrian enhancements using RRFBs). In addition, we are testing out a systemic project for rural road departure by providing the municipally owned locations to the ROW Section with the idea that ROW Section will review each location to know what layouts are available. Even though it is not a requirement for MassDOT to develop an HSIP Implementation Plan, we are doing so to highlight the project types that would be most effective to reducing our fatalities and injuries. By highlighting these types of projects (possibly systemic), there will be a greater urgency to resolve some issues.

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
604434-CHICOPEE-RECONSTRUCTION & RELATED WORK ON FULLER ROAD, FROM MEMORIAL DR (RTE 33) TO SHAWNIGAN DR (2.0 MILES)	Roadway signs and traffic control	Roadway signs and traffic control - other	2	Miles	$2008553	$14039944.44	HSIP (23 U.S.C. 148)	Urban	Minor Arterial	19,100	40	City or Municipal Highway Agency	Spot	Intersections	Incorporate safety elements into infrastructure design and maintenance
605651-LEOMINSTER-RECONSTRUCTION ON ROUTE 13, FROM HAWES STREET TO PROSPECT STREET	Intersection geometry	Modify lane assignment	6	Intersections	$1186326	$6861072.22	HSIP (23 U.S.C. 148)	Urban	Principal Arterial-Other	28,064	30	State Highway Agency	Spot	Intersections	Incorporate safety elements into infrastructure design and maintenance
606011-DEERFIELD-WHATELY-RESURFACING & RELATED WORK ON ROUTES 5&10, FROM OLD STATE ROAD TO CONWAY ROAD (1.1 MILES)	Roadway	Pavement surface - other	1.1	Miles	$4572497	$4648643.9	HSIP (23 U.S.C. 148)	Urban	Principal Arterial-Other	15,455	45	State Highway Agency	Spot	Lane Departure	Incorporate safety elements into infrastructure design and maintenance
606272-BARNSTABLE-INTERSECTION IMPROVEMENTS AT IYANOUGH ROAD (ROUTE 28) AND YARMOUTH ROAD	Intersection traffic control	Modify traffic signal – modernization/replacement	1	Intersections	$168924	$29024975.86	HSIP (23 U.S.C. 148)	Urban	Principal Arterial-Other	60,900	40	State Highway Agency	Spot	Intersections	Incorporate safety elements into infrastructure design and maintenance
606635-NEEDHAM-NEWTON-RECONSTRUCTION OF HIGHLAND AVENUE, NEEDHAM STREET & CHARLES RIVER BRIDGE, WEBSTER STREET TO RTE 9 (NEWTON)	Pedestrians and bicyclists	Install sidewalk	1.7	Miles	$4500000	$28513526.1	HSIP (23 U.S.C. 148)	Urban	Principal Arterial-Other	34,700	35	State Highway Agency	Spot	Pedestrians	Incorporate safety elements into infrastructure design and maintenance
607733-AUBURN-REHABILITATION OF AUBURN STREET,	Pedestrians and bicyclists	On road bicycle lane	0.5	Miles	$735132	$5751658.55	HSIP (23 U.S.C. 148)	Urban	Minor Arterial	11,840	35	Town or Township	Spot	Bicyclists	Incorporate safety elements

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
FROM WALSH AVENUE TO MILLBURY STREET												Highway Agency			into infrastructure design and maintenance
607756-GREAT BARRINGTON-INTERSECTION & SIGNAL IMPROVEMENTS ON US 7 (SOUTH MAIN STREET) AT SR 23 & SR 41 (MAPLE AVENUE)	Intersection traffic control	Modify control – Modern Roundabout	1	Intersections	$2339521	$8322984.91	HSIP (23 U.S.C. 148)	Rural	Minor Arterial	24,428	35	State Highway Agency	Spot	Intersections	Incorporate safety elements into infrastructure design and maintenance
608088-BROCKTON-CORRIDOR IMPROVEMENTS ON ROUTE 123 (BELMONT STREET), FROM ANGUS BEATON DRIVE TO WEST STREET	Intersection traffic control	Modify traffic signal – modernization/replacement	0.5	Miles	$386938	$7778744	HSIP (23 U.S.C. 148)	Urban	Principal Arterial-Other	24,400	40	State Highway Agency	Spot	Intersections	Incorporate safety elements into infrastructure design and maintenance
608347-BEVERLY-INTERSECTION IMPROVEMENTS @ 3 LOCATIONS	Intersection traffic control	Modify traffic signal – modernization/replacement	3	Intersections	$4247549	$5945612.09	HSIP (23 U.S.C. 148)	Urban	Principal Arterial-Other	40,874	35	State Highway Agency	Spot	Intersections	Incorporate safety elements into infrastructure design and maintenance
608378-DANVERS-TOPSFIELD-BOXFORD-ROWLEY-INTERSTATE MAINTENANCE AND RELATED WORK ON I-95	Roadside	Barrier – cable	20.3	Miles	$2000000	$26591890.55	HSIP (23 U.S.C. 148)	Urban	Principal Arterial-Interstate	86,887	65	State Highway Agency	Systemic	Roadway Departure	Incorporate safety elements into infrastructure design and maintenance
608575-CHICOPEE TO HOLYOKE-GUIDE AND TRAFFIC SIGN REPLACEMENT ON I-391	Roadway signs and traffic control	Sign sheeting - upgrade or replacement	4.7	Miles	$1861310	$2350681	HSIP (23 U.S.C. 148)	Urban	Principal Arterial-Interstate	57,650	65	State Highway Agency	statewide, systematic update	Older Drivers	Incorporate safety elements into infrastructure design and maintenance

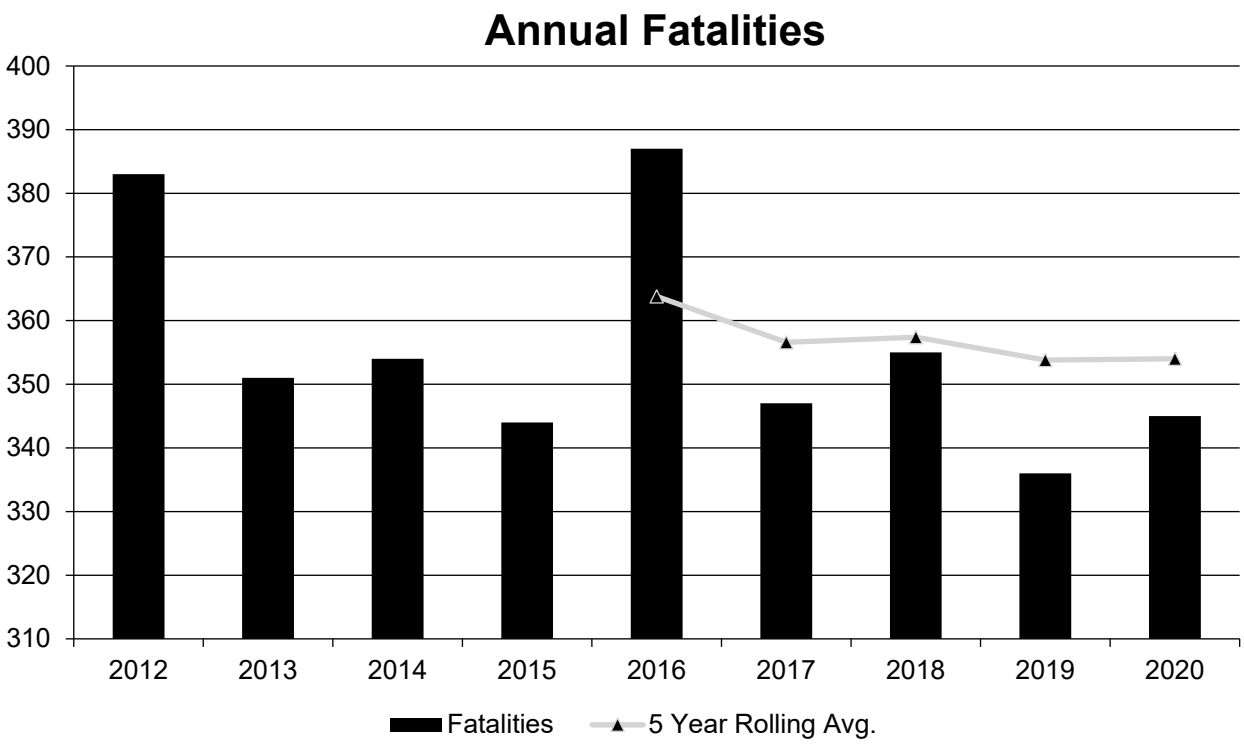
PROJECT NAME	IMPROVEMENT CATEGORY	SUBCATEGORY	OUTPUTS	OUTPUT TYPE	HSIP PROJECT COST($)	TOTAL PROJECT COST($)	FUNDING CATEGORY	LAND USE/AREA TYPE	FUNCTIONAL CLASSIFICATION	AADT	SPEED	OWNERSHIP	METHOD FOR SITE SELECTION	SHSP EMPHASIS AREA	SHSP STRATEGY
609299-FALL RIVER-WESTPORT-INSTALLATION OF SIGN PANELS AND SUPPORTS AT EIGHT LOCATIONS ON I-195 AND ROUTE 24	Roadway signs and traffic control	Sign sheeting - upgrade or replacement	1.9	Miles	$1000000	$1001195	HSIP (23 U.S.C. 148)	Urban	Principal Arterial-Interstate	0	65	State Highway Agency	statewide, systematic update	Older Drivers	Incorporate safety elements into infrastructure design and maintenance
609414-STATEWIDE-WRONG WAY ENTRY COUNTERMEASURES	Advanced technology and ITS	Wrong-way Driving Detection System			$3000000	$2724501	HSIP (23 U.S.C. 148)	Multiple/Varies	Principal Arterial-Interstate	0	65	State Highway Agency	Systemic	Impaired Drivers and Older drivers	Incorporate safety elements into infrastructure design and maintenance
610646-DISTRICT 1-DISTRICT 2-DISTRICT 3-CONVERSION OF INTERSTATE AND FREEWAY EXIT SIGNS TO MILEPOST-BASED NUMBERING	Roadway signs and traffic control	Sign sheeting - upgrade or replacement			$1163876	$1195361	HSIP (23 U.S.C. 148)	Multiple/Varies	Principal Arterial-Interstate	0	65	State Highway Agency	statewide	Assist with emergency response	Incorporate safety elements into infrastructure design and maintenance
610699-DISTRICT 4-DISTRICT 5-DISTRICT 6-CONVERSION OF INTERSTATE AND FREEWAY EXIT SIGNS TO MILEPOST-BASED NUMBERING	Roadway signs and traffic control	Sign sheeting - upgrade or replacement			$1163876	$1389182	HSIP (23 U.S.C. 148)	Multiple/Varies	Principal Arterial-Interstate	0	65	State Highway Agency	statewide	Assist with emergency response	Incorporate safety elements into infrastructure design and maintenance

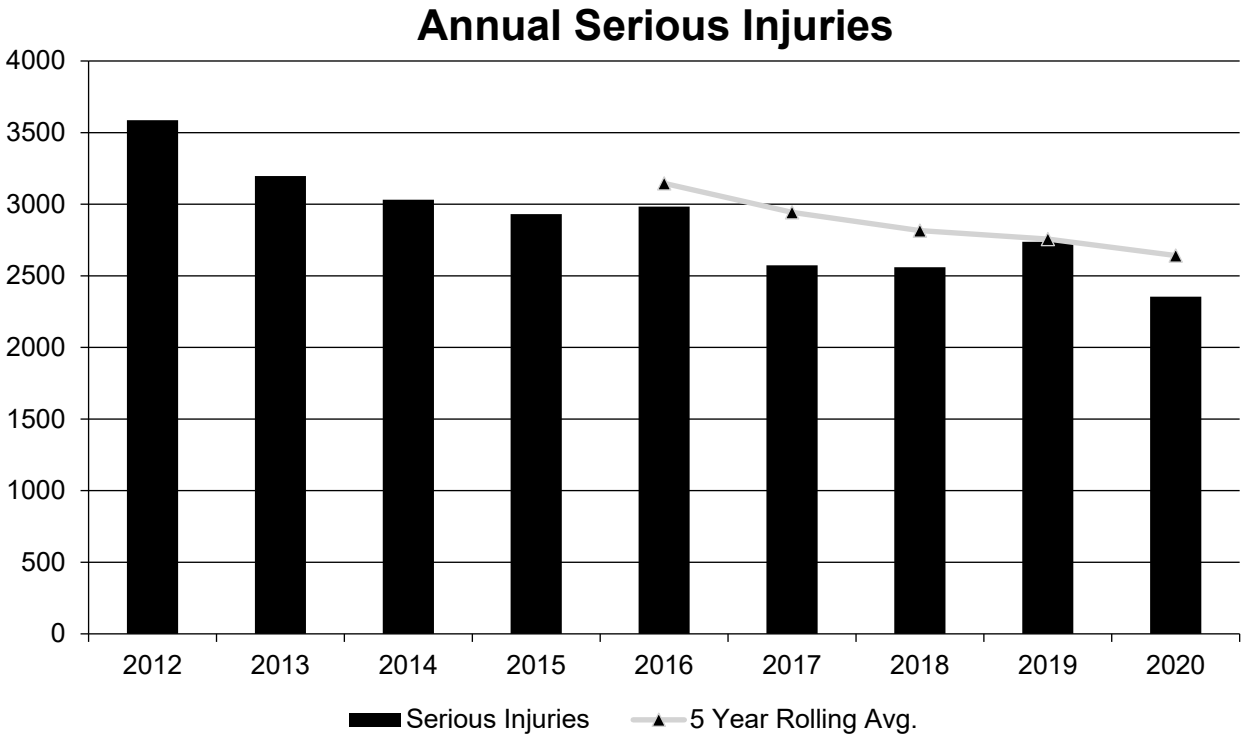
Safety Performance

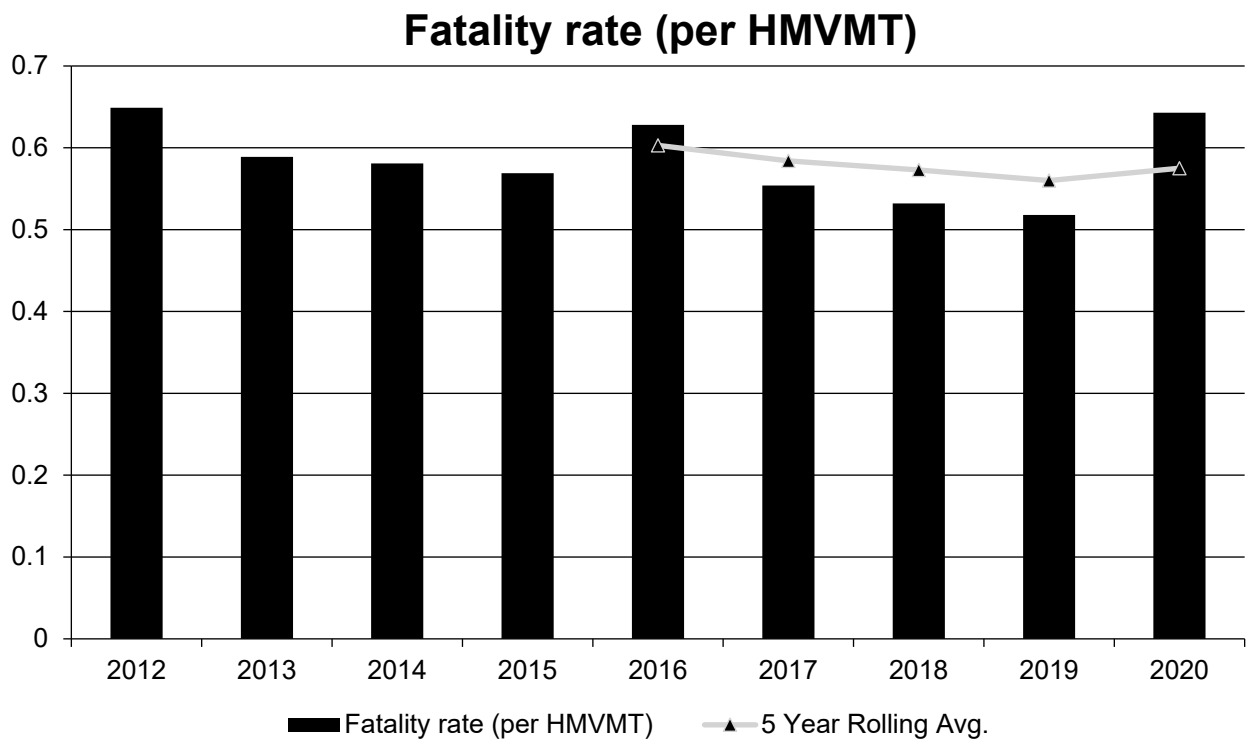
General Highway Safety Trends

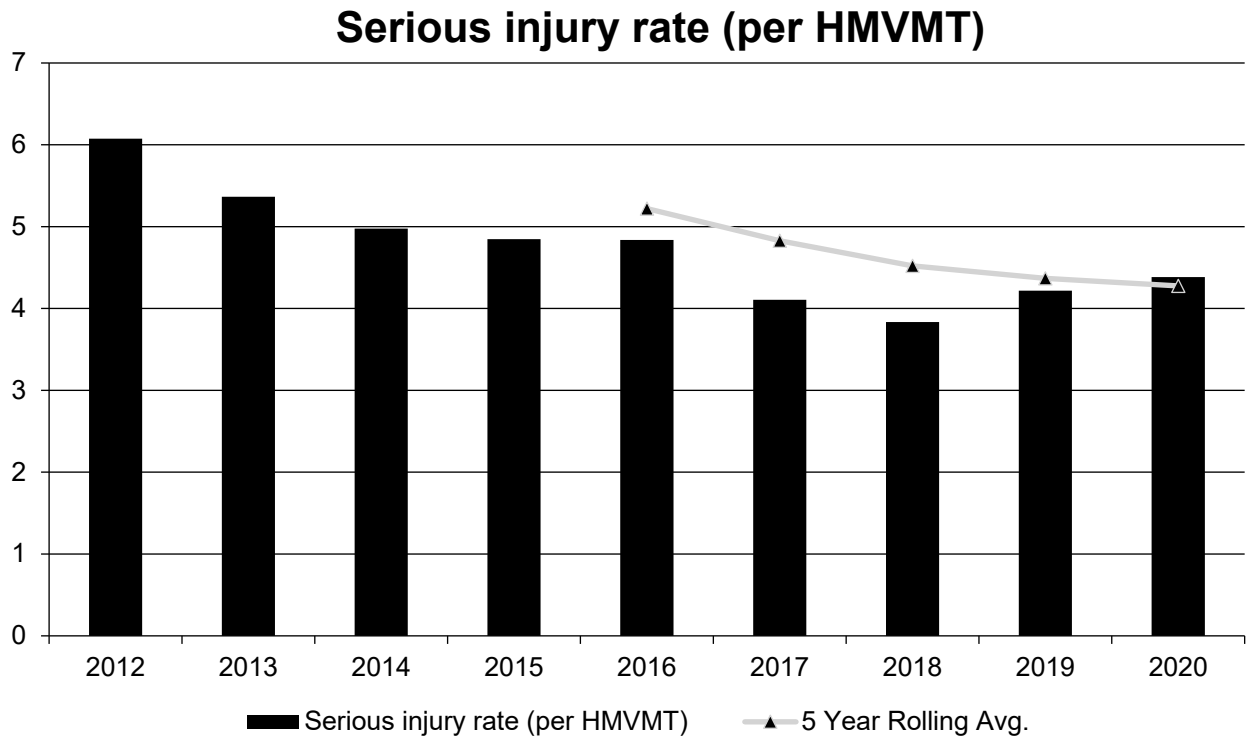
Present data showing the general highway safety trends in the State for the past five years.

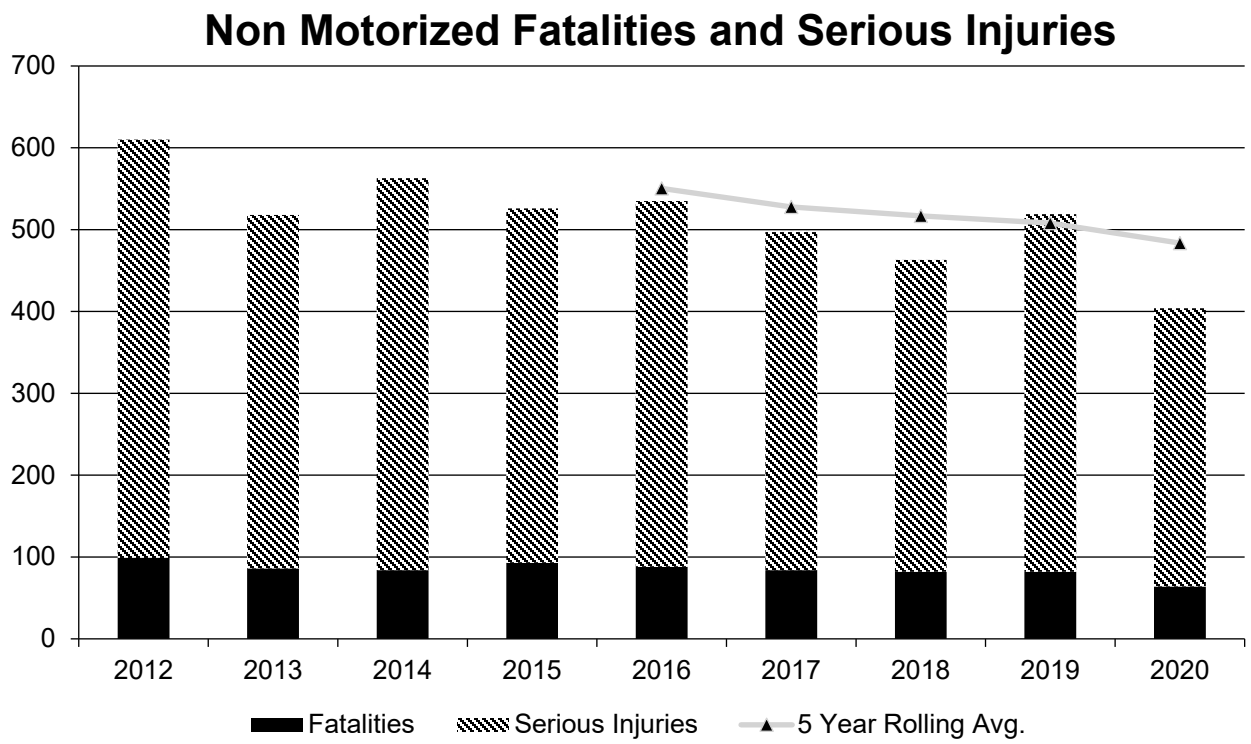
PERFORMANCE MEASURES	2012	2013	2014	2015	2016	2017	2018	2019	2020
Fatalities	383	351	354	344	387	347	355	336	345
Serious Injuries	3,587	3,197	3,031	2,931	2,983	2,573	2,560	2,737	2,354
Fatality rate (per HMVMT)	0.649	0.589	0.581	0.569	0.628	0.554	0.532	0.518	0.643
Serious injury rate (per HMVMT)	6.076	5.365	4.977	4.848	4.838	4.106	3.834	4.218	4.384
Number non-motorized fatalities	99	86	84	93	88	84	82	82	64
Number of non-motorized serious injuries	511	432	479	433	447	413	381	437	340


Annual Fatalities
400
390
380
370
360
350
340
330
320
310
2012
2013
2014
2015
2016
2017
2018
2019
2020
Fatalities
5 Year Rolling Avg.


Annual Serious Injuries
4000
3500
3000
2500
2000
1500
1000
500
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
Serious Injuries
5 Year Rolling Avg.


Fatality rate (per HMVMT)
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
Fatality rate (per HMVMT)
5 Year Rolling Avg.


Serious injury rate (per HMVMT)
7
6
5
4
3
2
1
0
2012
2013
2014
2015
2016
2017
2018
2019
2020
Serious injury rate (per HMVMT)
5 Year Rolling Avg.



The fatality data was provided to us by FARS Analyst in March 2021. The Serious Injuries came from the IMPACT crash data portal from March 2021. Note that data from 2019 and 2020 are not final and change over time. It is likely that these data will change before the final file closes.

Describe fatality data source.

Other
If Other Please describe

Pre 2018, the fatality data came from FARS. But 2018-2020 came from FARS Analyst as of March 2021

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

Year 2020

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	9	0.26	1.02
Rural Principal Arterial (RPA) - Other Freeways and Expressways	0.6	1.6	0.48	1.3
Rural Principal Arterial (RPA) - Other	2	8	0.72	2.46

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 Minor Arterial	5.4	14.6	1.12	3.07
Rural Minor Collector	2.4	12	2.01	10.06
Rural Major Collector	5.6	27.4	0.9	4.47
Rural Local Road or Street	5.4	26.6	1	4.9
Urban Principal Arterial (UPA) - Interstate	55.6	236.2	0.34	1.45
Urban Principal Arterial (UPA) - Other Freeways and Expressways	13.6	122.6	0.22	1.94
Urban Principal Arterial (UPA) - Other	100	757.8	0.83	6.25
Urban Minor Arterial	90	779.4	0.76	6.6
Urban Minor Collector	0.4	0		
Urban Major Collector	30.2	265.6	0.74	6.53
Urban Local Road or Street	39.8	286	0.49	3.53
Local Highway Agency (combined City/Town)	180.4	1,612.2	0.69	6.17
Federal/Army/Navy/Air Force	0	0.2	0	0.49
Unaccepted	3	34.8	0.26	3.02

Year 2020

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	151.6	836.4	0.46	2.52
County Highway Agency	0	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	0.4	0.8	0.48	0.95
Local Park, Forest or Reservation Agency	0	0	0	0
Other State Agency	8.2	40.8	0.91	4.44
Other Local Agency	0	0	0	0
Private (Other than Railroad)	0.2	0.6	0.84	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	0.2	0	0.51
Indian Tribe Nation	0	0	0	0
Local Highway Agency (combined City/Town)	180.4	1,612.2	0.69	6.17
Federal/Army/Navy/Air Force	0	0.2	0	0.49
Unaccepted	3	34.8	0.26	3.02
Unaccepted				

- Vehicle mile traveled data are taken from the MassDOT GIS VMT Viewer (https://gis.massdot.state.ma.us/dataviewers/vmt/) for 2017-2019 with adjustments from the Planning

office. Earlier years are from Federal Highway Administration Office of Policy Information website https://www.fhwa.dot.gov/policyinformation/statistics/2007/vm2.cfm (link shown for 2007 but used for other years) and then checked against VMT information provided by the MassDOT Planning Office. 2020 VMTs for Federal Functional Classification were obtained from the 2020 HPMS submittal. 2020 VMTs for Jurisdiction were pro-rated (reduced by 16.81% which is the total amount that VMTs changed decreased between 2019 and 2020) because these VMTs were not available from the MassDOT Planning Office.

- The fatality data for functional classification and jurisdiction came from FARS where available but updated based on updated data in the statewide system. The serious injury data for functional classification and for jurisdiction was obtained from IMPACT crash portal (https://apps.impact.dot.state.ma.us/cdp/home) from the Cross Tabulation tool. Fatal data for jurisdiction for years 2018-2020 were obtained from the IMPACT crash portal.
- Although the crash data is separated by urban major and minor collector, the VMTs are not and therefore, the two categories were combined. Major and minor collector crash numbers were pulled from the IMPACT crash portal.
- Non-geocoded crashes that contain no jurisdiction or functional classification were not included so totals may not add up.
- The category of “City OR Town Highway Agency” was added because Massachusetts did not make a distinction between these roads and the FARS data may not have been allocated to the official governance of the municipality type.
- Mapping of jurisdiction between FARS and MassDOT is below

MassDOT Code	**MassDOT Jurisdiction**	FARS Code	**FARS Ownership**
0	Unaccepted by city or town	? 26	Private (other than Railroad)
1	MassDOT	? 01	State Highway Agency
2	City or Town accepted road	? 03 **OR** 04	Town or Township Highway Agency **OR** City or Municipal Highway Agency (use chart)
3	Dept. of Conservation and Recreation	? 21	Other State Agency
5	Massachusetts Port Authority	? 21	Other State Agency
6	State Park or Forest	? 11	State Park, Forest, or Reservation Agency
7	State Institutional	? 40	Other Public Instrumentality (i.e., Airport)
8	Federal Park or Forest	? 66	National Park Service
9	County Institutional	? 40	Other Public Instrumentality (i.e., Airport)
B	State college or university	? 40	Other Public Instrumentality (i.e., Airport)
C	US Air Force	? 72	Air Force
D	US Army Corps of Engineers	? 72	Air Force
E	Federal Institution	? 40	Other Public Instrumentality (i.e., Airport)
F	Other Federal	? 60	Other Federal Agency
G	Federal Bureau of Indian Affairs	? 62	Bureau of Indian Affairs
H	Private	? 26	Private (other than Railroad) **OR** (only if open to public travel, otherwise null)
I	US Army	? 74	Navy/Marines
J	US Navy	? 74	Navy/Marines

Safety Performance Targets

Safety Performance Targets

Calendar Year 2022 Targets *

Number of Fatalities:340.0

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

Per FHWA guidance, our target setting process began with a trend line projection based on the most recent available data. The 2019 fatalities were not finalized on the NHTSA FARS website when we began this process so the Massachusetts FARS statistician provided us with the 2019, 2020 and 2021 fatalities to date. Due to COVID and the shutdowns, our 2020 fatalities were not following the trend and we did not want to base our target setting on 2020. So we took this opportunity as a restart and based our trendline and targets from 2019 and ignored 2020. We assumed our 2021 fatalities would be the same as our 2019 fatalities (based on how the total fatalities were trending year-to-date). We then assumed a 2.5% reduction from 2021 to 2022 for annual fatalities. Based on assumptions above that brings our **2022 5 year average fatalities projection to 340**. While we had to reset our targets because of COVID and the increases we had (based on preliminary information only) from behavioral components like speeding, unbelted, impaired, we are projecting that the fatalities will decrease based on our work efforts. MassDOT continues our efforts with HSIP, closely aligned work with our Highway Safety Office (NHTSA funded), joint efforts with our Sustainable transportation (bicyclist and pedestrian safety), commitment on several EDC programs and more. We recently started a Speed Management focus, a Safe Systems focus and are beginning planning for our SHSP that will be updated in 2023. This target was developed in coordination with the Executive Office of Public Safety and Security – Highway Safety Division (EOPSS/HSD) (required to submit targets to NHTSA), the MassDOT Office of Transportation Planning (OTP) working closely with the MPOs, and the Office of Performance Management and Innovation (OPMI, which produces an annual performance report called *Tracker* that serves the public and State Legislature) and senior leadership. Moreover, it should be noted that our overarching goal is towards zero deaths and we will continue to work towards that goal by implementing SHSP strategies.

Number of Serious Injuries:2504.0

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

FHWA guidance, our target setting process began with a trend line projection based on the most recent available data. The 2019 serious injuries were not finalized when we began this process so the most current serious injury data in the statewide crash system for 2019, 2020 and 2021 were used. On January 1st, 2019, Massachusetts moved from "incapacitating injuries" to "suspected serious injuries" on the crash form, as per Federal requirements. Some police departments had not yet fully converted over so 2019 is still a mix of injury severities and the full impact of moving to suspected serious injury is not fully known. However, it appears that 2019 serious injuries went up compared to previous years and then settled back down in 2020 (we also compared to hospitalizations which did not show a dramatic spike). Furthermore, COVID and the shutdowns, may have also impacted the number of serious injuries. So we took this opportunity as a restart. We assumed a 3% reduction in the annual serious injuries from 2020 to 2021 and then a 4% annual reduction from 2021 to 2022. Based on assumptions above that brings our **2022 5 year average serious injuries projection to 2,504**. MassDOT continues our efforts with HSIP, closely aligned work with our Highway Safety Office (NHTSA funded), joint efforts with our Sustainable transportation (bicyclist and pedestrian safety), commitment on several EDC programs and more. We recently started a Speed Management focus, a Safe Systems focus and are beginning planning for our SHSP that will be updated in 2023. This target was developed in coordination with the Executive Office of Public Safety and Security – Highway Safety Division (EOPSS/HSD) (required to submit targets to NHTSA), the MassDOT Office of Transportation Planning (OTP) working closely with the

MPOs, and the Office of Performance Management and Innovation (OPMI, which produces an annual performance report called *Tracker* that serves the public and State Legislature) and senior leadership. Moreover, it should be noted that our overarching goal is towards zero deaths and serious injuries and we will continue to work towards that goal by implementing SHSP strategies.

Fatality Rate:0.560

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

The fatality rate is simply math. So once we have our projections for fatalities and have our projected VMTs, the fatality rate is simply the 5 year average fatalities divided by the 5 year average VMTs. Like nearly every other state, COVID greatly impacted our VMTs so our rates spiked in 2020 with significantly lower VMTS and slightly higher fatalities. The projection is now **0.56 fatalities per 100 million vehicle miles traveled for 2022 (5 year average of 2018-2022).** The long term goal is towards zero deaths, so the long term fatality rate target is 0.0 fatalities per 100 million VMTs.

Serious Injury Rate:4.110

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

The serious injury rate is simply math. So once we have our projections for serious injuries and have our projected VMTs, the serious injury rate is simply the 5 year average serious injuries divided by the 5 year average VMTs. Like nearly every other state, COVID greatly impacted our VMTs so our rates spiked in 2020 with significantly lower VMTS and slightly lower serious injuries. The projection is now **4.11 serious injuries per 100 million vehicle miles traveled for 2022 (5 year average of 2018-2022).** The long term goal is towards zero deaths and serious injuries, so the long term serious injury rate target is 0.0 fatalities per 100 million VMTs.

Total Number of Non-Motorized Fatalities and Serious Injuries:471.0

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. Using historical data to create a trend line, the number of fatalities and serious injuries for non-motorists had been going up until 2016 when the annual numbers of fatalities and serious injuries for non-motorists went consistently down through 2018. We saw a large jump in 2019 in serious injuries, however, fatalities continued to trend downward. Again, the increase in the 2019 serious injuries could have been due to the reporting change of the injury type from incapacitating to suspected serious. In 2020, during the COVID pandemic, we experienced a steep decline in both fatalities and serious injuries. Because of the high fluctuations in numbers, to establish our target, we assumed 2021 non motorist fatalities and suspected serious injuries to be equal to the average of 2018, 2019 and 2020. To project the non motorist fatality and serious injuries for 2022, we assumed an overall 2% drop. **Overall, this translated to a 2022 5 year average of 471 fatalities and serious injuries combined for non-motorists.** Massachusetts is actively working on strategies to ameliorate non-motorist fatality and injuries, while promoting and encouraging walking and cycling. The 2018 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 to eliminate fatalities and serious injuries of people walking and bicycling. The new focus on Speed Management and a Safe Systems approach should also help to drive down the fatalities and serious injuries. There also may be some implementation of low-cost systemic projects related to pedestrian safety in an effort to further drive down fatalities and serious injuries. Therefore, we hope to experience at least this reduction in non-motorist fatalities and serious injuries, which is working towards our ultimate goal towards zero deaths and serious injuries.

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

The targets were developed in coordination with the Executive Office of Public Safety and Security – Highway Safety Division (EOPSS/HSD) (required to submit targets to NHTSA), the MassDOT Office of Transportation Planning (OTP) working closely with the MPOs, and the Office of Performance Management and Innovation (OPMI, which produces an annual performance report called *Tracker* that serves the public and State Legislature) and senior leadership. The Secretary of Transportation and Administrator of Highways for MassDOT approved the targets based on several meetings.

Does the State want to report additional optional targets?

No

Describe progress toward meeting the State's 2020 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	347.0	354.0
Number of Serious Injuries	2689.0	2641.4
Fatality Rate	0.560	0.575
Serious Injury Rate	4.300	4.276
Non-Motorized Fatalities and Serious Injuries	505.4	483.6

Both the fatalities and the fatality rates did not meet the targets. Some of that was the unpredictability during COVID where speeding, impaired, distracted and unbelted behaviors increased (based on feedback received). Specifically, the VMTs dropped 17% between 2019 and 2020 yet the fatalities year to year increased between 2019 and 2020. Regardless the reason, this showcased the need to make changes. Although it was not yet required, MassDOT started development of an HSIP Implementation Plan so that HSIP projects can be more efficient and effective. The Secretary of Transportation began bi-weekly fatality review meetings to discuss fatality trends and specific fatalities that have occurred during the previous two weeks. Discussions center around infrastructure, licensing, awareness/education and enforcement with attendees from the Secretary's office, MassDOT Highway Division, Registry of Motor Vehicles and the Executive Office of Public Safety and Security Highway Safety Division. MassDOT is also beginning to update our SHSP and the framework is intended to use Safe System.

While the serious injuries and serious injury rates exceeded our target, our goal is zero deaths and serious injuries so we are taking the measures described above which should also have an impact on the serious injuries to bring them closer to our goal.

The non-motorized fatalities and serious injuries exceeded our target, much of that was due to the dramatic drop in 2020. But we cannot just accept this because already in 2021 the pedestrian fatalities are nearly back to 2019 levels. Therefore, we need to take the measures described earlier to try and move towards zero deaths and fatalities.

Applicability of Special Rules

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

No

While it does not appear that the HRRR rule applies to Massachusetts, we re in the process of developing a rural run off the road systemic project based on our newly developed network screening risk models. We hope to be able to advertise this project and others like it.

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	2014	2015	2016	2017	2018	2019	2020
Number of Older Driver and Pedestrian Fatalities	59	65	75	49	77	77	73
Number of Older Driver and Pedestrian Serious Injuries	271	281	297	265	273	296	224

Note for fatalities, that 2019 is from FARS but from the early release data and 2020 is from our State system and not from FARS. Other fatality information is from FARS. All serious injury information is from our statewide system.

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)

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

Since 2014, Massachusetts has experienced, on average, a decline of 3.6 fatal injuries per year. The five-year rolling average number of fatal injuries also indicate this decreasing trend. From 2014 to 2019, five-year average statewide fatalities dropped 2.4 percent, compared to the national trend, which saw an increase from 32,744 fatalities in 2014, rising to a peak in 2016 of 37,806 fatalities, to the most recent measure of 36,096 in 2019, a 10-percent increase since 2014. Even with a modest decrease in fatalities, Massachusetts has performed better than the national average.

Massachusetts has also seen a decline in annual suspected serious injury occurrence in recent years. On average, suspected serious injuries (called incapacitating injuries until 2019) have decreased by approximately 86 per year in the period from 2014 to 2019. The five-year rolling average of suspected serious injuries decreased 18 percent from 2014 to 2019. However, 2019 did see an increase in suspected serious injuries across the state following decreases three out of the previous four years. While happy with the downward trends, Massachusetts would like to see larger annual reductions in fatalities and suspected serious injuries and feels improvements to the HSIP can help achieve further reductions.

Massachusetts also focuses on the economic effectiveness of their program, both in terms of benefit-cost analysis and the number of dollars spent per crash reduced. A recent evaluation of Massachusetts’s HSIP program showed that for HSIP projects reported in the 2017, 2018, 2019, and 2020 HSIP reports (projects completed in 2013 through 2016, respectively), Massachusetts saw a benefit/cost ratio of 1.46. This implies recent Massachusetts HSIP projects have returned $1.46 in safety benefits over the expected service life for every $1 spent. For the HSIP projects reported this year, which were completed in 2016, the projected benefit/cost is 1.48 for the service life based on three years of after data, a similar value to what has been observed in previous years. It should be noted that the calculations for benefit/cost included all funds spent on the projects not just HSIP funds and, in many cases, HSIP funding was a small portion of the funding because the project was primarily a mobility project or some other type of project and there are many other benefits realized besides safety. So the benefit/cost indicated here is understating the comprehensive benefits. Further, the HSIP funding for these projects is expected to reduce 198.6 fatal or injury crashes over the 20-year service lives of the improvements, an average of $129,276 spent to reduce one crash.

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

Massachusetts programmed $28,094,654 of HSIP Federal funds in 2020 and $28,454,771 of Federal funds were obligated. While that is one indicator of success, a better indicator is using the HSIP funds in the most efficient manner to reduce fatalities and injuries. This is why we are preparing an HSIP Implementation Plan to provide the best indicators of the types of projects MassDOT should focus on. Of the 15 projects funded at least partially with HSIP funds, four involve sign projects, of which two are systemwide updates to exits and two are systematic upgrades to guide signs. Another project is a systemic wrong way driving signage and marking project. The remaining 10 projects are hot spot locations and all 10 of them have had road safety audits conducted as part of the design and development process in order to diagnose the safety issues and identify countermeasures. During the design process, the design is compared against the RSA recommendations to ensure the project is moving in the right direction. This road safety audit process helps to ensure safety issues will be addressed. The fact that 10 out of 10 spot location projects have had an RSAs is another good indicator.

MassDOT is also in the process of finalizing a safety alternatives analysis guide and complementary state-preferred CMF lists and tools to standardize alternatives analysis. This will allow for the expansion of data-driven safety analysis as part of standard MassDOT business, especially when incorporated as part of MassDOT's new Intersection Control Evaluation (ICE) protocol. The production of the HSIP Implementation Plan and presentation to leadership will also expand the knowledge of data-driven safety analysis at the executive leadership level. Finally, MassDOT's addition of a safety analysis module to the IMPACT website will allow all users to identify potential safety projects through crash-based and risk-based network screening, while also providing crash tree and test of proportions tools for users to easily identify safety issues in their communities. The risk-based maps also help with MassDOT's goal of increasing the number of systemic projects in the HSIP.

Describe significant program changes that have occurred since the last reporting period.

MassDOT is in the process of completing an HSIP Implementation Plan that will document proposed changes to the HSIP. Primarily, this plan will attempt to quantify the benefits of a future systemic component of the HSIP, something lacking in Massachusetts. MassDOT's addition of risk factor network screening maps on the IMPACT portal will assist with the development of this new systemic program. MassDOT currently has 3 systemic projects on the STIP.

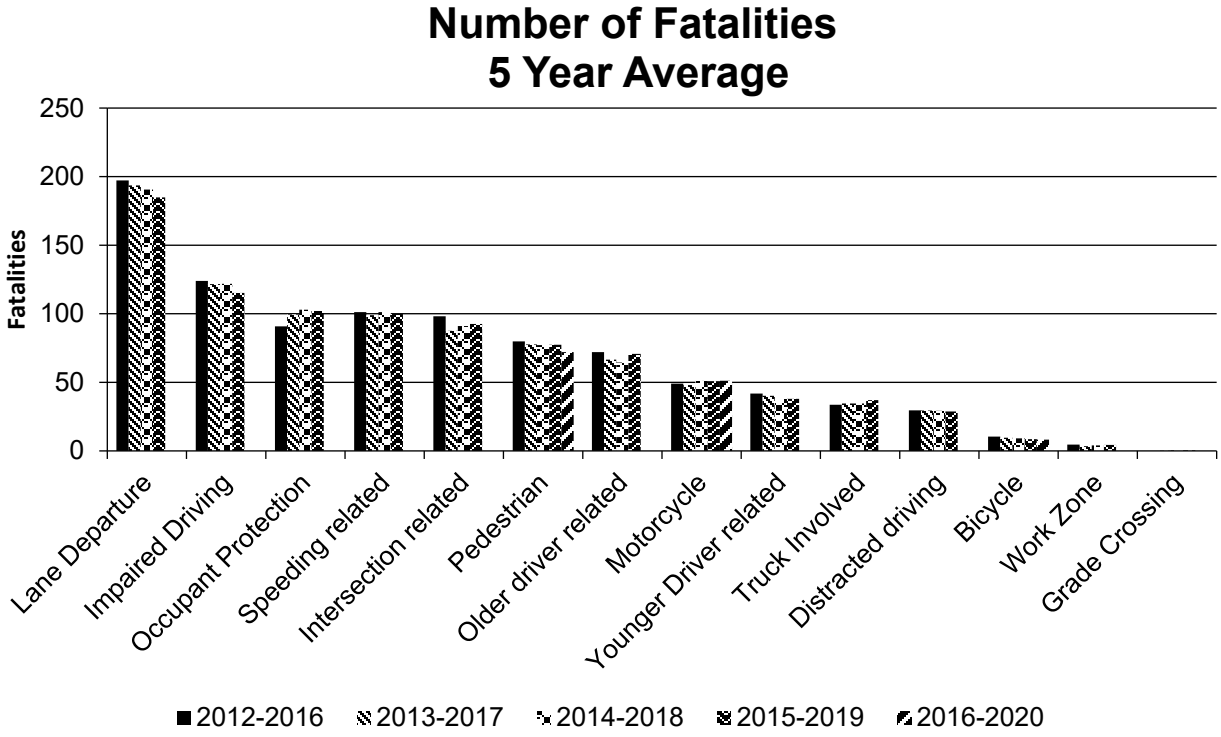
Effectiveness of Groupings or Similar Types of Improvements

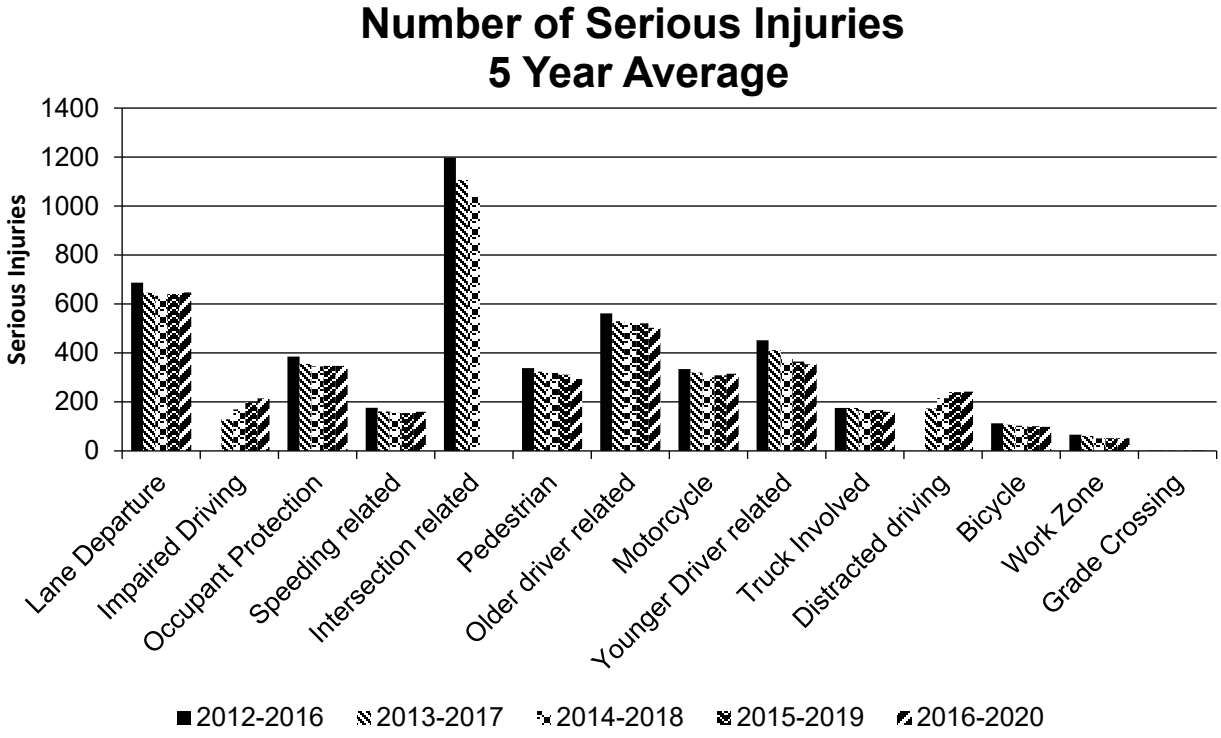
Present and describe trends in SHSP emphasis area performance measures.

Year 2020

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)
Lane Departure			647.2		1.06
Impaired Driving			214.8		0.35
Occupant Protection			347.2		0.57
Speeding related			159.6		0.26
Intersection related					

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)
Pedestrian		72	293.8	0.12	0.47
Older driver related			502.8		0.81
Motorcycle		51.2	315	0.08	0.52
Younger Driver related			353.6		0.58
Truck Involved			159.4		0.26
Distracted driving			241.8		0.4
Bicycle		8.2	98.4	0.02	0.16
Work Zone			51.6		0.08
Grade Crossing			1.4		0


Number of Fatalities
5 Year Average
Fatalities
250
200
150
100
50
0
Lane Departure
Impaired Driving
Occupant Protection
Speeding related
Intersection related
Pedestrian
Older driver related
Motorcycle
Younger Driver related
Truck Involved
Distracted driving
Bicycle
Work Zone
Grade Crossing
2012-2016
2013-2017
2014-2018
2015-2019
2016-2020


Number of Serious Injuries
5 Year Average
Serious Injuries
1400
1200
1000
800
600
400
200
0
Lane Departure
Impaired Driving
Occupant Protection
Speeding related
Intersection related
Pedestrian
Older driver related
Motorcycle
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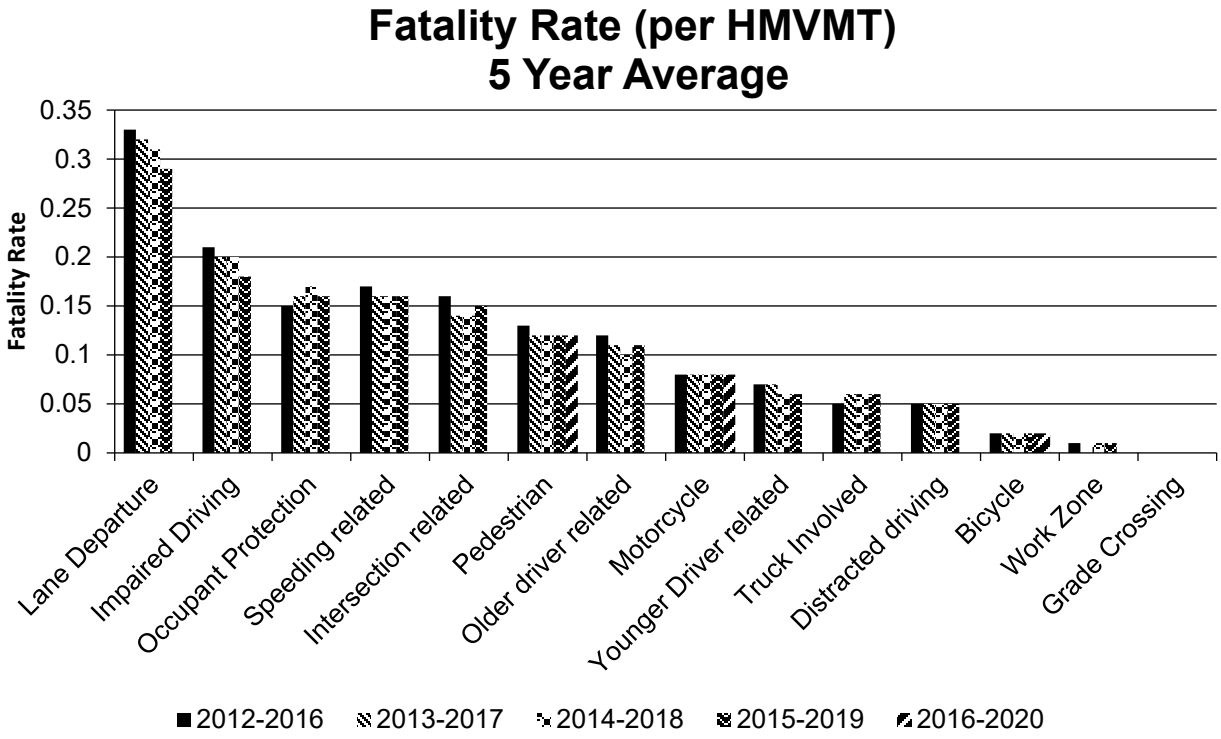
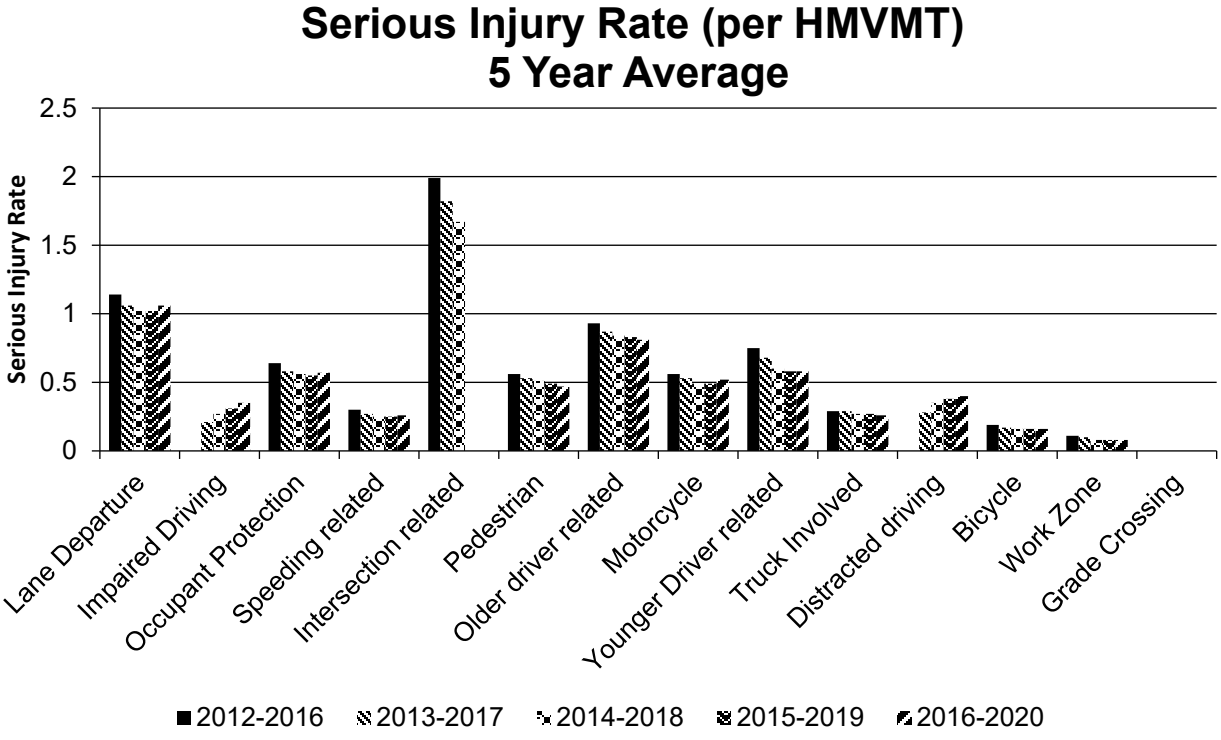
Truck Involved
Distracted driving
Bicycle
Work Zone
Grade Crossing
2012-2016
2013-2017
2014-2018
2015-2019
2016-2020





The 2019 fatal and serious injury data are not finalized and may change. The 2020 fatal data is based on information from the FARS statistician and not the FARS website and is only available for a few of the emphasis areas. 2020 serious injury data are based on the statewide crash data system and are preliminary only.

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:	This was a preliminary naïve before/after study for various FYA configurations (3SG, 4SG with one FYA, 4SG with two or more FYA) and various crash types (by severity, by left turn crashes, rear end crashes, etc) See report for details. A detailed study will be performed after we have an adequate number of crash years post implementation. The attached report has all the detailed breakdowns of crash types but this is simply providing an overall summary of total crashes for all FYA types.
Target Crash Type:	All
Number of Installations:	166
Number of Installations:	166
Miles Treated:	
Years Before:	1
Years After:	1
Methodology:	Simple before/after
Results:	See attached report since this summary only provides total crashes for all crash types and FYA configurations so is not really useful in itself. This report is PRELIMINARY only since it is simply naïve before/after with only 1 years of data in most cases. A detailed evaluation will be performed once there are multiple years of data.

File Name: dot_pln_FYA_ReportFinal_04292021.pdf

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)
602182 - GREAT BARRINGTON-RECONSTRUCTION OF MAIN STREET (ROUTE 7)	Urban Principal Arterial (UPA) - Other	Pedestrians and bicyclists	On road bicycle lane	66.00	66.00					11.00	6.00	77.00	72.00	1.09
603457 - WEST BRIDGEWATER-INTERSECTION IMPROVEMENTS AT ROUTE 106 & ROUTE 28 (CENTRAL SQUARE)	Urban Principal Arterial (UPA) - Other	Intersection traffic control	Modify traffic signal – modernization/replacement	52.00	72.00					10.00	16.00	62.00	88.00	-1.24
604553 - ADAMS-ROUNDABOUT CONSTRUCTION AT ROUTE 8 & FRIEND STREET	Urban Principal Arterial (UPA) - Other	Intersection traffic control	Modify control – Modern Roundabout	21.00	26.00					3.00	4.00	24.00	30.00	-0.29
605668 - RAYNHAM-SIGNAL & INTERSECTION IMPROVEMENT @ ROUTE 44 (NEW STATE HIGHWAY), ORCHARD STREET & ROUTE 24 (NB) OFF-RAMP	Urban Principal Arterial (UPA) - Other	Intersection traffic control	Modify traffic signal – modernization/replacement	71.00	36.00			4.00	1.00	26.00	10.00	101.00	47.00	4.59
606071 - EASTON-SIGNAL & INTERSECTION IMPROVEMENTS @ ROUTE 138 (TURNPIKE STREET) AND ROUTE 106 (FOUNDRY STREET)	Urban Principal Arterial (UPA) - Other	Intersection traffic control	Modify traffic signal – modernization/replacement	22.00	27.00			2.00	1.00	10.00	6.00	34.00	34.00	2.37
606298 - ANDOVER-TEWKSBURY-INTERSECTION & SIGNAL IMPROVEMENTS AT DASCOMB	Rural Major Collector	Intersection traffic control	Modify control – new traffic signal	5.00	7.00						2.00	5.00	9.00	-1.29

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)
ROAD, EAST STREET & SHAWSHEEN STREET														
606904 - HOLYOKE-SIGNAL INSTALLATION & IMPROVEMENTS ON CHERRY STREET @ I-91 (INTERCHANGE 16)	Urban Principal Arterial (UPA) - Other	Intersection traffic control	Modify control – new traffic signal	38.00	31.00	1.00		2.00	1.00	21.00	12.00	62.00	44.00	6.74
607223 - GREENFIELD-INTERSECTION IMPROVEMENTS AND RELATED WORK (INCLUDING SIGNALS) AT ROUTE 2A (MOHAWK TRAIL) AND SHELBURNE ROAD/RIVER STREET	Urban Principal Arterial (UPA) - Other	Intersection traffic control	Modify traffic signal – modernization/replacement	16.00	9.00					6.00	2.00	22.00	11.00	3.17
607745 - LENOX-INTERSECTION & SIGNAL IMPROVEMENTS AT US 7 & US 20 (VETERAN'S MEMORIAL HIGHWAY) @ SR 183 (WALKER STREET)	Urban Principal Arterial (UPA) - Other	Intersection traffic control	Modify traffic signal – modernization/replacement	13.00	4.00					5.00	4.00	18.00	8.00	3.48

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

MassDOT reported on the safety and economic effectiveness of nine HSIP projects which were completed in 2016, thus having three years of complete “after” data for evaluation. From a naïve standpoint, the project sites had a total of 405 crashes in the three years before the projects and 343 crashes in the three years after, an average annual reduction of 20.7 crashes. When looking at fatal and injury (FI) crashes, there were 101 FI crashes in the three years before and 65 FI crashes in the three years after. While these naïve results are promising, MassDOT used Empirical Bayes and crash rates to estimate how many crashes were expected to happen in the after years, thus being able to determine how many were reduced. In total, the nine projects are expected to reduce 9.9 FI crashes and 14.3 total crashes per year. Additionally, MassDOT used the reduced crashes – the difference between expected and observed – to estimate annual monetary benefits of the reduction. Overall, the reported projects cost $25.7 million and are expected to return $38.0 million in benefits over the projects’ service life – a benefit/cost ratio of 1.48. It should be noted that the calculations for benefit/cost included all funds spent on the projects not just HSIP funds and, in many cases, HSIP funding was a small portion of the funding because the project was primarily a mobility project or some other type of project and there are many other benefits realized besides safety. So the benefit/cost indicated here is understating the comprehensive benefits.

Compliance Assessment

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

12/31/2018

What are the years being covered by the current SHSP?

From: 2012 To: 2016

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

2023

MassDOT does prepare interim updates to our SHSP which includes updates on the Action Plan. An update was prepared in March 2020 (https://www.mass.gov/service-details/strategic-highway-safety-plan) . However, a complete revision will be prepared and completed in 2023. We have already begun some high level discussion of connecting it to the Safe Systems approach.

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]	0.997843349046747	0.999445648943059								
	Federal Aid/Route Type (21) [21]	0.998772301509386	0.999162296660252								
	Rural/Urban Designation (20) [20]	1	1					1	1		
	Surface Type (23) [24]	0.996019992360286	0.997415003564396					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]	0.998998983068699	0.999527592379749								

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]	0.998089429517049	0.995183413293783								
	Access Control (22) [23]	0.994447627521098	0.997456734254667								
	One/Two Way Operations (91) [93]	0.99765735288513	0.996974281591317								
	Number of Through Lanes (31) [32]	0.998431813923494	0.996968787582517					0.994375887800542	0.985794300118418		
	Average Annual Daily Traffic (79) [81]	0.999845002385621	0.999946245877989					0.950183013605771	0.980764369760676		
	AADT Year (80) [82]	0.999845002385621	0.999946245877989								
	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						

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
INTERCHANGE/RAMP	Unique Interchange Identifier (178) [168]										
	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]										
	Ramp AADT (191) [181]					0.9742782490452	0.985211391248016				
	Year of Ramp AADT (192) [182]					0.9742782490452	0.985211391248016				
	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**	**0.45**	**0.45**	**0.99**	**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 is in relatively good shape. Our largest deficiencies are with the intersections. To overcome that, we assembled an intersection collection tool (using HSIP funds) and two procured two contracts with University of Massachusetts students (using HSIP funds) to collect the intersection MIRE FDE. There are approximately 70,000 intersections to be collected and, based on recent performance measures, each intersections takes approximately 8 minutes. We are just about complete and UMASS is just running through QA/QC processes now. We anticipate this will be completed within a few months. While AADTs are available on nearly 96% of all roadways (State owned and non-state owned), we are still looking into a process to have some quality control.

Optional Attachments

Program Structure:

hwy_HSIP_Criteria_07-2020.pdf
dot-hwy_safety_analysis_guide080220.pdf
Project Implementation:

Safety Performance:

Evaluation:

dot_pln_FYA_ReportFinal_04292021.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.