Highway Safety Improvement Program National Scan Tour

FHWA-SA-16-024

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16. Abstract

The Highway Safety Improvement Program (HSIP) is a core Federal-aid program with the purpose of achieving a significant reduction in traffic fatalities and serious injuries on all public roads, including non-State-owned facilities. In its efforts to ensure that the program investment produces an optimal outcome, the Federal Highway Administration (FHWA) conducted a scan tour of HSIP practices in the fall of 2015, visiting Alaska, Illinois, Massachusetts, New Hampshire, North Carolina, Oregon, and Utah. The purpose of the Scan Tour was to identify notable practices in the areas of HSIP administration, planning, implementation and evaluation in high-performing States with the goal of sharing this information among all the States. The Scan Tour findings highlighted a number of notable practices related to: documenting HSIP processes; coordinating with internal and external partners; understanding the relationship between the Strategic Highway Safety Plan (SHSP) and HSIP; making data-driven safety decisions; using advanced safety analysis methods and tools; addressing local road needs; considering all four "E's"; establishing multi-year plan and budget; and identifying opportunities to streamline project delivery.

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
	NOTE: volumes greater than 1000 L shall be shown in m^3			
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE (exact degrees)		
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	$candela/m^2$	cd/m^2
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
		TEMPERATURE (exact degrees)		
°C	Celsius	1.8C+32	Fahrenheit	°F
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	$candela/m^2$	0.2919	foot-Lamberts	fl
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380.
(Revised March 2003)

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ACRONYMS

4E's	Enforcement, Education, Emergency Response, and Engineering
AASHTO	American Association of State Highway and Transportation Officials
AHSO	Alaska Highway Safety Offices
AOC	Association of Oregon Counties
ARTS	All-Roads Transportation Safety
ATSC	Alaska Traffic Safety Corridor
B/C	Benefit/Cost
BSE	Bureau of Safety Engineering
CEA	Critical Emphasis Area
CEI	Cost-Effectiveness Index
CMF	Crash Modification Factor
CPM	Crash Prediction Model
CRF	Crash Reduction Factor
CRS	Condition Rating Survey
CUUATS	Champaign-Urbana Urbanized Area Transportation Study
DMV	Department of Motor Vehicles
DOH	Department of Health
DOT	Department of Transportation
DOT&PF	Department of Transportation & Public Facilities
DPS	Department of Public Safety
DSC	District Safety Committee
DTS	Division of Traffic Safety
DTZ	Driving Toward Zero
EPDO	Equivalent Property Damage Only
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
GHSO	Governor's Highway Safety Office
GHSP	Governor's Highway Safety Program
HSIP	Highway Safety Improvement Program
HSM	Highway Safety Manual
HSP	Highway Safety Plan
ICWS	Intersection Cross-Road Warning System
IDOT	Illinois Department of Transportation
IRI	International Roughness Index
ISP	Illinois State Police
LOC	League of Oregon Cities
LPA	Local Public Agency
LSA	Limited Service Agreement

M&S	Mobility and Safety
M&SFO	Mobility and Safety Field Operations
MassDOT	Massachusetts Department of Transportation
MCDOT	McHenry County Department of Transportation
MCR	Mobile Capture Reporting
MPO	Metropolitan Planning Organization
NCDOT	North Carolina Department of Transportation
NCHRP	National Cooperative Highway Research Program
NHDOT	New Hampshire Department of Transportation
NHSP	New Hampshire State Police
NHTSA	National Highway Traffic Safety Administration
ODOT	Oregon Department of Transportation
PH	Potentially Hazardous
PSI	Potential for Safety Improvement
RMV	Registry of Motor Vehicles
ROW	Right of Way
RPC	Regional Planning Commission
RSA	Road Safety Audit
RTE	Regional Traffic Engineer
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SHSP	Strategic Highway Safety Plan
SPF	Safety Performance Function
SRI	Safer Roads Index
STIP	State Transportation Improvement Program
T&S	Traffic & Safety
TESS	Traffic Engineering and Safety Section
TIP	Transportation Improvement Plan
TSAP	Transportation Safety Action Plan
TSD	Transportation Safety Division
UDOT	Utah Department of Transportation
UNC-HSRC	University of North Carolina Highway Safety Research Center
USDOT	United States Department of Transportation
usRAP	United States Road Assessment Program

EXECUTIVE SUMMARY

The Highway Safety Improvement Program (HSIP) is a core Federal-aid program with the purpose of achieving a significant reduction in traffic fatalities and serious injuries on all public roads, including non-State-owned facilities. In its efforts to ensure that the program investment produces an optimal outcome, the Federal Highway Administration (FHWA) conducted a scan tour of HSIP practices in the fall of 2015. The purpose of the Scan Tour was to identify notable practices in the areas of HSIP administration, planning, implementation and evaluation in high-performing States with the goal of sharing this information among all the States.

FHWA in partnership with the American Association of State Highway and Transportation Officials (AASHTO) considered a variety of factors in selecting the seven Scan Tour States, including the:

- Geographic size of the State.
- Size of the overall roadway system and fraction of the system under State control.
- Composition of the State Department of Transportation (DOT) oversight organization.
- State's documentation and reporting practices.
- State's performance in reduction of fatalities and serious injuries.

Based on these factors, the scan team visited Alaska, Illinois, Massachusetts, New Hampshire, North Carolina, Oregon, and Utah on the Scan Tour.

The Scan Tour findings highlighted a number of notable practices related to: documenting HSIP processes; coordinating with internal and external partners; understanding the relationship between the Strategic Highway Safety Plan (SHSP) and HSIP; making data-driven safety decisions; using advanced safety analysis methods and tools; addressing local road needs; considering all four "E's"; establishing multi-year plan and budget; and identifying opportunities to streamline project delivery. However, five common initiatives stood out across all of the States. Table 1 provides a brief description of each of these initiatives.

Table 1. Five common HSIP initiatives.

Initiative	Description
Streamlined Access to Crash Data and Crash Report Information	The use of electronic crash reporting efforts impacts timeliness of data. For each State, the crash report information is key in developing collision diagrams for projects, supplementing road safety audit (RSA) preparation, and identifying the causative effects of crashes. Since most States do not actually own the crash data, it is important that not only the DOT, but all safety stakeholders have access to the data. Many States have a web portal, or something similar, enabling access to crash data. Typically, the DOT was a key partner in ensuring this level of accessibility exists.
Strong Documentation of System Screening and Project Selection Processes	In all States, extensive documentation of the screening and project selection processes creates accountability for HSIP staff decisions and demonstrates transparency, which increases accessibility and understanding across the DOT and to local agencies.
Pathway for Local Involvement and Nomination of Projects	The inclusion of local agency officials, particularly those from county highway departments and regional planning associations, is imperative if the HSIP is to be successful in States with large rural systems that are not State-maintained. All host States provide a mechanism for local agencies to use HSIP funds, either via a set-aside or similar program, or competition through the State program.
Extensive Use of RSAs	All States identified RSAs as a key component of screening, project development, and project design. The use of HSIP funds to conduct local agency RSAs was found to be particularly helpful in engaging local agencies in the identification of correctable crashes and potential countermeasures. Most notably, several States

Initiative	Description
	require RSAs as part of project scoping and project development, which leads to a more robust project that delivers on crash correction.
Deliberate and Documented Assessment of Project Performance	Project evaluation is the basis of validating project and program performance. All Host States complete some form of project evaluation, such as reviewing before/after crash history at individual project locations, developing measures of effectiveness for particular countermeasures or evaluating the success of the program as a whole.

It is anticipated that these key practice areas will engage State DOTs in their individual efforts to evaluate the HSIP and consider strategic initiatives designed to implement the notable practices described in this report. There is more than one means for carrying out a highway safety improvement program. Each State must tailor its program to its unique needs and take into account existing strengths, weaknesses and opportunities. The goal of this report is to give States a better understanding of successful HSIP practices that can help enhance and improve their existing HSIP.

CHAPTER 1—INTRODUCTION

The Highway Safety Improvement Program (HSIP) is a federally-funded, State-administered program with the purpose of reducing fatalities and serious injuries on all public roads (including non-State-owned public roads and roads on tribal land) through the implementation of highway safety improvement projects. The HSIP requires a data-driven, strategic approach to improving highway safety on all public roads that focuses on performance. While the Federal Highway Administration (FHWA) establishes the program requirements under 23 CFR Part 924, each State is required to develop and implement processes to support their HSIP planning, implementation and evaluation efforts. More information about the HSIP is available at the FHWA Office of Safety HSIP Web Site - http://safety.fhwa.dot.gov/hsip/.

Each State submits an annual report to FHWA that describes the current status of HSIP implementation efforts and the effectiveness of highway safety improvement projects. FHWA uses this information and knowledge of various State programs to identify and publish individual HSIP-related noteworthy practices. However, the last time FHWA led a national review of the HSIP was in 2001, which predates Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) – the Federal transportation bill that transformed the HSIP to what it is today. While there have been several interim review efforts, they have been focused on specific aspects of the HSIP (e.g. high risk rural roads, local road safety). Therefore, FHWA initiated a scan tour in 2015 to gain a holistic perspective of national HSIP implementation efforts. The 2015 HSIP Scan Tour focused on identifying and documenting key characteristics of State HSIP administration, planning, implementation, and evaluation practices from States known to have strong State HSIP practices that would benefit other States.

SCAN SCOPE

The domestic scan involved a tour of seven States (Host States) by a team of transportation professionals from the Federal and State levels. The seven host States were Alaska, Illinois, Massachusetts, New Hampshire, North Carolina, Oregon, and Utah. FHWA and AASHTO considered a variety of factors in selecting the seven States, including the geographic size of the state, the size of the overall roadway system and fraction of the system under State control, the composition of the State DOT oversight organization, the State's performance in documentation and reporting, the State's performance in reduction of targeted crashes, and the accessibility of State DOT information on the HSIP. The selection process involved reviews of State HSIP practices and interviews with States selected for advancement to the final selection process.

At each of the seven States, the Scan Team conducted a one-day meeting with representatives from Federal, State, and local transportation safety organizations. Each meeting began with an HSIP overview presentation given by FHWA, followed by a presentation on the State's HSIP

practices, presentations from various stakeholder perspectives, and a roundtable discussion. The roundtable discussion focused on successful practices; issues that have been faced and how they have been overcome; safety initiatives and countermeasures that have been pursued; what prompted them and how they have been implemented; how the State is incorporating performance measures and preparing for the impending performance measurement/target setting requirements; data collection, management, and analysis efforts; funding of non-infrastructure projects; and other topics, as appropriate.

Appendix A includes a list of the Scan Tour State key points of contact.

SCAN TEAM COMPOSITION

Representatives from FHWA and State DOTs participated on the Scan Team. FHWA members of the Scan Team included a member from the Headquarters Office of Safety and Division Office personnel from Oregon, Indiana, and Tennessee. FHWA and AASHTO selected State DOT representatives from Nevada, Kansas, and Georgia, based on interest and geographic diversity. FHWA hired a contractor to serve as the Scan Team facilitator and logistics coordinator. Appendix B includes the full list of the Scan Team members.

USING AND APPLYING THIS REPORT

This report provides the findings of the Scan Tour, organized by the top characteristics of a successful HSIP. [1] The report includes a chapter on each characteristic, highlighting relevant practices that the Host States use to manage and implement their HSIP:

- Chapter 2 - Documentation of HSIP Processes.
- Chapter 3 - Coordination with Internal and External Partners.
- Chapter 4 - Understanding the Relationship Between the SHSP and HSIP.
- Chapter 5 - Making Data-Driven Safety Decisions.
- Chapter 6 - Using Advanced Safety Analysis Methods and Tools.
- Chapter 7 - Addressing Local Road Needs.
- Chapter 8 - Considering All "4E's."
- Chapter 9 - Identifying Opportunities to Streamline Project Delivery.
- Chapter 10 - Evaluating the Success of the Program.

States can use the information in these chapters to learn more about successful State programs and practices, or to help address specific recommendations from program reviews. For example, if a program review identifies an opportunity for a State to better streamline project

delivery, the HSIP Manager from that State could jump to Chapter 9 to learn more about how the Host States have streamlined their project delivery processes.

Each chapter contains at least one "Spotlight on Safety." The "Spotlight on Safety" segments highlight practices that stood out as useful or innovative during the Scan Tour. In addition, the report highlights several "Safety Innovations." The "Safety Innovations" contain information that may not be directly related to the HSIP, but still may be of interest to State safety programs.

The report concludes with observations that were consistent across all host States, and which were derived from an analysis of the common themes and notable practices.

Appendix C provides a summary of successful practices by State. The intent of this Appendix is to enable readers to find all information from each Scan Tour State in one succinct place and to view information for the State(s) that most closely match their own State's characteristics. It includes information on the annual HSIP apportionment for each State, the number of roadway miles, and the five year average for fatalities, as well as a summary of notable practices in each chapter.

Appendix D provides a list of HSIP resources, including the FHWA Office of Safety HSIP web site and links to the Host State HSIP web sites.

FHWA understands that there is more than one means for carrying out a highway safety improvement program. Each State must tailor its program to its unique needs and take into account existing strengths and weaknesses. However, the goal of this report is to give States a better understanding of successful HSIP practices that can help enhance and improve an existing HSIP.

CHAPTER 2—DOCUMENTATION OF HSIP PROCESSES

Many States develop clear documentation of the processes they use to administer the HSIP. These processes typically define how to identify, evaluate, prioritize, and fund safety improvement projects. This documentation not only helps to ensure implementation consistency across an agency, but it also helps stakeholders understand the requirements for using these funds.

Each of the Host States exhibited comprehensive documentation regarding the HSIP program, policies, procedures, outcomes, and safety data. Each of these types of documents are useful not only in that they provide a framework for DOT operation but also because they are useful tools for the cooperating agencies, particularly assisting them in understanding how to take participate in the HSIP. Appendix D provides links to State HSIP documentation.

SPOTLIGHT ON SAFETY:

HSIP Documentation in Alaska

In Alaska, the Department of Transportation & Public Facilities (DOT&PF) State Traffic and Safety Engineer has the responsibility of maintaining a variety of manuals and project development policy documentation. The *Alaska HSIP Handbook* (Figure 1) is evaluated and updated annually and on an as-needed basis to address changes in law, program and policy rules, and clarifications. Updates also address crash costs and crash modification factors (CMF) as needed. The *Handbook* is readily accessible from the Alaska DOT&PF web site, in addition to other HSIP documentation. (2)

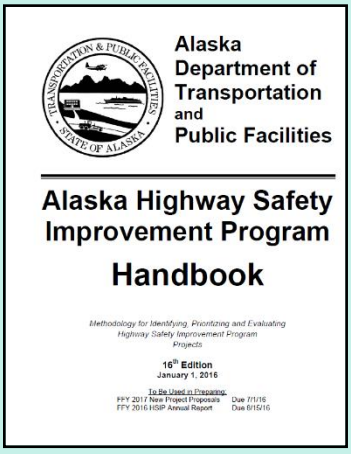


Figure 1. The Alaska HSIP Handbook.

The *Handbook* clearly defines the process of HSIP project development, the criteria for project selection, and handling of funds and project delivery activities. Development of this documentation was the result of a facilitative relationship between the FHWA Division Office and the State Traffic and Safety Engineer's office. The support of the Commissioner ensured that resources were available to address the HSIP regulations with appropriate and sufficient documentation, ensuring the program would be equitably and consistently applied.

PROGRAM HANDBOOKS AND POLICY MANUALS

These handbooks define how the HSIP functions in each State. Alaska, Illinois, Utah, and New Hampshire highlighted their extensive and regularly-updated handbooks. These handbooks contain direction on how the agency will identify, evaluate, prioritize, and fund safety improvement projects. This documentation not only helps to ensure implementation consistency across an agency, but it also helps stakeholders understand the requirements for using these funds.

In Illinois, the HSIP documentation is organized as an engineering policy memorandum, publication Safety 1-06, available from the Illinois Department of Transportation (IDOT) web site. [3] This publication includes several appendices that provide complete information about the program administration and procedures, shown in Table 2. The policy memorandum, which is published by the Central Bureau of Safety Engineering (BSE) at the direction of the Bureau Chief, is followed by all of the Districts, along with other engineering policy memoranda issued by the IDOT Central Office in Springfield.

Table 2. Appendices in IDOT HSIP engineering policy memorandum.

Appendix	Topic
Appendix A	Funding Allocation Process Federal HSIP Funding Flow Chart
Appendix B	HSIP Project Selection Process
Appendix C	Peer Groups and References on Countermeasures
Appendix D	Benefit-to-Cost Methodology
Appendix F	Safety Improvements-Service Life
Appendix G	HSIP Candidate Form
Appendix H	Example of Submittal Package

Like Illinois, New Hampshire also provides information useful to local agencies wishing to participate in the New Hampshire Department of Transportation (NHDOT) HSIP. Included in

the appendices of the NHDOT *HSIP Manual and Guidance* are a sample HSIP Project Application spreadsheet and a sample Road Safety Audit Application. The NHDOT *Manual* is developed and updated by the NHDOT HSIP Committee.

The Utah Department of Transportation (UDOT) *HSIP Program Manual* includes information on the non-infrastructure project process, addressing projects related to education, crash data improvements, and integration of safety into the planning process.[4] In Oregon, the *Highway Safety Program Guide* addresses the development of all safety projects, including HSIP projects, particularly emphasizing the relationship of the projects to the Oregon SHSP.[5] Oregon's efforts to create a jurisdictionally-blind system are reflected in the Guide's clear instructions regarding applying with the local Region Traffic office.

In Massachusetts, the *Massachusetts Department of Transportation (MassDOT) HSIP Guidelines* address project selection criteria in a policy briefing. Massachusetts, Utah, and North Carolina have established practices for conducting Road Safety Audits and those are reflected in the RSA documentation maintained by each department.

SAFETY ENGINEERING MANUALS

In addition to the engineering policy memorandum which describes the function and rules of the program, States also publish safety engineering documentation to assist agency staff in executing the program in a consistent manner. IDOT provides extensive documentation for agency staff and consultants, including the Systemic Safety Manual, various spreadsheet-based evaluation tools including the Benefit/Cost (b/c) Analysis Tool and Highway Safety Manual (HSM) Crash Prediction Tool, and the HSIP Process Flow Chart in Appendix B of the *IDOT HSIP Policy*. IDOT is also developing a Safety Engineering Manual as a supplement to the IDOT HSIP policy memorandum, designed to support the deployment of documented safety engineering processes. In addition, the BSE is developing a policy regarding safety in project development, which will provide guidance for safety-related project advancement decisions for all projects, including HSIP-funded work.

The North Carolina Department of Transportation (NCDOT) also publishes guidelines related to the Safety Warrants, including regular updates to Safety Warrant Criteria , published by the Traffic Safety Systems Section of the NCDOT.[6] Publications by MassDOT, UDOT, and the Oregon Department of Transportation (ODOT) also provide information on how to undertake the process of safety engineering and ensure that countermeasures and procedures with documented success are used in the project development process.

DOCUMENTING SAFETY OUTCOMES

States with strong monitoring and evaluation programs, including Alaska, Illinois, North Carolina, Oregon, and Utah, all have developed channels to share the safety outcomes within their agencies and outside. North Carolina conducts a Safety Projects Evaluation Program and publishes the results of those evaluations on its web site, specifically in the Crash Reduction Factor (CRF) List. [7] This list, similar to State-specific lists prepared by UDOT, ODOT, and Alaska DOT&PF, provides local context for b/c analysis and addresses limitations associated with using non-geographic crash data.

Alaska, Illinois, North Carolina, Oregon, and Utah also participate in the development and ongoing growth of the Crash Modification Factor Clearinghouse by providing data related to HSIP and other safety projects. In addition to publishing data related to safety program outcomes in the CRF, the NCDOT also provides access to the completed RSAs associated with the HSIP projects.

WEB SITES

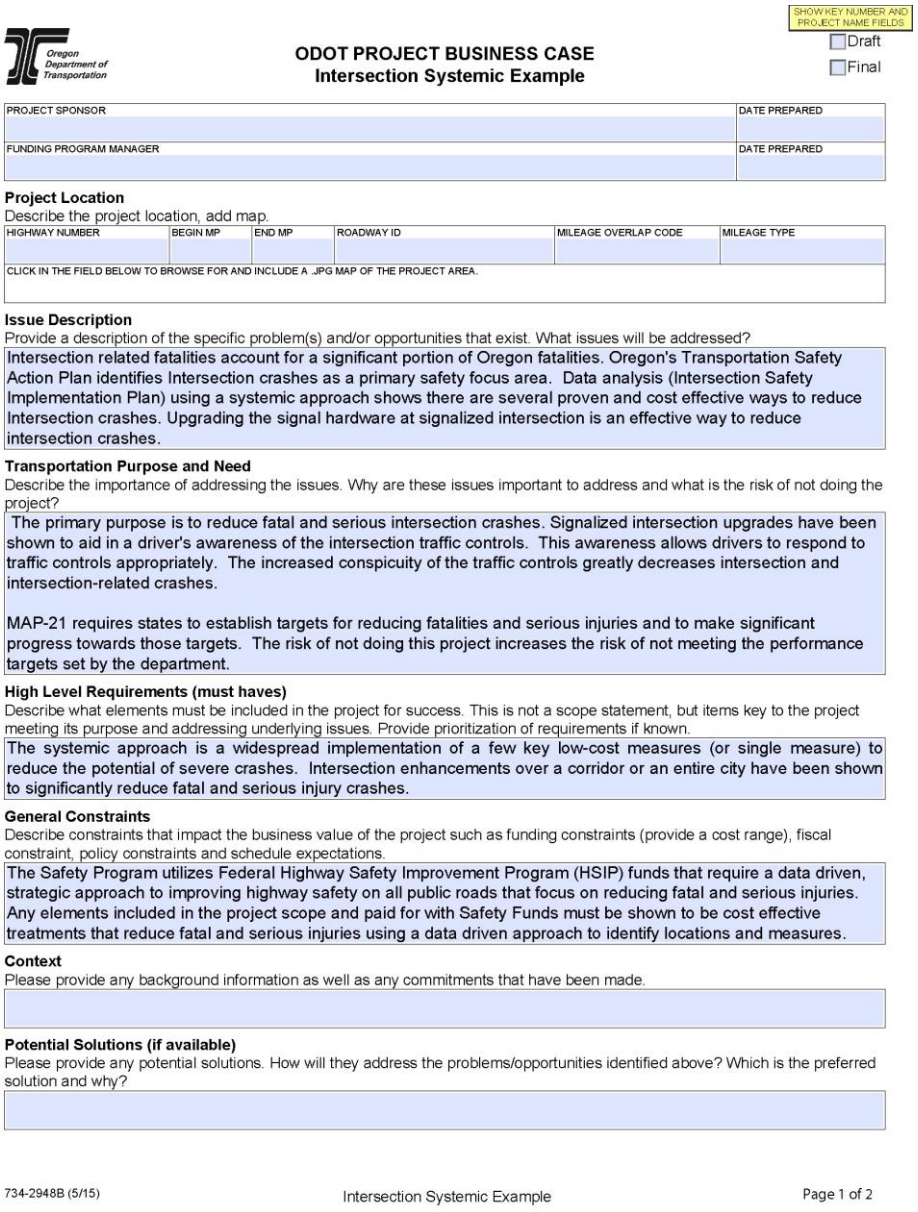
Nearly all of the States visited on the Scan Tour maintain web pages dedicated to their HSIP. Appendix D provides links to State HSIP web pages. Agencies maintaining public-facing web sites generally provide a background of the program and links to resources such as the program manual. The IDOT web site provides extensive information on the program and, like MassDOT, provides public access to a crash data portal.

North Carolina provides detailed reports on the HSIP projects for past years for each project, including roadway sections, intersections, and bicycle/pedestrian projects. This web site is available to the public. [8]

While UDOT's HSIP web site provides a focus on the engineering fundamentals and program, UDOT's partners maintain web sites focused much more on behavioral aspects, including Utah's Zero Fatalities program and various Department of Public Safety (DPS) initiatives.

ODOT provides HSIP related guidance and materials on its All-Roads Transportation Safety (ARTS) web site. [9] This includes a list of 120 safety countermeasures, implementation plans for the three focus areas of roadway departure, intersections, and pedestrian/bicycle, and example business cases for safety projects. The key to the ARTS program web site is that it provides accessibility to all local agencies seeking HSIP funding for a safety project. In addition to providing application forms, ODOT also provides example business cases (those with positive ratios), including the example business case for an intersection systemic project displayed in Figure 2.

Chapter 5 includes further discussion of the countermeasures and implementation plans in the section on spot versus systemic improvements.



Oregon Department of Transportation

ODOT PROJECT BUSINESS CASE
Intersection Systemic Example

SHOW KEY NUMBER AND PROJECT NAME FIELDS
☐ Draft
☐ Final

PROJECT SPONSOR	DATE PREPARED
FUNDING PROGRAM MANAGER	DATE PREPARED

Project Location
Describe the project location, add map.

HIGHWAY NUMBER	BEGIN MP	END MP	ROADWAY ID	MILEAGE OVERLAP CODE	MILEAGE TYPE

CLICK IN THE FIELD BELOW TO BROWSE FOR AND INCLUDE A .JPG MAP OF THE PROJECT AREA.

Issue Description
Provide a description of the specific problem(s) and/or opportunities that exist. What issues will be addressed?

Intersection related fatalities account for a significant portion of Oregon fatalities. Oregon's Transportation Safety Action Plan identifies Intersection crashes as a primary safety focus area. Data analysis (Intersection Safety Implementation Plan) using a systemic approach shows there are several proven and cost effective ways to reduce Intersection crashes. Upgrading the signal hardware at signalized intersection is an effective way to reduce intersection crashes.

Transportation Purpose and Need
Describe the importance of addressing the issues. Why are these issues important to address and what is the risk of not doing the project?

The primary purpose is to reduce fatal and serious intersection crashes. Signalized intersection upgrades have been shown to aid in a driver's awareness of the intersection traffic controls. This awareness allows drivers to respond to traffic controls appropriately. The increased conspicuity of the traffic controls greatly decreases intersection and intersection-related crashes.

MAP-21 requires states to establish targets for reducing fatalities and serious injuries and to make significant progress towards those targets. The risk of not doing this project increases the risk of not meeting the performance targets set by the department.

High Level Requirements (must haves)
Describe what elements must be included in the project for success. This is not a scope statement, but items key to the project meeting its purpose and addressing underlying issues. Provide prioritization of requirements if known.

The systemic approach is a widespread implementation of a few key low-cost measures (or single measure) to reduce the potential of severe crashes. Intersection enhancements over a corridor or an entire city have been shown to significantly reduce fatal and serious injury crashes.

General Constraints
Describe constraints that impact the business value of the project such as funding constraints (provide a cost range), fiscal constraint, policy constraints and schedule expectations.

The Safety Program utilizes Federal Highway Safety Improvement Program (HSIP) funds that require a data driven, strategic approach to improving highway safety on all public roads that focus on reducing fatal and serious injuries. Any elements included in the project scope and paid for with Safety Funds must be shown to be cost effective treatments that reduce fatal and serious injuries using a data driven approach to identify locations and measures.

Context
Please provide any background information as well as any commitments that have been made.

Potential Solutions (if available)
Please provide any potential solutions. How will they address the problems/opportunities identified above? Which is the preferred solution and why?

734-2948B (5/15) Intersection Systemic Example Page 1 of 2

Figure 2. ODOT project business case - intersection systemic example.

SUMMARY

Top-performing HSIP States have developed HSIP documentation, including program handbooks, procedure manuals, and documentation regarding statistical information used in safety analysis. States with web sites have engaged stakeholders, including local agencies seeking to address safety issues using HSIP funding for an eligible project. In an effort to provide

consistency and assist local agencies and consultants in HSIP and safety program development and project design work, several Host States provide safety engineering manuals and other documentation related to the HSIP and general safety engineering project development.

- The Alaska HSIP Handbook clearly defines the process of HSIP project development, the criteria for project selection, and handling of funds and project delivery activities. Alaska DOT&PF evaluates the Handbook annually or on an as-needed basis.
- The NHDOT Handbook, like the IDOT and MassDOT documentation, provides sample project and RSA applications, providing local agencies with transparent access to HSIP materials.
- Illinois DOT's HSIP documentation includes their HSIP Engineering Policy Memorandum (Safety 1-06), the SharePoint site for the applications, the Systemic Safety Manual, various spreadsheet-based evaluation tools including the Benefit/Cost Analysis Tool and HSM Crash Prediction Tool, and the HSIP Process Flow Chart in Appendix B of the *IDOT HSIP Policy*. They are also developing a Safety Engineering Manual as a supplement to their HSIP policy.
- Both North Carolina and Oregon have developed HSIP documentation which includes information such as a list of countermeasures with CMFs identified, implementation plans for the three focus areas of roadway departure, intersections, and pedestrian/bicycle, and example business cases for safety projects.
- MassDOT provides information on the HSIP in conjunction with the information on location and project eligibility related to crash data from the clustering tool, described in Chapter 6.
- UDOT has coupled the engineering-oriented HSIP web site with extensive and public-facing cooperative efforts with the initiatives from DPS and the Zero Fatalities program.

CHAPTER 3—COORDINATING WITH INTERNAL AND EXTERNAL PARTNERS

In highly successful programs, internal stakeholders within the DOT (e.g. maintenance, design, and finance) hold a shared commitment towards placing safety first and working together to facilitate and accelerate the planning, design, and construction of HSIP projects. Likewise, it is also important that the HSIP is fully coordinated and integrated with the work of other organizations, associations, and stakeholders (e.g., law enforcement, safety advocates, metropolitan planning organizations [MPO]) that play a role in reducing fatalities and serious injuries.

INTERNAL COORDINATION

The structure of the traffic safety functions within the Host States was most coordinated when it was a top priority of the traffic operations unit or was itself a separate safety engineering unit with top-level representation to the transportation chief executive. All States exhibited a successful integration of the HSIP into the regional traffic engineering staff, indicating that a core function of regional traffic engineers was to understand safety performance and participate, to varying degrees, in the development and implementation of highway safety improvement projects. In Illinois and Massachusetts, the State's central safety office retains the ability to fund projects with statewide funds controlled directly by that office.

SPOTLIGHT ON SAFETY:

Using a Coordinated Approach to Internally Managing the HSIP in Illinois

In Illinois, the Bureau of Safety Engineering, despite having no corresponding bureau in each of the nine Districts, has a specific, targeted mission and has achieved a high degree of cooperation with the Central Bureau of Operations and the corresponding Operations, Traffic, and Program Development bureaus in each District. The Illinois DOT (IDOT) finds value in using a coordinated approach to manage the program. A successful HSIP requires coordination and cooperation between the Central Office, the Districts, and contractor support. It also requires that the Central Office understands the needs of the Districts and works with them throughout the project selection process.

The IDOT Bureau of Safety Engineering centrally manages the HSIP to ensure the program goals are being met. However, the Districts still have broad latitude in developing and implementing their programs. Every District has a safety/HSIP coordinator and a safety

committee, which identifies and reviews the projects and helps prioritize them prior to sending them to the Central Office for review. The Central Office reviews and gives final approval for implementation of projects and provides funding, typically through the District's annual allocation.

The Central Office is responsible for performing statewide analysis and network screening, identifying statewide trends, and providing analysis results to the districts to develop their safety program. The Central Office will identify specific systemic issues and fund improvements to address them. This approach allows them to have an overall view of which projects fit best in a systemic approach.

The Central Safety Committee meets annually to select projects for local roads and continuously reviews applications from the Districts for their projects. The Committee consists of representatives from BSE, the Bureau of Design, the Bureau of Local Roads, and FHWA.

In Illinois, the local share of HSIP funding has increased, becoming a larger portion of the $74 million allocated annually under MAP-21. Illinois has the challenge of obligating 15 percent of HSIP funding for highway-rail grade crossings, which comprise a small amount of the overall severe crash risk on account of significant progress in highway-rail safety since 1990. Under SAFETEA-LU, IDOT obligated 50 percent of local funding to high-risk rural roads. The BSE held $5.5 million of the $35 million annual appropriation for BSE Statewide Safety Funds, to be disbursed at BSE discretion. This policy of BSE-designated projects, typically systemic in nature, has provided BSE an avenue for addressing statewide safety concerns systematically and across District and Region boundaries

Shared Delivery of HSIP

The Alaska DOT&PF delivers their HSIP through Headquarters staff, which consists of the traffic safety engineering practitioners and program development, and the Region staff, which consists of traffic operations engineering and project development staff. This organizational structure, wherein specialists are available from the headquarters and the Regions to carry out day-to-day delivery, is considered a model for other processes and functions within the DOT&PF.

Alaska, Massachusetts, Utah, Oregon, and North Carolina deliver their HSIPs through a combination of Headquarters and Region/Division staff, similar to Illinois.

The MassDOT Traffic Engineering and Safety Section (TESS) is staffed with eight employees and is responsible for all statewide HSIP management, crash data management, and the coordination of HSIP implementation. Traffic Engineers in each of the six Districts work with the 13 MPOs

and the TESS to identify candidate sites and recommend projects based on the screening process, within the structure of the District project development process. TESS has established working relationships with MassDOT Planning in order to deliver the HSIP, with TESS providing information, the MPOs and Districts working together to identify projects either from TESS list or other data-driven means, and the Districts delivering the projects.

In Utah, the Central Office, working in conjunction with Region staff, identifies and selects projects, and the Region Engineers deliver the projects. The Traffic and Safety Division develops a list of prioritized eligible HSIP projects and then the Safety Programs Engineer, in conjunction with the Region Offices, programs the projects. This Safety Leadership comes from the UDOT Executive Office and Safety Leadership Committees within UDOT. UDOT staff recognized that the reason the program has been so successful is due to the support they receive from executive leadership in making decisions.

ODOT delivers their entire HSIP through the ARTS program, using Central Office-originated screening processes that rely on input from the ARTS staff in each Region. The Central Office provides guidance and policy, while the five ODOT Regions locally manage the ARTS program, with ARTS oversight responsibilities assigned to the Regional Traffic Engineer/Manager. The ARTS staff in the regions select the projects and supervise the design of selected projects, delivering them through the conventional capital construction program using HSIP funds.

In Oregon, the Central ODOT office provides HSIP guidance and policy, but the five ODOT Regions locally manage the program.

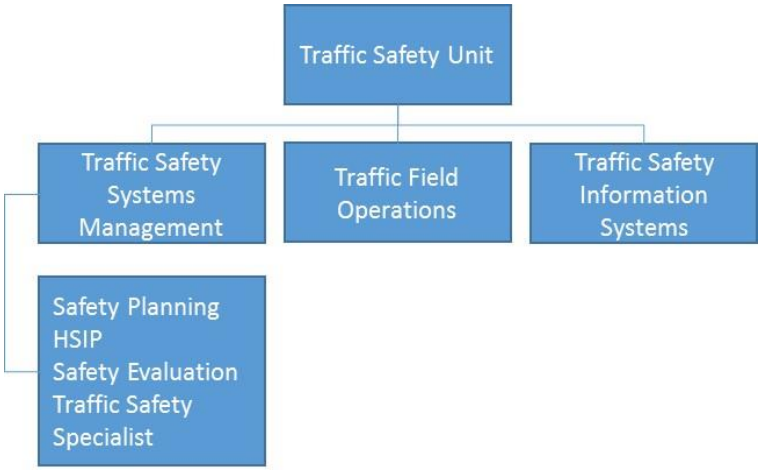


Figure 3. NCDOT traffic safety unit organization chart.

The NCDOT's Traffic Safety Unit has 43 positions dedicated to improving safety and mobility in North Carolina; they are organized into the Traffic Safety Systems Management Section, the

Traffic Field Operations Section, and the Traffic Safety Information Systems Section. The Traffic Safety Systems Section is comprised of three groups: Safety Planning, HSIP, and Safety Evaluation. Figure 3 depicts the Traffic Safety Unit organization chart.

The State is divided into three geographic Regions (West, Central, and East) that have eight Mobility and Safety Traffic Safety Field Engineering offices across the State that are responsible for investigations, countermeasure identification, project development, project inspections, appeals, regulatory and traffic ordinances, and project recommendations across NCDOT's 14 Divisions (100 Counties). All three of these sections (Traffic Safety Systems Section, the Traffic Field Operations Section, and the Traffic Safety Information Systems Section) work closely to improve and deliver the HSIP as well as other safety programs, initiatives, and traffic engineering and regulatory recommendations and responsibilities.

Centralized Delivery of HSIP

New Hampshire was the only Host State that managed and delivered the HSIP solely from Headquarters. NHDOT's HSIP staff are a part of the Design section and work with the State Traffic Engineer and the Highway Safety Engineer to plan, select, deliver, and evaluate projects. This organizational strategy has been a driver for incorporating highway safety methodologies into design for all projects, even those not subject to HSIP funding. NHDOT's Districts are small in geographic size and the District Engineers have solely a maintenance function, as the Central Office carries out the functions of planning, design, and traffic operations and safety engineering. As with several of the other Host States, NHDOT addresses staffing level issues through the use of consultants. NHDOT has two on-call consultant contracts, one for design of projects and the other for analysis.

RELATIONSHIPS WITH EXTERNAL PARTNERS

Every Host State identified relationships with external partners as key to the success of HSIP. This included relationships with the Governor's Office of Highway Safety, Federal agencies, State agencies (such as law enforcement), and universities. States typically meet with partners through HSIP and Safety Committees. States also had significant relationships with MPOs, which is further discussed in Chapter 7 – Addressing Local Road Needs.

HSIP and Safety Committees

In North Carolina, the Secretary of Transportation chairs the Executive Committee for Highway Safety and NCDOT executive staff and partner agency representatives are actively involved in the committee. The Executive Committee meets three times annually and provides oversight and leadership of North Carolinas' safety efforts, particularly in the area of strategic direction and program performance. The Executive Committee is instrumental in achieving

collaboration and a unified direction with multiple State agencies, including NCDOT. NCDOT also has a Safety Project Review & Selection Team comprised of the State Traffic Engineer, State Traffic Safety Engineer, Field Operations and Investigations Engineer, Mobility and Safety Field Operations (M&SFO) Program Manager, Governor's Highway Safety Program representative, and a representative from the Rail Division. This Team meets quarterly to review, assess and provide recommendations for candidate Safety Projects for investment under the Department's State Transportation Improvement Program (STIP).

In New Hampshire, the Assistant Director of Project Development chairs the HSIP Committee. Membership on the NHDOT HSIP Committee includes representatives from FHWA, a local agency, an MPO, a regional planning commission (RPC), and various divisions within NHDOT, including design, maintenance, traffic, rail and transit, and those representing the needs of vulnerable users. The committee's composition helps to deliver a broad perspective on both program operations and program policy. In addition to reviewing and selecting projects, the HSIP Committee also meets annually and as necessary to review project progress, identify trends in funding and project development, and address policy and compliance issues related to program performance and FHWA policy changes and guidance. In their efforts to monitor projects, the HSIP Committee examines progress in construction and project cost. If project costs are set to exceed a relative value, defined by policy, the Committee undertakes a more intensive review. The Committee also evaluates the need for integrating SHSP emphasis areas and oversees the project evaluation processes, ensuring that the HSIP investments are addressing the SHSP objectives and that those same investments are achieving strategic and system safety performance goals such as the targeted return on investment and expected crash reduction.

The NHDOT HSIP Committee includes representatives from FHWA, a local agency, an MPO, an RPC, and various NHDOT divisions. The committee reviews and selects projects, identifies trends in funding and project development, monitors projects, and addresses policy and compliance issues.

The MassDOT HSIP Task Force consists of seven members. These members include two FHWA staff members, three MassDOT staff members (the Chief Engineer and representatives from the Bureau of Traffic and Safety and the Bureau of Planning), and members from two MPOs. The task force meets annually or as needed to develop guidelines for acceptable HSIP projects but does not approve individual projects. The guidelines for the HSIP program and an interactive map of eligible locations are both available on the MassDOT web site. [10] The HSIP guidelines correlate with programs, projects and systemic approaches in the Massachusetts SHSP.

Governor's Office of Highway Safety

Relationships with the National Highway Traffic Safety Administration (NHTSA)-mandated Governor's Office of Highway Safety were often key contributors to the success of public outreach campaigns and successful integration of enforcement efforts.

In Utah, the Governor's Office of Highway Safety resides within the DPS, and UDOT and DPS staff in the Secretary's Office work closely together to coordinate the work of the DPS and UDOT. This relationship has led to coordinated media campaigns, a unified approach to expending NHTSA funds that complements UDOT efforts to promote passenger safety and combat impaired driving, and a public face that demonstrates that UDOT and the DPS are partners in transportation safety work.

The strong relationship between NCDOT and the Governor's Highway Safety Program (GHSP) allows the two entities to work together to share information, leverage resources, and coordinate efforts. Furthermore, a GHSP representative sits on the NCDOT Safety Project Review and Selection Team.

North Carolina DOT's Safety Project Review and Selection Team includes a Governor's Highway Safety Program representative.

In Illinois, the Governor's Highway Safety Office manages Illinois-apportioned NHTSA funding and works with the Illinois State Police (ISP) on traffic safety initiatives through the Division of Traffic Safety (DTS), which, like the Division of Highways, reports directly to the Illinois Secretary of Transportation. In addition to managing deployment of NHTSA initiatives, the DTS also provides for the collection, entry, and management of the Department's traffic crash data system. IDOT is also cooperating with the ISP to use their crash reconstruction teams to identify crash trends and locations with potential for safety improvement as well as to use the "heat map" capabilities of the Department's analysis tools to assist in planning special and emphasis enforcement activities.

Safety Innovation

In Illinois, coordination between the Division of Highways through its Bureau of Safety Engineering and Bureau of Operations and the Division of Traffic Safety has led to the development of policy concerning the use of variable message signs on freeways for traffic safety messages, the content of those messages, and the refinement and development of future approaches to public information related to

Federal Agencies

Utah's Safety Leadership Executive Committee is a broad coalition of executive-level State officials and partner agency representatives. The Committee includes representatives from the DPS, Department of Health (DOH), UDOT, FHWA, Federal Motor Carrier Safety Administration (FMCSA), and NHTSA, providing for coordination between these organizations. UDOT also views FHWA as a resource and partner in the HSIP effort and works closely with the FHWA Utah Division Office to ensure HSIP program objectives align with FHWA strategic and tactical initiatives.

Utah's Safety Leadership Executive Committee includes representatives from UDOT, DPS, DOH, FMCSA, and NHTSA.

Universities

Some States emphasized their relationships with universities as key to the success of data evaluation improvements, validation of screening and selection approaches, and their ability to develop new and innovative programs that engage local agencies.

Partnerships with universities can help agencies develop tools, new approaches, and implement new programs to enhance various aspects of the HSIP.

IDOT worked with the University of Illinois to develop their initial set of Safety Performance Functions (SPF) for each roadway type for the State highway system. Chapter 5 further describes the use of SPFs to analyze potential projects.

UDOT's partnerships with the University of Utah and Brigham Young University have led to substantial advancements in the understanding of crash prediction modeling and the success of safety countermeasures. Chapter 6 further describes these efforts.

NCDOT is working in partnership with the University of North Carolina Highway Safety Research Center (UNC-HSRC) to deliver a pilot program to introduce communities to the concepts required to implement low-cost safety improvements in a data-driven traffic engineering program. Chapter 6 further describes this program.

SUMMARY

The traffic safety engineering functions within each of the Host States were most coordinated when safety was a top priority of the traffic operations unit or was itself a separate safety engineering unit with top-level representation to the transportation chief executive. In Illinois, the Bureau of Safety Engineering, despite having no corresponding bureau in each of the nine Districts, has a specific, targeted mission and has achieved a high degree of cooperation with the Central Bureau of Operations and the corresponding Operations and Traffic bureaus in

each District. In smaller States, such as New Hampshire and Alaska, the centralization of traffic safety engineering functions is complemented by the collaborative involvement of local traffic engineers and maintenance and operations personnel.

All States exhibited a successful integration of the HSIP effort at the regional or division level, indicating that a core function of regional traffic engineers was to understand safety performance and participate, to varying degrees, in the development of the HSIP. In Illinois, this means District staff has direct control over evaluation and programming a portion of the HSIP dedicated to that District. In North Carolina and Oregon, staff participation in project development is supported by a centralized screening of the roadway network. In Alaska, Utah, and New Hampshire, the screening of the roadway network is a key function of the central office staff. New Hampshire centralizes all project development efforts and thus the HSIP is administered from the Planning office.

Every State identified relationships with partners as key to the success of HSIP. Utah and Alaska both indicated that relationships with their NHTSA-mandated Governor's Office of Highway Safety were key contributors to the success of public outreach campaigns and successful integration of enforcement efforts. Utah, Illinois, and North Carolina emphasized their relationships with universities as key to the success of data evaluation improvements, validation of screening and selection approaches, and their ability to develop new and innovative programs that engage local agencies.

CHAPTER 4—UNDERSTANDING THE RELATIONSHIP BETWEEN THE SHSP AND HSIP

One of the basic foundations of the HSIP is the direct linkage between the data-driven priorities established in the State's SHSP and the identification, development and implementation of HSIP projects. Understanding the contribution of HSIP projects towards achieving the goals and objectives of the SHSP can help guide program decisions and project selections. Every Scan Tour State considered an important part of the overall safety program to be the use of the SHSP as a tool for defining HSIP initiatives and areas of emphasis.

ALIGNING HSIP PROJECTS WITH THE SHSP

SPOTLIGHT ON SAFETY:

Coordinating HSIP with the SHSP in New Hampshire

New Hampshire's SHSP addresses nine critical emphasis areas (CEA) – adolescent drivers, comprehensive safety data improvement, crash locations, distracted driving, impaired driving, motorcycles and vulnerable roadway users, older drivers, speeding, and vehicle occupant protection. Each CEA includes strategies for addressing the emphasis area challenges. Data-driven projects that target strategies identified in the State SHSP are the only types of projects eligible for HSIP funding in New Hampshire. The crash locations CEA includes lane departure crashes and intersection crashes as crash types of special interest and therefore NHDOT targets HSIP projects that include these types of crashes. The HSIP Committee makes final decisions on project selection in the context of the nine SHSP emphasis areas, prioritizing b/c ratio and examining net benefit from reduction of all crashes. NHDOT works to revise the SHSP emphasis areas annually, with an overall revision of the document occurring every four years. This helps align priorities with emerging trends and encourages internal assessment of strategy and direction.

In Oregon, the goal is for HSIP projects to align with the SHSP implementation plan and the strategic initiatives identified in the plan. This has long been done in Oregon with regard to bicycle and pedestrian safety projects. In particular, the Oregon Toward Zero Deaths initiative recognizes the importance of high-visibility safety corridors, further complementing the SHSP emphasis on correcting behavioral issues.

The Oregon SHSP emphasizes correcting behavioral issues.

In Utah, coordination of the HSIP and SHSP is accomplished by tailoring HSIP projects to one of three areas identified in the SHSP. The Utah SHSP framework is built around Emphasis Safety Areas, Continuing Safety Areas, and Special Safety Areas. Emphasis areas include behaviors such as Roadway Departures and Impaired Driving, while Continuing Safety Areas address Work Zones, Bicycle Safety, and Rural Local Road Safety. The Special Safety Areas are Traffic Data, Judicial System, and Emergency Services. For each of the Emphasis Safety Areas, a Challenge and Direction is identified and Priority Strategies are identified for each of the safety areas in accordance with each of the UDOT "5E's," which include the fifth "E" of "EVERYONE."

In Utah, HSIP projects are tailored to the three areas of the Utah SHSP framework.

In Alaska, the DOT&PF develops the SHSP and the Alaska Highway Safety Office (AHSO) develops the Highway Safety Plan (HSP) and participates in the development of the SHSP which informs future implementation of the HSP. The SHSP identifies target user groups, behavioral and infrastructure-related strategies. The HSP identifies safety strategies, as well as educational, behavior, and data-related grants which complement HSP strategies; NHTSA funding constraints; and SHSP strategies. The SHSP incorporates educational, behavioral, and engineering strategies, and is implemented through HSIP and other initiatives by the DOT&PF. All nominated HSIP projects are developed in order to align with one or more of the long-term goals in the SHSP. The long-term goals include strategies for improving highway safety, including Strategy 5, which specifically addresses improving roadway safety through HSIP-qualified activities and projects.

The Alaska SHSP includes a strategy that specifically addresses improving roadway safety through HSIP-qualified activities and projects.

The Massachusetts SHSP addresses a broad range of countermeasures across 15 emphasis areas, divided into three groups. The first is "strategic," for issues identified as mature and correctable with validated measures. The second group, "proactive," addresses issues where trends indicate an increase in crashes and fatalities. The third group of emphasis areas is "emerging," where data may be insufficient to quantify the breadth of the problem at the current time. The current emerging areas include driver inattention and data systems, both becoming an area of increased focus for MassDOT. Each HSIP project must address a SHSP emphasis area and each SHSP emphasis area provides strategies for addressing common safety problems. For each emphasis area, the Emphasis Area Teams can identify projects. In general, these are considered to be improvements to data analysis and access, and often they can be addressed using existing MassDOT staff.

In Massachusetts, each HSIP project must address a SHSP emphasis area and each SHSP emphasis area provides strategies for addressing common safety problems.

Illinois recently prioritized the emphasis areas within its SHSP based on the percentage of fatalities and serious injuries. They learned of this approach from Washington Department of Transportation. The outcome of this analysis, depicted in Figure 4, divides the SHSP emphasis areas into the three priority levels, allowing for focus of efforts on those emphasis areas with greatest opportunity for reduction in fatalities and serious injuries.

Illinois divides their SHSP emphasis areas into the three priority levels, allowing for focus of efforts on those emphasis areas with greatest opportunity for reduction in fatalities and serious injuries.

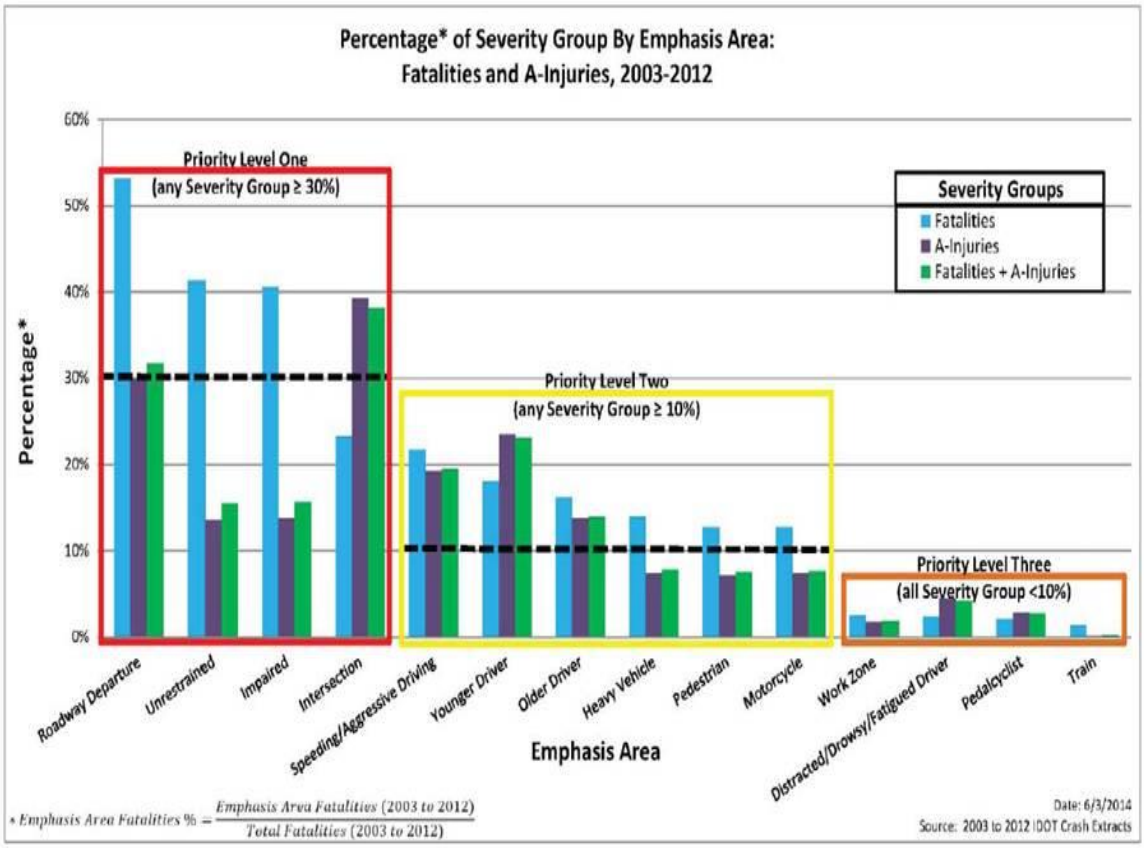


Figure 4. Illinois SHSP emphasis area priority levels.

USING COUNTY SHSPS FOR NETWORK SCREENING

IDOT funded the development of county SHSPs that address all public roads within a specific county with a consultant contract. This effort was specific for the top 35 counties with the most fatalities and serious injuries and those additional counties within MPOs. The county SHSPs identify opportunities for focus of multi-discipline safety efforts, and in particular HSIP implementation, and support performance targets for the MPOs and local agencies as well as

the IDOT districts. The local SHSP include comparison of safety performance of State and local roadways within emphasis areas, heat maps, and data trees to aid local agencies in the network screening processes. These align with the statewide SHSP.

SUMMARY

In every Host State, the use of the SHSP as a tool for defining HSIP initiatives and areas of emphasis was considered an important part of the overall safety program. New Hampshire evaluates updates to its SHSP on an annual basis and the use of SHSP emphasis areas has helped build public support for NHDOT safety programs. Alaska has a specific initiative related to the HSIP in their SHSP, by addressing improving roadway safety through HSIP-qualified activities and projects.

In Utah, Illinois, and Massachusetts, safety emphasis areas are identified in the SHSP. In Utah, emphasis area working groups are tasked with identifying strategies and targets, providing investment from throughout the organization and from partners. Utah's strong SHSP coalition, which includes dozens of non-UDOT partners, ensures that the SHSP is not only inclusive of community and coalition needs, but also widely publicized and supported by invested partners.

In locations not on the State roadway system, Illinois allows the use of county SHSPs for network screening processes and the identification of emphasis areas and focus areas, just as in the statewide SHSP.

CHAPTER 5—MAKING DATA-DRIVEN SAFETY DECISIONS

A complete, consistent, and comprehensive data collection process is necessary to assess potential safety issues on all roadways in the State. Successful States maintain a statewide inventory of crash, roadway and traffic characteristics to locate and evaluate a comprehensive program of potential spot and systemic safety projects. A quantitative project prioritization process enables the selection of HSIP projects that provide the greatest opportunity for reducing fatalities and serious injuries.

CRASH DATA COLLECTION AND ANALYSIS TOOLS

Several States gave presentations on their crash data collection systems and crash data analysis tools.

SPOTLIGHT ON SAFETY:

Accessing and Analyzing Crash Data in Illinois

The Illinois DOT (IDOT) provides easy access to crash data through the Safety Portal, a web-based tool that provides access to data related to safety on Illinois roads. Among its tools is Crash Manager, which provides a comprehensive searching function for all Illinois motor vehicle Traffic Crash Reports submitted to IDOT. Every crash report that has been submitted to IDOT in the last 10 years (IDOT's record retention policy for non-fatal crashes) can be retrieved using this utility. This includes crash reports submitted on paper, through IDOT's current Mobile Capture Reporting (MCR) system, and also through a third party XML vendor. The Crash Manager utility also allows for searching crash reports that were just received, no matter how they were received. Items recently scanned from paper reports can be retrieved, but the amount of information available to search for them is considerably less than the reports that are received electronically through MCR or third party XML vendors. Crashes can be mapped if they have location information. Figure 6 shows an example crash map, the different colored dots indicate different years. Figure 5 shows the information that appears when zooming in on a crash location.

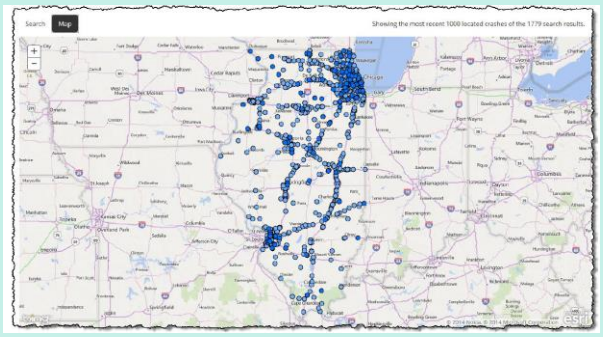


Figure 5. Example crash map from IDOT crash manager. (11)

Figure 6. More detailed crash map information from IDOT crash manager. (11)

IDOT utilizes GIS and its SafetyData Mart to perform more detailed safety analysis. This is done in addition to IDOT's annual statewide analysis to calculate the Potential for Safety improvement (PSI) for State route intersections and segments and assign each roadway segment and intersection to a safety tier in IDOT's Safer Roads Index (SRI). IDOT has used a weighting system for fatalities and serious injuries to develop a local roads 5% List which aids local agencies in identifying local roadways with higher potential for safety improvement and applying for local HSIP funding. In addition, the statewide analysis has been used to identify locations to address specific trends, i.e. curves, roadway departure (rumblestrip prioritization maps), pedestrian safety corridors, etc.

Crash Data Collection

In North Carolina, the majority of crash reports are available within one week. State and local law enforcement agencies send reports to the North Carolina Department of Motor Vehicles (DMV), submitting 70 percent of crash reports electronically. The DMV owns the data and most of the electronically submitted crash reports are fully available within five days, with the lag on roughly 30 percent paper reports being typically less than four weeks in duration. The four week lag on crash reports submitted on paper is primarily due to them being submitted via mail and then entered manually into the data system.

NCDOT has comprehensive access to the DMV system, including the ability to view images of crash reports with the crash diagram and narrative. Data is geo-coded using an automated process based on mileposts, but there is no dedicated staff for the 30 percent of reports that are not on the State-mile post system or that cannot

The North Carolina DOT has comprehensive access to the DMV crash data system. Because the DMV is part of NCDOT, traffic engineering staff work closely with DMV staff to understand the data and its use.

milepost via automated processes. Because the DMV is part of the NCDOT, the traffic engineering staff are able to work closely with DMV staff to help foster an understanding of the data and its use, particularly with regard to data compliance and validity concerns, essentially offering technical assistance in return for DMV custodianship of the data.

In Massachusetts, safety performance evaluation efforts are primarily based on the use of crash data obtained from police reporting of the roughly 125,000 statewide annual crashes. Massachusetts requires by statute the use of a common form and roughly two-thirds of all police reports are submitted electronically. The MassDOT Division of Highway and Registry of Motor Vehicles (RMV) is responsible for entering crash data, but is not staffed with analysts. MassDOT's Traffic Safety Section's Crash Data unit performs attempted geo-coding of all crash data obtained from RMV and also conducts quality control on crash data, examining the information for anomalies in coding and geographic disparities.

The Massachusetts DOT attempts to geo-code all crash data and conducts quality control on crash data. MassDOT also has the ability to query citation data and uses that data to understand where behavioral issues are occurring and what countermeasures and public outreach campaigns can help correct those issues.

Massachusetts also maintains hospitalization data and is undertaking a project to link that data with the crash dataset. This project will address MassDOT's identified shortcomings of the Crash Outcome Data Evaluation System.

In addition to accessing crash reports, MassDOT also has the ability to query citation data, but citations and crash information are not linked with any guarantee of quality, so the citation query is performed independently of the crash information. Citation data has been particularly useful to MassDOT as they attempt to understand where behavioral issues are occurring and what countermeasures and public outreach campaigns would be most useful in correcting those behavioral issues.

In Utah, the DPS developed the statewide crash database, which receives electronic input from all of Utah's police agencies whenever a crash report is submitted. The Utah Highway Patrol began submitting electronic reports in 2003 and other agencies were required to participate in the program by 2012. State statute requires the electronic submittal of crash reports within 10 days of the incident.

Utah's statewide crash database receives electronic input from all Utah police agencies whenever they submit a crash report.

Using a Tiered Crash Data Entry System

Alaska statute requires electronic transmission of crash reports, but the format is unspecified. Recent changes to the crash report itself include fields compliant with the Model Minimum Uniform Crash Criteria, some being additional fields that are often ignored by law enforcement. Changes in the police reporting form have resulted in an increase in civilian reporting on account of the complexity in the police form requiring additional officer time for completion.

Alaska and Utah see value in a tiered crash reporting system to reduce complexity of crash reporting and obtain additional details about higher-order crashes.

In lieu of simplifying the reporting categories and losing valuable data, the DOT&PF is studying the use of a tiered reporting system, where higher-order crashes would trigger the input of additional details, up to and including all available data fields.

Like Alaska, UDOT is currently undertaking development of a tiered reporting system to encourage additional data collection from higher-order crashes. The University of Utah is under contract to develop interfaces for the statewide crash database in addition to researching and developing the database architecture. The interfaces with the crash data system allow for access by discrete users and integration with UDOT GIS systems for display and access from other tools.

Crash Data Analysis Tools

The Alaska DOT&PF contracted with the University of Alabama in the development of the Alaska eCrash system, called CRASH/Alaska CARE, in order to improve the accessibility of crash data. It is anticipated that this new system will use the conventional traffic records coding for severity in crash data. This system will provide a portal with access to the latest crash data with powerful analysis tools that will aid in network screening and crash data management, supporting repeatable network screening processes. Recent changes in reporting requirements have necessitated the Municipality of Anchorage to convert prior data to the fields in the new crash reporting architecture and DOT&PF is exploring how the eCrash system can be used to reduce the municipal burden in data collection and data management. Under the eCrash development contract, the DOT&PF is obtaining data entry services for the non-electronically-transmitted crash records, aiding in reducing the data entry backlog. While the system will be available only to DOT&PF employees and potentially to the Municipality of Anchorage, outputs

CRASH/Alaska CARE will provide a portal with access to the latest crash data and will include powerful analysis tools to aid in network screening.

from the system, including those that demonstrate monitoring of progress in the SHSP emphasis areas, will be made available to the public.

The MassDOT Crash Analysis Tool produces a clustered crash map using GIS tools and the geo-coded crash system. The crash clusters use a search radius of 25 m from adjacent crashes and a search radius of 100 m for bicycle and pedestrian crashes, which are clustered separately. MassDOT developed the mapping tool in-house using contractor assistance and updates the Tool annually based on crash data collected in the prior calendar year. Over the last three years, roughly 94 percent of crashes have been geo-coded on average statewide, with the remainder lacking sufficient information for accurate coding.

MassDOT's Crash Analysis Tool provides a clustered crash map, coded by crash type and normalized to EPDO values for screening projects. MassDOT uses this tool to generate the HSIP-eligible projects list.

The database of crashes for the Crash Analysis tool uses a chaining algorithm, creating a map of crashes that is coded by crash type, where possible, and normalized to Equivalent Property Damage Only (EPDO) values for the purposes of screening projects. This EPDO normalization is the basis of the candidate project selection system, as crashes and crash clusters are ranked to create the 5% List, the top five percent of all crashes (the list previously mandated by FHWA), ranked by EPDO for each MPO region within the State. MassDOT Planning staff, District staff, and MPOs all use ESRI software to examine crash clusters in the process of developing the scope of future improvements.

MassDOT generates the 5% List using the clustering process and considers this the HSIP-eligible project list. The Crash Analysis Tool enables a visual confirmation of HSIP eligibility. Users of the tool can see crash clusters and individual crashes, and identification of segments with poor safety performance is easily undertaken.

In addition to the Crash Analysis Tool, MassDOT also operates a Crash Portal, which permits data distribution of crash information.[12] This tool is available to the general public and is used by MPOs, in particular, as they work with local agencies to evaluate locations as potential HSIP candidate projects. MassDOT also maintains the Cross-Tabulation Analysis Tool, which was recently made externally accessible.

UDOT contracted with Numetric to provide a crash query and safety data investigation system. The system analyzes crashes in selected locations and along segments and suggests countermeasures based on CMFs for low-cost safety improvements. As with all Utah HSIP projects, CMFs are only applied to targeted

Utah's crash system analyzes crashes and suggested countermeasures for low cost safety improvements.

crashes, producing conservative b/c ratios.

SYSTEM SCREENING, PROJECT NOMINATION, AND PROJECT SELECTION

Each Host State used a documented process for system screening, project nomination, and project selection. Among all States, North Carolina, Illinois, and Alaska offered the highest degree of flexibility for project nomination and selection. Several Host States made extensive use of regional engineering staff in the process of scoping potential improvements. While all of these agencies have centralized the system screening process, the deployment of local resources in scope and contract plans development was seen as key to effective cost control and identification of projects appropriate for the system.

Using Safety Warrants to Screen and Select Projects

NCDOT uses a safety warrants system for project screening, prioritizing and selecting projects on the basis of b/c ratio and a safety index decision support tool. This warrant system is divided into three areas, those being Intersections, Highway Sections (non-freeway, freeway, and city-maintained), and Bicycle and Pedestrian sites. The Safety Warrants are updated on a routine basis using crash data analysis, part of the overall evaluation process in North Carolina.

NCDOT identified intersection warrants, using frequency, severity, and combinatory factors to justify investments. When the location meets the warrants it is categorized as potentially hazardous. The goal is to identify correctable locations, with Potentially Hazardous (PH) locations prioritized using weighting factors for frequency, severity, and percentage of target crashes. Weighting factors are summed for locations that meet multiple warrants.

The NCDOT GIS portal uses a sliding window application to assist in identifying segments. The GIS portal displays both intersection and segment locations, permitting a view of present-year and prior-year PH sites, a useful tool for evaluating changes over time. Analysts segregate freeway sections based on minimum total crash and minimum crash-per-mile values, while persons bicycling and persons walking crash locations must have a minimum of five crashes in a ten year period.

An annual Potentially Hazardous Listing report is created based on the Safety Warrant Screening process. The current report includes 1,819 intersections, 491 sections, and 127 bicycle/pedestrian locations. NCDOT believes that this report is a strong demonstration of their commitment to correcting traffic safety deficiencies, with project selection from the report occurring on a quarterly basis, one means of advancing an HSIP project in North Carolina. Because this network screening process is based on pattern recognition, NCDOT believes the generated list provides highest-value projects.

Following the identification of a PH site (site for investigation), HSIP staff research and conduct a detailed crash analysis using the Traffic Engineering Accident Analysis System— a North Carolina developed, web-based system for crash data access, analysis, and collision diagram data export capabilities. HSIP staff submit the findings from this investigation to the Field (Regional Traffic) Engineering staff for additional analysis, research, and engineering field investigations and assessments. Based on the evidence-driven findings, observational analysis, and professional recommendations of the Field Engineer, a location may require additional analysis. It may also yield countermeasure recommendations and initiate either project development, project recommendation for inclusion in other active project, or a more immediate maintenance action. In some cases, the Engineer will determine and recommend no further action or treatment.

The Transportation Mobility and Safety (M&S) Regional Traffic Engineering (RTE) professional staff investigation includes evaluation of traffic control devices and operations, driver factors, and regulatory factors in conjunction with the collision diagram and crash form narrative content. The RTE:

- Researches the projects.
- Identifies active projects and recent condition changes.
- Conducts a thorough site investigation.
- Analyzes patterns and conditions to determine appropriate and feasible countermeasures (treatment scenarios).
- Collaborates with local Division and local stakeholders.
- Develops a project work scope (design, right of way _+ utilities, and construction) and engineering cost estimate.
- Completes a safety b/c analysis worksheet (based on the CRF), as appropriate for the candidate safety project.

This is all done using the project development resources of the field engineering office. For all projects advanced to preliminary design, the RTE coordinates with the Division public hearings, designs review sessions and press releases, and facilitates the project planning process. Mobility and Safety's Field Engineers (RTE's) are all Professional Engineers, and all safety project packets require the seal of a Professional Engineer.

Using an Electronic Application Process to Screen and Select Projects

In Illinois, project identification may occur at the District level or at the Central Office. Typically Central Office driven projects focus on statewide systemic safety improvements, i.e., wrong way driving, curves, pedestrians, etc. The nomination of all HSIP projects in Illinois

occurs through an electronic application process. Figure 7 depicts a portion of the application form. The Districts and local agencies complete the same project candidate forms and have use of all of the web-based analysis tools, including the crash data portal. Documentation and tools for the program include the Systemic Safety Manual, various spreadsheet-based evaluation tools including the Benefit/Cost Analysis Tool and HSM Crash Prediction Tool, and the HSIP Project Selection Process Flow Chart shown in Figure 8 and found in Appendix B of the *IDOT HSIP Policy*.[13] This allows for statewide tracking of HSIP projects, monitoring performance, and ease of annual reporting.

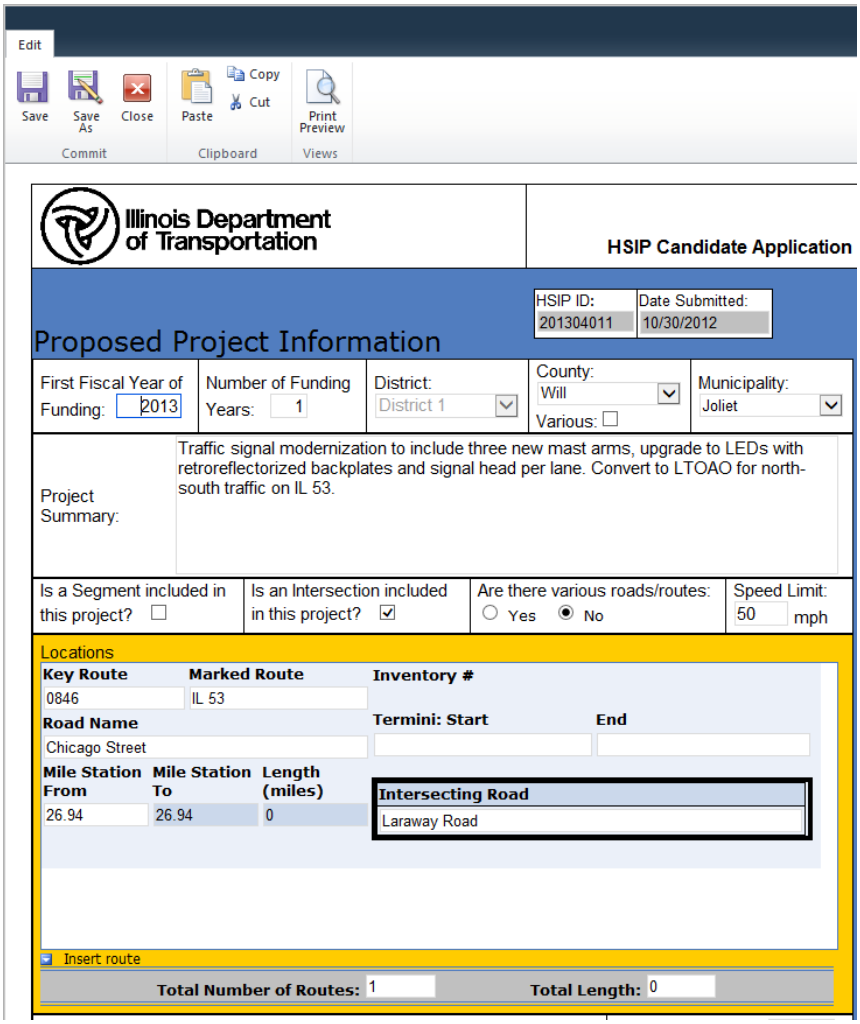


Figure 7. IDOT HSIP candidate application form.

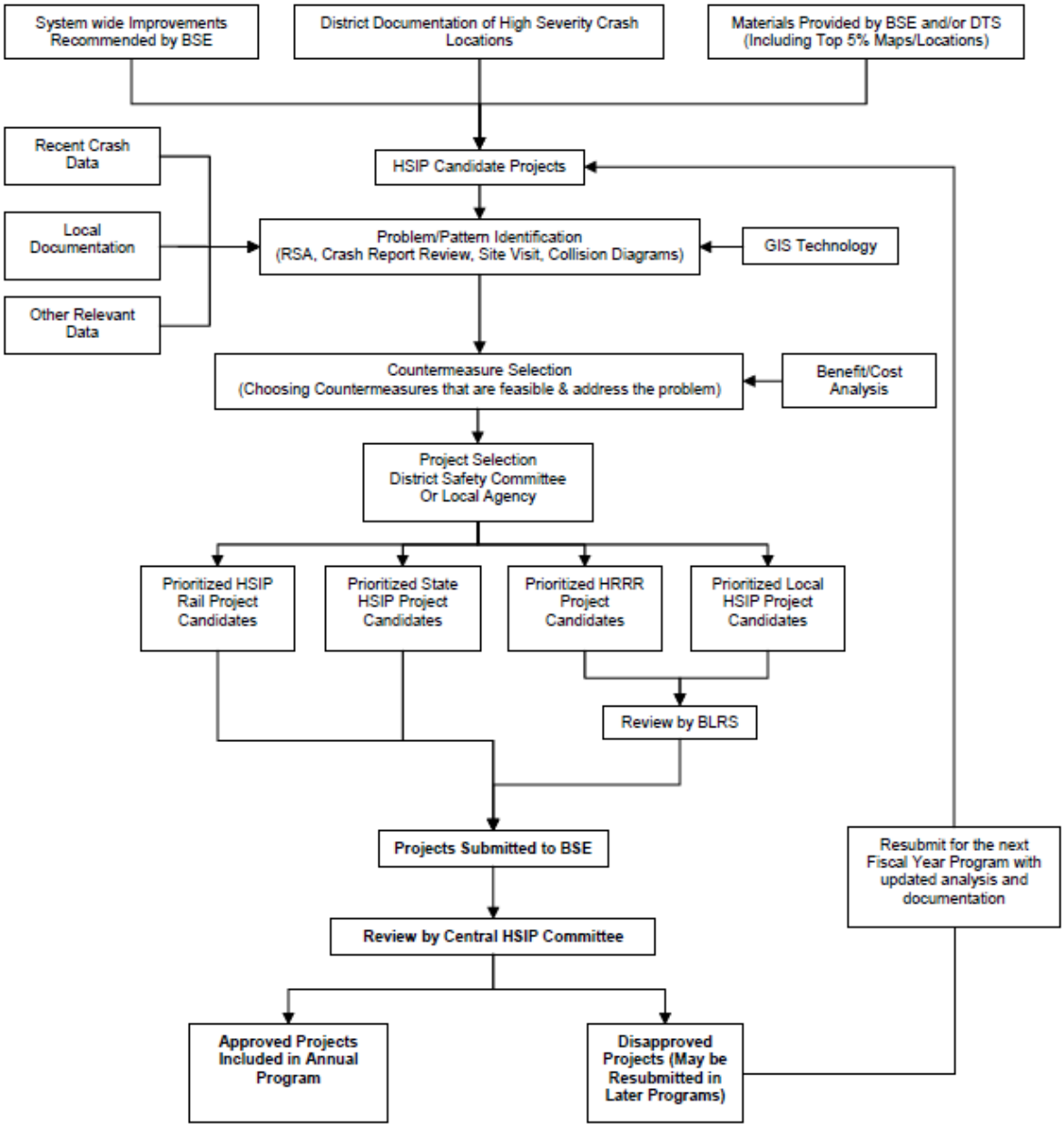


Figure 8. IDOT HSIP project selection process flow chart. [14]

Districts have access to an HSIP SharePoint site to submit projects throughout the year. IDOT solicits local agency projects on an annual basis and local agency officials submit candidate projects to the Districts. This is to allow the District staff to review the projects, ensure that the proposed location is not a State route and that the agency submitting the application is the roadway owner and has authority over the roadway itself, determine if the proposed project meets the criteria of HSIP and if the proposed scope of work is reasonable, and that either the supporting documentation is included or additional information is needed. The submission

process for the Districts is open throughout the year, as previous submission deadlines were the cause of a large receipt of submissions in a very short period prior to the deadline.

In Illinois, all projects are subjected to the same criteria for evaluation by the Central Safety Committee. The Committee considers the following criteria:

- SHSP emphasis areas.
- Crash data.
- 5 percent Location and PSI rating.
- Crash types and identification of safety problem.
- Countermeasure selection with attention paid to low-cost safety improvements.
- Proportion of project funding from HSIP.
- CMF selection.
- Cost reasonable and accurate.
- B/C ratio.
- Screening for a "project looking for a funding source."

The process of selecting HSIP projects includes submission, review, notification of approval/denial, planning and programming, Federal authorization, project design, letting and award, and, in parallel, HSIP funding.

Using Crash Data to Screen and Select Projects

Figure 9 depicts the Alaska DOT&PF project selection process. DOT&PF Traffic & Safety (T&S) performs an annual screening for all roads, using five years of crash data. This screening identifies the need and serves as the basis for new project nominations of spot and systemic improvements on the entire system, as the DOT&PF includes local roadway systems in the screening process, providing a solid basis for determining the ranking of projects based on correctable crashes. The Districts can use this information or other data-driven means to identify HSIP candidate projects.

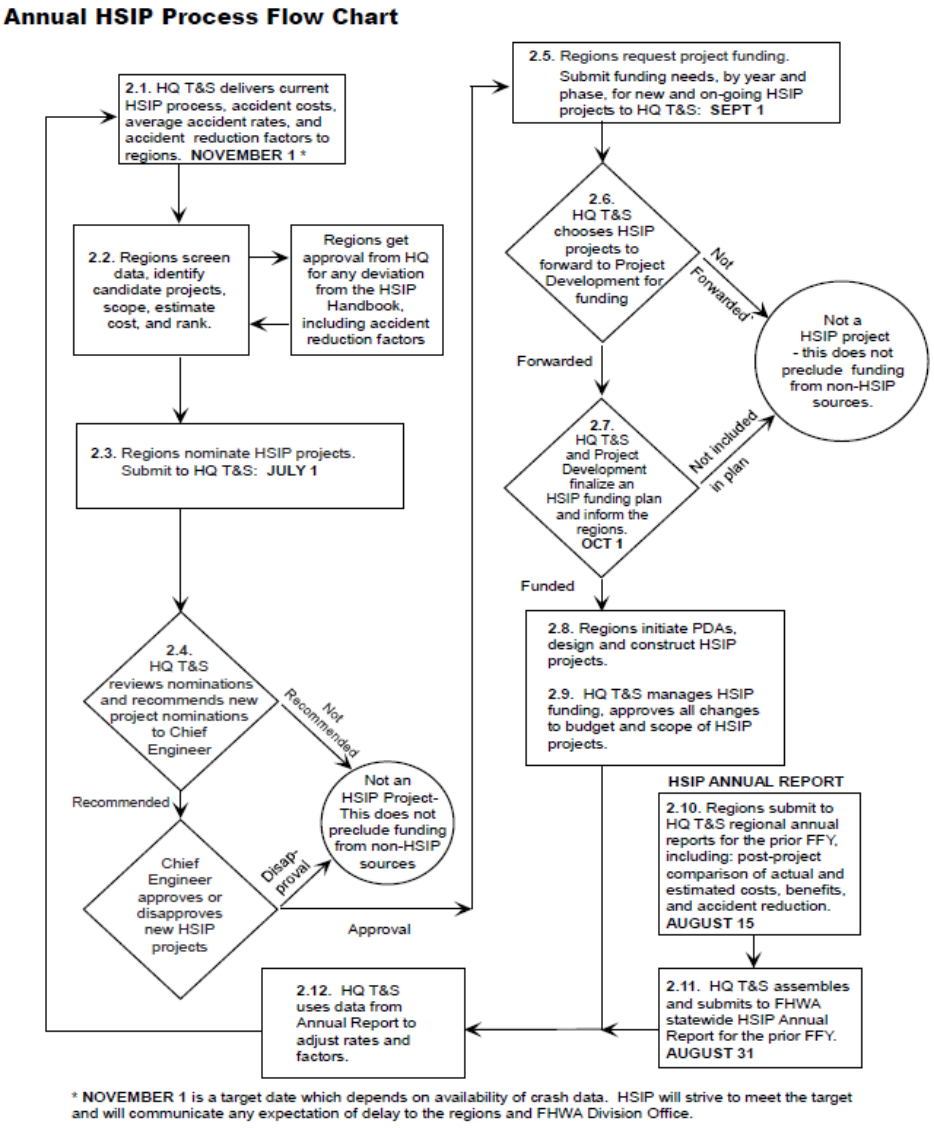


Figure 9. Alaska HSIP project selection process. [15]

T&S prepares the generated list of projects from lists submitted by regional engineers. This results in a list of projects identified as "ranked," "non-ranked," and "systemic." Each regional traffic engineer nominates local projects based on the screening process. Local agencies can nominate a project with informal DOT&PF assistance in selecting the project limits, countermeasures, and computational metrics. Projects are prioritized for funding according to the HSIP Handbook. Ranked projects with the highest benefit-cost ratio are the first priority in funding, regardless of the lower benefit-cost projects or threshold.

The DOT&PF employs the recommendations of *National Cooperative Highway Research Program (NCHRP) Special Report 214 Designing Safer Roads*, using a formula from the *Alaska HSIP Handbook* to describe the methodology for computing the b/c ratio when employing multiple

countermeasures. This approach handles the additive effects of multiple CMF applied to a spot improvement. Projects are considered "ranked" when they can be assigned a CMF and a calculated b/c ratio is available. The Ranked Projects are prioritized ahead of other projects based on the b/c ratio, while also considering history of fatal or serious injury crashes, deliverability, and project duration, as well as a cost factor. DOT&PF accepts projects with b/c less than 1 because a ratio of 0.2:1 can still eliminate crashes, and DOT&PF does not want to fail to obligate safety funding to any location where a crash reduction could occur based on the application of a safety countermeasure.

"Non-Ranked" projects are classified based on the absence of a CMF history of correctable crashes, which typically means that no b/c ratio can be computed. There are two categories of non-ranked projects, those with crashes at the location and lacking a CMF for the particular countermeasure and those without crashes at the location. This list exists primarily to allow safety engineering staff to apply engineering judgment in the development and recommendation of projects that have a high likelihood of reducing crashes, but may not have statistically-valid sample sets or are lacking other data necessary to complete the computational process. For example, there may be locations where barrier terminal end treatments are not compliant with NCHRP 350, yet are absent any record of crashes. However, speed and volume may demonstrate a high risk of severe crashes and engineering judgement would indicate that upgrading the end treatments would be an investment that, given any crash history, would have a high b/c ratio.

Non-ranked projects are prioritized among other projects based on history of fatal or serious injury crashes, deliverability, project duration, and a cost factor. Non-ranked projects require a narrative and, when a crash history exists, a sensitivity analysis to help evaluate project effectiveness. The sensitivity analysis is computed by performing two projected benefit-cost ratios assuming CRFs of 5 percent and 100 percent for historical crashes susceptible to correction. The minimum b/c ratio for ranked projects (those with a crash history and a known CRF for the countermeasure) is 0.2:1 in order to be considered eligible for funding. . Non-ranked project sensitivity analysis has been conducted since 2008, as DOT&PF staff wanted to avoid poorly-performing HSIP projects.

Applying Additional Factors in Screening

The NCDOT Spot Safety process uses a Safety Index Decision Support tool with the Safety Index comprising both Safety and Responsiveness indices. The Safety Index is weighted with 50 percent b/c, 10 percent severity, and 10 percent programmatic, with responsiveness being an aggregate measure of local priorities for 30 percent of the total weight. The

In North Carolina, spot improvement projects are identified using a Safety Index Decision Support Tool, which is comprised of both safety and responsiveness indices.

programmatic weighting factor reflects the degree to which the project satisfies the objectives of the overall HSIP, such as concurrence with SHSP or addressing a targeted strategic need (or a recommendation for an HSIP or RSA Identified Improvement).

SPOT VERSUS SYSTEMIC IMPROVEMENTS

Several Host States employ a comprehensive program of spot and systemic improvements.

IDOT does not utilize a set proportion for allocation of spot and systemic improvements. By means of data collection and analysis and identification of trends, IDOT expects to balance systemic and spot improvements, recognizing that both types of improvements are necessary to achieve safety outcomes. The Central Office can provide information to the Districts through the two types of analysis, assisting the Districts in the development of a District-specific safety program that includes an appropriate proportion of systemic improvements. Most Districts typically have project-level focused projects, and the Central Office identifies and funds the majority of systemic projects.

IDOT does not utilize a set proportion for allocation of funding to spot and systemic improvements. Instead they expect to balance both types of improvements, recognizing that both are important to improving safety.

The Central Office develops and provides to all Districts the SRI and Safety Tier information (further described in Chapter 5), data trees, heat maps, and systemic safety analysis results of safety issues such as curves, pedestrians, and roadway departure (i.e., rumblestrip prioritization and wrong way driving). The Districts then use this information in conjunction with District knowledge (i.e., emerging trends or most recent high severe crash location) to identify their District safety needs and priorities, and ultimately their District safety program. In one District, staff first works to identify the safety performance information in the Planning and Programming System, using the SRI and Safety Tiers provided by BSE with emphasis on roadway departure, curve, and pedestrian crashes. That particular district weights safety improvements for project priority selection. In another District, they utilize the information provided by the Central Office to develop a safety analysis report, which includes data, reports, and a Safety Tier map with the 5% List included on the map. The District utilizes the District data tree to identify significant needs, using the Safety Committee to select projects based on this analysis. District 5 prefers to program typical spot improvements, such as friction surface courses, hot-mix asphalt shoulders, and systemic rumble strips. They apply CMFs to

The IDOT BSE provides the data analysis results for network screening to the Districts and they use it in various ways to develop their own District safety program. All IDOT Districts use CMFs associated with the safety strategies selected and they all perform a benefit cost analysis.

SPFs to predict crash frequency and they use crash maps to identify locations with critical PSIs. Applying this analysis in the project development process for all SMART, 3P, and 3R projects facilitates the inclusion of safety improvements in all projects, even those without an HSIP funding component. ("SMART" (Surface Maintenance at the Right Time) and "3P" are pavement preservation project categories within IDOT. Projects classified as "3R" are a resurfacing, rehabilitation, and restoration projects per the Federal-Aid Highway Act of 1976.) District 5 applies b/c ratios across all projects in project development, not limiting that analysis to HSIP projects alone. In District 1, the project implementation process for spot improvements includes location screening with the 5% List, data trees, emphasis tables, correlation with BSE initiatives, and district-sourced information such as the daily fatality report. The District studies each location for crash and roadway data, identifies crash types, and identifies countermeasures, with an emphasis on reducing severe crashes. In the data tree analysis, IDOT divides crashes into categories that can be further subdivided for an examination of crash types and circumstances that contribute the greatest to the overall crashes. The project selection criteria include the frequency of severe crashes, PSI values, crash trends, b/c ratios, and emphasis areas. The multi-disciplinary District Safety Committee (DSC) selects projects, assigns them to the project schedule, and submits an application for HSIP consideration. The DSC once again reviews any non-selected projects for HSIP. Some projects, including those rejected, could be implemented with internal forces when funding permits.

IDOT uses systemic improvements (those deployed on segments and at locations with specific characteristics) in a systematic way, that is, everywhere on the system. HSIP funds can also be used for engineering work for project development and implementation, but typically for engineering design services. Within IDOT, systemic improvements are one driver for policy changes, particularly in engineering design, because the success of systemic improvements demonstrates the validity of engineering countermeasures.

Each IDOT District can select emphasis areas for systemic improvements. For example, District 5 selected clear zones. IDOT District 4 selected flashing yellow arrows, offset left turns, and yielding behavior in medians. Additionally, systemic projects for curves addressed critical types of curves, based on all crash data. The District initially considered using a traditional "KABC" (fatality/injury total) analysis method but instead analyzed the curves using an approach that examines system safety performance based on roadway characteristics. District 3, based on further analysis of identified curves through statewide analysis, determined the existing superelevation was a contributing factor to severe crashes. They developed projects that provided superelevation correction called for by policy, added bituminous shoulders and high friction surface treatments, and installed delineation. In District 4, Peoria County acted as the lead agency for a multi-county chevron installation program for curves, an arrangement that reduced administrative and project delivery costs.

Districts 3 and 4 have developed a systemic safety detailed analysis process which uses an extended 5-year analysis period (from the 3-year period typical of IDOT analyses). First, they analyze the data using the Safety Portal web tool, downloading police reports with photographs to study crash locations. They compare the generated list to the BSE screening list, including local roads, and parity is typically found between KABCP crashes and using EPDO/weighted crash methods. Other agencies use GIS queries to identify locations based on characteristics such as rumble strips on shoulders and guardrail end treatments. The Districts gather existing conditions, with District 3 typically using summer work program employees. The project implementation process includes priority evaluation, field reviews, selection of countermeasures, calculation of b/c ratios, and construction of the improvements. Implementation of the systemic improvements is typically "district-wide" and follows a comparison of corridor-wide or systematic improvement expected outcomes, undertaken by the District Safety Committee. Implementing new strategies at a District level rather than a statewide level helps gain buy-in and get other Districts to implement the same types of strategies.

NCDOT funds the delivery of safety projects using two primary investment mechanisms, the Federally-funded HSIP (formerly referred to as Hazard Elimination) and the State funded "Spot Safety" program. The primary difference between the HSIP and Spot Safety programs in North Carolina is that the Spot Safety program projects are smaller scale /quicker implement type projects (maximum investment $400,000) funded primarily with State funds (but eligible to compete for HSIP funding). HSIP annual investments of $40 million contrast with Spot Safety annual investments of approximately $12 million, with Spot Safety projects subjected to the above mentioned project cap – although companion funding and leverage is encouraged. On average NCDOT Mobility and Safety Division invests between $10 and $12 million in safety funding (Federal + State) on a quarterly basis. Candidate HSIP projects in excess of $900,000 require specific advance approval of the State Traffic Engineer. Table 3 compares the HSIP and the Spot Safety Program.

NCDOT allocates 20 to 30 percent of their annual HSIP appropriation to systemic projects. They also use a State-funded Spot Safety program, in addition to HSIP funding, to fund smaller scale/quicker implementation types of projects. A decision support tool is used to prioritize and review the systemic and Spot projects.

Table 3. Comparison of NCDOT's HSIP and SPOT safety programs.

HSIP	Spot Safety
Federal Funds & Rules	State Funded
$66 M Annually / $40 M Programmable for Safety	$13.1 M per Year
Projects above $1.0 M require advance justification and STE Authorization	$400K Cap per Project
Can be Combined with Other TIP Projects	Companion Funding Encouraged
Selected Quarterly	Selected Quarterly
Safety B/C Prioritization + Systemic Investments	Spot Safety Index Decision Support Tool
Advanced PE funds for Improved Surveys and better project estimates.	Vulnerable User and Administrative and Expedite Mechanisms when historical data may not reflect full safety circumstances or urgency of improvement.
Division-wide with Streamlined Programming	Intended for readily constructible projects – on the ground within 12 to 18 months of funding approval.

Systemic projects and initiatives in North Carolina are funded using a dedicated portion of HSIP funding, currently estimated at approximately 20 to 30 percent of the State's annual appropriation. As with Spot Safety improvements delivered through HSIP and the Spot Safety program, North Carolina's goal is to obtain the highest return for each investment.

The Mobility & Safety Division and the Traffic Safety Unit are working toward a unified Safety Project selection and funding process that fully integrates HSIP and Spot Safety programs. Currently, a project selection committee comprised of NCDOT Headquarters staff selects

projects on a quarterly basis. NCDOT selects HSIP projects on the basis of safety b/c and prioritizes and reviews systemic and Spot Safety projects using a decision support tool (Safety Index) and the detailed project packets) further described in Chapter 5. The committee also meets bi-monthly to review the status of current HSIP projects, particularly with regard to cost and delivery (progress in construction).

NCDOT is focused on "readiness and delivery" and emphasizes the need for accurate cost estimates, realistic project scopes, community support, and expedited construction as a means of maintaining public support for the safety programs. NCDOT works to ensure that smaller projects are incorporated into the program and not eliminated on account of the funding demands from larger high-profile projects. Projects exceeding $1 million must have State Traffic Engineer advance approval prior to submission. Smaller Spot Safety projects, when indicated that federal funds are acceptable, will automatically be considered for both Spot Safety and HSIP funding opportunities (this can help with systemic and vulnerable user project programming).

NCDOT also provides incentives (bounty) to encourage investment in systemic HSIP projects that address systemic issues systematically, such as full movement crossover modifications on high speed routes. For this program, when systemic improvements are identified that may not have a b/c ratio that meets the general criteria, a funding amount can be allocated to the project. This funding amount, presently $350,000, is credited to the project cost, thereby improving the b/c ratio. NCDOT also encourages the use of companion funding to leverage limited safety dollars, by using only the Safety fund cost component in the safety b/c analyses.

ODOT delivers their entire HSIP through ARTS, using Central Office-originated screening processes that rely on input from the ARTS staff in each Region. The ARTS staff in the regions then select the projects and supervise the design of selected projects, delivering them through the conventional capital construction program using HSIP funds

ODOT delivers spot and systemic improvements based on scoping and selection processes carried out in the Regions. Fatal and Injury A crashes are used to identify spot improvement projects, while an application process is used for systemic projects.

ARTS is a data-driven program, based on crash performance and b/c analyses. Oregon divides their program into two parts, delivering spot improvements and systemic improvements based on scoping and selection processes carried out in the Regions. ODOT hired a consultant to develop a region specific "150% list" of potential spot improvement projects. Project selection is based on Fatal and Injury A crashes only. ODOT, local agencies, and the consultant work together to identify countermeasures, with attention paid to the CMF and treatment use in Oregon. ODOT Central Office staff, in consultation with Regional ARTS staff, decide which spot improvement CMFs are made available in order to provide for consistent comparisons between projects. As

part of the ARTS Program, ODOT developed a list of countermeasures, known as the ODOT CRF List, which will be revised as new countermeasures become available.

ODOT spot improvement projects are prioritized using the b/c ratio. Local agencies did not utilize this safety project selection process prior to the effort in 2013. Thus, the new 150% list has no predecessor that can permit a comparison to projects previously identified and discarded because of a lack of consistent screening of local agency roads prior to the existence of the ARTS program. The initial ranking during the ARTS project selection was based on EPDO Average Crash Frequency, but the current process does not normalize EPDO initially, relying only on serious crashes in the screening process and EPDO for ranking of crashes.

ODOT uses a conventional approach to systemic improvements and provides a wide range of validated countermeasures available to local agencies. Countermeasures implemented by local agencies using HSIP funds must be selected from the approved ODOT CRF list. ODOT does not require systemic project locations to demonstrate a history of Fatal and Injury-A crashes, recognizing that systemic project implementations are often undertaken in locations that are characteristically similar to locations with demonstrated crash histories. The b/c calculation for systemic improvements in those cases would consider B, C, and PDO crashes in the benefit analysis, and these projects are ranked using the b/c ratio, along with projects with demonstrated crash history with F and A severities. This ensures that systemic improvements are applied throughout the system and in locations where future F and A crashes could be prevented.

The treatments to be used on priority corridors are identified in ODOT's *Systemic Plans* document. ODOT has 120 countermeasures available, with the complete list available on the ARTS web site. [9] About half of these countermeasures were identified as systemic countermeasures. The *Systemic Plans* are driven by ODOT's recognition that patterns of consistent similar crashes could be corrected more cost-effectively with planned systemic improvements. Unlike the hot spot process, the systemic process was an application-based process and the goal was to generate a region-specific "150% list" for each emphasis area. These separate lists for Roadway Departure, Intersections, and Pedestrians and Bicycles are the basis of the systemic project selection process. The funding allocation for systemic projects is further divided between these three emphasis areas based on the proportion of Fatal and Injury-A crashes occurring in these areas. The approximate allocations of HSIP funding, within the ARTS program, by spot and systemic projects, is displayed in Figure 10.

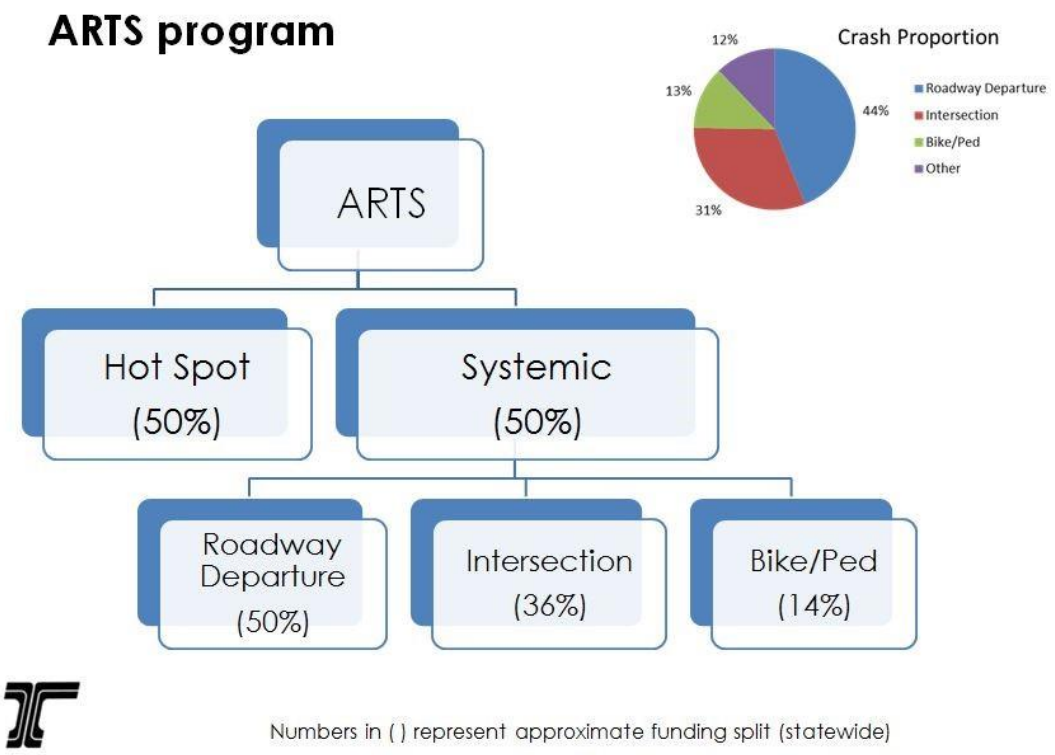


Figure 10. ODOT ARTS program funding allocations and crash proportions.

Oregon's systemic project prioritization is based on b/c ratios for the roadway departure and intersection projects. Pedestrian and bicycle crashes are random enough that insufficient data exists for a benefit computation. ODOT uses the Cost-Effectiveness-Index (CEI) for bicycle/pedestrian projects. The CEI is the proportion of the number of correctable bicycle/pedestrian crashes to the cost of the bicycle/pedestrian project. ODOT considers the CEI to be a tool for data-driven evaluation of bicycle- and pedestrian-focused HSIP projects.

UDOT differentiates between spot improvements (reactive projects) and systemic improvements (proactive projects). The UDOT HSIP screening process uses analysis of crash data to study roadways with similar characteristics in an effort to determine systemic improvements that can be implemented system-wide. Some system-wide projects use a prioritization system, which uses crash performance to allocate projects among multiple levels of priority, including use of a weighted average for Fatal and Injury-A crashes. This approach has been successful in fully

UDOT differentiates between spot improvements and systemic improvements and recognizes that successfully addressing spot crash locations will lead to the need for more and more systemic programs. Improved data collection systems and enhanced analysis tools will aid in making more systemic improvements.

implementing systemic improvements, which has been recognized as the key to eliminating the entire crash problem across all segments. While data on specific locations for systemic improvements may not indicate a crash trend, UDOT's systemic efforts have been successful in eliminating targeted crashes when the entire systemic project was completed, proving the merits of the systemic approach. One example of systemic improvements in the absence of crash trends is the installation of cable median barrier, where installation was predicated on a decision tree using factors such as traffic volumes, median widths, and curve radii. In some locations with characteristics matching the highest-risk criteria, crashes were occurring and the systemic project corrected the majority of system crashes, as Figure 11 indicates. However, the completion of the cable median barrier project throughout the system was necessary to nearly entirely eliminate those crash types.

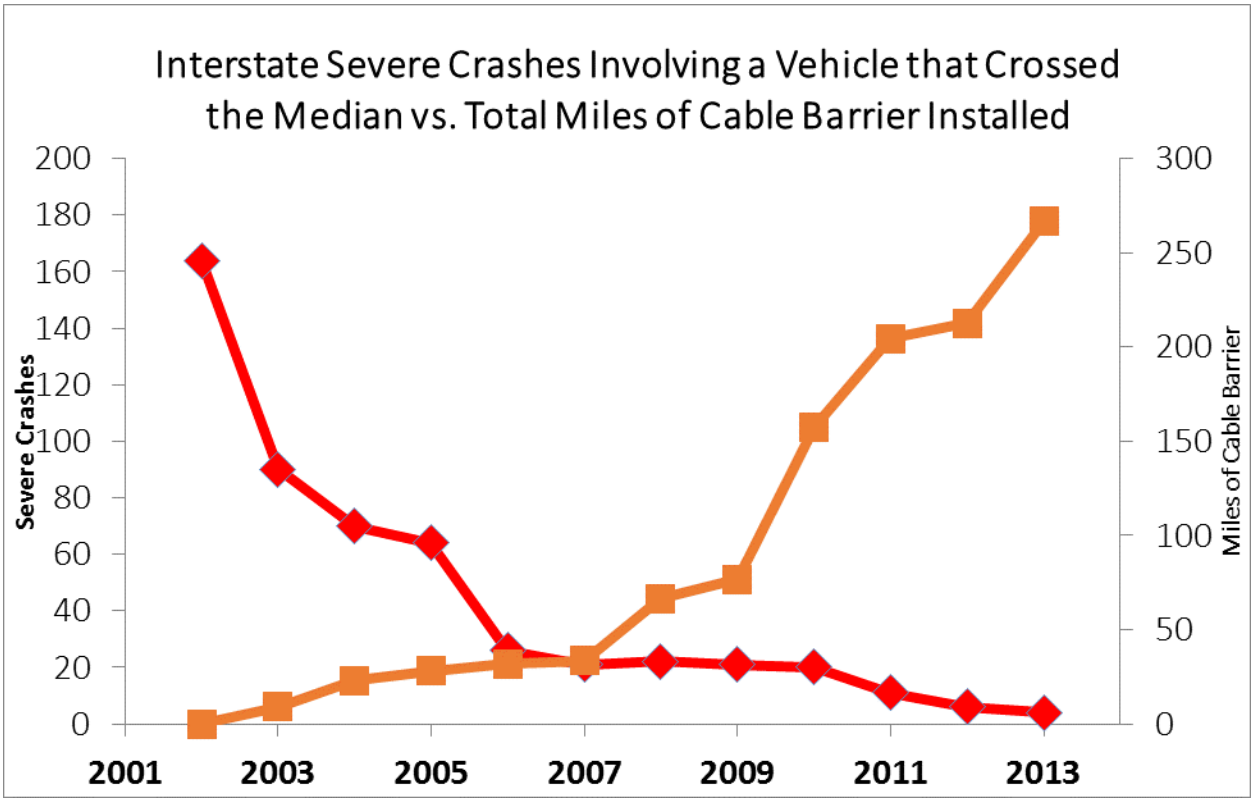


Figure 11. UDOT cable median barrier crash trends.

UDOT has observed a difference between public perception and data-driven safety management reality and is sensitive to the need to make the case for safety projects and behavioral programs. Utah recognizes that successfully addressing spot crash locations will lead to the need for more and more systemic programs. This change will be facilitated with improved data collection systems and enhanced analysis tools. UDOT's success in safety management outcomes is largely driven by policy that supports funding only those projects which can be related to a performance measure.

SUMMARY

The Host States use a variety of crash data collection and analysis tools to assist in making data-driven safety decisions. For each State, crash report information is key in developing collision diagrams for projects, supplementing RSA preparation, and identifying the causative effects of crashes. Since most States do not actually own the crash data, it is important that not only the DOT, but all safety stakeholders have access to the data. Many States have a web portal, or something similar, enabling access to crash data. Typically, the DOT was a key partner in ensuring this level of accessibility exists.

In many of the host States, a lag in data collection, coding, and entry was evident. Both Alaska and Utah have worked to address these issues with academic partnerships aimed at improving crash data collection and the timeliness of coding.

Each Host State uses a documented process for system screening, project nomination, and project selection. In Illinois, the use of an online portal for the submission of project nominations enables their Bureau of Safety Engineering to track every project while also facilitating local submission of project nominations. The IDOT system screening process relies on the Safer Roads Index, a numerical value indicating the potential for safety improvement on roadway segments, derived from SPFs and current crash statistics.

Among all States, Illinois and North Carolina offered the highest degree of flexibility for project nomination and selection. North Carolina's wide variety of Safety Warrants provide HSIP staff with a time-tested method of evaluating improvements. In Illinois, the strong collaboration with the District engineers and the Bureau of Safety Engineering retention of statewide funds provided two primary IDOT-led project nomination channels, facilitating the statewide perspective and the regional perspective.

North Carolina, Oregon, and Alaska, in particular, make extensive use of regional engineering staff in the process of scoping potential improvements. While all of these agencies have centralized the system screening, the deployment of local resources in scope and contract plans development was seen as key to effective cost control and projects appropriate for the system.

In Massachusetts, where crash data is provided in an online tool, local agencies and planning organizations are particularly empowered to undertake locally-sourced screening (with MassDOT assistance) in the effort to identify problem areas and generate projects for the State's multi-year plan.

Most States differentiate between spot and systemic improvements. In Illinois and Utah, strong investment in systemic projects was seen as a key means of reducing system-wide fatal and serious injury crashes, particularly in areas where crash concentrations were insufficient to trigger a spot investment in the screening process.

CHAPTER 6—USING ADVANCED SAFETY ANALYSIS METHODS AND TOOLS

The HSM provides States with new tools to more effectively predict the effectiveness of alternative safety strategies and countermeasures. High-performing States are not only using these tools, but are incorporating them into their processes for evaluating and prioritizing potential HSIP projects.

SPOTLIGHT ON SAFETY:

New Hampshire's Use of Safety Analyst

The effort to evaluate and integrate Safety Analyst into the HSIP and other NHDOT programs began in 2009, under the impetus of the then-in-force FHWA mandate for development of a 5% List. Additionally, NHDOT was struggling to evaluate the effects of systemic improvements such as signing and was seeking a robust analysis solution. Initially, the program's staff validated roadway data on State facilities. The most significant hurdle was the development of the data integration protocols for Safety Analyst, including a 2-year process to develop the intersection database and conduct supplemental data collection. Roadway segments were added first, starting with the State system and then the local system. Intersections and ramps were added in subsequent years. For segments between intersections, the road inventory database was translated into the format for Safety Analyst, with post-import calibration and post-processing. Prior to beginning this work, the Assistant Highway Safety Engineer conducted a data mapping exercise and correlated fields in existing databases with Safety Analyst fields, laying the groundwork for adding roadway data to the program and developing an intimate knowledge of the program architecture, processes, and data development needs.

The key for New Hampshire was the statewide existence of a Linear Referencing System and Road Inventory data, which exists for all public roads including intersection and ramps. HSIP funding was used for improvements to the inventory systems so that Safety Analyst development could take place without significant data integration challenges. NHDOT is working to improve data for local traffic volumes and local intersection traffic control types. With most roadway data included in the program and subsequent data needs well-defined, the analysis of crashes and safety outcomes is less intensive.

The Network Screening Module of Safety Analyst is used the most in New Hampshire, primarily because it assembles collision diagrams and crash data in one place. Safety Analyst reduces the expenditure of time for network screening and has been the driving factor for

multiple screenings with a variety of criteria, providing in-depth views of safety hazards and potential countermeasures. Prior to the implementation of Safety Analyst, NHDOT expended a large amount of time on data analysis in the development of safety efforts, but now data manipulation has replaced analysis as the time-consuming activity. The software's use of data for analysis beyond the fundamental data elements and network performance HSM-based methodologies has produced high-quality projects, particularly because of the availability of network-wide data. In particular, Safety Analyst's use of predictive methods mitigates the effects that occur on account of infrequent or non-existent crashes at specific sites.

The local planning agencies are trained to use Safety Analyst and have begun using the predictive method tools for evaluating safety performance of roadways in the course of capital improvement planning work. The 10-year Transportation Improvement Plan (TIP) is populated using planning agency solicitations of projects and the State Transportation Improvement Plan, a 3-year plan, includes projects identified using safety performance as one of the selection criteria. This use of Safety Analyst transportation planning beyond the safety program implementation is believed to be unique to New Hampshire and is particularly notable because of the effort to involve MPOs in the planning process by training them to use Safety Analyst as well.

NHDOT's first use of the Safety Analyst Effectiveness Evaluation module involved using before-and-after data to test the HSM evaluation process against the observed crashes method of evaluation. The eventual goal is to construct prior-to-project and subsequent-to-project SPFs, enabling cost-per-countermeasure evaluations to validate project performance and the return on investment.

ANALYSIS TOOLS

The delivery of the UDOT HSIP is partially based on information obtained from several primary analysis tools. Those tools are the crash query and safety data investigation system created by Numetric, the FHWA Systemic Safety Project SelectionTool, United States Road Assessment Program (usRAP), and the Utah Crash Prediction Model (CPM) developed jointly with Brigham Young University.

UDOT delivers their HSIP using several analysis tools, including a tool developed by Numetric, the FHWA Systemic Safety Tool, usRAP, and the Utah Crash Prediction Model.

The FHWA Systemic Safety Project Selection Tool analyzes input based on network crash data. The output is a visualization tool that helps understand crash trends and types throughout the system, aiding in selecting targeted areas for investment strategies.

The usRAP Safer Roads Investment Plan considers risk factors from roadway features and computes benefit cost ratios using safety performance functions to determine the potential for future crashes, computing a b/c ratio with UDOTs value of life inputs. The output from the Safer Roads Investment Plan explicitly considers risk to users by mode and provides a strategy for investment that maximizes benefit.

The Utah CPM is a Bayesian statistical model created in cooperation with Brigham Young University. The CPM examines risk factors and estimates the crash risk, a precursor to Safety Performance Function development. This independent network screening is also used to identify candidate HSIP projects. UDOT's partnership with the academic institutions has even led to positive media coverage on how the "science" of safety management involves this type of in-depth, rigorous data analysis. Figure 12 shows the output of the CPM.

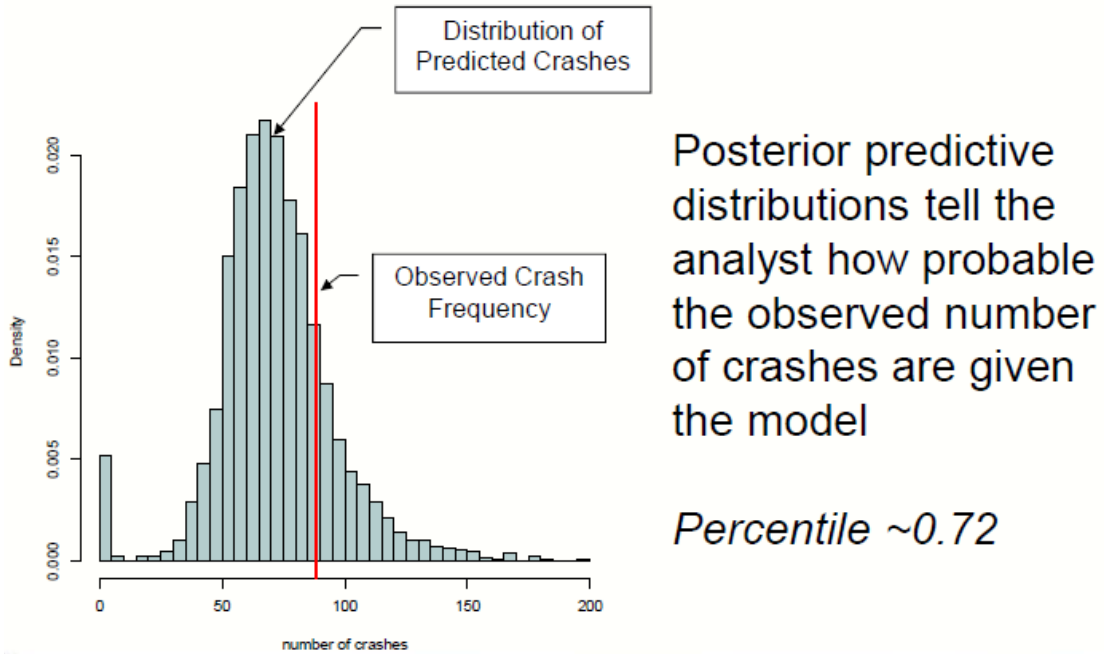


Figure 12. Output of Utah's crash prediction model.

USE OF SAFETY INDEXES

Illinois uses safety performance functions (SPF) for State-maintained routes to predict the average number of crashes as a function of exposure based on infrastructure characteristics (roadway segment versus intersection). IDOT uses the PSI, as described in the HSM Part B, in its effort to determine what percentage of the crashes observed exceed the predicted amount

The IDOT Safer Roads Index (SRI) improves the integration of quantitative safety performance in transportation project planning and programming.

for similar type roadways or intersections within assigned peer groups. IDOT uses weighted PSI to incorporate severity of crashes into the analysis methods. Using the KABCO scale, severe crashes are weighted 25 for fatal (K) crashes, 10 for A-injury crashes, and 1 for B-injury crashes. This method was used originally to develop IDOT's 5% List and was expanded to a "100% List."

IDOT developed the SRI with Safety Tiers and uses the PSI values for each roadway segment or intersection to move beyond the simple test of identifying whether or not a location is a 5% location and improve the integration of quantitative safety performance in transportation project planning and programming. Safety Tiers categorizes roadways segments and intersections based on their level of safety performance and opportunity for improvement, providing a rating for relative comparison. The Safety Tiers include a Critical/5 percent, High, Medium, Low, or Minimal designation. Safety Tiers allow transportation officials to understand relative performance of a location compared to similar types of roadways or intersections. For example, a rural 2-lane roadway segment would be compared to other similar types of rural 2-lane roadways statewide and would not be compared to an urban multi-lane facility. The Safety Tiers allow more locations to be identified and analyzed for similar roadway features and potential crash trends.

The SRI classifies locations (segments and intersections) based on the Safety Tiers and, in a GIS tool, assigns colors to each one consistent with the level of priority, as demonstrated in Figure 13.

2015 FIVE PERCENT Report: Segment Safety Tiers

Peer Group	Tier	Max. PSI	K+A	Σ K+A	Σ K+A %	Tier Mileage	Tier Mileage %	Σ Mileage	Σ Mileage %
1: Rural 2-Lane	5%	70.0	748	748	25.9%	422	5.1%	422	5.1%
	High	40.5	128	876	30.3%	431	5.2%	853	10.2%
	Medium	14.0	348	1,224	42.3%	1,281	15.3%	2,134	25.5%
4: Rural Freeway 4 Lanes	5%	54.0	457	457	15.8%	76	5.1%	76	5.1%
	High	24.0	221	678	23.4%	73	4.9%	149	10.1%
	Medium	16.0	111	789	27.3%	224	15.2%	373	25.2%

Figure 13. Illinois DOT safety tier classification.

The "High" classification locations are the second-highest category behind the "Critical or 5% List," comprising of locations (segments or intersections) which reflect 5 to 10 percent of the mileage within a peer group and the associated fatalities and serious injuries within the peer group. The "Medium" classification comprises of locations (segments or intersections) which reflect 10 to 25 percent of the mileage within a peer group and the associated fatalities and serious injuries within the peer group. These 3 top tiers account for approximately 25 to 50

percent of the fatalities and serious injuries on the State system. The SRI values, by segment, when used in mapping tools, allow direct segment-by-segment comparisons between the SRI and pavement data for the Condition Rating Survey (CRS) and the International Roughness Index (IRI). This tool is a visual and tactical aid found to be invaluable for programming of general capital improvement projects that accomplish all of three of these strategic objectives.

The analysis tools enabled by the SPFs in the SRI are allowing IDOT to transition from an emphasis on site-specific projects to system-wide and systemic projects and further to complete optimization of safety investments. For example, cable median barrier ("cable rail") installation research uncovered that on just 19 percent of the system, 49 percent of crashes occurred, typically in areas with a 40-ft median and average daily traffic in excess of 20,000 vehicles. Understanding the roadway segments that would benefit from systemic investment is just one outcome of the SRI. In addition, instead of a few intersections being identified and evaluated based on a 5% List, corridors of intersections can be evaluated to determine trends and potential policy changes.

The University of Illinois developed the SPFs for IDOT in 2007 at a cost of roughly $100,000. IDOT considers their investment in setting up the SPFs to be a programmatic investment with a substantial ongoing return. Use of the SPFs allows IDOT to direct efforts to appropriate locations, broaden areas of focus, and improve analysis of corridors and system-wide safety improvements. The Districts have embraced the SRI, which has helped IDOT to institutionalize safety as part of their culture.

IDOT intends to include SRI and Safety Tier information in the statewide roadway inventory, providing planning and programming staff a means of readily accessing this information as they make decisions within the planning and programming process, which includes evaluation of pavement and bridge performance.

SUMMARY

The Host States use a variety of methods and analysis tools to identify safety concerns and countermeasures. New Hampshire DOT's use of Safety Analyst helps reduce the expenditure of time for network screening and has been the driving factor for multiple screenings with a variety of criteria, providing in-depth views of safety hazards and potential countermeasures. UDOT delivers their HSIP using several analysis tools from Numetric, the FHWA Systemic Safety Tool, usRAP, and the Utah Crash Prediction Model. IDOT uses a SRI to incorporate safety into their overall transportation management process and improve the integration of quantitative safety performance in transportation project planning and programming.

CHAPTER 7—ADDRESSING LOCAL ROAD NEEDS

Where a high percentage of crashes occur off the State system, DOTs with high-performing HSIPs work with local jurisdictions to help them develop and implement HSIP projects that address priority safety issues on locally-owned roadways. In some States this is done by allocating safety funds to local organizations. In other States, the State DOT leads the design and construction of these projects.

SPOTLIGHT ON SAFETY:

Forming a Positive Relationship with Local Agencies in Oregon

The Oregon Department of Transportation (ODOT) worked with the Association of Oregon Counties (AOC) and the League of Oregon Cities (LOC) to create a jurisdictionally-blind process for project nomination and selection through their ARTS program. All public roads are included in the program, regardless of agency ownership or responsibility. Oregon uses the ARTS program to facilitate the expenditures of federal funds with local agency liaisons who assist in project nomination, development, and delivery. The involvement of the ODOT Central Office technical staff, in cooperation with the local agencies throughout the selection process, was a major contributor to local understanding of how projects were prioritized and what factors contributed to a project not being selected, with local agencies viewing the Central Office involvement as highly objective. Additionally, ODOT's use of consultants in screening and project development efforts results in a greater degree of local agency acceptance because the consultants serve as an independent third party following the process. In Oregon, the local agencies have generally been very receptive to the ARTS program and appreciate ODOT's desire to provide assistance in screening and project development.

Many local agencies identified the ODOT-managed screening process as an asset, given local agency staff limitations. In particular, medium-sized cities such as Salem lack the staff necessary to conduct their own screening, and the ODOT screening process is helpful because it helps identify priorities. The results of the screening are considered successful on account of the statewide process of distributing funds managed by the State. Local agencies find the application process to be straightforward and they appreciate the ability to participate in the selection of countermeasures. The applications are available directly from the ARTS web site and Region ARTS staff have been extremely approachable and helpful as agencies looked to apply for projects to be included in the selection process. Some regions hold workshops with stakeholders to identify locations that are candidates for applications.

While local agencies in Oregon were occasionally unfamiliar with some countermeasures, particularly those related to signal operations and unusual intersection treatments, the knowledge transfer associated with local access to ARTS personnel has been extremely helpful.

ASSISTING LOCAL AGENCIES

The North Carolina Local Safety Partnership is a pilot program involving a cooperative effort between NCDOT and the UNC-HSRC. The purpose of the program is to introduce communities to the concepts required to implement low-cost safety improvements in a data-driven traffic engineering program. The project is funded by NCDOT and is deployed in six pilot communities where NCDOT is providing $50,000 for HSIP-funded Low-Cost Safety Improvements as an incentive for participation.

North Carolina's Local Safety Partnership is a cooperative effort between NCDOT and UNC-HSRC. The program is helping six pilot communities learn about implementing low-cost safety improvements.

NCDOT data indicates that 70 percent of all crashes occur in the 72 municipalities with populations over 10,000. The development of locally-driven safety programs is a critical element in addressing deficiencies in infrastructure that may contribute to some of these crashes. Recognizing that many smaller agencies do not uniformly practice the "traditional" process of screening, evaluation, project selection, and funding provision, the program staff developed a program of site identification using HSIP funds for low-cost safety improvement implementation. The fundamentals of safety engineering and network screening are provided in a classroom environment, with local agencies learning the essentials of understanding crash data, identifying locations, interpreting collision diagrams, selecting interventions, and executing evaluations using various methods. The expectation is that local agencies will establish some formal safety engineering procedures and policies, based on these experiences and the program's evaluation of project performance. The program's goal of creating safety engineering functionality in communities will be evaluated based on project outcomes and community investment in safety program development, serving as a potential model for future iterations of the program.

In Utah, UDOT assists the local agencies by providing network screening and data analysis. This information is obtained easily by the local agency officials, largely due to the accessibility of UDOT's Region and Central Office traffic and safety engineering staff. Local agency staff can use a toolbox of proven countermeasures developed by UDOT to address safety problems,

UDOT provides network screening and data analysis for local agencies, as well as a toolbox of proven safety countermeasures.

particularly in the preparation of HSIP project applications, which are available online. The overall participation of local agencies, however, depends on the scale of the agency and its ability to utilize internal resources to leverage the valuable crash analysis information received from UDOT. Local agencies lacking the resources necessary to examine the crash data provided by UDOT have the option to request UDOT assistance with crash analysis.

In Illinois, the Central Bureau of Local Roads and Streets provides programmatic, policy, and technical assistance to Local Roads Bureaus in each District. Between the Central office and the Districts' Bureau of Local Roads, these offices function as IDOT's means of assisting local agencies with funding, policy, and design issues. The Bureau of Safety Engineering works with these offices and the local agencies specifically for safety and HSIP implementation. The District offices provide additional technical support to and coordination with local agencies to advance HSIP implementation. IDOT allocates 20 percent of its HSIP funds toward local roadway safety improvements. Typically, local agency HSIP projects are 90 percent federal HSIP funding with the remaining 10 percent share being a local match. The exception is where IDOT has provided the 10 percent match using State funds specifically for IDOT's rural local roads sign upgrade program. IDOT allocated $13.3 million for local agencies in FY 2015. IDOT provides one-day workshops to local agencies seeking HSIP funding. These workshops help agencies understand the HSIP program goals, the basics of crash analysis, spot and systemic safety improvements, the mechanics of funding and delivering projects, and the process for preparing an HSIP project application. IDOT also provides bid advertisement services for locally-delivered safety improvements using its regular letting calendar, relieving local agencies of the expense of supporting a bid advertisement system for infrequent and small advertisements. In some cases, such as the rural local sign upgrade program, IDOT purchased signs using HSIP funding and the local agency installed the signs.

IDOT assists local agencies with funding, policy and design issues by providing workshops to help agencies understand the HSIP application and delivery process and providing bid advertisement services for local projects, among other efforts.

Other funding sources in Illinois for local projects include the Surface Transportation Program for Federal Aid highways and bridges, which allocates $190 million annually to local agencies. The Safe Routes to School Program, State Motor Fuel Tax, and other funding sources are used to deliver projects with occasional coordination with HSIP.

Even when 100 percent funding is available, participation of local agencies is not guaranteed, as local agencies do find some federal funding rules to be a challenge. As a result, some 2008 obligations remain unspent, leading IDOT to set a 2-year limit on obligations for local agencies.

WORKING WITH METROPOLITAN PLANNING ORGANIZATIONS

Because MassDOT does not have a local assistance program, the origination of projects and HSIP candidate project submission activities are the responsibility of the MPOs. For HSIP projects, MassDOT provides the 10 percent federally matching funds against the HSIP portion, eliminating the need for local agencies to provide matching funds for HSIP projects. This eliminates cost as a barrier to local agency use of the HSIP.

In Massachusetts, municipalities may be responsible for the development of the design for HSIP projects, but for projects on the local system, those agencies are responsible for ROW acquisition, with assistance from MassDOT if those purchases involve HSIP or State funds. MassDOT allocates $10 million of the annual program to regional needs, to be disbursed by the 13 MPOs. The MPOs have a great deal of flexibility in disbursing these HSIP funds, as they can be applied to local agency projects as well as projects on the State-owned system, creating a jurisdictionally-independent disbursement for the MPO-allocated HSIP funding. Likewise, the Statewide HSIP category (where MassDOT HQ allocates the HSIP funds) can conversely be used to fund projects on locally-owned roadways.

MassDOT eliminates cost as a barrier to local agency use of the HSIP by providing the 10 percent federally matching funds against the HSIP portion of funds.

One Massachusetts MPO has identified and maintained a list of the 100 most "dangerous" intersections in the region. This list has helped focus their efforts on mitigating intersection crashes, consistent with the SHSP and other priorities. That same MPO, in the prior fiscal year, allocated $896,000 to HSIP projects, an amount the MPO has found insufficient to cover intersection crash needs. However, MPO relationships with the Districts and with TESS ensure that MPO perspectives are brought forward in the HSIP planning process. In addition to representation on the HSIP Committee, MPO officials also conduct regular meetings with the District traffic engineering staff and with TESS staff administering the MassDOT HSIP. The purpose of these meetings is to ensure that the Districts and TESS are aware of MPO concerns, updated on MPO efforts to program HSIP projects, and MPO feedback on HSIP projects.

In Illinois, some MPOs have demonstrated a desire to become more involved in assisting local agencies with safety planning and HSIP project development activities. The Champaign-Urbana Urbanized Area Transportation Study (CUUATS) has a safety philosophy, wherein the MPO developed a safety goal and remains strongly interested in further developing safety projects that reflect the organization's desire to meet that goal. CUUATS analyzes safety data to help locals with grant applications, having

In Illinois, some MPOs have demonstrated a desire to become more involved in assisting local agencies with safety planning and HSIP project development activities.

developed its own analysis tools. The key to MPO involvement is BSE's use and deployment of management and support tools, especially data portal access and clear program documentation. Additionally, MPOs provide support to local agencies in the process of completing HSIP applications.

DELIVERING LOCAL SAFETY PROJECTS

States deliver local-agency projects with varying levels of support. Some States facilitate HSIP project applications, funding allocations, and design coordination, while others participate directly in the delivery process by providing the local agency with access to the State's bidding services, as is done in Illinois.

The Alaska DOT&PF undertakes design (or manages consulting designers) and delivers local projects with the exception of those projects where the City of Anchorage will conduct design engineering and construction engineering and management functions. This improves the project outcomes, including consistency in the application of engineering standards and the quality of materials and construction.

In some cases, local safety project delivery can be carried out more efficiently with State DOT assistance. In Massachusetts, where right-of-way can be complicated by the historic nature of records, MassDOT's Right-of-Way (ROW) Bureau works through its Community Compliance Section to ensure that right-of-way acquisition for Local Public Agency (LPA) projects is conducted in compliance with the Uniform Act. The Bureau provides training on the ROW processes because LPAs are responsible for the ROW acquisition process for LPA-owned facilities. MassDOT-funded projects are not advertised for bids until the Bureau has issued a ROW certificate, underscoring the importance of LPA coordination and compliance for MassDOT-funded projects. MassDOT attention to ROW policies and procedures has significantly shortened the timeframe for ROW delivery to less than nine months in most cases.

SUMMARY

Some Host States, such as North Carolina, Utah, and Alaska, have limited roadway miles owned and operated by local agencies, but still focus efforts on local agency partnerships. Other States, such as Oregon, Illinois, New Hampshire, and Massachusetts, made extensive use of local agency partnerships to address local road safety issues.

The Alaska DOT&PF undertakes design (or manages consulting designers) and delivers local projects with the exception of projects in Anchorage. UDOT provides network screening and data analysis for local agencies, as well as a toolbox of proven safety countermeasures. NCDOT partners with the UNC-HSRC to deliver the North Carolina Local Safety Partnership, a pilot

program to introduce communities to the concepts required to implement low-cost safety improvements in a data-driven traffic engineering program.

In New Hampshire and Massachusetts, the regional planning authorities provide the State DOTs with support in identifying projects, coordinating with local agencies to procure contract documents, and other activities necessary to prepare a project for contract advertisement. In Massachusetts, the regional planning authorities have specific responsibilities related to the programming of projects. MassDOT eliminates cost as a barrier to local agency use of the HSIP by providing the 10 percent federally matching funds against the HSIP portion of funds.

In Illinois and Oregon, established county and municipal governments are engaged with regional DOT contacts. In Oregon, this is done with the All Roads Transportation Safety Program, an effort that specifically targets local engagement and a jurisdictionally-blind project submission and screening process. In Illinois, some MPOs have demonstrated a desire to become more involved in assisting local agencies with safety planning and HSIP project development activities.

CHAPTER 8—CONSIDERING ALL "4E'S"

Highly successful programs look beyond just engineering solutions to address safety issues. When appropriate, consideration is given to possible solutions and countermeasures in all "4E's" (i.e. Enforcement, Education, Emergency Response, and Engineering). In some cases, States have developed alternate procedures for evaluating the effectiveness of these projects so they can be included in the overall ranking of HSIP projects.

SPOTLIGHT ON SAFETY:

Utah's Zero Fatalities Program

UDOT has a coordinated effort to send consistent messages related to Zero Fatalities. The campaign promotes the message of Zero Fatalities, which originated with "Put the Brakes on Fatalities Day." All public information campaigns are branded as a joint effort, showing the cooperative atmosphere, and developed to address some behavioral issues identified in the SHSP. Funding is appropriated for paid media and public outreach activities. Outreach efforts include more than 50 events every year, including some at high schools that target typical risky behaviors associated with younger drivers. The biennial Zero Fatalities conference is another way in which UDOT brings partners together to advance the traffic safety culture within Utah. UDOT has collected data on behavioral-related crashes that demonstrate it has addressed driver behavior issues, particularly in the area of restraint use.

The Traffic and Safety Division manages the Zero Fatalities program, reporting directly to the Safety Programs Engineer and Director of Traffic and Safety. The Zero Fatalities program office has obtained grassroots-originated ideas and support through its extensive public involvement program. Roughly 90 percent of citizens in the State recognize the program. The program is funded with an appropriation of approximately $2 million annually. UDOT used HSIP funds for this activity in the past but, are no longer eligible under the new federal transportation bill, the December 2015 Fixing America's Surface Transportation (FAST) Act. The Traffic and Safety Division is working to find other sources of funding to keep the Zero Fatalities program running into the future.

Utah's approach to safety outreach has been to create positive and/or thought-provoking messages, particularly related to restraint use and driving habits. As UDOT and DPS have worked together to achieve saturation in their public relations efforts, the agencies have made use of many available outlets, including variable message signs. The "Monday Messages" set a safety theme for a given week by displaying a safety-focused message on variable message sign

boards throughout the State. Utah's Zero Fatalities staff manage an active social media presence, using social media and video sharing platforms with a single, cohesive marketing strategy to disseminate the message using conventional and social media outlets and in cooperation with UDOT Traffic Operations. Figure 14 demonstrates the public's interest in UDOT's social media outreach efforts.

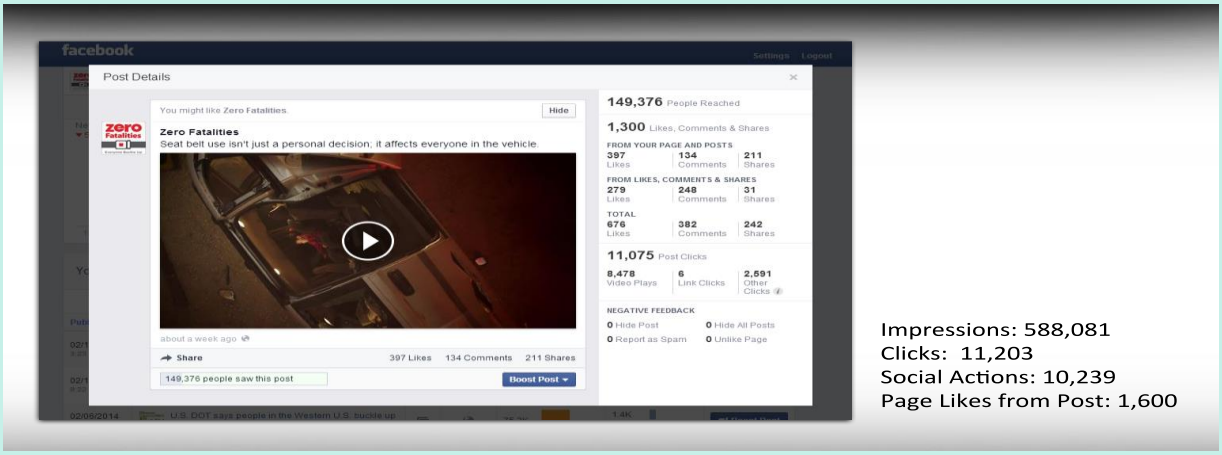


Figure 14. UDOT's zero fatalities Facebook posts reach a large audience.

PUBLIC OUTREACH AND INVOLVEMENT

In many of the Host States, public information campaigns and public involvement were key features of HSIP implementation. Utah's DPS and Zero Fatalities offices coordinate extensive public information campaigns and NHDOT provides SHSP and Driving Toward Zero outreach at community events that reach the substantial number of out-of-State visitors, particularly motorcyclists.

Addressing Driver Behavioral Issues

UDOT recognition that 93 percent of crashes have a correctable behavioral component has led to the development of a strong behavioral education program. This necessarily involves extensive coordination with the DPS, the agency responsible for administering NHTSA funding. In Utah, the DPS and UDOT have executive-level coordination concerning traffic safety, providing for a coordinated and cooperative approach. Utah outreach efforts also include explaining and building support for safety engineering analyses.

> UDOT and Utah DPS coordinate to deliver a strong driver behavioral education program using HSIP funding.

The Utah Department of Public Safety began using HSIP funds a decade ago as a result of limitations in other funding options. For example, 23 U.S.C. 402 and 405b funds are restricted for use solely in seatbelt outreach efforts. HSIP helps supplement these efforts to target areas that cannot be covered with 402 and 405b funds. HSIP funds are transferred for a specific project or enforcement activity area and UDOT is billed by DPS for reimbursement by means of a memorandum of understanding between the agencies. At this time, DPS receives reimbursement only for enforcement programs related to seat belt use, exceeding the posted speed limit, and aggressive driving. DPS and UDOT share the view that behavioral change is the responsibility of all State agencies with activities not merely limited to law enforcement initiatives. Everything within DPS that is funded is designed to support a specific performance measure.

In Oregon, all projects have a community outreach component, typically managed by ODOT staff. These behavioral programs involve coordination between the GHSO (Governor's Highway Safety Office) Transportation Safety Division (TSD) Region Safety Coordinator and ARTS staff in each Region. The importance of involving the public in the project development process was explicitly identified as a key to project success. ODOT indicated that the solicitation of public input on project scope and content increases public satisfaction with projects and provides a platform for conveying the importance of highway safety investments.

ODOT coordinates with the GHSO Region Safety Coordinator and ARTS staff in each Region to deliver community outreach behavioral programs.

MassDOT is addressing bicycle and pedestrian issues with a specific bicycle/pedestrian safety program which includes enforcement, awareness, education and infrastructure. A $500,000 behavioral public information campaign for bicycle/pedestrian crashes is being used to address all modes and yielding/right-of-way behavior in particular. Because of its relationships with local law enforcement agencies and the State Police, MassDOT has been able to partner with regional advocacy groups MassBike and Walk Boston in an effort to deliver messages regarding effective behavioral campaigns to law enforcement personnel. MassBike partnered with the Boston Police Department and the Massachusetts Department of Public Health and produced a series of videos regarding the application of traffic laws related to bicycles, raising awareness of how often motorists and vulnerable users engage in unsafe behavior. [16] The videos are shown during the police department roll calls so that police personnel can immediately apply what they have learned.

MassDOT's partnership with regional advocacy groups, local law enforcement, and the Massachusetts DPH has helped with delivery of a bicycle/pedestrian safety program that includes enforcement, awareness, education, and infrastructure.

Zero Fatalities Messaging and Media Outreach

NHDOT selected "Driving Toward Zero" as an alternative to "Toward Zero Deaths," emphasizing the positive aspect of the program and its focus on the goal and not the present outcomes. When NHDOT developed the Driving Toward Zero (DTZ) campaign, the initial goal of the campaign was to raise awareness of DTZ, including branding and marketing. The program, deployed by the NHDOT staff, was the impetus in transforming the SHSP from an engineering document to an easily-understandable resource that is a tool for engaging the public. NHDOT issued a contract to a marketing firm and worked with that firm to publicize DTZ throughout New Hampshire, including through the use of trained DTZ ambassadors who staffed the various festivals and events throughout NH, reaching both residents and visitors. HSIP funding was used to conduct this effort, amounting to $250,000 for this and a second contract.

NHDOT contracts with marketing firms to assist in the delivery of their Driving Toward Zero campaign. The campaign also involves coordination between NHDOT and the New Hampshire State Police to promote the SHSP strategies and maximize the investment of HSIP funds.

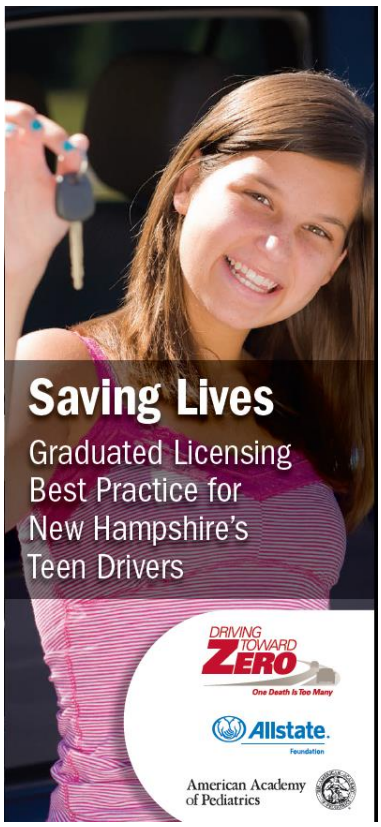


Figure 15. Brochure created under NHDOT's Driving Toward Zero program.

Using a second marketing contract, NHDOT performed public outreach activities related to the goals of the new SHSP, building on the awareness efforts and illustrating their partnerships with the New Hampshire State Police (NHSP) and other State agencies. SHSP strategies have aided agencies in their efforts to target resources on emphasis areas, such as exceeding the posted speed limit, distracted driving, and, notably, Liquor Control Board efforts to use driving under the influence arrest information to target liquor establishments in high-risk areas and ensure compliance to liquor service laws. In addition, the program's efforts have created public outreach tools related to the new hands-free legislation.

The emphasis on achieving the DTZ goal has led to change within the State government as well, such as including the New Hampshire Office of Highway Safety in the Department of Safety, with oversight from the New Hampshire State Police. NHDOT and NHSP are working closely together, using established relationships, to leverage this new arrangement in promoting the SHSP and maximizing the investment of HSIP funds.

All of these campaigns, delivered on a contract overseen by NHDOT, require approval from the Governor's office. Obtaining support from that office to use HSIP funds for this purpose was instrumental in developing trust that NHDOT was promoting the interests of official policy through the campaign.

Tribal Outreach Efforts

Utah has conducted tribal outreach efforts focusing on data collection on tribal lands. The Four Corners Conference helps tribes plan for traffic safety outcomes with a focus on child passenger safety and teen driving. The Department of Public Safety's work with the Native American Advisory group is leading to successful efforts to promote occupant protection by using HSIP funds to supply car seats in tribal areas.

ROAD SAFETY AUDIT

Nearly every Scan Tour State identified RSAs as a key component of screening, project development, and project design.

SPOTLIGHT ON SAFETY:

Requiring RSAs for all HSIP Projects in Massachusetts

Massachusetts was the only Scan Tour State to require the completion of an RSA for all project development activities that include locations on the 5% List, including non-HSIP projects. This use of RSAs ensures that successful evaluation of project alternatives is undertaken in project development, increasing the effectiveness of chosen countermeasures. Figure 16 depicts the incorporation of the RSA into design in Massachusetts.

Figure 16. Incorporating RSA into design in Massachusetts.

In Massachusetts, RSAs are required to be completed prior to the submission of the 25 percent-level design plans and Functional Design Report for all HSIP projects. In addition to using RSAs as a tool for HSIP projects, RSAs are also required for all projects which include any element within the boundary of a 5% List location and the same 25 percent-level submission requirement exists.

Headquarters performs design reviews of 25 percent-level submissions in project development, determining if the RSA has been properly evaluated and incorporated into the project design. Just as HSIP projects often begin with an RSA, the 25 percent-level RSAs for non-HSIP projects are likewise developed prior to the initial design, although RSAs occasionally may not be conducted until near the end of the process of preparing the 25 percent-level submission. An RSA consultant handles the 20 percent of cases where the RSAs are not submitted.

The Functional Design Report includes the resolution to RSA elements, closing the loop on the RSA process and providing a means of ensuring that the value of RSAs is captured in the design process. The MassDOT web site includes all RSA reports, divided by District to permit for easy access.[17]

Towns may request RSAs and MPOs participate in MassDOT RSAs and local-agency-initiated RSAs, bringing local perspectives to projects. In those cases, MassDOT funding covers the $5,000 cost of the RSA, eliminating the barrier of cost and facilitating local efforts aimed at addressing traffic safety issues. In typical project development, however, the cost of the RSA is incorporated into the preliminary design activities and paid for by the facility owner, as appropriate.

NCDOT's Road Safety Review/Audit (RSA) Program is designed and managed to reduce crashes and injuries by generating safety projects/actions, assist field staff in addressing persistent safety problem areas, and improve collaboration amongst stakeholders. NCDOT's RSA Program is managed to be flexible in addressing multiple strategic focus areas. RSAs are conducted to address both rural and urban safety concerns, but the process has also been used to address motorcycle, bicycle, pedestrian, and truck related concerns.

Safety Innovation
While not considered an RSA, NCDOT is moving towards requiring a safety analysis for all Traffic Impact Studies for improvements on the highway system.

Local stakeholders can request RSAs. All RSAs are intended to result in a variety of actions and projects that lead to a reduction in fatalities, injuries, and crashes. Local agencies can bring these RSA requests forward for both State-maintained and non-State maintained roadways and NCDOT will assist in either case. NCDOT funds approximately 15 RSAs on an annual basis.

Not only does NCDOT conduct RSAs on corridors with multiple HSIP locations, they also query the Field Engineers and Field Division staff for locations where RSAs could lead to potential HSIP projects. NCDOT staff and consultants conduct the RSAs, with staff from the TSSS in the Central Office leading the audit team. Typically, the Central Office expends 160 hours per RSA and Central Office-led RSA teams include representatives from other Regions within NCDOT. These representatives include maintenance and operations personnel who bring the perspective of other Regions to the RSA process and ensure practice-sharing and consistency throughout North Carolina.

In North Carolina, Central Office-led RSA teams include maintenance and operations personnel from other Regions, bringing multiple Regional perspectives to the audit and ensuring practice sharing and consistency throughout the State.

NCDOT requires that local agencies provide a response to the RSA documents within 90 days, addressing how the agency will respond to the issues identified in the RSA. For NCDOT's own RSAs, the RTE prepares a response for the Region on handling the specific issues identified.

NHDOT established an RSA process to assist the local planning agencies and municipal governments in their efforts to identify and address road safety issues, aiding responsiveness to inquiries regarding safety issues in a community or along a roadway segment. Figure 17 depicts the RSA process. The program was originally conducted entirely with NHDOT staff, but now a consultant is responsible for execution of the program. The municipal or town government coordinates with the Regional Planning Commission to complete the RSA application, which is required for each locally-sourced RSA request. This coordination enables the gathering of crash data and other information, followed by submission of the application to the Highway Safety Engineer.

New Hampshire's RSA process defines responsibilities and outcomes. It is a useful tool for identifying the potential scope of safety improvements and it can serve as a pre-screening for HSIP projects on local facilities, particularly those that are not highly-ranked in the network screening process.

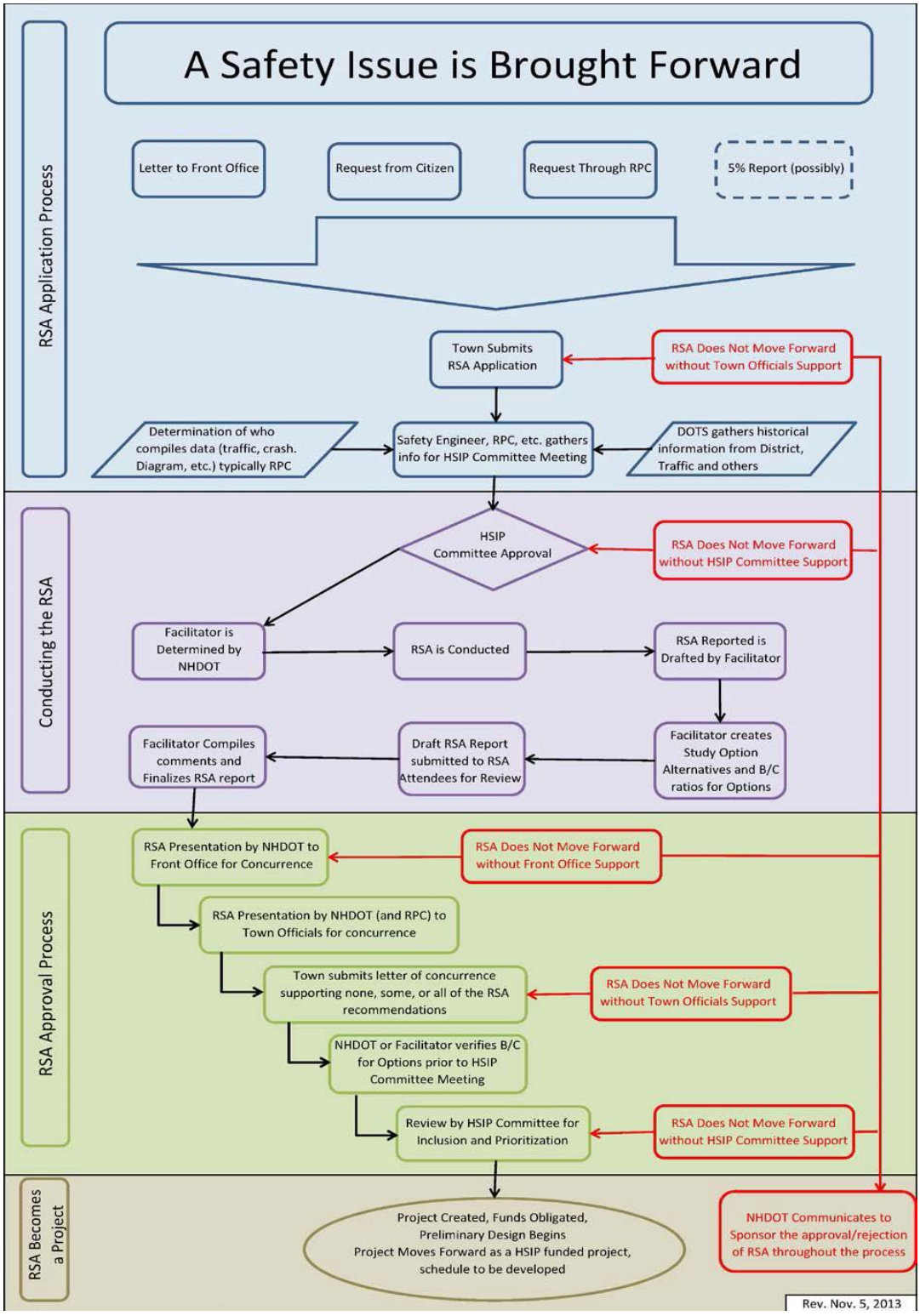


Figure 17. NHDOT RSA process.

Because the NHDOT RSA process defines responsibility and outcomes, it is a useful tool for identifying the potential scope of safety improvements and it can serve as a pre-screening for

HSIP projects on local facilities, particularly those that are not highly-ranked in the network screening process. The District Engineers participate in the RSA process, in addition to Central Office, regional planning, and local agency staff, providing valuable input from the perspective of maintenance operations. The RSA costs roughly $10,000 and provides documentation of potential safety hazards and defines the responsibility for correcting those, a key driver in generating HSIP projects.

The New Hampshire RSA requests are screened on the basis of crash performance, which is developed using crash data typically obtained from the local police agency so that crash report details are available. RSA applications are accepted at any time and screened annually, and projects advanced to the HSIP candidate list are evaluated with all other RSAs sourced from throughout New Hampshire. NHDOT is considering moving toward an annual solicitation of RSA applications.

IDOT policy requires HSIP projects over $1 million to procure for design documentation an independently-conducted Road Safety Audit/Assessment (RSA) or internal Road Safety Review. IDOT staff conducts approximately 12 RSAs annually and IDOT has made use of T2 funding for travel for law enforcement officials for RSAs. In addition, the McHenry County Department of Transportation (MCDOT) performs its own RSAs after observing how IDOT used the process to identify safety countermeasures and facilitate local involvement. MCDOT makes use of consultant services in the preparation of RSAs for high-crash intersections, a practice that delivers insights for HSIP projects.

IDOT requires all HSIP projects over $1 million to have an RSA. One county in Illinois now performs its own RSAs after observing how IDOT's process helped identify safety countermeasures and facilitate local involvement.

SAFETY CORRIDORS

Alaska established the four Alaska Traffic Safety Corridors (ATSC), based on the presence of high-crash locations and approved by the commissioners of Transportation and Public Safety. The Bureau of Highway Patrol, part of the Department of Public Safety's Alaska State Troopers, provides enhanced enforcement in ATSCs. The program is loosely modeled after Oregon and Ohio safety corridor programs. Corridor implementation was coupled with a public information campaign, including commissioners explaining the Report Every Dangerous Driver Immediately (REDDI) program.[18] HSIP funds are used within the limits of ATSCs. This has been one of the more effective ways of addressing the ATSC issues in a timely manner. Because HSIP projects are smaller and more focused, HSIP funds can be used to implement relatively lower-cost improvements sooner than a typical infrastructure solution, which allows a greater degree of flexibility in the corridors where project implementation is often part of a broader and swiftly-deployed strategy to deal with a particular safety issue

Fatal and injury crashes on the ATSCs were reduced by 42 percent overall, over a 5-year period. The DOT&PF AHSO web site includes the reports related to the ATSC program. [19]

In Alaska, the TSCs are not decommissioned when a crash reduction is observed, unless the DOT&PF and the police agency with jurisdiction agree the ATSC is no longer effective or conditions have changed in a way that make it unnecessary. It is believed that ATSC presence, characterized by implementation of appropriate measures (including education, enforcement and engineering) has a beneficial effect on safety and compliance with traffic laws when the public conversation is fed by interagency cooperation and consistent messaging. Alaska's initial experience with the ATSCs was seen as a paradigm shift from addressing total crashes to focusing on the high benefits of successfully curtailing Fatal and Injury-A crashes.

ENFORCEMENT AND EMERGENCY RESPONSE

Utah's bi-annual Safety Summit attracts over 500 practitioners from throughout Utah to collaborate and advance transportation safety in Utah. The participants represent a truly multi-disciplinary coalition, including engineering, public safety, and public health. The Summit is jointly funded by the DPS and UDOT, with DPS using a variety of funds and UDOT using HSIP funds exclusively.

In addition, UDOT's partnerships with local and regional emergency services providers and cooperation with local agencies facilitated the implementation of Emergency Medical Services traffic signal pre-emption in a majority of corridors, particularly along the Wasatch Front. Other efforts related to incident management and responsiveness include providing the Utah Highway Patrol with drones and advanced surveying equipment to assist in crash clearance efforts.

SUMMARY

The Host States undertake a variety of efforts related to the 4E's to improve safety in their States. This includes conducting public information campaigns and public involvement, conducting RSAs, identifying safety corridors, and coordinating with law enforcement and emergency responders.

In many Host States, public information campaigns and public involvement are key features of HSIP implementations. Utah, Alaska, and New Hampshire make extensive use of public information campaigns related to highway safety, with both Utah and New Hampshire strongly emphasizing a zero deaths initiative as the core of the public information campaign. Utah also conducts significant tribal outreach efforts, focusing on data collection on tribal land and helping tribes plan for traffic safety outcomes with a focus on child passenger safety and teen driving. In Massachusetts, innovative partnerships with advocacy groups have resulted in informed law

enforcement agencies improving efforts related to enforcement of bicycle and pedestrian laws, for both motor vehicle operators and vulnerable users.

In Oregon, the importance of involving the public in the project development process was explicitly identified as a key to project success. ODOT indicated that the solicitation of public input on project scope and content increases public satisfaction with projects and provides a platform for conveying the importance of highway safety investments.

Nearly every Host State identified RSAs as a key component of screening, project development, and project design. In North Carolina and Massachusetts, RSAs are conducted at State DOT expense and can be initiated at the request of the local agency.

Massachusetts was the only Host State to require the completion of an RSA for all project development activities that included locations on the 5% List, including non-HSIP projects. This use of RSAs, similar to the New Hampshire requirement for the completion of an RSA for all HSIP projects, ensures that successful evaluation of project alternatives is undertaken in project development, increasing the effectiveness of chosen countermeasures, particularly in States without a strong HSM emphasis.

The Alaska DOT&PF established four Alaska Traffic Safety Corridors based on the presence of high crash locations. DOT&PF uses education, enforcement, and engineering to reduce crashes in the ATSCs. Similarly, Utah uses a multi-disciplinary approach to safety through partnerships with public safety providers, public health providers, and tribal communities. The Utah Department of Public Safety uses HSIP funds for enforcement programs related to seat belt use, exceeding the posted speed limit, and aggressive driving.

CHAPTER 9—IDENTIFYING OPPORTUNITIES TO STREAMLINE PROJECT DELIVERY

Many States face challenges in advancing HSIP-funded projects through design and construction in a timely manner. In highly successful programs, processes have been implemented to streamline and expedite the design and construction of HSIP-funded safety improvements on State and local roads. Examples of these processes include the use of consultants to support the design and construction of highway safety improvement projects and multiple agency partnerships.

SPOTLIGHT ON SAFETY:

Improving Project Delivery Timelines and Reducing Costs in North Carolina

The NCDOT is evaluating a variety of methods to improve project delivery timelines and reduce the overall cost of delivering HSIP projects. Examples include combining multiple related safety projects in a single contract, the use of the design-build delivery mechanism for fast-track delivery of projects with well-defined scope, and the use of on-call contractors to facilitate immediate delivery of identified projects. Established limited services agreements (LSA) provide an opportunity to use on-call contractors to quickly deploy and conduct surveys (for improved estimates), and to project hearings and expedited designs for safety projects without the need for additional contract advertisement and the associated time and cost impacts. Using consultants for design also helps balance NCDOT staff workloads while addressing budget constraints with effective interim projects in cases where the full recommended project cannot be delivered.

COORDINATION OF PROJECT DELIVERY

The Alaska DOT&PF established a close working relationship between the regional traffic safety engineers, project development and engineering staff in the three Regions, and the traffic safety practitioners at the Headquarters. This working relationship promotes the highly-focused scoping of projects, resulting in excellent cost control and improved transition of projects from approval and funding into successful construction. Within the DOT&PF, the regional traffic and

Coordination between Headquarters and the Regions in Alaska helps with effective scoping of projects, cost control, and the transition of projects from approval and funding to successful construction.

safety engineers work with design engineers at the Region level to keep HSIP projects targeted at cost efficient safety improvements and on schedule. Design engineers serve as project managers and are responsible for delivering projects from the time the project funds are obligated for advancement through the preparation of construction contract documents. The project managers within DOT&PF also bring the DOT&PF "tunnel vision" approach to safety engineering to public meetings and apply it throughout HSIP project development. The "tunnel vision" approach in Alaska provides for a singular focus on safety outcomes as the driving factor behind infrastructure decisions for HSIP projects, such that project decisions that have outcomes other than safety are not part of the vision.

MassDOT has dedicated District project managers responsible for project delivery. These project managers oversee the preparation of reports, preliminary design and final design, the design waiver process for Design Exception Reports, and all other aspects of project development and delivery once a project is approved to advance to design, for all projects delivered by MassDOT. The MassDOT HSIP Program Manager works to coordinate project readiness with advertisement for bid schedules and works closely with the project managers to ensure the timely completion of all of the elements required for project delivery and construction. This working relationship has been the key to obligating HSIP funds to the full programmed amount.

MassDOT's use of dedicated District project managers for project delivery working in close coordination with the MassDOT HSIP Program Manager has been key to obligating HSIP funds to the full programmed amount.

USE OF CONTRACTORS/CONSULTANTS

The IDOT Central Office uses one consultant contract to support the implementation of the HSIP through tasks such as data analysis and development of analysis tools, policy and guidance development, and reporting. Having one consultant ensures continuity and provides a common approach in terms of statewide implementation. Districts do have the ability to use their HSIP funding to hire their own consultant. Currently, District 1 in Northeastern Illinois is the only District that hires their own consultant.

IDOT uses one consultant to assist with support of HSIP implementation, providing consistency across statewide implementation.

With the exception of Alaska, the other Host States also referenced the use of consultants to assist with their HSIP:

- In Utah, consultants have developed some of the safety analysis and project tracking tools, including consultants retained to assist UDOT in managing the HSIP.
- North Carolina uses consultants for design, project evaluation, and conducting RSAs.
- Oregon hired a consultant to draft a list of potential hot spot locations when implementing the ARTS program. During the initiation of ARTS, two ODOT Regions hired consultants to help local agencies fill the applications for systemic projects. In addition, ODOT uses consultants for screening and project development.
- New Hampshire maintains two on-call consultant contracts, one for design of projects and the other for analysis. In addition a consultant is responsible for managing NHDOT's RSA program.
- In Massachusetts, a consultant works with Headquarters to scope potential HSIP improvements. MassDOT also hires consultants to assist with RSAs.

PROGRAM AND PROJECT MANAGEMENT TOOLS

All States demonstrated a strong ability to manage the HSIP, particularly with regard to tracking funding obligations, project status, and project performance.

SPOTLIGHT ON SAFETY:

Using Program and Project Management Tools to Manage the HSIP in Illinois

The Illinois DOT maintains several tools to help manage the HSIP. This includes the HSIP SharePoint site, a Benefit/Cost Tool, and a Funding Allocation Spreadsheet.

The HSIP SharePoint is used to manage all State and local HSIP projects. Internal IDOT staff created the tool on the internal SharePoint site, sourcing data from the application forms. The SharePoint site has the HSIP application, assigns each HSIP candidate an "HSIP number" for tracking purposes, and incorporates criteria considered in support of the Illinois SHSP (i.e. emphasis areas) and the HSIP implementation. It includes project cost, type of improvement related to the SHSP emphasis area, scope of project, Benefit-Cost, crash data, and supporting documentation. The HSIP assigned number is required to input the HSIP project into IDOT's Planning and Programming System and when entering the project into FHWA's Financial Management Information System (FMIS) for federal authorization. The database generated from the SharePoint site is used to assist with queries on emphasis areas and improvement types for

the purposes of HSIP reporting. The elimination of paper applications was necessary to streamline processes. The management tool does not follow the life of the project, a process that occurs at the District level with District tools. IDOT has also developed a statewide GIS layer identifying all HSIP projects which can be used as part of the evaluation process. Additionally, IDOT provides FHWA's safety staff with access to the system so that they can review the scope of work and authorize HSIP funds.

Districts are responsible for maintaining their own project tracking tools. Some Districts, such as District 1, maintain a spreadsheet that includes information on where projects are in the project development process in order to manage their large number of projects. Districts with smaller HSIP programs tend to work on a year-to-year basis and tracking projects in a spreadsheet has evolved over time as those districts have programmed additional projects. The Districts upload all project information from the Districts to the SharePoint site, which can be queried as needed or reviewed to determine if there is a large enough sample size for evaluation of a specific project type or countermeasure.

IDOT used the HSIP consultant team to create the Benefit/Cost Tool, and aid in calculating b/c estimates using crash data and countermeasures proposed. The consultants designed the tool to offer the flexibility of user-defined crashes and benefits while also offering a library of common crash types and countermeasures with attributes that have been validated by research and use. This tool has been provided to other States for their modification and use.

BSE uses the Funding Allocation Tracking Spreadsheet, with a separate tool used in District 1, to determine the funding that has been allocated and obligated to projects. This tool, combined with the strong project development process and preparation of engineering estimates by IDOT staff, ensures that funding obligations are consistent with annual appropriations, facilitating a high obligation rate and reducing the potential lapsed funding.

The Alaska DOT&PF HSIP Funding Plan illustrates anticipated annual obligation by project, phase, and funding source for the current federal fiscal year. All new and on-going HSIP projects appear in the funding plan. It provides a mechanism for aligning projects with funding sources to assure funding sources will be fully utilized during each federal fiscal year. The HSIP Funding Plan is prepared by headquarters Traffic and Safety staff in cooperation with Program Development staff to allocate available funding to scheduled project phases according to priority. When the plan shows applicable funding sources are fully allocated, project phases that remain unallocated are assigned to advanced

Alaska DOT&PF uses an HSIP Funding Plan and Project Tracking Spreadsheet to manage their HSIP, allocate funding to scheduled project phases according to priority, anticipate future funding needs, and estimate new project funding requirement.

construction. Advancement on the construction calendar is a process that uses available funding to move projects forward in the bid advertisement schedule, meaning that projects and the corresponding improvements can be delivered sooner. This provides regional decision-makers the option to reallocate funds from one project to another in reaction to changes in project development schedules.

DOT&PF's Project Tracking Spreadsheet is a critically-important element of the success of the HSIP. The Project Tracking Spreadsheet is used to track obligations on all new and on-going projects. DOT&PF develops it in the Fall to align with expected obligations in the HSIP Funding Plan. When a region requests approval to obligate funds on an HSIP project, T&S staff verify the project is identified in the HSIP Funding Plan (or in a previous Funding Plan, in the case of a construction overrun or change order), then record the amount and the funding type in the spreadsheet (along with date and reason). The region then submits the T&S approval along with other paperwork to the staff in Capital Improvement Projects for processing and final funding approval by FHWA.

The Project Tracking Spreadsheet provides a point-in-time snapshot of progress toward DOT&PF's goal of full program obligation. Actual project obligations and timing of the obligations often differ from what is anticipated in the HSIP Funding Plan, so the funding situation during the fiscal year is fluid. The tool gives DOT&PF the ability to anticipate and respond to changes in the plan, for example, needing to request special attention on a High Risk Rural Roads project or railroad crossing project to ensure obligation of those funding types before the end of the fiscal year.

The Project Tracking Spreadsheet is not considered fully accurate as the Capital Improvement Program has the authoritative data and they may alter funding types or deobligate funds without T&S's knowledge after they approve a funding request (and record it in the Project Tracking Spreadsheet). However, it is extremely useful as a tool to follow the annual obligation of funds.

The Project Tracking Spreadsheet also allows the DOT&PF to identify funding that is unallocated, funding to be returned from projects constructed under bid price, and projects being held for future construction. Funds originally designated for HSIP all remain within the Alaska HSIP, providing flexibility in programming work. The DOT&PF Regions are responsible for maintaining a historical listing of HSIP Projects and are responsible for submitting annual reports to headquarters staff.

The New Hampshire DOT developed a spreadsheet-based tracking system for project origination method, scope, progress in project development, HSIP data, and project delivery information. A second spreadsheet-based tracking system was

New Hampshire DOT maintains two spreadsheet-based tracking systems to help manage their HSIP and track the funding of HSIP projects.

developed to track the funding of HSIP projects. Both of these tools have grown in scope and size, but NHDOT staff continue to manage them in-house, permitting immediate access to data in a structure that is consistent with NHDOT's approach to HSIP program delivery.

In an effort to manage project cost increases, NHDOT established Cost Thresholds for triggering a review of projects that exceed the obligated amount by a set percentage. The Cost Threshold values and process for handling projects falling within are included in the *NHDOT HSIP Manual and Guidance*, which is managed by the HSIP Committee and are shown in Figure 18.

Original Estimate	Threshold
0 to 300k	40%
300k to 600k	30% or 125k (whichever is greater)
> 600k	20% or 180k (whichever is greater)

Figure 18. New Hampshire DOT cost thresholds.

Being dependent on the size of a given HSIP project, the cost threshold policy divides projects into three size groups and identifies cost thresholds in whole dollars or a percentage of the project. If a project is trending toward exceeding the obligation amount plus the cost threshold, the project is referred to the HSIP Committee for review. The HSIP Committee can recommend changes to the scope of the project, identify issues related to project cost increases, and if necessary, terminate a project that will not provide an adequate return on investment.

UDOT developed the WorkFlow Manager (WFMan) tool, with support from a consultant, to enter, view, evaluate, rank, program, and track all UDOT HSIP applications and projects. Access is provided via a web interface and allows for unlimited users, including UDOT staff, consultants, and local government partners. WFMan provides HSIP funding applicants the ability to submit applications, perform real-time edits and revisions, receive summary notifications, and track the status of each application as it progresses through the evaluation, ranking, and programming process.

UDOT HSIP program managers use WFMan to review and qualify applications based on standardized ranking and eligibility criteria. Once ranked, program managers place applications into a 3-year program and ensure that annual budgets are efficiently allocated. As projects are initiated, WFMan tracks key project information to provide program managers the ability to monitor schedules, track project and program cash flow, document project-related decisions, and inform leadership. Figure 19 shows a screenshot of WFMan.

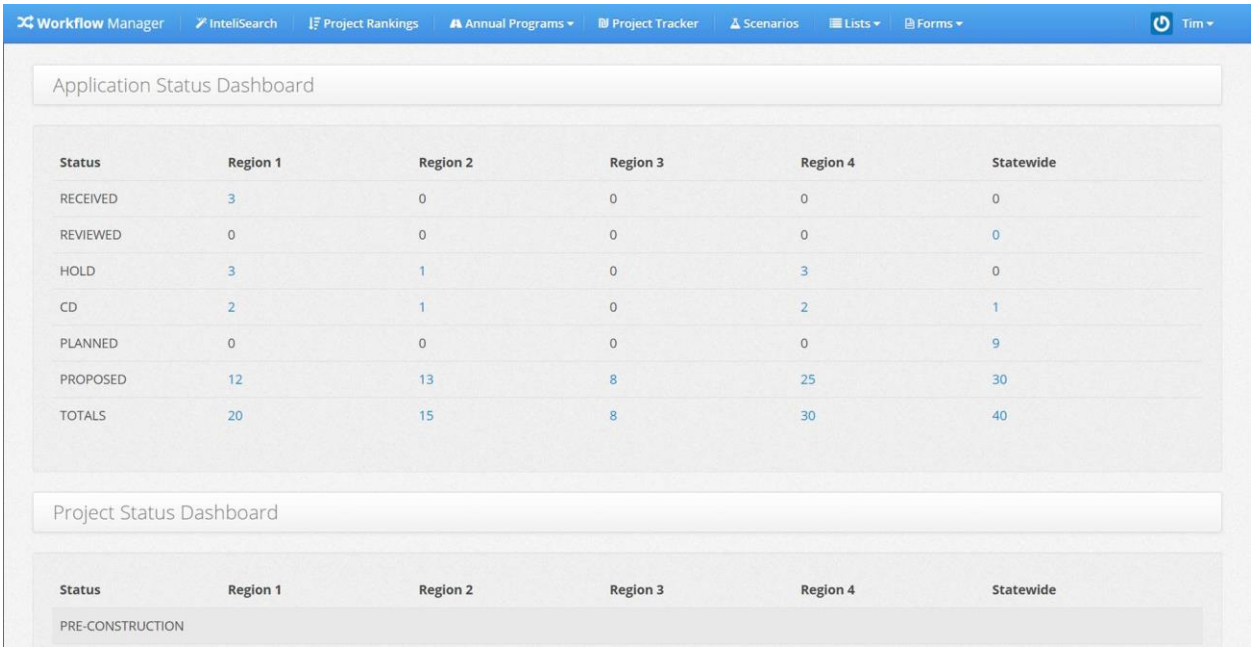


Figure 19. Screenshot of the UDOT WorkFlow Manager tool.

HSIP IN THE STIP

The Scan Tour highlighted various ways that States include the HSIP in the STIP.

IDOT uses a single category, Statewide Safety, in its STIP for safety projects, including railroad safety projects. This enables them to refer to just one STIP number when receiving federally-authorized funding and eliminates the impediments caused by using line items for safety projects. States often find that it is difficult to spend all available funding when line items are required in the STIP, as projects and programs are constantly changing. 23 CFR part 450.216 describes the use of grouping in the STIP.

Likewise, in Alaska, the HSIP is in the STIP as an "umbrella project," providing broad flexibility to the DOT&PF. In order to encourage flexibility in project development and the highest degree of success in correcting safety deficiencies, HSIP funds in Alaska are available to deliver safety improvements within other projects, provided that the funds are used in compliance with Section 1.4 of the Alaska *HSIP Handbook*.

In Massachusetts, the 13 MPOs represent the municipalities and towns in the statewide transportation planning processes. For each MPO, the local Joint

Illinois and Alaska use a single umbrella category for HSIP projects in the STIP, while Massachusetts uses a combination of an umbrella category and individually programmed safety projects in the STIP, and Oregon programs individual safety projects in the STIP.

Transportation Planning Group determines which projects will be included in the statewide STIP, serving as a bridge between the community and MassDOT. This identification of projects (not just HSIP projects) is based on evaluation criteria in which safety features and anticipated outcomes account for 24 out of 99 points. The projects are ranked by the total score for inclusion in the STIP. In addition, there is an SHSP emphasis area line item included in the STIP as a separate project, dedicating funding to addressing these issues. MassDOT has numerous safety projects that are individually programmed in the STIP. However, they also have a placeholder for "HSIP projects to address SHSP strategies." This enables MassDOT to quickly let projects as they come up from various SHSP Emphasis Area meetings.

In Oregon, under the ARTS Program, most selected projects are programmed into the STIP on an individual basis. ODOT anticipates that all projects under the ARTS Program will be stand-alone safety projects. However, Regions might decide to bundle similar safety projects into larger projects for efficient project development and delivery.

ESTABLISH A MULTI-YEAR PLAN AND BUDGET

The HSIP is a multi-year program that in any one year simultaneously supports the collection and analysis of data, the identification of highway safety improvement projects, the evaluation of countermeasures, and the design and construction of projects. States that plan and budget for the program on a multi-year basis can better coordinate and leverage all opportunities to advance HSIP implementation efforts and use all available funds efficiently and effectively to reduce fatalities and serious injuries.

SPOTLIGHT ON SAFETY:

New Hampshire's Multi-year Program

New Hampshire delivers systemic projects on a multi-year program, focusing on both infrastructure, behavioral, and data solutions. Upgrading guardrail from cable to beam, barrier end-terminal upgrades, rumble strip installation, and signal improvements including reflectorized backplates are characteristic of New Hampshire's infrastructure-based systemic projects. NHDOT has used the multi-year delivery approach to ensure the completion of projects, even if completed over time, and provide for program flexibility when identifying and funding other needs. In years where HSIP funding is needed for a larger project or group of projects, NHDOT can lower the investment in systemic projects while remaining confident that the projects will be completed over time.

In Utah, the Safety Programs Engineer programs all HSIP projects, working closely with the Department's project development staff. In general, the HSIP is programmed in excess of annual apportionment, with the expectation of returned funds from closed projects and constructed projects with less-than-expected bids. Additionally, programming in excess of apportionment also accounts for delayed projects. The programming of a 3-year STIP provides UDOT with opportunities to advance projects for construction and ensures flexibility for the addition of new projects to address emerging issues. Included in this flexibility is UDOT's preference to deliver projects that are able to be completed quickly, those with a smaller scope and those projects that have completed project delivery checklists for advertising and construction.

In Alaska, a similar statewide multi-year programming approach is taken, with projects being programmed and monitored by DOT&PF headquarters staff. The multi-year plan allows DOT&PF the flexibility to shift project start dates to account for readiness, availability of funding, and other factors, ensuring that multi-year objectives are being met. In addition, DOT&PF recognizes that development of a multi-year implementation for a systemic project can deliver cost efficiencies in project and construction management when larger projects are used for delivery.

SUMMARY

The streamlining and coordination of project delivery efforts was a key contribution to HSIP performance in terms of project timelines and cost control. This included efforts such as using contractors/consultants to assist with HSIP efforts, using program and project management tools, programming HSIP projects as an umbrella category in the STIP, and establishing multi-year plans and budgets.

Alaska, Massachusetts, and New Hampshire exhibited strong performance in the coordination with project development staff and project managers. In Massachusetts, close working relationships with project development and Federal Aid program staff ensured that project delivery was not encumbered by the availability of funding or incomplete contract plans. NCDOT is evaluating a variety of methods to improve project delivery timelines and reduce the overall cost of delivering HSIP projects. This includes combining multiple related safety projects in a single contract, the use of the design-build delivery mechanism for fast-track delivery of projects with well-defined scope, and the use of on-call contractors to facilitate immediate delivery of identified projects.

All States demonstrated a strong ability to manage the HSIP, particularly with regard to tracking funding obligations, project status, and project performance. In Illinois, one District created and maintained its own project tracking system, owing to the size of the HSIP obligation in that District. In New Hampshire, North Carolina, Alaska, and Utah, the central office tracks project obligations and status in the interest of ensuring projects continue to progress. New Hampshire

also tracks project budgets and has developed a documented means of dealing with projects that exceed the appropriation by a set amount so that a review of the project can be triggered.

CHAPTER 10—EVALUATING THE SUCCESS OF THE PROGRAM

By regularly evaluating their programs, States can continuously improve their strategies for achieving their SHSP goals and targets, as well as their own efficiency and effectiveness. Tracking and evaluating the effectiveness of completed HSIP projects is also a means to determine if those improvements are providing their predicted benefits. States with highly successful programs also "benchmark" themselves against other States, adopting new practices they find promising.

All States had developed some form of before-and-after project analysis. Alaska, Utah, Illinois, and North Carolina have strong evaluation programs that are being used to directly inform the development of safety performance functions (SPF), CRFs, and other values used in the screening and analysis portion of HSIP project development.

SPOTLIGHT ON SAFETY:

Safety Evaluations in North Carolina

The NCDOT Traffic Safety Unit conducts a Safety Evaluation for all completed safety projects. This evaluation includes project information, collision diagrams, and analysis of before and after crash frequency and severity. The analysis period is typically three years, but it can be extended for sites with a low pre-project crash rate. The Safety Unit executes roughly 120 safety project and program type evaluations each year and has trained consultant staff to perform evaluations in addition to in-house staff. Advanced evaluations are generally performed by NCDOT staff, such as the Empirical Bayes analysis of multiple sites.

There are three aspects to the NCDOT evaluation process. The first is NCDOT's evaluation of every HSIP, Spot Safety, and hazard elimination project, a site-specific, simple before/after review of crashes. Headquarters provides the regions with the reports generated from these project-level reviews. [20]

The second is NCDOT's Empirical Bayes evaluation of multiple site locations with similar countermeasure installations, which facilitates distinguishing between different treatments and the development of CMFs. The evaluations can be site-specific or taken across multiple similar sites. This was done for a variety of Intersection Cross-Road Warning System (ICWS) treatments and can be used to compare the effectiveness of varying treatment implementations.

The third aspect is a program-wide evaluation, undertaken program-wide for a Spot Safety or HSIP project. In the case of the Spot Safety program, NCDOT calculated a 14:1 b/c ratio for all

improvements in the program across 600 projects.

One of the significant outcomes of NCDOT's evaluation programs is the validation of CRF. NCDOT data collection efforts for projects, both prior to and subsequent to the construction of improvements, enables staff to conduct network-wide and site-specific evaluations of CRFs. This work, particularly with deployment of ICWS, has been crucial in preserving effective treatments for future implementations while permitting culling of less-effective treatments on the basis of location characteristics and countermeasure performance.

To that end, the NCDOT has developed an internal CRF list, covering roughly 260 countermeasures, and regularly correlates internal data with the FHWA CMF Clearinghouse. An in-house committee of technical experts performs the estimations of the CRFs, and the internal CRF lists are supported by the evaluations, all of which are included on the NCDOT web site.

The institutional establishment of this evaluation program and the various facets it encompasses has assisted NCDOT staff in retaining safety project funding and even obtaining increases in funding. The evaluation of project performance has also impacted other areas of NCDOT operations, leading to increased confidence in NCDOT investments.

HSIP PROJECT AND PROGRAM EVALUATION AND MONITORING

IDOT has not yet established a formal evaluation process. IDOT currently undertakes the evaluation of safety projects with three individual approaches.

Although they do not yet have a formal evaluation process, IDOT has informally evaluated safety projects at the programmatic, project, and systemic levels.

- Evaluation occurs at a programmatic level. For example, District 1 has a significant number of intersection HSIP projects. By looking at performance on State routes, where funding is directed, and identifying if there has been a significant reduction in fatalities and serious injuries, Districts can determine whether or not the strategies they are applying are working at the program level.
- Districts evaluate projects using before and after data, although this is an informal process and there is a significant delay in obtaining crash data.
- The Illinois Center for Transportation and the Safety Engineering Technical Advisory Group, which is chaired by the State Safety Engineer, conducted three research projects, funded by SP&R, to evaluate system-wide safety improvements.

The Illinois Center for Transportation is conducting the three research projects, which focus on evaluation of the effectiveness of flashing yellow arrows, right-turn islands, and interchange

improvements to prevent wrong-way movements. The Safety Technical Advisory Group within the Illinois Center for Transportation selected the research projects. The Technical Advisory Group solicits research proposals, and can also submit their own proposals. Research projects are selected based on what the Group perceives as priority research needs. For example, the SPFs used for statewide network screening and the basis for the SRI were selected by that group in 2007. It is important to note that if a researcher on the TAG submits a research topic proposal, they are not included in the review and approval of the project.

IDOT reviews the number of sites with implementation of countermeasures in order to determine which countermeasures to advance to evaluation in the research projects. Having a large sample size is important to obtaining system-wide before and after data. The research is reviewing the application of the strategies to over 100 intersections and over 400 interchanges. The results of the research projects will be used to develop State-specific CMFs and SPFs.

IDOT also conducts evaluations of experimental features when implementing new countermeasures. Doing so allows them to identify challenges, successes, and lessons learned, as well as develop policy based on what worked best. For example, when implementing cable rail, IDOT used different manufacturers on specific corridors so they could evaluate each type of system on its installation, maintenance, and by looking at crashes. They were then able to determine which types of cable rail to add to their approved products list. While the overall analysis of the cable rail was done as a corridor due to the fact that some segments may have not had any fatalities or injuries, but the corridor-wide data would show a different picture, the HSIP projects that came out of the analysis were done by funding segments.

The Alaska DOT&PF developed a methodology for demonstrating the effectiveness of HSIP projects. The Region Traffic Engineer prepares a Project Evaluation Worksheet for each project, evaluating the project based on 3-year post-construction data. The data is annualized for computation, and the cost of the project includes both the construction cost and the maintenance costs over the analysis period.

The Alaska DOT&PF evaluates projects based on 3-year post-construction data. They also use a program-wide b/c ratio to track performance of the overall HSIP.

The DOT&PF regions also use a project tracking report for HSIP that is turned into the Headquarters. The project report, which is separate from the HSIP Project Tracking Spreadsheet discussed in Chapter 9, evaluates targeted crashes for the before/after analysis and provides an overview of project performance. Incapacitating injuries are evaluated with fatalities to account for infrequency and isolation of crashes.

The DOT&PF has anticipated reductions in b/c ratios on account of the systemic approach that broadens applicability and breadth of a project, and these reductions are accepted as a result of

the program's initial effectiveness at addressing high-benefit locations. The b/c ratio for each project is calculated, when possible, and then aggregated to develop a program-wide b/c ratio, which is also an important metric of performance for DOT&PF.

CMF DEVELOPMENT

UDOT uses 3-year before/after comparisons of completed projects to analyze the performance of every HSIP project. Utah has developed a State specific CMF registry, which provides discrete CMFs and serves as a resource for project planning and screening. UDOT applies only one CMF to the targeted crashes identified for each project as part of the b/c analysis. This practice eliminates the additive effects of CMFs and ensures reliable b/c projections.

Enforcement presence can have an effect on traffic safety and the Alaska DOT&PF is conducting a research project to develop a CMF for enforcement presence (another means of quantifying the benefit of enforcement expenditures), particularly in the Alaska Transportation Safety Corridors. The research effort would be primarily focused on time spent on enforcement, providing the basis for a cost associated with potential benefits.

SUMMARY

All Host States have developed some form of before-and-after project analysis. Utah, Illinois, and North Carolina have strong evaluation programs that are being used to directly inform the development of SPF modifications, CRFs, and other values used in the screening and analysis portion of HSIP project development.

In both Alaska and North Carolina, each project is evaluated based on a standard evaluation form and methodology, using up-to-date crash data and measures of effectiveness appropriate for the countermeasures selected for use in the project. IDOT has an informal evaluation process that occurs at both the project and programmatic levels. In addition, IDOT is conducting research projects to evaluate system-wide safety improvements.

CHAPTER 11—OBSERVATIONS AND CONCLUSIONS

While the Scan Tour helped identify a number of notable practices in each State, the Scan Team observed that there were five overall characteristics that were consistent across all Host States:

- Streamlined Access to Crash Data and Crash Report Information.
- Strong Documentation of System Screening and Project Selection Processes.
- Pathway for Local Involvement and Nomination of Projects.
- Extensive Use of RSAs.
- Deliberate and Documented Assessment of Project Performance.

STREAMLINED ACCESS TO CRASH DATA AND CRASH REPORT INFORMATION

North Carolina and Alaska demonstrated that immediate and complete access to crash data was the foundation of a successful data development and screening effort, improving responsiveness to emerging issues and supporting timely evaluation of crash trends. The use of electronic crash reporting efforts, particularly those that parse electronic data submissions (as opposed to electronic submission of crash report images), has an impact on timeliness of data, whereas coding of crash reports can be affected by staffing levels and other complications. For each State, the specifics of crash report information were considered key in developing collision diagrams for projects, supplementing RSA preparation, and identifying the causative effects of crashes.

STRONG DOCUMENTATION OF SYSTEM SCREENING AND PROJECT SELECTION PROCESSES

In all States, extensive documentation of the screening and project selection processes creates accountability for HSIP staff decisions and demonstrates transparency, which increases accessibility across the DOT and to local agencies. In Utah, Illinois, and New Hampshire, the development of uniformity with the HSM predictive methods has been the basis of strong consistency in evaluation processes throughout each State, supportive of graphical tools that greatly assist in program development decisions and processes.

PATHWAY FOR LOCAL INVOLVEMENT AND NOMINATION OF PROJECTS

The inclusion of local agency officials, particularly those from county highway departments and regional planning associations, is imperative if the HSIP is to be successful in States with large rural systems that are not State-maintained. In New Hampshire, Illinois, and Oregon, local agencies can directly nominate projects to the State HSIP. In Alaska and North Carolina, State DOT relationships with municipal agencies are an important component of HSIP project development for the local agency and significant DOT support is offered to these agencies. In Massachusetts, extensive involvement with the MPOs provides a pathway for locally-initiated projects while Utah works directly with local agencies to assist them in pursuing HSIP funding for projects.

EXTENSIVE USE OF RSAS

RSAs were identified as a key component of screening, project development, and project design. States such as Massachusetts and New Hampshire require RSAs for all HSIP projects (MassDOT also requires RSAs for certain non-HSIP projects), with MassDOT (as well as IDOT) funding RSAs for local agencies. The use of HSIP funds to conduct local agency RSAs was found to be particularly helpful in engaging local agencies in the identification of correctable crashes and potential countermeasures. Most notably, the requirement that RSAs are used in project scoping and project development leads to a more robust project that delivers on crash correction. Like MassDOT, NHDOT uses RSAs to support HSIP project development efforts. The regional planning authorities can request an RSA and, using that information, determine the potential scope of an HSIP project. In North Carolina, the RSA process is a means of engaging Region staff in project development while providing the outside perspective that comes from a diversity of staff on the audit team.

DELIBERATE AND DOCUMENTED ASSESSMENT OF PROJECT PERFORMANCE

The strongest project evaluation performance was noted in Alaska, Illinois, and North Carolina, where long-term project evaluations are undertaken according to established policies. In all of these States, project evaluation was the basis of validating CRFs and formed the basis of observations related to project performance, including the effectiveness of systemic countermeasures applied across multiple locations.

CONCLUSION

The Scan Team observed that State DOT staff dedicated to HSIP were passionate about the success of the program and invested in the goal of saving lives.

In general, the internal coordination within the State DOT, particularly with regard to project delivery and funding allocation, is just as important as coordination with external partners. Relationships with the agencies collecting and coding crash data are an essential part of understanding the crash problem and scoping appropriate improvements.

The 2015 HSIP National Scan Tour resulted in the identification of key characteristics of successful HSIP administration, planning, implementation and evaluation practices. These findings come from States of varying sizes, with different roadway characteristics and safety concerns. The findings from the HSIP National Scan Tour provide a resource for all transportation safety practitioners to improve and enhance their HSIP processes and program implementation efforts.

APPENDIX A—KEY CONTACTS FROM HOST STATES

This report would not be possible without support from the Host States. Host States provided preliminary information prior to the visit, organized participants for the scheduled scan date, and supplied subsequent follow up information. The key participants in each State are presented below.

Alaska

- Jeff Jeffers, State Traffic and Safety Engineer
- Randy Warden, Assistant Division Administrator, FHWA
- Matt Walker, Assistant State Traffic and Safety Engineer
- Clint Farr, State Crash Data Manager
- Scott Thomas, Central Region Traffic and Safety Engineer
- Carla Smith, Project Manager, Central Region
- Pamela Golden, Northern Region Traffic and Safety Engineer
- Stephanie Mormilo, Municipal Traffic Engineer, Municipality of Anchorage
- David Epstein, Southcoast Region Traffic and Safety Engineer
- Jon Knowles, Central Region HSIP Coordinator
- Mark Neidhold, Chief of Design and Construction Standards
- Miles Brookes, FARS Analyst, Governor's Office of Highway Safety

Illinois

- Priscilla Tobias, Central Bureau Chief of Safety Engineering
- Aaron Weatherholt, Deputy Director, Division of Highways
- Tim Sheehan, Bureau of Safety Engineering
- Mike Gillette, Bureau of Safety Engineering
- Katherine Beckett, Bureau of Safety Engineering
- Traci Sisk, Office of Planning and Programming
- Kathy McNeill, Central Office of Planning and Programming
- Leigh Ann Lareau, Central Bureau of Planning and Programming
- John Paris, Office of Planning and Programming, Bureau of Local Roads Services

- Karen Shoup, Office of Planning and Programming, Bureau of Urban Planning
- Lisa Heaven-Baum, District 1 Bureau of Traffic
- Jonathan Lloyd, District 1 Bureau of Traffic
- Rob Macklin, District 7, Bureau of Program Development
- Peter Stresino, District 1 Bureau of Traffic
- Kevin Marchek, District 2 Bureau of Program Development
- Scott Ferguson, District 3 Bureau of Program Development
- Sean Coyle, District 4 Bureau of Program Development
- Maureen Addis, District 4 Bureau of Program Development
- Jeannie Bland, District 5 Bureau of Program Development
- Jeff Myers, District 6 Bureau of Program Development
- Marshall Metcalf, District 6 Bureau of Operations
- Kahn Kellams, District 7 Bureau of Operations
- Doug Keirn, District 9 Bureau of Program Development
- Alan Ho, FHWA Illinois Division Office
- Greg Piland, FHWA Illinois Division Office
- Rita Morocorma-Black, Champaign-Urbana MPO
- Wally Dittrich, McHenry County DOT
- Kim Kolody, CH2MHill
- Tommy Myszka, CH2MHill

Massachusetts

- Bonnie Polin, HSIP Program Manager
- Neil Boudreau, State Traffic Engineer
- John Mastera, Road Safety Audit Program Engineer
- Jennifer Inzana, Transportation GIS Safety Specialist
- Rick Conard, Safety/Traffic Engineering Crash Data Specialist
- Pam Marquis, Right-of-Way Compliance Administrator
- Bill Betts, Federal Aid Programming and Reimbursement Office (FAPRO)

- Carrie Lavallee, Project Manager
- Pam Haznar, District 5 Program Development Engineer
- Promise Otaluka, FHWA Massachusetts Division Office
- Lisa Estrela-Pedro, Southeastern Regional Planning and Economic Development District

New Hampshire

- William Oldenburg, Assistant Director of Project Development
- Mike Dugas, Chief of Preliminary Design
- Bill Lambert, State Traffic Engineer
- Tim Harmon, Assistant Highway Safety Engineer
- Jim Marshall, Administrator of Highway Design and Program Manager of HSIP
- Michelle Marshall, Highway Safety Engineer
- Martin Calawa, FHWA New Hampshire Division Office
- Donna Bean, NH Office of Highway Safety
- LuAnn Speikers, NH Office of Highway Safety
- Bob Hudson, LPA Program
- Nate Miller, Upper Valley/Lake Sunapee Regional Planning Commission
- Bruce Thomas, City of Manchester Public Works

North Carolina

- J. Kevin Lacy, State Traffic Engineer
- Terry Hopkins, State Traffic Safety Engineer
- Tony Wyatt, Field Operations & Investigations Engineer
- Kelly Becker, Capital Regional Traffic Engineer
- Brian Mayhew, Traffic Safety Systems Engineer
- Shawn Troy, Safety Evaluation Engineer
- Stephen Lowry, HSIP Engineer
- Daniel Carter, UNC-Highway Safety Research Center (via telephone)
- Brad Hibbs, FHWA North Carolina Division Office

Oregon

- Doug Bish, Traffic Services Engineer
- Kevin Haas, Traffic Investigations Engineer
- Zahidul Siddique, State Highway Safety Engineer
- Sue D'Agnese, Region 1 Regional Traffic Manager
- Chris Woods, FHWA Division Office
- Julia Uravich, Marion County Public Works
- Kevin Hottman, City of Salem
- Dorothy Upton, Region 2 Regional Traffic Engineer
- Derek Moore, DKS and Associates
- Scott Mansur, DKS and Associates

Utah

- Jason Davis, Director of Operations
- Robert Miles, Director of Traffic and Safety
- W. Scott Jones, Safety Programs Engineer
- Joseph Walker, Communications Director
- Kristen Hoschouer, Zero Fatalities Program Manager
- Stacy Johnson, Zero Fatalities Team - Consultant (Penna Powers)
- Kristy Rigby, Director of DPS Highway Safety Office
- Carrie Silcox, Deputy Director of DPS Highway Safety Office
- Roland Stanger, FHWA Utah Division Safety Engineer
- Erik Brondum, City Traffic Engineer, West Valley City
- RJ Porter, Professor, University of Utah
- Grant Schultz, Professor, Brigham Young University
- Tim Taylor, UDOT Safety Programs – Consultant (WCEC Engineers)
- Clancy Black, UDOT Traffic & Safety – Consultant (Numetric)
- Travis Jensen, UDOT Safety Programs Consultant (WCEC Engineers)

APPENDIX B—SCAN TEAM MEMBERS

FHWA Members

- Karen Scurry, Office of Safety
- Nick Fortey, Oregon Division
- Rick Drumm, Indiana Division
- Jessica Rich, Tennessee Division

State DOT Members

- Steven Buckley, Kansas DOT
- Ken Mammen, Nevada DOT
- Michael Turpeau, Jr., Georgia DOT

AASHTO Members

- Kelly Hardy, Senior Engineering Program Manager for Safety
- Tracy Lovell, Kentucky Transportation Cabinet (on assignment to AASHTO)

Contractor Facilitators

- Bruce Ibarguen, Toxcel
- Scott Kuznicki, Toxcel

APPENDIX C—NOTABLE PRACTICES BY STATE

This Appendix provides the notable practices described in the report organized by each Host State. The subheadings under each State link back to the relevant chapters. Table 4 summarizes information about each Host State and provides links to each Host State section.

Table 4. Host State statistics.

State	FY14 HSIP Apportionment	State-Owned Roadway Miles	Non-State Owned Roadway Miles	5 Yr Average Fatality Rate
Alaska	$29,668,529	5,591	10,089	1.26
Illinois	$73,695,955	15,986	129,722	0.90
Massachusetts	$32,218,108	3,018	33,352	0.64
New Hampshire	$7,924,497	3,921	12,176	0.88
North Carolina	$57,438,779	79,546	26,656	1.24
Oregon	$28,137,964	7,661	63,568	1.00
Utah	$19,948,410	5,869	40,385	0.89

SUMMARY OF STATE PRACTICES: ALASKA

Documentation of HSIP Processes

In Alaska, the DOT&PF State Traffic and Safety Engineer has the responsibility of maintaining a variety of manuals and project development policy documentation. The *Alaska HSIP Handbook* is evaulated and upated annually or on an as-needed basis to address changes in law, program and policy rules, and clarifications. Updates also address crash costs and CMFs as needed. The *Handbook* is readily accessible from the Alaska DOT&PF web site, in addition to other HSIP documentation - http://www.dot.state.ak.us/stwddes/dcstraffic/hsip.shtml.

The *Handbook* clearly defines the process of HSIP project development, the criteria for project selection, and handling of funds and project delivery activities. Development of this documentation was the result of a facilitative relationship between the FHWA Division Office and the State Traffic and Safety Engineer's office. The support of the Commissioner ensured that resources were available to address the HSIP regulations with appropriate and sufficient documentation, ensuring the program would be equitably and consistently applied.

Coordination with Internal and External Partners

- DOT&PF delivers the Alaska HSIP through headquarters staff, which consists of the traffic safety engineering practitioners and program development, and the Region staff, which consists of traffic operations engineering staff and project development staff.
- The detailed documentation and program requirements and policies have greatly facilitated the involvement of Anchorage and other local agencies that lack engineering support.
- The FHWA Alaska Division Office has helped to facilitate the development of HSIP "champions" within the program, those on staff at Headquarters who cooperate closely with FHWA and have a passion for advancing the mission of the HSIP and achieving collaboration and results.

Understanding the Relationship Between the SHSP and HSIP

- All nominated HSIP projects are developed in order to align with one or more of the action items and long-term goals in the SHSP.
- The Alaska SHSP features a specific section devoted to the HSIP, describing its function and role in the State's strategic approach to safety management on the roadway system.

Making Data-Driven Safety Decisions

- Crash Data Collection and Analysis Tools.
    - DOT&PF contracted with the University of Alabama to develop a crash information portal known as CRASH/Alaska CARE.
    - Electronic reporting of crashes improves reliability and speed data delivery.
    - Considering a tiered reporting system to encourage additional data collection from higher-order crashes, which also improves FARS reporting.
    - Cooperation with local municipalities for data sharing agreements and transition to improved electronic reporting response rates.
- System Screening, Project Nomination, and Project Selection.
    - Annual screening of all roads, including local roads.
    - Local agency nomination process is supported by DOT&PF region personnel.
    - The project ranking process allows for a tiered list of projects, including ranked, non-ranked and systemic projects.
    - A narrative for all non-ranked projects and a sensitivity analysis for non-ranked projects with a crash history determine suitability for HSIP investments.

Addressing Local Road Needs

- DOT&PF is cooperating with local municipalities for data sharing agreements and transition to improved electronic reporting response rates.
- Local agencies can nominate a project with informal DOT&PF assistance in selecting the project limits, countermeasures, and computational metrics.
- Alaska DOT&PF undertakes design (or manages consulting designers) and delivers local projects, with the exception of projects in Anchorage.

Considering All "4E's"

- Public Outreach and Involvement.
    - The primary safety-related public outreach activities of the DOT&PF are taking place through the efforts of the Regions, particularly in the Region public information staff, which has achieved AASHTO recognition for Public Service Announcements related to highway safety.

  - The headquarters public information staff participates in the outreach efforts as well.

- Safety Corridors.
  - Alaska established the four Alaska Traffic Safety Corridors (ATSCs), based on the presence of high-crash locations and approved by the commissioners of Transportation and Public Safety.
  - Traffic Safety Corridor successes are documented and form the foundation for future expansion of the program as funding for enforcement is available.

Identifying Opportunities to Streamline Project Delivery

- Coordination of Project Delivery.
  - Coordination between Headquarters and the Regions in Alaska helps with effective scoping of projects, cost control, and the transition of projects from approval and funding to successful construction.
  - DOT&PF traffic safety and project development staff work very closely together to ensure project scoping is accurate and appropriate, controlling costs.
  - HSIP analysis targets fatal and serious injury crashes where 1R and 3R formulas do not identify a problem.
- Program and Project Management Tools.
  - Alaska DOT&PF uses an HSIP Funding Plan and a Funding Tracking Spreadsheet to help manage their HSIP, allocate funding to scheduled project phases according to priority, anticipate future funding needs, and estimate new project funding requirement.
- HSIP in the STIP.
  - HSIP is in the STIP as an "umbrella project," providing broad flexibility to the DOT&PF.
  - In order to encourage flexibility in project development and the highest degree of success in correcting safety deficiencies, HSIP funds in Alaska are available to deliver safety improvements within other projects, provided that the funds are used in compliance with Section 1.4 of the Alaska HSIP Handbook.

Evaluating the Success of the Program

- Project Evaluation Worksheets are locally administered and reported to headquarters.
- Project evaluation occurs over a three-year period.

- Annualized benefits are evaluated against construction cost and maintenance costs.
- DOT&PF has also calculated an overall b/c ratio for the entire HSIP program, using data obtained in the program evaluation process.

SUMMARY OF STATE PRACTICES: ILLINOIS

Documentation of HSIP Processes

The Illinois DOT (IDOT) has extensive HSIP documentation to help deliver their program, available at http://www.idot.illinois.gov/transportation-system/local-transportation-partners/county-engineers-and-local-public-agencies/funding-opportunities/highway-safety-improvement-program. This includes the IDOT HSIP Policy, the Systemic Safety Manual, and various spreadsheet-based evaluation tools, including the Benefit/Cost Analysis Tool and HSM Crash Prediction Tool. IDOT is also developing a Safety Engineering Manual as a supplement to their HSIP policy, designed to support the deployment of documented safety engineering processes. In addition, they are developing a policy regarding safety in project development, which will provide guidance for safety-related project advancement decisions.

Coordination with Internal and External Partners

- IDOT has a centralized, yet coordinated approach to managing HSIP that also allows for flexibility within the Districts.
- The Central Office works with Districts to understand their needs and ensure they are comfortable with processes being implemented.
- Districts meet together on a periodic basis to share best practices and lessons learned.
- Gathering of District input to develop a statewide safety briefing.
- IDOT worked with the University of Illinois to develop their initial set of Safety Performance Functions for each roadway and intersection type for the State highway system. This was based on the peer groups identified in Safety Analyst.

Understanding the Relationship Between the SHSP and HSIP

- The SHSP emphasizes impaired drivers, roadway departure, occupant protection, intersections, and information systems. IDOT prioritizes the emphasis areas within its SHSP based on the percentage of fatalities and serious injuries.
- Each HSIP application requires an SHSP emphasis area to be identified to ensure alignment between SHSP and HSIP.

Making Data-Driven Safety Decisions

- Crash Data Collection and Analysis Tools.
    - IDOT has staff dedicated to the creation, maintenance, and web-based dissemination of a variety of safety analysis tools.
    - The Safety Portal provides all agencies with one interface for accessing the statewide crash database. IDOT also utilizes a Safety DataMart and GIS to perform safety analysis. The GIS includes various layers that include the SRI and other analysis results.
- System Screening, Project Nomination, and Project Selection.
    - IDOT solicits local agency projects on an annual basis and local agency officials submit candidate projects to the Districts.
    - All projects are subjected to the same criteria for evaluation by the Central Safety Committee, which meets annually to select projects for local roads and continuously reviews applications from the Districts for their projects. The Committee consists of representatives from BSE, the Bureau of Design, the Bureau of Local Roads, and FHWA.
    - IDOT uses an electronic application process for the nomination of all HSIP projects by Districts and local agencies. The submission process is open throughout the year for the districts to submit candidate projects. The SharePoint tool for project nomination centralizes all nominations in electronic and accessible format, providing automation to the approval process and reducing paperwork.
    - Benefit/cost tool ensures consistency throughout IDOT as Districts generate b/c ratios based on project-specific inputs.
    - BSE has final say in selection of projects.
    - Districts can create their own systemic and systematic focus areas.
    - BSE gets a statewide HSIP allocation, which allows IDOT to address statewide safety issues across district lines. BSE can distribute funds using reserved appropriation.
- Spot Versus Systematic Improvements.
    - IDOT does not utilize a set proportion for allocation of funding to spot and systemic improvements. Instead they expect to balance both types of improvements, recognizing that both are important to improving safety.

- While the Districts have been told that funding is available to pursue systemic projects, most Districts are typically project-level focused and the Central Office identifies and funds the majority of systemic projects.

Using Advanced Safety Analysis Methods and Tools

- IDOT uses safety performance functions developed through the University of Illinois to perform network screening and identify those roadway segments and intersections with high potential for safety improvement.
- The IDOT Safer Roads Index improves the integration of quantitative safety performance in transportation project planning and programming.
- Safety Tiers categorizes roadways segments and intersections based on their level of safety performance and opportunity for improvement, providing a rating for relative comparison - Critical/5 percent, High, Medium, Low or Minimal.
- Safety Tiers allow transportation officials to understand relative performance of a location compared to similar types of roadways or intersections.
- The SRI classifies locations (segments and intersections) based on the Safety Tiers and, in a GIS tool, assigns colors to each one consistent with the level of priority. The SRI values, by segment, when used in mapping tools, allow direct segment-by-segment comparisons between the SRI and pavement data for the CRS and the IRI. This tool is a visual and tactical aid found to be invaluable for programming of general capital improvement projects that accomplish all three of these strategic objectives.

Addressing Local Road Needs

- IDOT assists local agencies with funding, policy, and design issues by providing workshops to help agencies understand the HSIP application and delivery process and providing bid advertisement services for local projects, among other efforts.
- IDOT BSE has funding set-aside dedicated to local agency safety projects and administers that funding through their HSIP application/nomination and award process.
- MPOs are valuable partners in Illinois, even as strong local agency programs exist. Some MPOs have taken an active role in safety analysis for their jurisdictional areas, using that data to develop and submit HSIP project applications and obtaining funding for the construction of those safety improvements.

Considering All "4E's"

- RSAs.
    - IDOT policy requires projects over $1 million to procure for design documentation an independently-conducted RSA or internal Road Safety Review.
    - IDOT supports local agencies, particularly county highway departments, in conducting RSAs by providing funding and technical support. One agency, having seen the benefit of the RSAs in project prioritization and development, now self-funds its own RSA program.

Identifying Opportunities to Streamline Project Delivery

- Coordination of Project Delivery.
    - IDOT has strong project development and delivery processes.
    - District tracking system allows for control of scope, schedule, and cost while ensuring that projects are coordinated with letting and project delivery schedules.
    - Uploading of District tracking information to SharePoint enables querying of all projects and determining which countermeasures have a large enough sample size for evaluation.
    - IDOT uses a Funding Allocation Tracking Spreadsheet, with a separate tool used in District 1, to determine the funding that has been allocated and obligated to projects. This tool, combined with the strong project development process and preparation of engineering estimates by IDOT staff, ensures that funding obligations are consistent with annual appropriations, facilitating a high obligation rate and reducing the potential lapsed funding.
    - Implementing new strategies at a District level rather than statewide allows other Districts to see how their counterparts are benefitting and makes them more likely to implement similar strategies.
- Use of Contractors/Consultants.
    - IDOT uses one consultant to assist with HSIP implementation, providing consistency across statewide implementation.
- Program and Project Management Tools.
    - The Illinois DOT maintains several tools to help manage the HSIP. This includes the HSIP SharePoint site, a Benefit/Cost Tool, and a Funding Allocation Spreadsheet.

- HSIP in the STIP.
    - IDOT uses a single category, Statewide Safety, in its STIP for safety projects, including railroad safety projects.
    - In locations not on the State roadway system, Illinois allows the use of county SHSPs for network screening processes, in addition to the identification of emphasis areas and focus areas, just as in the statewide SHSP. IDOT funded the development of the SHSPs with a consultant contract for HSIP support for the 35 counties with the most fatalities and serious injuries and those additional counties within MPOs.

Evaluating the Success of the Program

- IDOT does not have a formal evaluation process but uses multiple methods of evaluation to gather both project-level results and system-wide results. This includes evaluation at the program level and using before and after data to evaluate projects.
- IDOT uses SP&R funding for research projects to evaluate countermeasures and develop CMFs and SPFs.

SUMMARY OF STATE PRACTICES: MASSACHUSETTS

Documentation of HSIP Processes

All Massachusetts HSIP documentation is available at http://www.massdot.state.ma.us/highway/Departments/TrafficandSafetyEngineering/HighwaySafety/HighwaySafetyImprovementProgram.aspx. Documentation includes HSIP Guidelines and a Crash Clusters map.

Coordination with Internal and External Partners

- Within the headquarters office of the Highway division, the TESS cooperates with other bureaus, including Construction, Design, and Project Management, to deliver the Massachusetts HSIP.
- The TESS supports the Districts in understanding the HSIP program and providing RSA services. The Districts develop the cooperative relationship with the MPOs to ensure that central office objectives for highway safety and the HSIP tools promoted by TESS are available and used by the MPOs as they plan and program projects to the STIP.
- TESS has established working relationships with MassDOT Planning in order to deliver the HSIP, with TESS providing information and the Districts delivering the projects.

MassDOT Planning supports the HSIP by assisting in programming the projects into the STIP and ensuring funding is allocated and available.

- The MassDOT HSIP Task Force consists of seven members. These members include two FHWA staff members, three MassDOT staff members (the Chief Engineer and representatives from the Bureau of Traffic and Safety and the Bureau of Planning), and members from two MPOs. The task force meets annually or as needed to develop guidelines for acceptable HSIP projects but does not approve individual projects.

Understanding the Relationship Between the SHSP and HSIP

- Each HSIP project must address a SHSP emphasis area and each SHSP emphasis area provides strategies for addressing common safety problems.
- Because bicycle issues are considered a proactive emphasis area, MassDOT is addressing them with a specific bicycle/pedestrian safety program which includes enforcement, awareness, education, and infrastructure.
- In Massachusetts, HSIP projects are each separately nominated to the STIP.

Making Data-Driven Safety Decisions

- Crash Data Collection and Analysis Tools.
    - The Crash Analysis Tool provides a hierarchal screening process in the absence of exposure and severity data, permitting data-driven selection of candidate projects. The Crash Analysis Tool produces a clustered crash map using GIS tools and the geo-coded crash system. MassDOT developed the mapping tool in-house using contractor assistance, and the Tool is updated annually based on crash data collected in a prior calendar year. The tool is used to generate the HSIP-eligible projects list.
    - The Crash Portal allows for open access of crash information to the general public and MassDOT partners.
    - MassDOT is undertaking a project to link hospitalization data with their crash dataset.
    - MassDOT can also query citation data independently of crash information. MassDOT uses the citation data to better understand and address behavioral issues.

- System Screening, Project Nomination, and Project Selection.
    - Traffic Engineers in each District work with the MPO and the TESS to identify candidate sites and recommend projects based on the screening process, within the structure of the District project development process.
    - The TESS works with a consultant for scoping of potential HSIP improvements.
    - HSIP projects in Massachusetts address intersections with both spot and systemic improvements, in addition to roadway departure and vulnerable user projects.
    - MassDOT has used HSIP funds to conduct non-infrastructure improvements for safety data collection.
    - MassDOT traffic engineers have also examined using HSIP funds to improve safety in work zones, and are presently funding enhanced enforcement efforts in work zones.

Addressing Local Road Needs

- MPOs have significant responsibilities in programming projects for local agencies, in addition to programming State DOT projects.
- The MPO use of the Crash Analysis Portal stratifies projects by jurisdiction while also providing for an objective process where availability of traditional exposure data is limited.
- MassDOT provides project funds for matching the HSIP contribution for local agency projects, eliminating need for local agency matching funds.
- MassDOT provides local agencies with training the right-of-way processes because LPAs are responsible for the ROW acquisition process for LPA-owned facilities. MassDOT-funded projects are not advertised for bids until the Bureau has issued a ROW certificate, underscoring the importance of LPA coordination and compliance for MassDOT-funded projects.

Considering All "4E's"

- RSAs.
    - RSAs are required as part of the Functional Design Report for all HSIP projects. RSAs are incorporated into the project development process for all projects that encompass 5% List locations and segments, even when not HSIP-funded.

  - Local involvement in RSAs is solicited and is required.
  - The HSIP portion of projects funded from multiple sources is typically based on items identified in RSAs.
  - MassDOT uses the Highway Safety Corridor Program as a means to address driver behavioral issues within designated corridors. MassDOT's efforts focus on excessive speed and impaired driving and often include roadside advertising and mobile data collection of vehicle speeds.

- Public Outreach.
  - A $500,000 behavioral public information campaign for bicycle/pedestrian crashes is being used to address all modes and yielding/right-of-way behavior in particular.
  - MassDOT has partnered with regional advocacy groups MassBike and Walk Boston in an effort to deliver messages regarding effective behavioral campaigns to law enforcement personnel.

Identifying Opportunities to Streamline Project Delivery

- Coordination of Project Delivery.
  - MassDOT has dedicated project managers responsible for project delivery. These project managers oversee the preparation of reports, preliminary design and final design, the design waiver process for Design Exception Reports, and all other aspects of project development and delivery once a project is approved to advance to design, for all projects delivered by MassDOT.
  - The MassDOT HSIP Program Manager works to coordinate project readiness with advertisement for bid schedules, and works closely with the Project Managers to ensure the timely completion of all of the elements required for project delivery and construction.
  - The design and funding of projects occur on concurrent tracks. In some cases, funding is appropriated before the project is ready for construction.
  - Ensuring that HSIP projects are prepared for construction is a priority for the TESS.
  - Most projects are delivered with mixed funding sources and project managers are able to work in parallel with the funding staff to ensure that the project is prepared for delivery and is aligned with the proposed funding sources.

- Use of Contractors/Consultants.
    - A consultant works with Headquarters to scope potential HSIP improvements. MassDOT also hires consultants to assist with RSAs.
- HSIP in the STIP.
    - SHSP emphasis area projects are included in the STIP as a separate project, dedicating funding to addressing these issues.

Evaluating the Success of the Program

- MassDOT has not yet begun a full-scale evaluation program for project success and derivation of CMFs.
- MassDOT's safety performance evaluation efforts are primarily based on the use of crash data obtained from police reporting of the roughly 125,000 statewide annual crashes.
- Citation data has been particularly useful to MassDOT as they attempt to understand where behavioral issues are occurring and what countermeasures and public outreach campaigns would be most useful in correcting those behavioral issues.

SUMMARY OF STATE PRACTICES: NEW HAMPSHIRE

Documentation of HSIP Processes

The New Hampshire DOT does not have an HSIP web site, but does maintain HSIP policy and guidelines in their *HSIP Manual and Guidance* document. The *HSIP Manual and Guidance* document addresses safety data, project screening, project selection, and project administration and management. It includes an RSA application (and accompanying process flow diagram) and an HSIP project application, placing all information needed to complete the process in one place.

Coordination with Internal and External Partners

- The NHDOT Executive Office is aware of and involved in the HSIP program, and HSIP receives significant support from the FHWA Division Office.
- HSIP staff are a part of the Design section and work with the State Traffic Engineer and the Highway Safety Engineer to plan, select, deliver, and evaluate projects.
- District Engineers have a solely maintenance function, as the Central Office carries out the functions of planning, design, and traffic operations and safety engineering.

- The NHDOT HSIP Committee includes representatives from FHWA, a local agency, an MPO, an RPC, and various divisions within NHDOT, including design, maintenance, traffic, rail and transit, and those representing the needs of vulnerable users. The Committee reviews and selects projects and meets annually and as necessary to review project progress, identify trends in funding and project development, and address policy and compliance issues related to program performance and FHWA policy changes and guidance.

Understanding the Relationship Between the SHSP and HSIP

- The SHSP addresses nine critical emphasis areas, including impaired driving, distracted driving, and motorcyclists and vulnerable users. Allocation of funding to SHSP initiatives is related to the cause of crashes in the emphasis areas.
- The HSIP Committee evaluates the need for integrating SHSP emphasis areas and oversees the project evaluation processes, ensuring that the HSIP investments are addressing the SHSP objectives and that those same investments are achieving strategic and system safety performance goals, such as the targeted return on investment and expected crash reduction.
- SHSP emphasis areas were the basis of priorities for other agencies, including those responsible for enforcement of non-traffic regulations, such as the liquor control agency and agencies responsible for on-sale serving establishments.
- NHDOT revises the SHSP emphasis areas annually, with an overall revision of the document occurring every four years. This helps align priorities with emerging trends and encourages internal assessment of strategy and direction.
- The SHSP has also emphasized non-infrastructure, non-behavioral needs, particularly by elevating crash data reporting to be an area of emphasis.

Making Data-Driven Safety Decisions

- System Screening, Project Nomination, and Project Selection.
    - There are three means of submitting a project for consideration in the HSIP. The "traditional approach" involves the network screening process and the generated 5% List.
    - The other State-generated candidates are in the "systematic program," which is New Hampshire's means of delivering systemic projects throughout the State highway system.

- Finally, some projects are placed on the candidate list as a result of the RSA program.
- Each of the three candidate generation processes produces a separate list of candidate projects.
- NHDOT does not set a funding allocation for the "traditional," systemic, and RSA-initiated project types.
- The HSIP committee examines the candidate project list, with projects chosen based on the project's size, its ability to be designed and constructed in the short-term, and the b/c ratio generated in the project screening and scoping process, typically obtained from Safety Analyst.

Using Advanced Safety Analysis Methods and Tools

- NHDOT expended a multi-year effort on Safety Analyst development, particularly in the area of data management, data manipulation, and correlation with traditional methods.
- Network screening and multi-criteria screening methods ensure comprehensive examination of corridor, segment, and intersection performance.
- Integration of Safety Analyst into capital investment planning will yield long-term results. Safety Analyst has provided for the transition from observed crash evaluations to SPF-based evaluations and cost-per-countermeasure evaluations.
- Safety Analyst is used by local planning organizations in the development of public works transportation projects.

Addressing Local Road Needs

- Membership on the NHDOT HSIP Committee includes representatives from within NHDOT, from a local agency, an MPO, and an RPC.
- The NHDOT HSIP Committee has been a catalyst for local agency involvement in safety engineering work and traffic safety initiatives in New Hampshire, particularly on account of the four positions for MPO and RPC representatives.
- The RPC/MPO agencies are extremely involved and all nine agencies have the opportunity to participate over the course of a decade as committee members rotate.

Considering All "4E's"

- RSAs.
    - NHDOT established a RSA process to assist the local planning agencies and municipal governments in their efforts to identify and address road safety issues, aiding responsiveness to inquiries regarding safety issues in a community or along a roadway segment.
    - RSA process is State-funded but advanced by local agencies through an application process.
    - RSAs can serve as HSIP project precursors, identifying the scope of improvements in an effort to ensure improved project outcomes.
    - Executing an RSA involves staff from multiple agencies at various levels, including NHDOT maintenance staff from the field offices and RPC/MPO staff.
    - RSA applications are accepted at any time and screened annually, and projects advanced to the HSIP candidate list are evaluated with all other HSIP projects sourced from throughout New Hampshire.
    - NHDOT is considering moving toward an annual solicitation of RSA applications.
- Public Outreach.
    - NHDOT selected "Driving Toward Zero" as an alternative to "Toward Zero Deaths," emphasizing the positive aspect of the program and its focus on the goal and not the present outcomes. The program, deployed by the NHDOT staff and managed by a contractor, was the impetus in transforming the SHSP from an engineering document to an easily-understandable resource that is a tool for engaging the public.
    - Using a second marketing contract, NHDOT performed public outreach activities related to the goals of the new SHSP, building on the awareness efforts and illustrating their partnerships with NHSP and other State agencies.

Identifying Opportunities to Streamline Project Delivery

- Coordination of Project Delivery.
    - The HSIP Committee meets annually and as necessary to review project progress, identify trends in funding and project development, and address policy and compliance issues related to program performance and FHWA policy changes and guidance.

- Use of Contractors/Consultants.
    - New Hampshire maintains two on-call consultant contracts, one for design of projects and the other for analysis. In addition, a consultant is responsible for managing NHDOT's RSA program.
- Program and Project Management Tools.
    - NHDOT developed a spreadsheet-based tracking system for project origination method, scope, progress in project development, HSIP data, and project delivery information.
    - A second spreadsheet-based tracking system was developed to track the funding of HSIP projects.
    - Both of these tools have grown in scope and size, but NHDOT staff continue to manage them in-house, permitting immediate access to data in a structure that is consistent with NHDOT's approach to HSIP program delivery.
- Cost Control and B/C Ratio Preservation.
    - Initial calculations of b/c ratios uses costs with a contingency of 30 percent or more in order to accurately predict the true b/c ratio.
    - NHDOT tracks the expected total cost of a project. Those projects exceeding a cost threshold beyond a percentage of given project cost based on project size are referred to the HSIP Committee for a review to determine continued project eligibility for HSIP funds.
- Establish a Multi-Year Plan and Budget.
    - New Hampshire delivers systemic projects on a multi-year program, focusing on infrastructure, behavioral, and data solutions. The multi-year delivery approach ensures the completion of projects, even if completed over time, and provides for program flexibility when identifying and funding other needs.
- HSIP in the STIP.
    - SHSP emphasis area projects are included in the STIP within the HSIP umbrella project

Evaluating the Success of the Program

- Project evaluation tools provide for the evaluation of projects based on changes in crashes and the outcome b/c ratio.

- NHDOT's evaluation period can include up to six years prior to construction and three to four years following construction; longer periods are key factors in identifying project performance where limited crash frequency impacts statistical variability.

SUMMARY OF STATE PRACTICES: NORTH CAROLINA

Documentation of HSIP Processes

The North Carolina DOT maintains all HSIP documentation on https://connect.ncdot.gov/resources/safety/Pages/NC-Highway-Safety-Program-and-Projects.aspx. This includes mapped HSIP locations from 2010-2014, HSIP Potentially Hazardous Location Detailed Reports by county, intersection reports, bike/pedestrian reports, the active spot safety project list, and the NCDOT Crash Reduction Factor list.

Coordination with Internal and External Partners

- NCDOT has an experienced and capable Traffic Safety Unit within Headquarters. The Traffic Safety Unit manages and includes eight (8) Field Traffic Engineering and Safety offices that serve all of NCDOT's 14 Transportation Divisions and North Carolina's 100 counties.
- In addition to the M&SFO sections, there is a Traffic Safety Systems Section and a Mobility and Safety Information Section. The Traffic Safety Systems Section is comprised of three units, Safety Planning, HSIP, and Safety Evaluation. All three of these units work together to deliver the HSIP in North Carolina, in addition to other safety programs.
- The Traffic Safety Unit's relationship with the GHSP is positive and strong. The Mobility and Safety and GHSP Teams work together to share information, initiatives, leverage resources and coordinate efforts. The GHSP was one of NCDOT's 42 core safety partners in the development of the SHSP development process and GHSP and its Director serve a vital role in NC's Executive Committee for Highway Safety. The Secretary of Transportation chairs the Executive Committee for Highway Safety and NCDOT executive staff and partner agency representatives are actively involved in the committee. The Executive Committee meets three times annually and provides oversight and leadership of North Carolina's safety efforts, particularly in the area of strategic direction and program performance.
- Headquarters conducts network screening to identify potential project locations, Headquarters and Regions work together to identify potential projects, and a project selection committee that includes Headquarters staff and other partner agencies selects the projects.

- NCDOT has a Safety Project Review & Selection Team comprised of the State Traffic Engineer, State Traffic Safety Engineer, Field Operations and Investigations Engineer, M&S Program Manager, Governor's Highway Safety Program representative, and a representative from the Rail Division. They meet quarterly to review, assess, and provide recommendations for candidate Safety Projects for investment under the Department's STIP.

Understanding the Relationship Between the SHSP and HSIP

- The GHSO was one of NCDOT's 42 partners in the development of the SHSP development process.
- The nine emphasis areas in the plan are developed collaboratively with Emphasis Area Working Groups, establishing the problem and goals for each emphasis area.
- The plan drives the Vision Zero initiative in North Carolina and progress toward that is reflected in the SHSP Progress Dashboard, a public-facing web portal.

Making Data-Driven Safety Decisions

- Crash Data Collection and Analysis Tools.
    - Near-immediate availability of crash data owing to relationship with DMV and data held within NCDOT.
    - State and local law enforcement agencies send reports to the North Carolina DMV, submitting 70 percent of crash reports electronically.
    - The DMV system provides comprehensive access to the NCDOT.
    - Availability of all crash report images electronically for instant access to collision diagrams and narratives, provided from central source.
    - NCDOT commitment to open data has provided public-appropriate views of agency performance in safety program delivery, through their online dashboard.
- System Screening, Project Nomination, and Project Selection.
    - NCDOT uses a safety warrants system for project screening, prioritizing, and selecting projects on the basis of b/c ratio. The safety warrants system is used to identify locations that have a demonstrated need for safety improvements. This warrant system is divided into three areas: Intersections, Highway Sections (non-freeway, freeway, and city-maintained), and Bicycle and Pedestrian sites.
    - NCDOT also uses a Safety Index Decision Support Tool to provide for analysis of projects where b/c data availability is insufficient.

- The Safety Warrants are updated on a routine basis using crash data analysis.
- All projects are selected quarterly by a project selection process and team comprised of Headquarters staff.
- NCDOT selects HSIP projects on the basis of safety b/c and prioritizes and reviews systemic and Spot Safety projects using a decision support tool (Safety Index) and the detailed project packets.
- NCDOT works to ensure that smaller projects are incorporated into the program and not eliminated on account of the funding demands from larger high-profile projects.
- The NCDOT Spot Safety process uses a Safety Index Decision Support tool with the Safety Index comprising both Safety and Responsiveness indices. The Safety Index Decision Support tool provides a programmatic approach to project selection from an overall list, whether or not the project is HSIP-involved. The entire process is driven by data (field verified) and rigorous analysis, with extensive documentation of criteria.

Addressing Local Road Needs

- The North Carolina Local Safety Partnership is a pilot program involving a cooperative effort between NCDOT and the UNC-HSRC. The purpose of the program is to introduce communities to the concepts required to implement low-cost safety improvements in a data-driven traffic engineering program.
- NCDOT funds are used to establish a training program for local agency staff to strengthen their safety programs (understanding crash analyses and the importance of documented evaluation procedures) as well as sharing ideas quarterly in conference call setting.
- HSIP funding is used to deploy low-cost safety improvements, minimizing impact on community budgets.
- Evaluation of the partnership program focuses both on safety outcomes and policy outcomes for community public works departments.

Considering All "4E's"

- RSAs.
  - NCDOT's Road Safety Review/Audit (RSA) Program is designed and managed to reduce crashes and injuries by generating safety projects/actions, assist field staff

in addressing persistent safety problem areas, and improve collaboration amongst stakeholders.

- NCDOT conducts RSAs in an effort to support HSIP project origination and project development.
- NCDOT RSAs are conducted with Department-wide support to ensure perspectives of trained personnel who understand NCDOT policy and procedures.
- Local stakeholders can bring RSA requests forward for both State-maintained and non-State maintained roadways and NCDOT will assist in either case.
- NCDOT conducts RSAs on corridors with multiple HSIP locations, and they also query the Field Engineers and Field Division staff for locations where RSAs could lead to potential HSIP projects.
- Staff from regions throughout the State participate in the RSAs in other regions, ensuring an outside perspective is obtained in the RSA process.

Identifying Opportunities to Streamline Project Delivery

- Coordination of Project Delivery.
  - NCDOT funds the delivery of safety projects using two primary investment mechanisms: the Federally-funded HSIP and the State funded Spot Safety program.
  - Delivery in both programs, for design, bidding, and construction, is overseen by M&S Division through the regional offices, the M&S Programs Manager and in coordination with the 14 Division Offices and NCDOT Program Management.
  - Systemic projects and initiatives in North Carolina are funded using a dedicated portion of HSIP funding, currently estimated at 20-30 percent of the State's annual appropriation.
  - NCDOT makes extensive use of headquarters, Division and District staff, and including the RTE and M&S personnel, for the purposes of developing project scope, design, and project delivery. NCDOT is evaluating a variety of methods to improve project delivery timelines and reduce the overall cost of delivering HSIP projects. Examples include combining multiple related safety projects in a single contract, the use of the design-build delivery mechanism for fast-track delivery of projects with well-defined scope, and the use of on-call contractors to facilitate immediate delivery of identified projects.

- Use of Contractors/Consultants.
    - North Carolina uses consultants for design, project evaluation.
    - Established LSAs provide an opportunity to use on-call contractors to deploy and conduct surveys quickly (for improved estimates), project hearings and expedited designs for safety projects without the need for additional contract advertisement and the associated time and cost impacts.
- HSIP in the STIP.
    - Generally, each HSIP project location has its own individual STIP number. However, NCDOT also programs projects that have multiple locations with a certain type of improvement. For example, they have had projects in each Division to install 6 in. long life pavement markings over numerous routes. Each of those Division projects had one STIP number; e.g., 14 Divisions, 14 STIP numbers, numerous routes per Division.

Evaluating the Success of the Program

- A publicly-available Organizational Performance Dashboard provides such metrics as the fatality rate and fatality and crash trends, delivery rate for projects, delay due to incidents, and other information related to the NCDOT programs and outcomes.
- For each completed safety project, the NCDOT M&S Traffic Safety Unit conducts a Safety Evaluation. This evaluation includes project information, collision diagrams, and analysis of before and after crash frequency and severity. The analysis period is typically three years, but it can be extended for sites with a low pre-project crash rate. This Safety Evaluation is shared with the Region staff and demonstrates the success of the investment.
- NCDOT also conducts Empirical Bayes evaluation of multiple site locations with similar countermeasure installations, which facilitates distinguishing between different treatments and the development of CMFs. The evaluations can be site-specific or taken across multiple similar sites.
- NCDOT also conducts a program-wide evaluation, undertaken program-wide for a Spot Safety or HSIP projects.
- The institutional establishment of this evaluation program and the various facets it encompasses has assisted NCDOT staff in retaining safety project funding from NCDOT and even obtaining increases in funding.
- The evaluation of project performance has also impacted other areas of NCDOT operations, leading to increased confidence in NCDOT investments.

SUMMARY OF STATE PRACTICES: OREGON

Documentation of HSIP Processes

The Oregon Department of Transportation provides HSIP related guidance and materials on its ARTS web site - http://www.oregon.gov/ODOT/HWY/TRAFFIC-ROADWAY/Pages/ARTS.aspx. This includes a list of 120 safety countermeasures, safety implementation plans for the three focus areas of roadway departure, intersections, and pedestrian/bicycle, and example business cases for safety projects.

Coordination with Internal and External Partners

- HSIP is delivered through the All-Roads Transportation Safety Program (ARTS). Oregon delivers the HSIP using Central Office-originated screening processes that rely on input from the ARTS staff in each Region. The five ODOT Regions locally manage the ARTS program, with ARTS oversight responsibilities assigned to the Regional Traffic Engineer/Manager. The ARTS staff in the regions then select the projects and supervise the design of selected projects, delivering them through the conventional capital construction program using HSIP funds.
- The involvement of these Central Office technical staff, in cooperation with the local agencies throughout the selection process, was a major contributor to local understanding of how projects were prioritized and what factors contributed to a project not being selected, with local agencies viewing the Central Office involvement as highly objective.
- ODOT's use of consultants in screening and project development efforts results in a greater degree of acceptance because the consultants serve as an independent third party following the process.
- Outreach efforts involve coordination between the GHSO TSD Region Safety Coordinator and ARTS staff in each Region. The Oregon Traffic Control Devices Committee (OTCDC) can bring needs to the TSD and they typically allocate 402 funds to address those needs.

Understanding the Relationship Between the SHSP and HSIP

- ODOT worked with the Governor's Highway Safety Office to integrate engineering and safety work into a mature behavioral Transportation Safety Action Plan (TSAP), the precursor to the SHSP and today is the ODOT name for the SHSP.
- The systemic component of the ARTS Program is divided into three emphasis areas: roadway departure, intersections, and pedestrian/bicycle. The 2011 Edition of the TSAP

identified these three emphasis areas as high priority areas for improving safety. In order to address this, ODOT developed Safety Implementation Plans for these areas. In last few years, ODOT has delivered many projects in these areas.

- Part of the relationship between the TSAP and HSIP is the Data-Driven process for the Safety Management System (Action 24 in the TSAP). The HSIP uses the Safety Management System, data derived from the system, and processes to select HSIP projects. The Safety Management System was used during HSIP screening, selection, and development of the Hot Spot projects.

Making Data-Driven Safety Decisions

- Crash Data Collection and Analysis Tools.
    - Crash data is GIS-based and robust, but is missing a linear referencing system. Every crash is coded so that the latitude/longitude location can be analyzed through GIS.
- System Screening, Project Nomination, and Project Selection.
    - Program is data-driven and based on b/c analysis, focusing on projects that will deliver the highest reduction in serious injuries and fatalities in comparison to the project cost.
    - Funding is divided to each region based on the number of fatalities and serious injury crashes. Potential projects within each region are prioritized by their benefit cost. The available money is separated evenly into two categories — hot spots and systemic.
    - ODOT hired a consultant to create a draft list of potential hot spot projects (prioritized based on b/c ratios) for all roads in each Region identifying locations and the appropriate countermeasures. Spot project selection is based on Fatal and Injury A crashes only.
    - The process for systemic projects is an application-based process. Projects are selected triennially. Two ODOT Regions hired consultants to help local agencies fill the applications. Local Agencies and ODOT Regions submit applications for systemic projects in three focus areas — roadway departure, intersections, and pedestrian/bicycle. Projects are prioritized based on benefit cost ratio (for roadway departure and intersections projects) and cost-effectiveness index (pedestrian/bicycle projects). ODOT does not require systemic project locations to demonstrate a history of Fatal and Injury-A crashes, recognizing that systemic project implementations are often undertaken in locations that are characteristically similar to locations with demonstrated crash histories.

- As part of the ARTS Program, ODOT developed a list of countermeasures, known as the ODOT CRF List, which will be revised as new countermeasures become available. The treatments to be used on priority corridors are identified in ODOT's Systemic Plans document. ODOT has 120 countermeasures available.
- ODOT uses the CEI for bicycle/pedestrian projects. The CEI is the quotient of the number of correctable bicycle/pedestrian crashes and the cost of the bicycle/pedestrian project. ODOT considers the CEI to be a tool for data-driven evaluation of bicycle- and pedestrian-focused HSIP projects.

Using Advanced Safety Analysis Methods and Tools

- Oregon identified that current network screening methods may not be sufficient to select and/or prioritize intersections with very high traffic volumes. Development of a new advanced technique using the Empirical-Bayes method may be necessary to properly identify the best potential intersection projects when signalized intersections are operating in excess of design capacity.

Addressing Local Road Needs

- ODOT worked with the AOC and the LOC to create a jurisdictionally-blind process for project nomination and selection.
- The local agencies have generally been very receptive to the ARTS program and appreciate ODOT's desire to provide assistance in screening and project development. Many local agencies identified the ODOT-managed screening process as an asset, given local agency staff limitations.
  Local agencies find the application process to be straightforward and they appreciate the ability to participate in the selection of countermeasures. The applications are available directly from the ARTS web site and Region ARTS staff have been extremely approachable and helpful as agencies looked to apply with projects to be included in the selection process. Some regions hold workshops with stakeholders to identify locations that are candidates for applications.
- The knowledge transfer associated with local access to ARTS personnel has been extremely helpful.

- Considering All "4E's"
- Public Outreach.
    - All projects have a community outreach component, typically managed by ODOT staff.
    - ODOT coordinates with the GHSO Region Safety Coordinator and ARTS staff in each Region to deliver community outreach behavioral programs.
- Use of RSAs.
    - Although use of RSA's are not requirement of Oregon's HSIP process, the information from completed RSAs is often used in the scoping process.

Identifying Opportunities to Streamline Project Delivery

- Coordination of Project Delivery.
    - The ARTS staff in the regions select the projects and supervise the design of selected projects, delivering them through the conventional capital construction program using HSIP funds.
- Use of Contractors/Consultants.
    - Oregon hired a consultant to draft a list of potential hot spot locations when implementing the ARTS program. During the initiation of ARTS, two ODOT Regions hired consultants to help local agencies fill the applications for systemic projects. In addition, ODOT uses consultants for screening and project development.
- HSIP in the STIP.
    - Under the ARTS Program, most selected projects are programmed into the STIP on an individual basis. ODOT anticipates that all projects under the ARTS Program will be stand-alone safety projects. However, Regions might decide to bundle similar safety projects into larger projects for efficient project development and delivery.

Evaluating the Success of the Program

- ODOT is evaluating cost/benefit and implementations of systemic measures for some crash types. The HSIP report is the primary means of obtaining this information, a naïve aggregate-of-projects comparison at this standpoint, including 3-year before/after studies.

- ARTS has a 90 percent approval rating for project success, from a subjective survey of stakeholders.
- ODOT will do before-and-after evaluations for system changes, such as the speed limit increase on US 95 and I-84 in Eastern Oregon.

SUMMARY OF STATE PRACTICES: UTAH

Documentation of HSIP Processes

The Utah Department of Transportation provides their HSIP Manual at http://www.udot.utah.gov/main/f?p=100:pg:0:::1:T,V:2933. The Manual includes information on program oversight and funding, special rules, reporting information, and flowcharts depicting the processes for both infrastructure and non-infrastructure projects.

Coordination with Internal and External Partners

- The Utah safety culture is an internal, behavior-based program for employees that influences every aspect of the UDOT program delivery, from inception and planning to construction and operations. This culture change is seen not as a program or a training event, but rather as an investment by employees who are empowered by managers to respond to and address all safety concerns at every level.
- The Traffic and Safety Division undertakes the process of planning HSIP projects using a screening process, which includes the analysis and prioritization. Once a prioritized list is developed, from the annual screening, projects are programmed from a pool of eligible HSIP projects, by the State Traffic Safety Engineer. The implementation of the projects is carried out using the typical delivery channels for transportation infrastructure projects within UDOT.
- The Region Traffic Engineers have safety engineering functions and direct involvement in HSIP deployment.
- The Traffic Safety Engineer programs all HSIP projects, working closely with the Department's project development staff. In general, the HSIP is programmed in excess of annual apportionment, with the expectation of returned funds from closed projects and constructed projects with less-than-expected bids. Additionally, programming in excess of apportionment also accommodates delayed projects.
- UDOT's Safety Leadership Executive Committee includes executive-level representatives from the Department of Public Services, Department of Health, UDOT, Federal Motor Carrier Safety Administration, and National Highway Traffic Safety Administration.

- UDOT works closely with the FHWA Utah Division Office to ensure HSIP program objectives align with FHWA strategic and tactical initiatives.
- UDOT's partnerships with the University of Utah and Brigham Young University have led to substantial advancements in the understanding of crash prediction modeling and the success of safety countermeasures.

Understanding the Relationship Between the SHSP and HSIP

- UDOT considers the emphasis areas of the SHSP when screening and selecting projects for advancement into the HSIP; this accomplishes both strategic and operational goals.

Making Data-Driven Safety Decisions

- Crash Data Collection and Analysis Tools.
    - In Utah the Department of Public Safety developed the statewide crash database, which receives electronic input from all of Utah's police agencies.
    - UDOT contracted with Numetric to provide a crash query and safety data investigation system that analyzes crashes and suggests countermeasures.
- System Screening, Project Nomination, and Project Selection.
    - Projects are selected based on the b/c ratio and the highest ability to reduce crashes, in addition to the likelihood of coordination with other projects in an effort to optimize investments.
    - UDOT's flexibility permits HSIP funds as a supplement to project funds for follow-on safety improvements not otherwise incorporated into a project. The programming process works within a three year timeframe and the Regions deliver the projects using Region construction administration staff.
    - UDOT differentiates between spot improvements (reactive projects) and systemic improvements (proactive projects).
    - The UDOT HSIP screening process studies roadways with similar characteristics, with analysis of crash data, in an effort to determine systemic improvements implemented system-wide. Some system-wide projects use a prioritization system, which uses crash performance to allocate projects among multiple levels of priority, including use of a weighted average for Fatal and Injury-A crashes.

Using Advanced Safety Analysis Methods and Tools

- UDOT delivers their HSIP using several analysis tools: Numetric, FHWA Systemic Safety Tool, usRAP, and the Utah Crash Prediction Model.

Addressing Local Road Needs

- The State Highway Safety Office and UDOT assist the local agencies by providing network screening and data analysis.
- Local agency staff can use a toolbox of proven countermeasures developed by UDOT to address safety problems, particularly in the preparation of HSIP project applications. The toolbox is available online.

Considering All "4E's"

- Public Outreach.
    - UDOT's recognition that 93 percent of crashes have a correctable behavioral component has led to the development of a strong behavioral education program.
    - UDOT has a coordinated effort to send consistent messages related to Zero Fatalities. All public information campaigns are branded as a joint effort, showing the cooperative atmosphere, and developed to address some behavioral issues identified in the SHSP. Funding is appropriated for paid media and public outreach activities. Outreach efforts include more than 50 events every year and additional events at high schools that target typical risky behaviors associated with younger drivers. The biennial Zero Fatalities conference is another way in which UDOT brings partners together to advance the traffic safety culture within Utah.
    - Utah's approach to safety outreach has been to create positive messages, particularly related to restraint use and driving habits. As UDOT and DPS have worked together to achieve saturation in their public relations efforts, the agencies have made use of many available outlets, including variable message signs. In the case of the message signs, "Monday Safety Messages" set a safety theme for a given week. Utah's Zero Fatalities staff manage an active social media presence, using social media and video sharing platforms with a single, cohesive marketing strategy to disseminate the message using conventional and social media outlets and in cooperation with UDOT traffic operations.
    - The Department of Public Safety uses HSIP funds. HSIP funds are transferred for a specific project or enforcement activity area and UDOT is billed by DPS for

reimbursement by means of the memorandum of understanding between the agencies. At this time, DPS receives reimbursement only for enforcement programs related to seat belt use, exceeding the posted speed limit, and aggressive driving.

Identifying Opportunities to Streamline Project Delivery

- Coordination of Project Delivery.
  - The implementation of the projects is carried out using the typical delivery channels for transportation infrastructure projects within UDOT.
- Coordination with 3R Projects.
  - Where possible, UDOT works within the project delivery calendar to coordinate the delivery of HSIP projects with 3R projects to reduce contract costs.
- Use of Contractors/Consultants.
  - Consultants have developed some of the safety analysis and project tracking tools, including consultants retained to assist UDOT in managing the HSIP.
- Program and Project Management Tools.
  - UDOT developed the WorkFlow Manager (WFMan) tool, with support from a consultant, to enter, view, evaluate, rank, program, and track all UDOT HSIP applications and projects. Access is provided via a web interface and allows for unlimited users, including UDOT staff, consultants, and local government partners.
  - WFMan provides HSIP funding applicants the ability to submit applications, perform real-time edits and revisions, receive summary notifications, and track the status of each application as it progresses through the evaluation, ranking, and programming process.
  - UDOT HSIP program managers use WFMan to review and qualify applications based on standardized ranking and eligibility criteria.
  - As projects are initiated, WFMan tracks key project information to provide program managers the ability to monitor schedules, track project and program cash flow, document project-related decisions, and inform leadership.
- HSIP in the STIP and Establish a Multi-Year Plan and Budget.
  - The programming of projects in the STIP by including HSIP as a program over a three-year time span in the STIP provides UDOT with the flexibility necessary to

move projects between fiscal years to accommodate project delays. It also provides opportunities to advance projects for construction and ensures flexibility for the addition of new projects to address emerging issues.

Evaluating the Success of the Program

- UDOT uses three-year before/after comparisons of completed projects to analyze the performance of every HSIP project and develops State-specific CMFs.

APPENDIX D: HSIP RESOURCES

OFFICE OF SAFETY HSIP RESOURCES

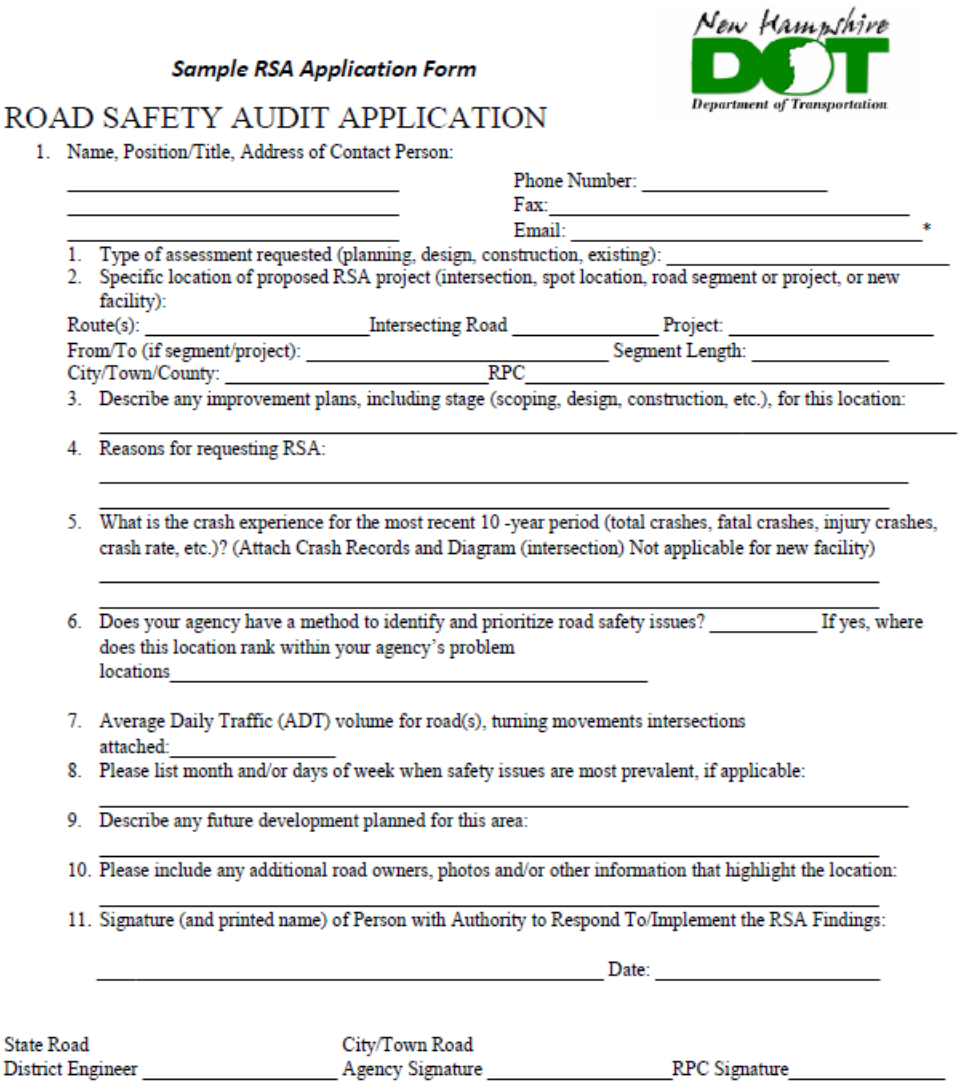
- HSIP Web Site - http://safety.fhwa.dot.gov/hsip/.
- HSIP Reports - http://safety.fhwa.dot.gov/hsip/reports/.

HOST STATE HSIP WEB SITES

- Alaska - http://www.dot.state.ak.us/stwddes/dcstraffic/hsip.shtml.
- Illinois - http://www.idot.illinois.gov/transportation-system/local-transportation-partners/county-engineers-and-local-public-agencies/funding-opportunities/highway-safety-improvement-program.
- Massachusetts - http://www.massdot.state.ma.us/highway/Departments/TrafficandSafetyEngineering/HighwaySafety/HighwaySafetyImprovementProgram.aspx.
- North Carolina - https://connect.ncdot.gov/resources/safety/Pages/NC-Highway-Safety-Program-and-Projects.aspx.
- NCDOT Safety Evaluations - https://connect.ncdot.gov/resources/safety/Pages/Safety-Evaluation.aspx.
- Oregon - http://www.oregon.gov/ODOT/HWY/TRAFFIC-ROADWAY/Pages/ARTS.aspx.
- Utah - http://www.udot.utah.gov/main/f?p=100:pg:0:::1:T,V:2933.

NEW HAMPSHIRE HSIP FORMS

The New Hampshire DOT does not maintain a public facing web site with HSIP information. Samples of the RSA Application and HSIP Project Application are included on the following pages.



Sample RSA Application Form

ROAD SAFETY AUDIT APPLICATION

1. Name, Position/Title, Address of Contact Person:

_____ Phone Number: _____
_____ Fax: _____
_____ Email: _____ *

1. Type of assessment requested (planning, design, construction, existing): _____
2. Specific location of proposed RSA project (intersection, spot location, road segment or project, or new facility):

Route(s): _____ Intersecting Road _____ Project: _____
From/To (if segment/project): _____ Segment Length: _____
City/Town/County: _____ RPC _____

3. Describe any improvement plans, including stage (scoping, design, construction, etc.), for this location:

_____

4. Reasons for requesting RSA:

_____
_____

5. What is the crash experience for the most recent 10 -year period (total crashes, fatal crashes, injury crashes, crash rate, etc.)? (Attach Crash Records and Diagram (intersection) Not applicable for new facility)

_____
_____

6. Does your agency have a method to identify and prioritize road safety issues? _____ If yes, where does this location rank within your agency's problem locations _____

7. Average Daily Traffic (ADT) volume for road(s), turning movements intersections attached: _____
8. Please list month and/or days of week when safety issues are most prevalent, if applicable:

_____

9. Describe any future development planned for this area:

_____

10. Please include any additional road owners, photos and/or other information that highlight the location:

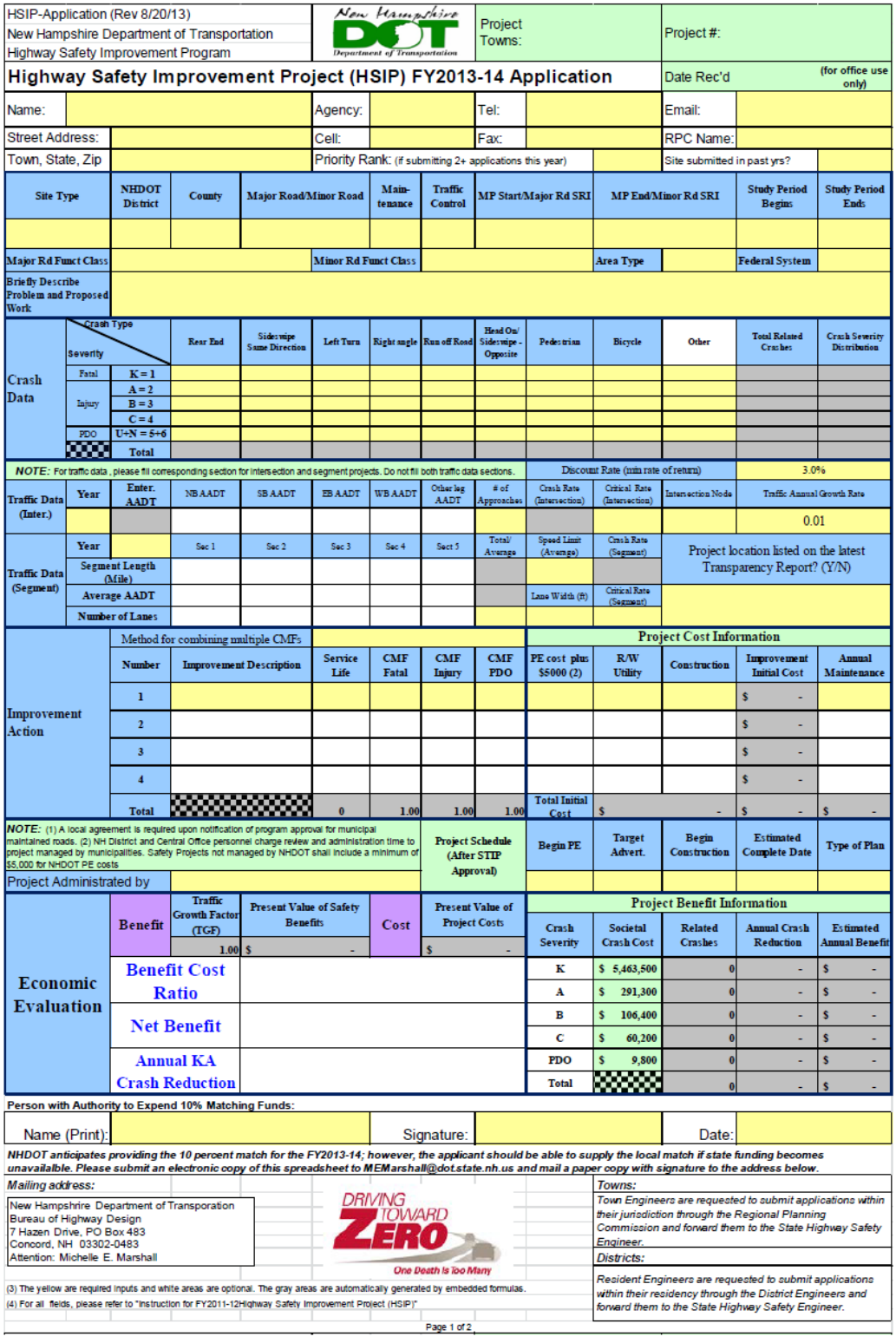
_____

11. Signature (and printed name) of Person with Authority to Respond To/Implement the RSA Findings:

_____ Date: _____

State Road
District Engineer _____ City/Town Road
Agency Signature _____ RPC Signature _____

Figure 20. RSA application.



HSIP-Application (Rev 8/20/13)
New Hampshire Department of Transportation
Highway Safety Improvement Program

Project Towns:

Project #:

Highway Safety Improvement Project (HSIP) FY2013-14 Application

Date Rec'd (for office use only)

Name:		Agency:		Tel:		Email:	
Street Address:		Cell:		Fax:		RPC Name:	
Town, State, Zip		Priority Rank: (if submitting 2+ applications this year)				Site submitted in past yrs?	

Site Type	NHDOT District	County	Major Road/Minor Road	Main-tenance	Traffic Control	MP Start/Major Rd SRI	MP End/Minor Rd SRI	Study Period Begins	Study Period Ends

Major Rd Funct Class		Minor Rd Funct Class		Area Type		Federal System	

Briefly Describe Problem and Proposed Work

Crash Data	Severity		Rear End	Sideswipe Same Direction	Left Turn	Right angle	Run off Road	Head On/ Sideswipe - Opposite	Pedestrian	Bicycle	Other	Total Related Crashes	Crash Severity Distribution
	Fatal	K = 1											
	Injury	A = 2											
		B = 3											
		C = 4											
	PDO	U+N = 5+6											
		Total											

NOTE: For traffic data , please fil corresponding section for intersection and segment projects. Do not fil both traffic data sections.

Discount Rate (min rate of return): 3.0%

Traffic Data (Inter.)	Year	Enter. AADT	NB AADT	SB AADT	EB AADT	WB AADT	Other leg AADT	# of Approaches	Crash Rate (Intersection)	Critical Rate (Intersection)	Intersection Node	Traffic Annual Growth Rate
												0.01

Traffic Data (Segment)			Sec 1	Sec 2	Sec 3	Sec 4	Sect 5	Total/ Average	Speed Limit (Average)	Crash Rate (Segment)	Project location listed on the latest Transparency Report? (Y/N)
	Year										
	Segment Length (Mile)										
	Average AADT								Lane Width (ft)	Critical Rate (Segment)	
	Number of Lanes										

Method for combining multiple CMFs

Improvement Action	Number	Improvement Description	Service Life	CMF Fatal	CMF Injury	CMF PDO	PE cost plus $5000 (2)	R/W Utility	Construction	Improvement Initial Cost	Annual Maintenance
	1									$ -	
	2									$ -	
	3									$ -	
	4									$ -	
	Total		0	1.00	1.00	1.00	Total Initial Cost	$ -		$ -	$ -

NOTE: (1) A local agreement is required upon notification of program approval for municipal maintained roads. (2) NH District and Central Office personnel charge review and administration time to project managed by municipalities. Safety Projects not managed by NHDOT shall include a minimum of $5,000 for NHDOT PE costs

Project Administrated by		Project Schedule (After STIP Approval)	Begin PE	Target Advert.	Begin Construction	Estimated Complete Date	Type of Plan

Economic Evaluation	Benefit	Traffic Growth Factor (TGF)	Present Value of Safety Benefits	Cost	Present Value of Project Costs
		1.00	$ -		$ -
	Benefit Cost Ratio				
	Net Benefit				
	Annual KA Crash Reduction				

Project Benefit Information

Crash Severity	Societal Crash Cost	Related Crashes	Annual Crash Reduction	Estimated Annual Benefit
K	$ 5,463,500	0	-	$ -
A	$ 291,300	0	-	$ -
B	$ 106,400	0	-	$ -
C	$ 60,200	0	-	$ -
PDO	$ 9,800	0	-	$ -
Total		0	-	$ -

Person with Authority to Expend 10% Matching Funds:

Name (Print):		Signature:		Date:	

NHDOT anticipates providing the 10 percent match for the FY2013-14; however, the applicant should be able to supply the local match if state funding becomes unavailalble. Please submit an electronic copy of this spreadsheet to MEMarshall@dot.state.nh.us and mail a paper copy with signature to the address below.

Mailing address:

New Hampshrire Department of Transporation
Bureau of Highway Design
7 Hazen Drive, PO Box 483
Concord, NH 03302-0483
Attention: Michelle E. Marshall

DRIVING TOWARD ZERO
One Death is too Many

Towns:
Town Engineers are requested to submit applications within their jurisdiction through the Regional Planning Commission and forward them to the State Highway Safety Engineer.

Districts:
Resident Engineers are requested to submit applications within their residency through the District Engineers and forward them to the State Highway Safety Engineer.

(3) The yellow are required inputs and white areas are optional. The gray areas are automatically generated by embedded formulas.
(4) For all fields, please refer to "Instruction for FY2011-12Highway Safety Improvement Project (HSIP)"

Page 1 of 2

Figure 21. HSIP project application spreadsheet (page 1).

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For More Information:

http://safety.fhwa.dot.gov

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