Highway Safety Improvement Program
2016 National Summary Report

FHWA Safety Program

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Federal Highway Administration

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16. Abstract

The HSIP 2016 National Summary Report compiles and summarizes aggregate information related to the States' progress in implementing HSIP projects. Progress in implementing HSIP projects is described based on the amount of HSIP funds available and the number and general listing of projects obligated during the 2016 reporting cycle. The HSIP 2016 National Summary Report is not intended to compare states; rather to illustrate how the states are collectively implementing the HSIP to reduce fatalities and serious injuries on all public roads across the nation. The HSIP 2016 National Summary Report also presents a national benefit cost ratio for the HSIP.

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Executive Summary

The Highway Safety Improvement Program (HSIP) is a core Federal-aid highway program with the purpose to achieve a significant reduction in fatalities and serious injuries on all public roads. Under the Fixing America's Transportation System (FAST) Act, Congress authorized up to $2.4 billion per year for States to achieve this goal through the implementation of highway safety improvement projects. The States not only met this challenge, but far exceeded it obligating nearly $4 billion for over 4,400 highway safety improvement projects in 2016.

These highway safety improvement projects come in all shapes and sizes. Some HSIP projects are much bigger in scope than others, while other projects include countermeasure installations across multiple sites. The 2016 HSIP National Summary Report provides an aggregate summary of the type and cost of projects across all States. Provided below are highlights of the States' 2016 HSIP implementation efforts.

- Most States have intersection (30 States) and roadway departure (29 States) programs.
- States continue to use crash frequency and crash rate to identify projects in a majority of their safety programs.
- A majority (roughly 63 percent) of HSIP projects cost less than $500,000 each, with 25 percent of all projects costing less than $100,000.
- About 24 percent of HSIP projects would be considered high cost, coming in at over $1 million each. These projects often include widening shoulders, installing cable barrier, adding auxiliary lanes, or other miscellaneous intersection geometry and roadway projects.
- Projects associated with a functional class were most often categorized as rural major collector or other urban principal arterial.
- Projects on rural principal arterial freeways and expressways had the highest average total cost per project of $2.4 million, whereas projects on rural local roads or streets had the lowest average total cost per project of $475,000.
- There are fewer urban projects than rural projects but the average total cost per project of the urban projects is greater than the average total cost per project of the rural projects.
- About 70 percent of highway safety improvement projects occur on roads owned by the State Highway Agency.
- Projects on roads owned by City or Municipal Highway Agencies had the highest average total cost per project of $1.6 million, while State Highway Agencies had the third highest average total cost per project of approximately $1.2 million. Projects on roads owned by State Park, Forest, or Reservation Agency had the lowest average cost at just under $32,000.
- A majority (67%) of highway safety improvement projects falls into the following categories: roadway, intersection traffic control, intersection geometry, roadside, and roadway signs and traffic control.
- On average, States obligated 38 percent of HSIP funds to address systemic safety improvements.
- Advanced technology and ITS, shoulder treatments, and alignment have the highest average cost per project; whereas parking, roadway signs and traffic control, and non-infrastructure projects have the lowest average cost per project.
- States use HSIP funds to address the predominant infrastructure-related crash types – roadway departure, intersection, and pedestrian crashes.

While the spending patterns don't change much form year to year, the number and cost of HSIP projects has continued to increase. There were 1,684 projects with a total cost of $1.61B in 2009 compared to 4,468 projects with a total cost of $4.03B in 2016. Over the past eight years, States obligated $20.6 billion for more than 24,000 highway safety improvement projects. Based on a sample of 2016 HSIP projects, FHWA estimates that the benefits of the HSIP outweigh the costs on a scale ranging from 4.4 to 6.5.

Background

The Highway Safety Improvement Program (HSIP) is a core Federal-aid highway program with the purpose to achieve a significant reduction in traffic fatalities and serious injuries on all public roads through the implementation of highway safety improvement projects. The HSIP, similar to other Federal-aid highway programs, is a federally-funded, state administered program. The FHWA establishes the HSIP requirements via 23 CFR Part 924, and the States develop and administer a program to best meet their needs.

The HSIP requires a data-driven, strategic approach to improving highway safety on all public roads that focuses on performance[1]. To obligate HSIP funds, each State shall:

- Develop, implement, and update a State strategic highway safety plan;
- Produce a program of projects or strategies to reduce identified safety problems; and
- Evaluate the SHSP on a regularly recurring basis. [23 U.S.C. 148(c)(1)]

States are also required to submit a report that describes the progress being made to implement highway safety improvement projects and the effectiveness of those improvements. [23 U.S.C. 148(h)] States prepared the 2016 reports using the *HSIP MAP-21 Reporting Guidance*, dated February 13, 2013. The HSIP MAP-21 Reporting Guidance outlines the content and schedule for the annual HSIP report. The HSIP report should include, at a minimum, a discussion of each State's:

- Program Structure
- Progress in Implementing the HSIP projects
- Progress in Achieving Safety Performance Targets
- Assessment of the Effectiveness of the Improvements (Program Evaluation)

The HSIP 2016 National Summary Report compiles and summarizes aggregate information related to the States progress in implementing HSIP projects during the 2016 reporting cycle. Progress in implementing HSIP projects is described based on the amount of HSIP funds available and the number and general listing of projects obligated as documented in the 2016 HSIP reports. The HSIP 2016 National Summary Report is not intended to compare states; rather to illustrate how the states are collectively implementing the HSIP to reduce fatalities and serious injuries on all public roads across the nation. The HSIP 2016 National Summary Report also presents a national benefit cost ratio for the HSIP.

A summary of available funding and the number and general listing of projects from prior years is available in the HSIP National Summary Baseline Report: 2009 -2012, HSIP 2013 National Summary Report, HSIP 2014 National Summary Report, and HSIP 2015 National Summary Report.

HSIP Funding Approach

The FAST Act authorizes a single amount for each year for all the apportioned highway programs combined. That amount is apportioned among the States, and then each State's apportionment is divided among the individual apportioned programs.

[1] FHWA, Fast Act HSIP Fact Sheet, February 2016. https://www.fhwa.dot.gov/fastact/factsheets/hsipfs.cfm

The FAST Act (Section 1101) authorizes a total combined amount ($39.7 billion in FY 2016, $40.5 billion in FY 2017, $41.4 billion in FY 2018, $42.4 billion in FY 2019, and $43.4 billion in FY 2020) in contract authority to fund six formula programs (including certain set-asides within the programs described below):

- National Highway Performance Program (NHPP);
- Surface Transportation Block Grant Program (STBG);
- **Highway Safety Improvement Program (HSIP);**
- Congestion Mitigation and Air Quality Improvement Program (CMAQ);
- Metropolitan Planning; and
- The new National Highway Freight Program (NHFP)[2].

Figure 1 illustrates the distribution of funds across programs under the FAST Act.

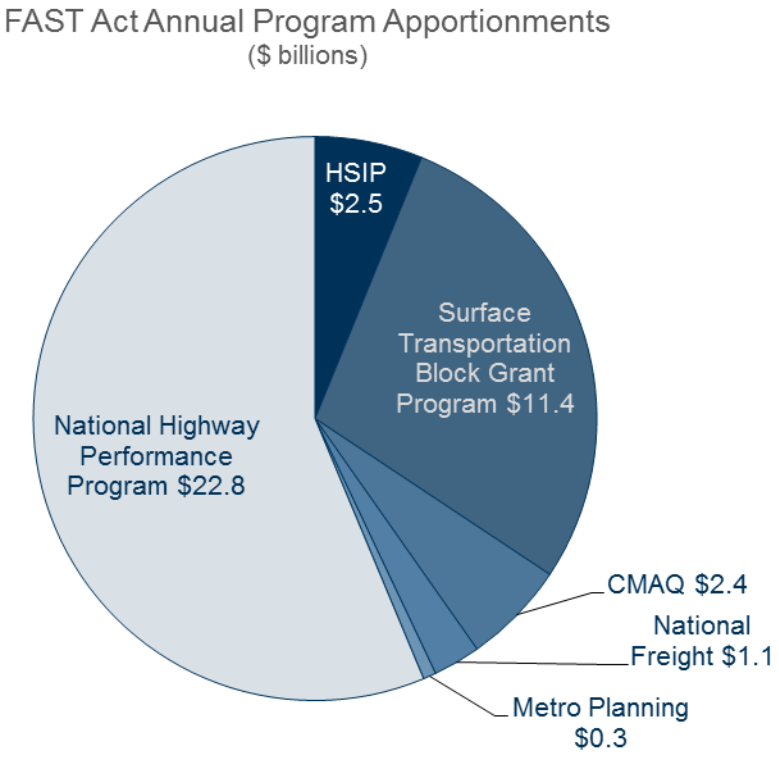

Figure 1: FAST Act Annual Program Apportionments

HSIP receives 7% of the States apportionment remaining after allocations to NHFP, CMAQ and Metropolitan Planning, which amounts to approximately $2.5 billion each year. The following sums are set-aside from the State's HSIP apportionment:

- Railway-highway crossings -- $230 million [23 U.S.C. 130(e)]; and
- 2% for State Planning and Research (SPR). [23 U.S.C. 505(a)]

[2] FHWA, Fast Act Apportionment Fact Sheet, February 2016.
https://www.fhwa.dot.gov/fastact/factsheets/apportionmentfs.cfm

In addition, if the High Risk Rural Roads Special rule applies to a State, then in the next fiscal year the State must obligate an amount at least equal to 200% of its FY 2009 HRRR set-aside for high risk rural roads. [23 U.S.C. 148(g)] Further, States that are subject to the 23 U.S.C. 154 and 164 penalties may also receive additional funding for HSIP projects.

HSIP funds, as defined for the remainder of this report, includes HSIP, HRRR and penalty transfer funds that are available to States for the advancement of highway safety improvement projects.

Data-Driven Safety Decision Making

Beginning in 2016, the HSIP National Summary Report includes an evaluation of how states are using data-driven safety decision making to support their HSIP. This includes the States safety program administered under the HSIP and the methodologies states use to identify projects in each of these programs, as well as the amount of funds used for systemic improvements. On average, States obligated 38 percent of HSIP funds to address systemic improvements. The following sections and figures present information on State's safety programs and problem identification methodologies.

State Safety Programs Administered Under HSIP

States provide a brief overview of each program administered under the HSIP as part of their annual HSIP report. The HSIP Manual[3] defines a program as a group of projects (not necessarily similar in type or location) implemented to achieve a common highway safety goal. For example, some States have one program that includes all projects resulting from the HSIP planning component. Other States have multiple "sub" programs. An example of a "sub" program may be a skid treatment program designed to reduce wet-weather-related crashes at different locations. Some States also refer to "sub" programs as initiatives.

Figure 2 and Figure 3 present the number of State safety programs for the 2016 reporting period. Most states have "Intersection" (30 States) and "Roadway Departure" (29 States) programs. Twenty-nine states selected 49 programs in the "Other" category. Examples of programs in the "Other" category are: "pavement marking improvements", "longitudinal rumble strips", and "vulnerable road users".

[3] FHWA, Highway Safety Improvement Program Manual, FHWA-SA-09-029, January 2010. https://safety.fhwa.dot.gov/hsip/resources/fhwasa09029/

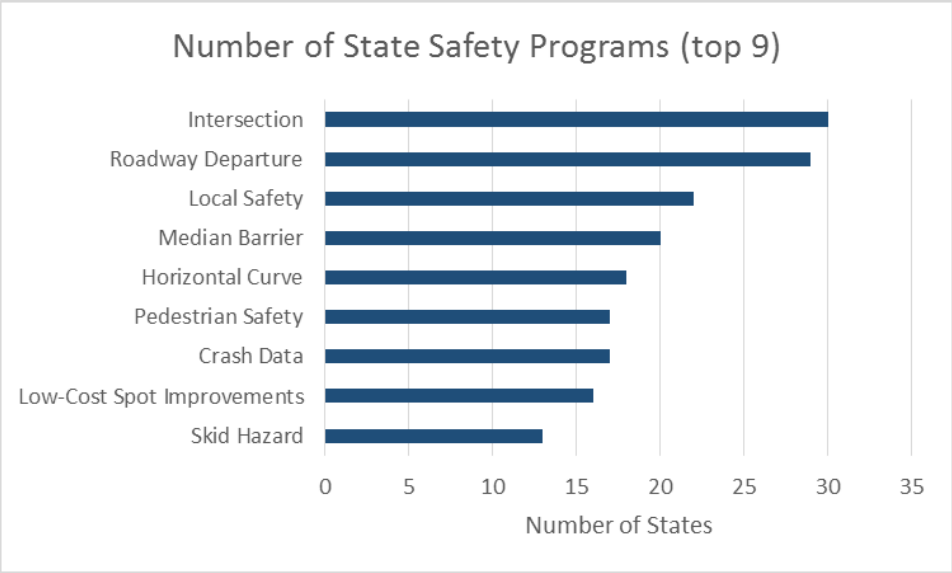

Figure 2: Number of State Safety Programs (top 9)

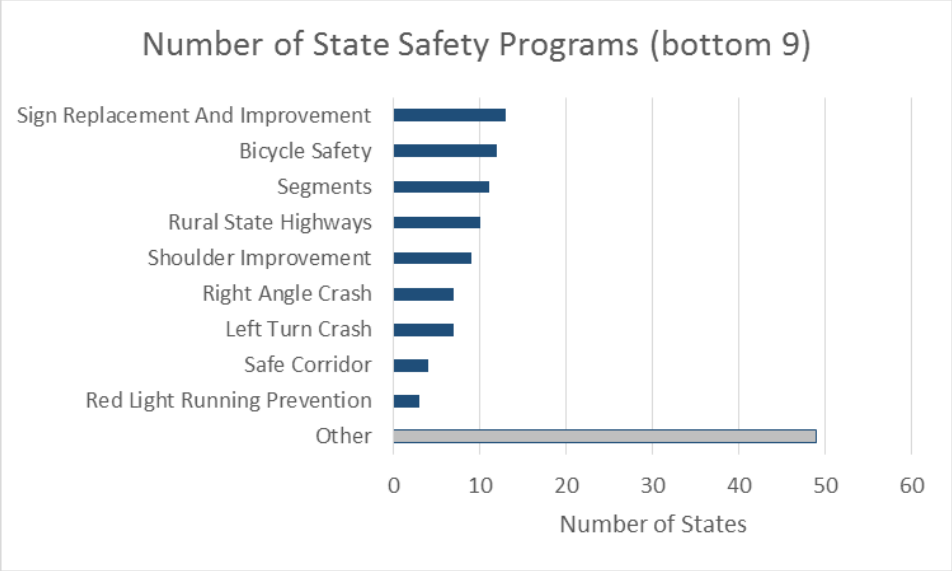

Figure 3: Number of State Safety Programs (bottom 9)

Methodology Types for Selected Programs Administered Under HSIP

For each State safety program administered under the HSIP, a State can also indicate what project identification methodology (PIM) was used for each program, consistent with the 13 PIMs or performance measures defined in the Highway Safety Manual[4]. Figure 4 presents the number of times a particular PIM was selected by the States. Please note that a State can select more than one PIM for each safety program. "Crash frequency" was selected 228 times while "Excess expected crash frequency using methods of moments" was only selected 2 times. Examples of methodologies in the "Other" category are: "Collaboration with county engineers" and "Hierarchical Bayesian Model".

[4] Highway Safety Manual, 1st edition, AASHTO, Washington, D.C., 2010.

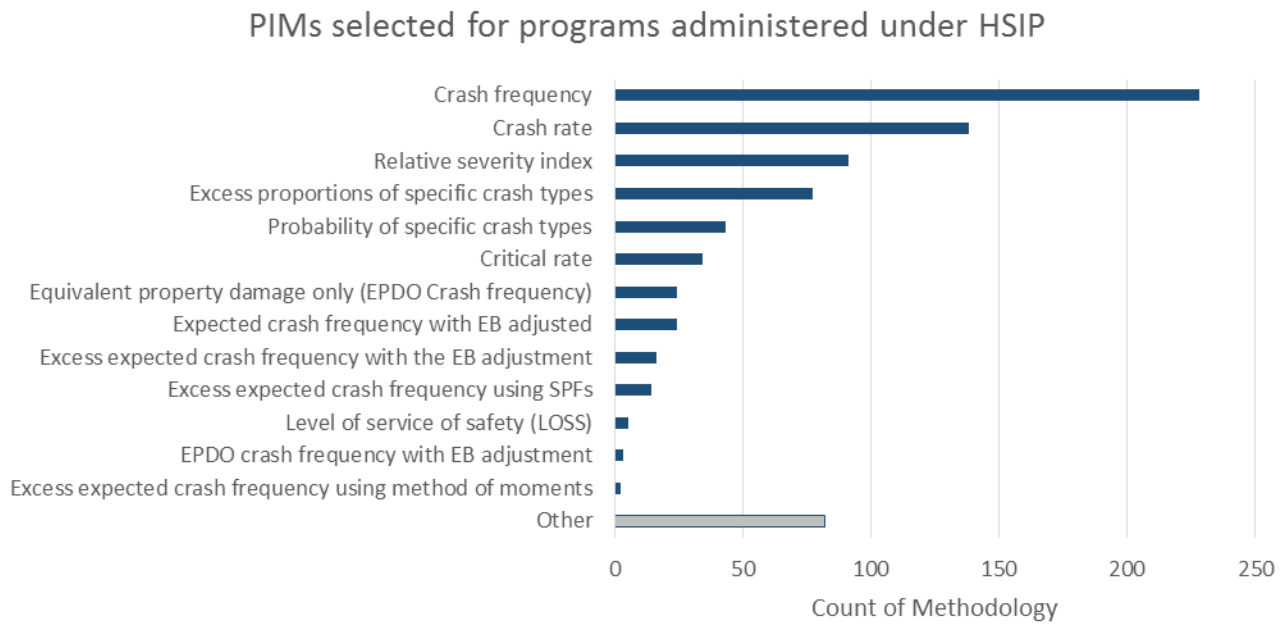

Figure 4: Count of PIM selected for programs administered under HSIP

HSIP Projects Overview

States provide project specific information for all projects obligated with HSIP funds during the reporting period in their annual HSIP reports. The reporting period is defined by the State and can be calendar year, state fiscal year or federal fiscal year. For 2016, the States obligated $4.03B for 4,468 total projects. On average, States obligated 38 percent of HSIP funds to address systemic improvements. These obligations utilized funds apportioned during the 2016 fiscal year as well as HSIP funds available from previous years' apportionments.

As per the HSIP MAP-21 Reporting Guidance, project specific information may include:

- Improvement Category and Sub Category (see Appendix A for complete descriptions)
- Project output (e.g., miles of rumble strips)
- Project cost (both HSIP cost and total cost)
- Funding category
- Functional classification
- AADT
- Posted speed limit
- Roadway ownership
- Relationship to the State's strategic highway safety plan (SHSP) (i.e. emphasis area, strategy)

The following sections present various summaries of the nationwide HSIP project obligations for the 2016 reporting cycle. It should be noted that limited analysis of the project information can be done because not all states have included all of the above information for each project in their annual HSIP reports. Full use of the HSIP online reporting tool and the most recent HSIP reporting guidance will enable more complete and accurate reporting of national HSIP project data. In addition, HSIP projects come in all shapes and sizes. For example, some HSIP projects may be much bigger in scope than others,

countermeasure installations across multiple sites, or non-infrastructure projects (i.e. transportation safety planning, data improvements). Nonetheless, the summaries in the following sections provide a broad scale analysis of HSIP spending in 2016 by project cost, functional classification and ownership, improvement categories and subcategories, and SHSP emphasis areas.

Project Cost

The cost per HSIP project in 2016 ranged widely. Some projects were small in scope and cost, such as replacing signs on a particular route. Others were higher cost projects, such as widening a highway or reconfiguring an intersection. Figure 5 shows the breakdown by project cost, grouped into general categories with breakpoints at $100,000, $500,000, and $1,000,000.

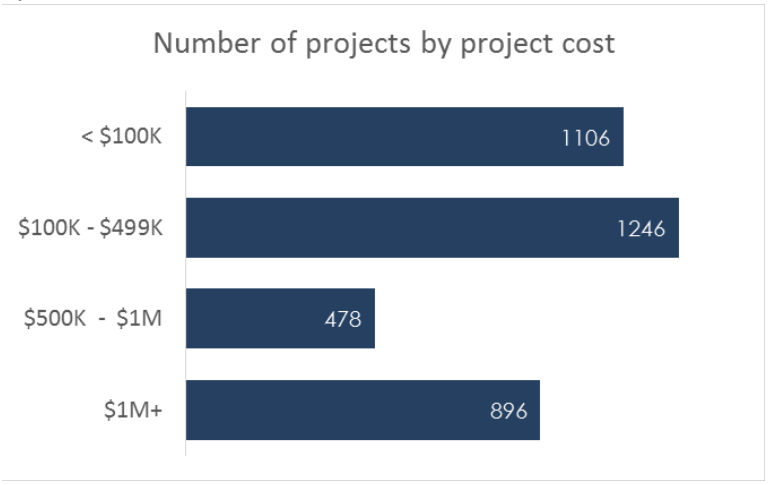

Figure 5: Number of Projects by Project Cost

Roughly 63 percent of the projects had costs less than $500K. A small percentage (13 percent) fell into the $500K - $1M category. The remaining 24 percent were high cost projects totaling $1M or more. The top five sub categories selected for these high cost projects are:

- Widen shoulder – paved or other (127 projects ranging from 1.2 to 25 miles treated)
- Roadway – other (57 projects)
- Barrier – metal (38 projects ranging from 0.7 to 150 miles treated)
- Auxiliary lanes – add left-turn lane (33 projects)
- Intersection geometry – other (33 projects)

In 2013, 2014, and 2015, the breakdowns were similar. About two-thirds of the projects had costs less than $500K, about 11 to 13 percent fell into the $500K - $1M category, and the remaining 20 percent were more than $1M.

Functional Class and Ownership

Figure 6 through Figure 10 illustrate the distribution of projects by the types of roads on which they were conducted. Figure 6 shows number of projects by functional class, following the HPMS classification scheme; Figure 7 shows average total cost of projects by functional class; Figure 8 shows the number and average total cost of projects by urban/rural designation; Figure 9 shows projects by the agency who owns the road; and Figure 10 shows average total cost of projects by the agency who owns the road. If the functional class or road ownership was not indicated, the project is counted under

the “unknown” category. Examples of classifications in the “other” category include multiple functional classes, state or citywide implementation, or non-infrastructure projects.

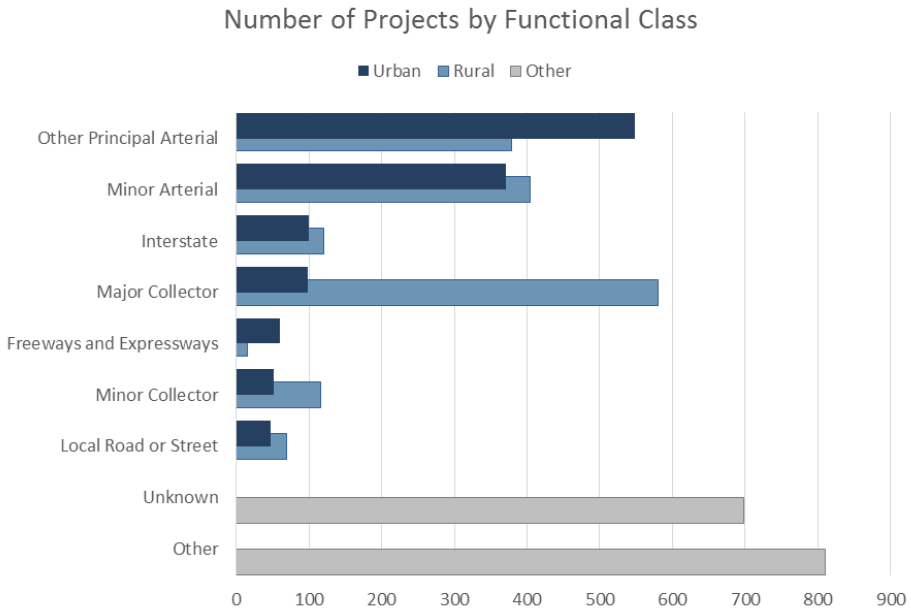

Figure 6. Number of Projects by Functional Class

Unlike 2014 and 2015, most projects were categorized as “Other” indicating that the State classified the project as multiple functional classes, state or citywide implementation, or non-infrastructure projects (810 projects). As in 2015, projects that were associated with a functional class were most often categorized as “Rural Major Collector” or “Urban Principal Arterial – Other”. There were 698 projects categorized as “Unknown” indicating the State did not assign a functional classification to the project.

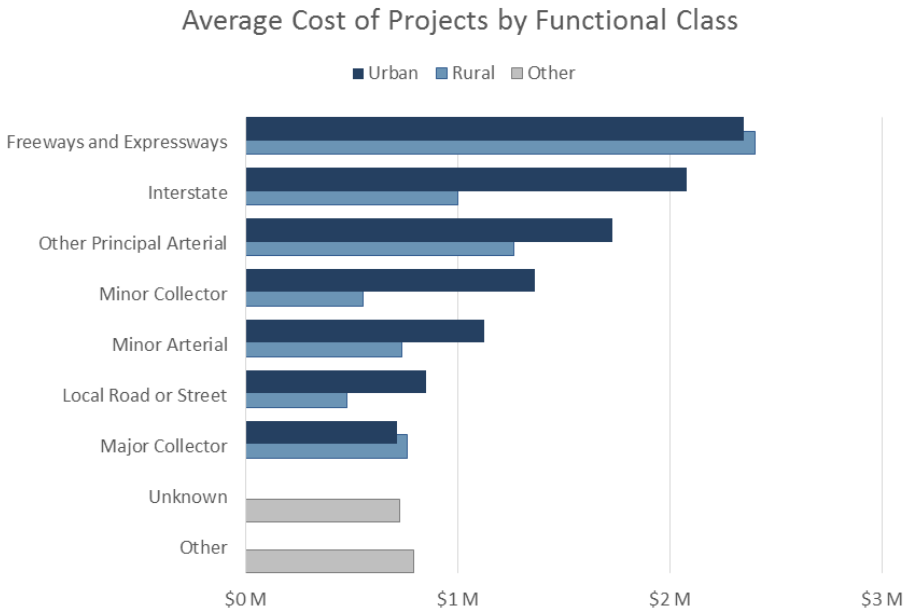

Figure 7. Average Total Cost of Projects by Functional Class

Figure 7 shows the average total cost of projects by functional class. It is important to note that not every project had an associated cost so the average is based on the number of projects which had cost information available (including de-obligated costs). Projects categorized as "Rural Principal Arterial – Freeways and Expressways" had the highest average total cost per project of $2.4 million (compared to $2.7M in 2015) and projects categorized as "Rural Local Road or Street" had the lowest average total cost per project of $475,000 (compared to $329,000 in 2015).

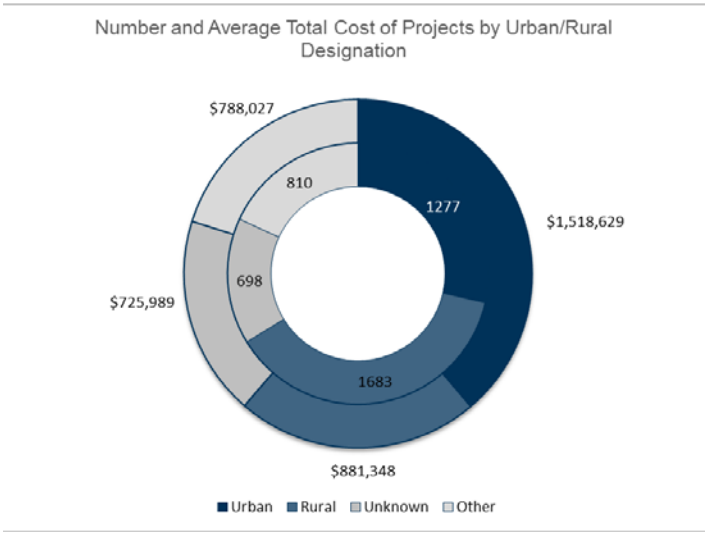

Figure 8. Number and Average Total Cost of Projects by Urban/Rural Designation

Figure 8 illustrates the number and average total cost of projects by urban/rural designation. As in 2014 and 2015, there are fewer total urban projects than rural projects but the average total cost of the urban projects is greater than the average total cost of the rural projects.

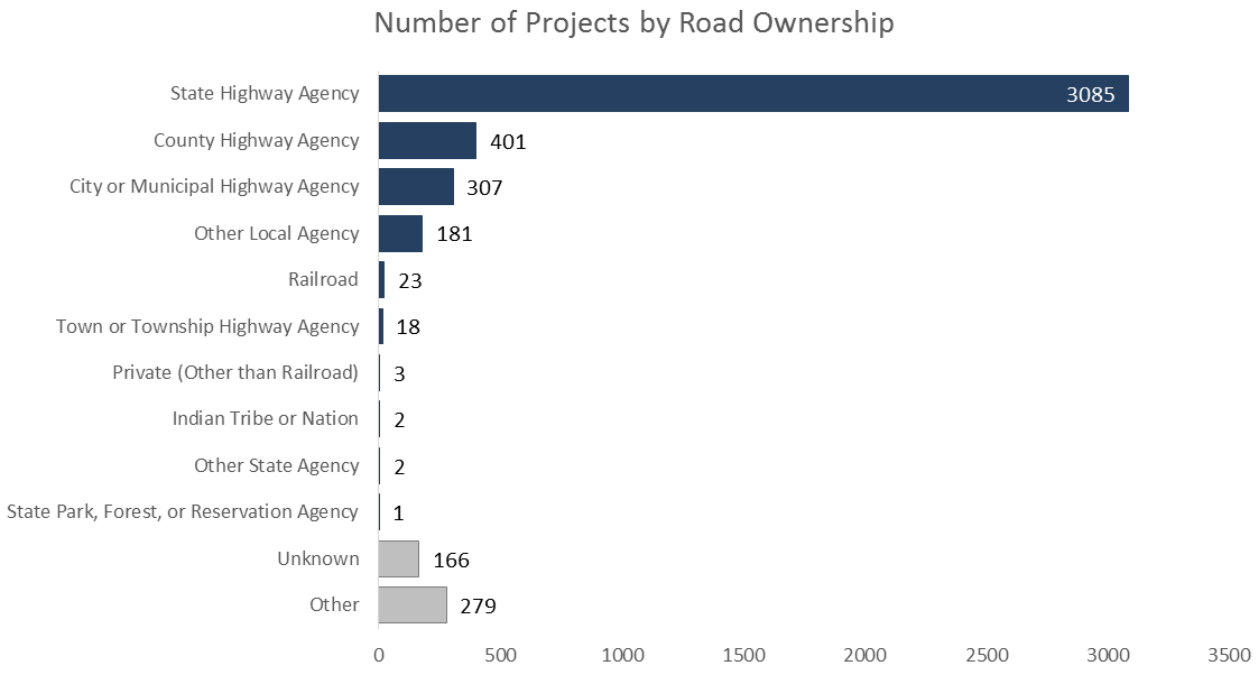

Figure 9. Number of Projects by Road Ownership

As in 2014 and 2015, States implement most projects on roads owned by a "State Highway Agency". There were 166 projects categorized as "Unknown" (indicating that the State did not indicate road ownership for a particular project). There were 279 projects categorized as "Other" and of those, roughly 70 were categorized in state-defined ownership categories. No projects were categorized for the following ownerships:

- Local Park, Forest, or Reservation Agency
- State Toll Authority
- Local Toll Authority
- Other Public Instrumentality

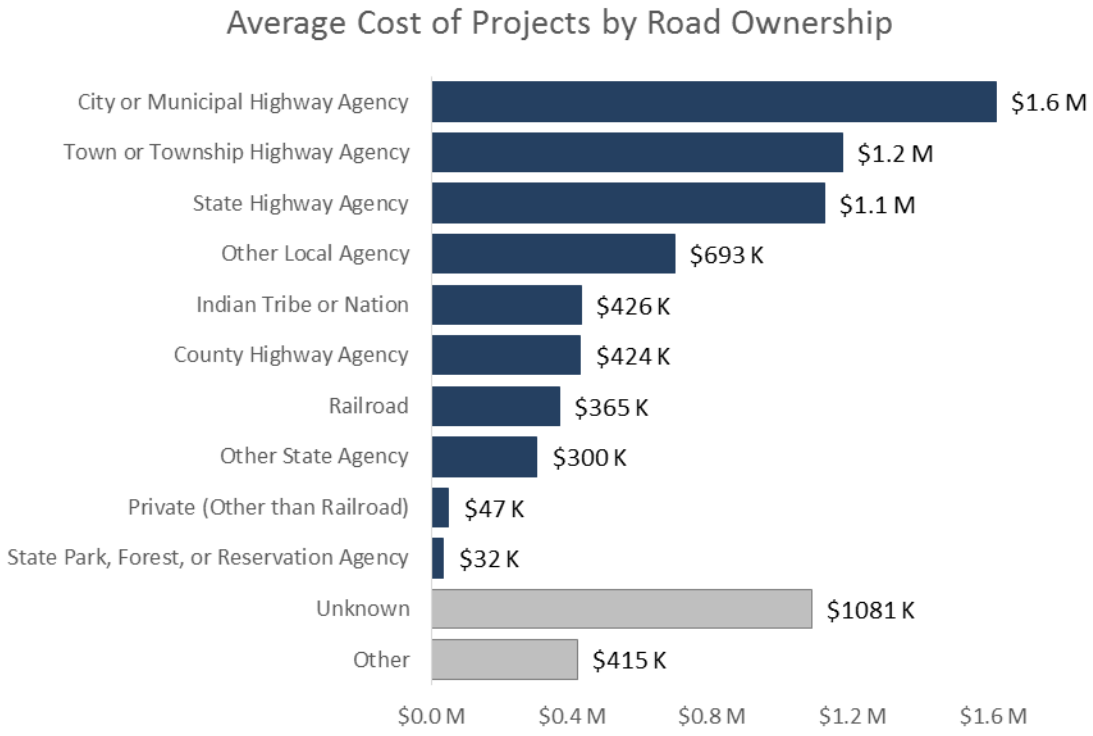

Figure 10. Average Total Cost of Projects by Road Ownership

Figure 10 shows the average total cost of projects by road ownership. It is important to note that not every project had an associated cost so the average is based on the number of projects which had cost information available (including deobligated costs). Projects categorized as "City or Municipal Highway Agency" had the highest average total cost per project of $1.6 million and projects categorized as "State Park, Forest, or Reservation Agency" had the lowest average total cost per project of $32,000.

Improvement Categories and Subcategories

Under the HSIP MAP-21 reporting guidance, each project should be assigned a general improvement category and a subcategory under that general category. While a single project may consist of multiple project types, FHWA suggests States to assign each project to only one category. The category chosen should align with the primary purpose of the project. Figure 11 and Figure 12 show the distribution of the number of projects by general improvement category. Figure 13 and Figure 14 combined show the distribution of the total cost of projects by general improvement category. Projects categorized as "Unknown" indicate that there was no general improvement category assigned by the State. Figure 15

through Figure 19 show the breakdown of the number of projects by subcategory for five improvement categories: Intersection geometry, Intersection traffic control, Pedestrians and bicyclists, Roadway, and Roadside. More detailed tables with the cost spent in each subcategory are available in Appendix B. For ease of reporting, similar subcategories were grouped together. For example, in Figure 15 below, "Auxiliary lanes – other" combines adding acceleration lanes, adding auxiliary through lanes, adding two way left turn lanes, and several other related subcategories.

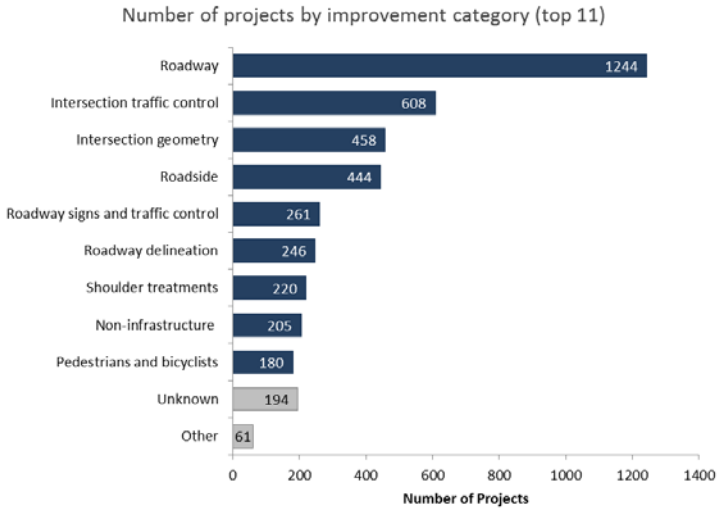

Figure 11. Number of Projects by Improvement Category (Top 11)

Figure 11 shows the number of projects by improvement category (top 11) as classified in the HSIP MAP-21 Reporting Guidance. Based on the project information reported by the States, the top five improvement categories are roadway, intersection traffic control, intersection geometry, roadside, and roadway signs and traffic control. In 2015, the top five improvement categories were the same with the exception of roadway signs and traffic control (shoulder treatments was the fifth most classified improvement category in 2015). The number of projects classified in each category and the ranking of project categories were similar, also, compared to 2015.

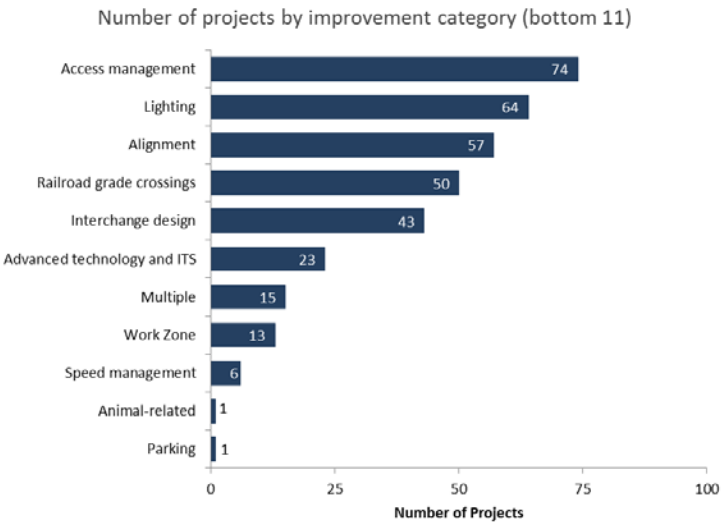

Figure 12. Number of Projects by Improvement Category (Bottom 11)

Figure 12 shows the number of projects by improvement category (bottom 11) as classified in the HSIP MAP-21 Reporting Guidance. In 2015, the number and ranking of projects classified in each category for the bottom 11 were similar with the exception of railroad grade crossings. In 2016, 50 projects were classified as railroad grade crossings compared to 18 projects in 2015.

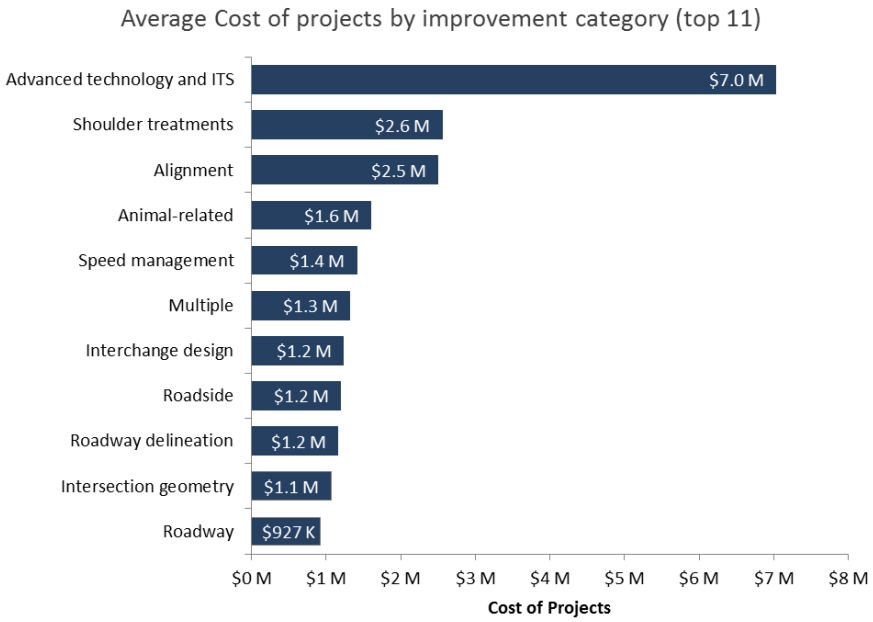

Figure 13. Average Total Cost of Projects by Improvement Category (top 11)

Figure 13 shows the average total cost of projects by improvement category (top 11). Again, it is important to note that not every project had an associated cost so the average is based on the number of projects with cost available (including deobligated costs). Compared to 2015, the following categories had notable differences in average project costs. Note that the "Multiple" category indicates that a State selected more than one improvement category. For example, the project could include changes to intersection geometry, traffic control, pedestrian access, signs, or pavement markings).

- Railroad grade crossings – moved from the top 11 in 2015 to the bottom 11 in 2016 (decreased from $1.7M in 2015 to $574K in 2016)
- Parking – moved from the top 11 in 2015 to the bottom 11 in 2016 (decreased from $1.4M in 2015 to $245K in 2016)
- Pedestrians and bicyclists – moved from the top 11 in 2015 to the bottom 11 in 2016 (decreased from $965K in 2015 to $866K in 2016)
- Multiple – moved from the bottom 11 in 2015 to the top 11 in 2016 (increased from $190K in 2015 to $1.3M in 2016)
- Speed management – moved from the bottom 11 in 2015 to the top 11 in 2016 (increased from $378K in 2015 to $1.4M in 2016)
- Roadway – moved from the bottom 11 in 2015 to the top 11 in 2016 (increased from $608K in 2015 to $927K in 2016)
- Advanced technology and ITS – remained in the top 11 for 2016 but with much higher average cost (increased from $2.8M in 2015 to $7.0M in 2016)
- Animal related – remained in the top 11 for 2016 but with much lower average cost (decreased from $7.5M in 2015 to $1.6M in 2016)

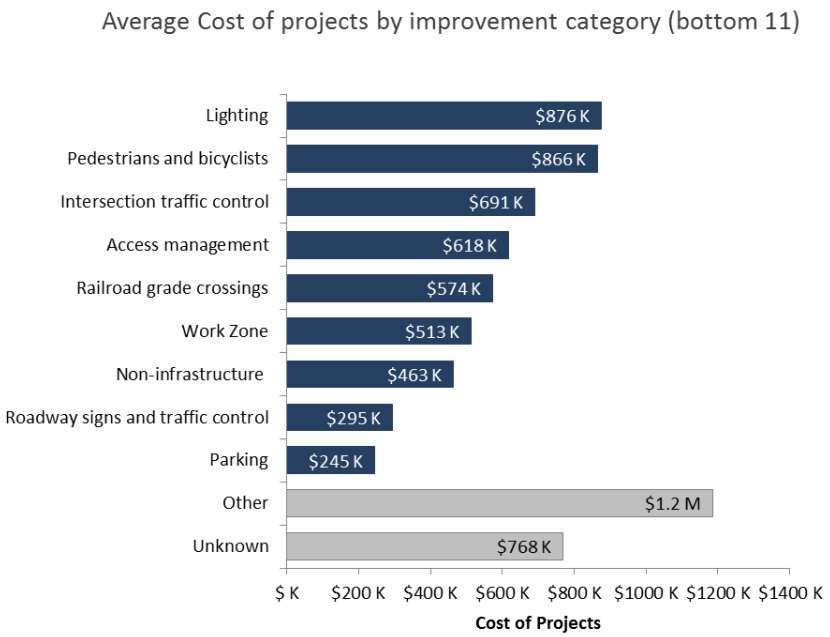

Figure 14. Average Total Cost of Projects by Improvement Category (bottom 11)

Based on project information reported by the States, the lowest average HSIP cost projects are in the following categories:

- Railroad grade crossings; 30 projects with cost information
- Work Zone; 13 projects with cost information
- Non-infrastructure; 181 projects with cost information
- Roadway signs and traffic control; 239 projects with cost information
- Parking; 1 project with cost information

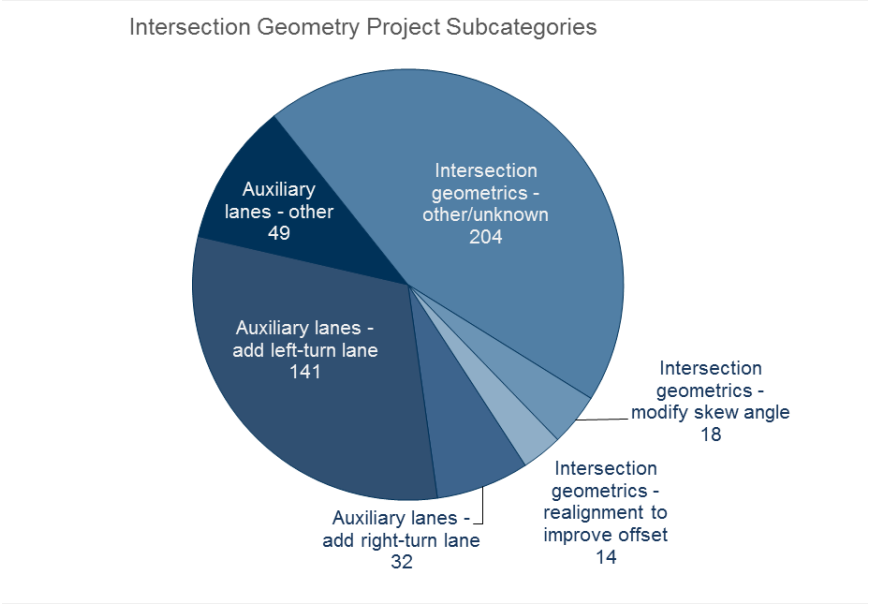

Figure 15: Number of Intersection Geometry Projects by Subcategory

The Intersection geometry category was selected for further evaluation because in 2016 (as in previous years) it ranked in the top five in terms of number of projects categorized and ranked in the top 11 in terms of average cost per project. FHWA has also identified intersections as one of three focus areas for the Focused Approach to Safety effort.

For the Intersection geometry category, most projects are sub categorized as "Intersection geometrics – other/unknown" (45 percent; 204 of 458 projects), "Auxiliary lanes – add left-turn lane" (31 percent; 141 of 458 projects), and "Auxiliary lanes – other" (11 percent; 49 of 458 projects). Examples of projects in the "Intersection geometrics – other/unknown" subcategory include modify intersection corner radius and general intersection safety improvement projects. The "Intersection geometrics – other/unknown" subcategory is predominately used without any project description, therefore, no other information is available for these projects.

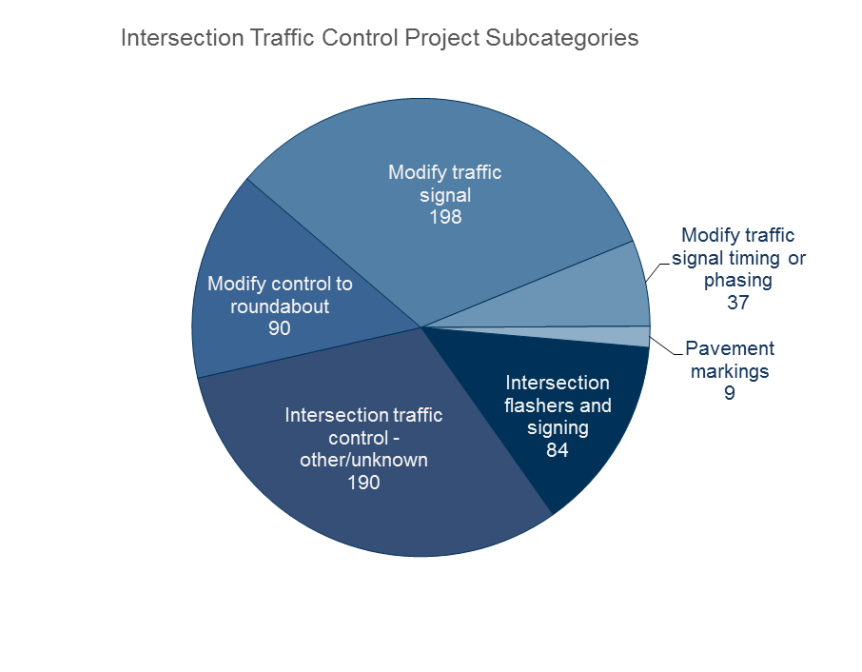

Figure 16: Number of Traffic Control Projects by Subcategory

The Intersection traffic control category was selected for further evaluation because in 2016 (as in previous years) it ranked in the top five in terms of number of projects categorized. FHWA has also identified intersections as one of three focus areas for the Focused Approach to Safety effort.

For the Intersection traffic control category, most projects are subcategorized as "Modify traffic signal" (33 percent; 198 of 608 projects) and "Intersection traffic control – other/unknown" (31 percent; 190 of 608 projects). Examples of projects in the "Intersection traffic control – other/unknown" category include projects described as signal and stop controlled systemic improvements and general intersection traffic control improvement projects. The "Intersection traffic control – other/unknown" subcategory is predominately used without any project description, therefore, no other information is available for these projects. Examples of projects in the "Modify traffic signal" category include modernization/replacement of traffic signal and adding flashing yellow arrow signals.

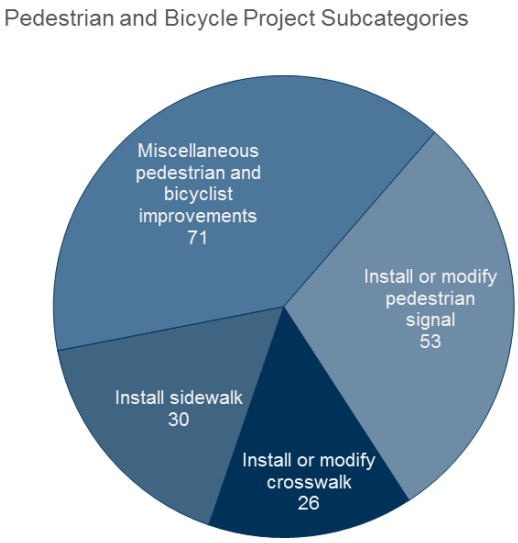

Figure 17: Number of Pedestrian and Bicyclist Projects by Subcategory

The Pedestrian and bicycle category was selected for further evaluation because infrastructure improvements in this category are of significant interest to various stakeholders. FHWA has also identified pedestrians and bicyclists as one of three focus areas under the Focused Approach to Safety effort.

For the Pedestrians and bicyclists category, most projects are subcategorized as “Miscellaneous pedestrian and bicyclist improvements” (39 percent; 71 of 180 projects) and “Install or modify pedestrian signal” (29 percent; 53 of 180 projects). Many of the projects in the “Miscellaneous pedestrian and bicyclist improvements” subcategory do not have any project description, therefore, no other information is available for these projects.

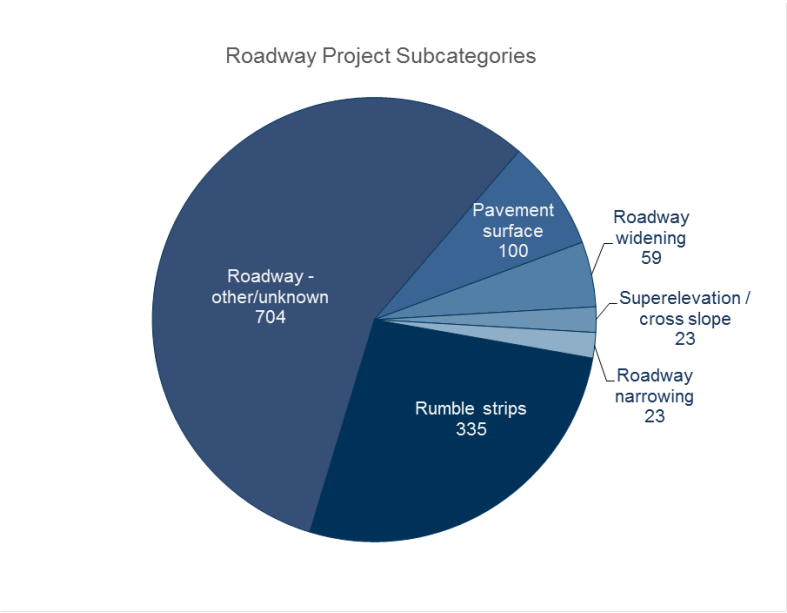

Figure 18: Number of Roadway Projects by Subcategory

The Roadway category was selected for further evaluation because in 2016 (as in previous years) it ranked as the number one category in terms of number of projects categorized. FHWA has also identified roadway departure as one of three focus areas for the Focused Approach to Safety effort.

For the Roadway category, most projects were subcategorized as "Roadway – other/unknown" (57 percent; 704 of 1244 projects) and "Rumble strips" (27 percent; 335 of 1244 projects). Examples of projects in the "Roadway – other/unknown" subcategory were projects such as "restripe to revise separation between opposing lanes and/or shoulder widths".

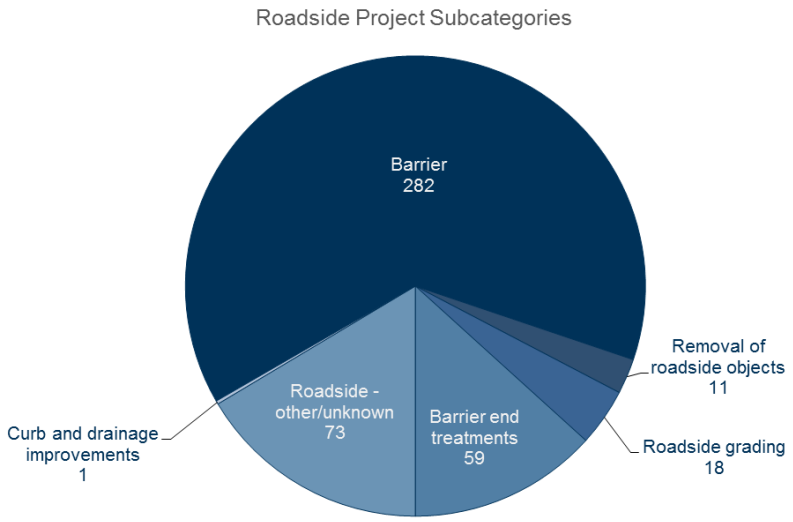

Figure 19: Number of Roadside Projects by Subcategory

The Roadside category was selected for further evaluation because in 2016 (as in previous years) it ranked in the top five in terms of number of projects categorized and is of national interest lately. For the Roadside category, most projects were subcategorized as "Barrier" (64 percent; 282 of 444 projects), "Roadside – other/unknown" (16 percent; 73 of 444 projects), and "Barrier end treatments" (13 percent; 59 of 444 projects). Examples of two projects in the "Roadside – other/unknown" subcategory were "Barrier - removal" and "Fencing".

SHSP Emphasis Areas

Based on a review of State SHSPs, FHWA identified the eight SHSP emphasis areas common across most States. These emphasis areas are used in the HSIP online reporting tool for categorizing HSIP projects. Figure 20 presents the number of HSIP projects categorized by SHSP emphasis area. For consistency and national reporting purposes, state-defined SHSP emphasis areas were assigned to these emphasis areas, where possible.

About 40 percent of the projects were categorized as "Roadway Departure" (33 percent in 2014 and 42 percent in 2015), 29 percent were categorized as "Intersections" (27 percent in 2014 and 31 percent in 2015), 13 percent categorized as "Unknown/Other" (26 percent in 2014 and 14 percent in 2015).

Examples of other categories used by the States include: “Highway infrastructure”, “Railroad”, and “Lighting”.

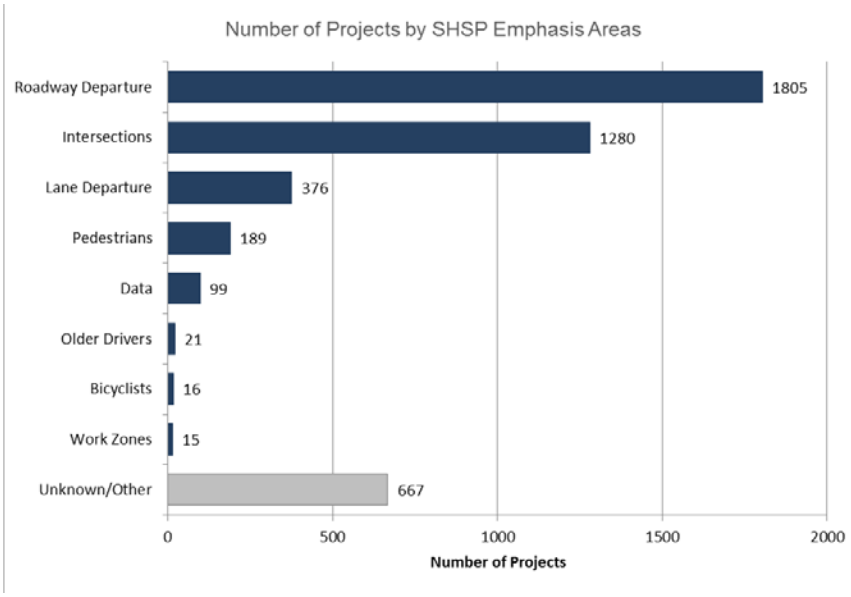

Figure 20: Number of Projects by SHSP Emphasis Area

2013-2016 Comparison

Most states prepared their 2013 through 2016 HSIP reports in accordance with the MAP-21 HSIP Reporting Guidance; therefore FHWA can make a direct comparison of information related to the 2013 through 2016 highway safety improvement projects. As can be seen in Table 3 below, the total number of projects and cost of projects did not change much from 2013 to 2014 but between 2015 and 2016, there were roughly 1000 more projects reported. However, the breakdown in project costs for various breakpoints was similar across years.

Table 1. Total number of projects and project cost breakdown, 2013-2016

Year	2013	Percentage	2014	Percentage	2015	Percentage	2016	Percentage
Number of projects	3292		3348		4188		4468	
Num. of projects (with cost info.)*	3171		3272		3830		3726	
Cost of projects**	$3.09B		$3.10B		$3.90B		$4.03B	
Average cost per project	$981K		$952K		$1.02M		$1.08M	
Number of projects <$100K	1154	35%	1011	30%	1374	33%	1106	25%
Number of projects $100K - $499K	985	30%	1054	31%	1131	27%	1246	28%

Year	2013	Percentage	2014	Percentage	2015	Percentage	2016	Percentage
Number of projects $500K-$1M	401	12%	450	13%	445	11%	478	11%
Number of projects $1M+	631	19%	757	23%	880	21%	896	20%
Number of projects with deobligated funds	60	2%	28	1%	146	3%	256	6%
Number of projects with $0 or blank	61	2%	48	1%	212	5%	486	11%

*Number of projects with cost info does not include projects with deobligated funds or where the value entered was $0 or null.
**Cost of projects is the sum of total cost for each year (including deobligated funds).

Table 2 shows the comparison from 2013 through 2016 of the number of projects and average total cost (does not include deobligated funds or where the value entered was $0 or null) of projects for various project types highlighted in this report. For most project types, the number and cost of projects has increased over the four year period.

Table 2. Number of projects and average total project cost for various project types, 2013-2016

Project Type	Num Projects 2013	Avg Cost 2013	Num Projects 2014	Avg Cost 2014	Num Projects 2015	Avg Cost 2015	Num Projects 2016	Avg Cost 2016
Urban projects	826	$1.4M	954	$1.3M	1236	$1.2M	1277	$1.7M
Rural projects	1244	$930K	1361	$890K	1847	$1.1M	1683	$956K
Roadway projects	854	$639K	722	$955K	1195	$671K	1244	$1.1M
Intersection traffic control projects	420	$682K	505	$702K	615	$798K	608	$704K
Intersection geometry projects	376	$1.3M	379	$983K	559	$1.0M	458	$1.1M
Ped/bike projects	103	$534K	118	$507K	122	$965K	180	$866K
Roadside projects	225	$951K	303	$810K	422	$893K	444	$1.2M

Comparison to Previous Years

The HSIP National Summary Baseline Report 2009-2012 reported project and cost information for HSIP reports submitted by the States for years 2009-2012. The information from the baseline report is summarized below with the purpose of comparing basic cost and project information to the 2013 through 2015 reports. Table 3 below shows that States obligated $16.6B for more than 19,000 projects over the seven-year period. These obligations include not only HSIP funds apportioned during the reporting period (2009-2015), but also HSIP funds available from previous years' apportionments.

Table 3: Total Number and Cost of Projects by Year

Year	2009	2010	2011	2012	2013	2014	2015	2016	Total
Num Projects	1,684	2,386	2,523	2,429	3,292	3,348	4,188	4,468	24,318
Num Projects (with cost info.)*	1,568	2,320	2,397	2,311	3,171	3,272	3,830	3,726	22,595
Cost of projects	$1.61B	$1.46B	$1.78B	$1.65B	$3.09B	$3.10B	$3.90B	$4.03B	$20.6B
Avg. Cost Per Project	$1.0M	$629K	$743K	$722K	$981K	$952K	$1.0M	$1.1M	$916K

*Number of projects with cost info does not include projects with deobligated funds or where the value entered was $0 or null.

**Cost of projects is the sum of total cost for each year (including deobligated funds).

Benefit-Cost Analysis of the HSIP

FHWA also conducted a national evaluation of the HSIP to estimate expected program results using the project information from the 2016 HSIP reports. The purpose of the evaluation was to estimate a national benefit cost ratio for the HSIP. The HSIP national benefit cost ratio provides an indication of the programs national impact and the benefits the public can expect from investments in the HSIP.

The evaluation methodology makes use of the full project listing information from 50 States plus the District of Columbia (2016 HSIP Database) and associated crash modification factors (CMFs) from the CMF Clearinghouse, the Fatality Analysis Reporting System (FARS), the Highway Performance Monitoring System (HPMS), the Highway Safety Information System (HSIS), FHWA, and various reports. The following steps indicate how to apply the selected methodology for projects in the 2016 HSIP Database with complete data:

1. Calculate the estimated crash reduction for each project group
    a. Estimate a "before" crash rate using data from FARS, HPMS, and HSIS.
    b. Identify appropriate CMFs from the CMF Clearinghouse.
2. Calculate the monetary benefit for each project category by converting crash savings to dollar amounts.

a. Update crash severity costs (K, KA, KABC, ABC, KABCO) to 2015 dollars using information from Council et al[5] and an internal FHWA memo[6].

3. Divide annual monetary benefit by the annualized project cost to calculate the benefit-cost ratio.
    a. Assume a service life per treatment type using information from the Service Life and Crash Cost User Guide available on the CMF Clearinghouse.
4. Calculate a program wide benefit-cost ratio by averaging the ratios from all project groups.
    a. Weight the average based on HSIP funds spent for a project to account for project groups which were more prevalent in the data.

For this reporting cycle, it was possible to calculate the expected project level benefit cost ratios for 1,077 segment and intersection based projects, which is approximately 24 percent of the projects listed in the 2016 HSIP Database. Table 4 presents the weighted results (based on amount of HSIP funds that were spent for that project). Many projects had a range of years for the assumed service life, so the table presents the BC ratio according to the minimum and maximum service lives.

The values in Table 4 (4.355 to 6.511) represent the range of BC ratios for the HSIP program for segment and intersection based improvement projects, depending on the minimum or maximum service life of the treatment and discount rate. Comparatively, the range for the 2015 HSIP project listing was 4.523 to 7.123.

Table 4. Weighted BC Ratio for Segment and Intersection Based Projects (weight based on total project cost)

	Weighted BC Ratio (min Service Life, 3% discount rate)	**Weighted BC Ratio (max Service Life, 3% discount rate)**	**Weighted BC Ratio (min Service Life, 7% discount rate)**	**Weighted BC Ratio (max Service Life, 7% discount rate)**
1,042 Segment Based HSIP Projects (weighted on segment project cost)	5.257	6.482	4.366	5.089
35 Intersection Based HSIP Projects (weighted on intersection project cost)	9.601	11.021	7.381	8.181
1,077 Segment & Intersection Based HSIP Projects (weighted on segment & intersection project cost)	**5.284**	**6.511**	**4.355**	**5.109**

Many projects could not be included in analysis because they were either missing key data elements (e.g., number of miles or intersections treated, CMF, project cost, etc.) or were non-infrastructure

[5] Council, F., E. Zaloshnja, T. Miller, and B. Persaud. "Crash Cost Estimates by Maximum Police-Reported Injury Severity Within Selected Crash Geometries", FHWA-HRT-05-051, FHWA Office of Safety R&D, October 2005.
[6] Persaud, B. "How to convert value of a statistical life to cost per crash by severity, crash type and speed limit", FHWA Draft Memo for DCMF Evaluations (unpublished), November 2014.

projects. The calculated benefit-cost ratio for each of the 1,077 projects relied heavily on assumptions for each project regarding the applicable CMF, service life, crash rate, and injury severity cost.

Summary

The HSIP is a strategic program that uses data and analysis to target safety resources. This HSIP 2016 National Summary Report shows that in 2016, States directed HSIP funds to address the predominant infrastructure -related crash types: roadway departure, intersection and pedestrian crashes, similar to previous years. On average, States obligated 38 percent of HSIP funds to address systemic improvements. While the basic characteristics (rural and urban, improvement categories, and SHSP emphasis areas) of HSIP spending remains fairly consistent from year to year, the number and cost of HSIP projects has continued to increase over the seven-year period from 1,684 projects with a total cost of $1.61B in 2009 to 4,468 projects with a total cost of $4.03B in 2016. Based on a sample of 2016 HSIP projects, FHWA estimates that the benefits of the HSIP outweigh the costs on a scale ranging from 4.4 to 6.5.

References

FHWA, MAP-21 Apportionment Fact Sheet
http://www.fhwa.dot.gov/map21/factsheets/apportionment.cfm

FHWA, HSIP Apportionment Notices
http://www.fhwa.dot.gov/legsregs/directives/notices/

FHWA, HSIP MAP-21 Fact Sheet
http://www.fhwa.dot.gov/map21/factsheets/hsip.cfm

FHWA, HSIP MAP-21 Reporting Guidance, February 13, 2013
http://www.fhwa.dot.gov/map21/guidance/guidehsipreport.cfm

FHWA, HSIP Online Reporting Tool
http://safety.fhwa.dot.gov/hsip/resources/onrpttool/

FHWA, HSIP National Summary Baseline Report 2009-2012
http://safety.fhwa.dot.gov/hsip/reports/nsbrpt_2009_2012.cfm

FHWA, HSIP 2013 National Summary Report
http://safety.fhwa.dot.gov/hsip/reports/nsbrpt2013.cfm

FHWA, HSIP 2014 National Summary Report
http://safety.fhwa.dot.gov/hsip/reports/pdf/2014/hsip_natl2014.pdf

FHWA, HSIP 2015 National Summary Report
http://safety.fhwa.dot.gov/hsip/reports/pdf/2015/hsip_natl2015.pdf

2016 State HSIP Reports
http://safety.fhwa.dot.gov/hsip/reports/

Appendix A: Full Description of HSIP Improvement Categories and Sub Categories for 2013 HSIP Reporting Guidance

Category	
Access management	Access management - other
	Change in access – close or restrict existing access
	Change in access – miscellaneous/unspecified
	Grassed median - extend existing
	Median crossover - close crossover
	Median crossover - directional crossover
	Median crossover - relocate existing
	Median crossover - unspecified
	Raised island - install new
	Raised island - modify existing
	Raised island - remove existing
	Raised island – unspecified
Advanced technology and ITS	Advanced technology and ITS - other
	Congestion detection / traffic monitoring system
	Dynamic message signs
	Over height vehicle detection
Alignment	Alignment - other
	Horizontal curve realignment
	Horizontal and vertical alignment
	Vertical alignment or elevation change
Animal-related	Animal related
Interchange design	Acceleration / deceleration / merge lane
	Convert at-grade intersection to interchange
	Extend existing lane on ramp
	Improve intersection radius at ramp terminus
	Installation of new lane on ramp
	Interchange design - other
	Ramp closure
	Ramp metering
Intersection geometry	Auxiliary lanes – add acceleration lane
	Auxiliary lanes – add auxiliary through lane
	Auxiliary lanes – add left-turn lane
	Auxiliary lanes – add right-turn lane
	Auxiliary lanes – add right-turn lane (free-flow)
	Auxiliary lanes – add slip lane
	Auxiliary lanes – add two-way left-turn lane
	Auxiliary lanes – extend acceleration/deceleration lane
	Auxiliary lanes – extend existing left-turn lane
	Auxiliary lanes – extend existing right-turn lane
	Auxiliary lanes – miscellaneous/other/unspecified

	Auxiliary lanes – modify acceleration lane
	Auxiliary lanes – modify auxiliary through lane
	Auxiliary lanes – modify free-flow turn lane
	Auxiliary lanes – modify left-turn lane offset
	Auxiliary lanes – modify right-turn lane offset
	Auxiliary lanes – modify turn lane storage
	Auxiliary lanes – modify turn lane taper
	Auxiliary lanes – modify two-way left-turn lane
	Intersection geometrics – miscellaneous/other/unspecified
	Intersection geometrics – modify intersection corner radius
	Intersection geometrics – modify skew angle
	Intersection geometrics – realignment to align offset cross streets
	Intersection geometrics – realignment to increase cross street offset
	Intersection geometrics – re-assign existing lane use
	Intersection geometry - other
	Splitter island – install on one or more approaches
	Splitter island – remove from one or more approaches
	Splitter island – unspecified
	Through lanes – add additional through lane
Intersection traffic control	Intersection flashers – add “when flashing” warning sign-mounted
	Intersection flashers – add advance emergency vehicle warning sign-mounted
	Intersection flashers – add advance heavy vehicle warning sign-mounted
	Intersection flashers – add advance intersection warning sign-mounted
	Intersection flashers – add miscellaneous/other/unspecified
	Intersection flashers – add overhead (actuated)
	Intersection flashers – add overhead (continuous)
	Intersection flashers – add stop sign-mounted
	Intersection flashers – modify existing
	Intersection flashers – remove existing
	Intersection signing – add basic advance warning
	Intersection signing – add enhanced advance warning (double-up and/or oversize)
	Intersection signing – add enhanced regulatory sign (double-up and/or oversize)
	Intersection signing – miscellaneous/other/unspecified
	Intersection signing – relocate existing regulatory sign
	Intersection traffic control - other
	Modify control – all-way stop to roundabout
	Modify control – modifications to roundabout
	Modify control – no control to roundabout
	Modify control – no control to two-way stop
	Modify control – remove right-turn yield

	Modify control – reverse priority of stop condition
	Modify control – traffic signal to roundabout
	Modify control – two-way stop to all-way stop
	Modify control – two-way stop to roundabout
	Modify control – two-way yield to two-way stop
	Pavement Markings – add advance signal ahead
	Pavement markings – add advance stop ahead
	Pavement markings – add dashed edge line along mainline
	Pavement markings – add lane use symbols
	Pavement markings – add stop line
	Pavement markings – add yield line
	Pavement markings – miscellaneous/other/unspecified
	Pavement markings – refresh existing pavement markings
	Modify traffic signal – add additional signal heads
	Modify traffic signal – add backplates
	Modify traffic signal – add backplates with retroreflective borders
	Modify traffic signal – add closed loop system
	Modify traffic signal – add emergency vehicle preemption
	Modify traffic signal – add flashing yellow arrow
	Modify traffic signal – add long vehicle detection
	Modify traffic signal – add railroad preemption
	Modify traffic signal – add wireless system
	Modify traffic signal – miscellaneous/other/unspecified
	Modify traffic signal – modernization/replacement
	Modify traffic signal – modify signal mounting (spanwire to mast arm)
	Modify traffic signal – remove existing signal
	Modify traffic signal – replace existing indications (incandescent-to-LED and/or 8-to-12 inch dia.)
	Modify traffic signal timing – left-turn phasing (permissive to protected/permissive)
	Modify traffic signal timing – left-turn phasing (permissive to protected-only)
	Modify traffic signal timing – adjust clearance interval (yellow change and/or all-red)
	Modify traffic signal timing – general retiming
	Modify traffic signal timing – signal coordination
	Systemic improvements – signal-controlled
	Systemic improvements – stop-controlled
Lighting	Continuous roadway lighting
	Intersection lighting
	Lighting - other
	Site lighting – horizontal curve
	Site lighting – intersection
	Site lighting – interchange

	Site lighting – pedestrian crosswalk
Miscellaneous	Miscellaneous
Non-infrastructure	Educational efforts
	Enforcement
	Data/traffic records
	Non-infrastructure - other
	Outreach
	Road safety audits
	Training and workforce development
	Transportation safety planning
Parking	Modify parking
	Parking - other
	Remove parking
	Restrict parking
	Truck parking facilities
Pedestrians and bicyclists	Crosswalk
	Install new "smart" crosswalk
	Install new crosswalk
	Install sidewalk
	Medians and pedestrian refuge areas
	Miscellaneous pedestrians and bicyclists
	Modify existing crosswalk
	Pedestrian beacons
	Pedestrian bridge
	Pedestrian signal
	Pedestrian signal - audible device
	Pedestrian signal – Pedestrian Hybrid Beacon
	Pedestrian signal - install new at intersection
	Pedestrian signal - install new at non-intersection location
	Pedestrian signal - modify existing
	Pedestrian signal - remove existing
	Pedestrian warning signs - add/modify flashers
	Pedestrian warning signs – overhead
Railroad grade crossings	Grade separation
	Model enforcement activity
	Protective devices
	Railroad grade crossing gates
	Railroad grade crossing signing
	Railroad grade crossings - other
	Surface treatment
	Upgrade railroad crossing signal
	Widen crossing for additional lane
Roadside	Barrier end treatments (crash cushions, terminals)
	Barrier transitions

	Barrier - cable
	Barrier - concrete
	Barrier- metal
	Barrier - other
	Barrier - removal
	Curb or curb and gutter
	Drainage improvements
	Fencing
	Removal of roadside objects (trees, poles, etc.)
	Roadside grading
	Roadside - other
Roadway	Install / remove / modify passing zone
	Pavement surface – high friction surface
	Pavement surface - miscellaneous
	Roadway narrowing (road diet, roadway reconfiguration)
	Roadway - other
	Roadway - restripe to revise separation between opposing lanes and/or shoulder widths
	Roadway widening - add lane(s) along segment
	Roadway widening - curve
	Roadway widening - travel lanes
	Rumble strips - center
	Rumble strips – edge or shoulder
	Rumble strips - transverse
	Rumble strips – unspecified or other
	Superelevation / cross slope
Roadway delineation	Improve retroreflectivity
	Longitudinal pavement markings - new
	Longitudinal pavement markings - remarking
	Delineators post-mounted or on barrier
	Raised pavement markers
	Roadway delineation - other
Roadway signs and traffic control	Curve-related warning signs and flashers
	Sign sheeting – upgrade or replacement
	Roadway signs and traffic control - other
	Roadway signs (including post) – new or updated
Shoulder treatments	Widen shoulder – paved or other
	Pave existing shoulders
	Shoulder grading
	Shoulder treatments - other
Speed management	Modify speed limit
	Radar speed signs
	Speed detection system / truck warning
	Speed management - other

	Traffic calming feature
Work Zone	Work zone

Appendix B. Detailed Tables of Project Costs Summaries

Table 5: Number and Cost of 2016 Projects by Improvement Category

Improvement Category	Number of Projects	Total Cost of Projects*	Average Total Cost*	Total HSIP Cost of Projects*	
Access management	74	$24,735,205.53	$618,380.14	$19,149,121.56	$478,728.04
Advanced technology and ITS	23	$133,498,042.07	$7,026,212.74	$18,717,355.65	$985,123.98
Alignment	57	$109,742,958.24	$2,494,158.14	$83,516,678.05	$1,942,248.33
Animal-related	1	$1,605,406.00	$1,605,406.00	$1,605,406.00	$1,605,406.00
Interchange design	43	$45,468,192.30	$1,228,870.06	$35,188,717.47	$951,046.42
Intersection geometry	458	$407,951,361.13	$1,065,147.16	$264,228,117.69	$697,171.81
Intersection traffic control	608	$370,872,781.67	$690,638.33	$280,015,667.29	$529,330.18
Lighting	64	$50,795,526.81	$875,784.95	$45,617,428.72	$800,305.77
Miscellaneous	61	$61,648,392.67	$1,185,546.01	$38,550,526.49	$755,892.68
Multiple	15	$19,712,910.48	$1,314,194.03	$19,440,563.48	$1,296,037.57
Non-infrastructure	205	$83,818,845.37	$463,087.54	$72,048,428.46	$400,269.05
Parking	1	$244,896.00	$244,896.00	$244,896.00	$244,896.00
Pedestrians and bicyclists	180	$101,308,610.06	$865,885.56	$81,405,462.91	$707,873.59
Railroad grade crossings	50	$17,231,494.00	$574,383.13	$12,297,082.00	$409,902.73
Roadside	444	$459,773,354.90	$1,191,122.68	$393,629,816.45	$1,033,149.12
Roadway	1244	$1,106,988,026.56	$927,125.65	$497,480,541.80	$417,699.87
Roadway delineation	246	$261,570,735.14	$1,157,392.63	$103,763,309.83	$459,129.69
Roadway signs and traffic control	261	$70,422,979.73	$294,656.82	$66,095,010.82	$281,255.37
Shoulder treatments	220	$538,903,795.63	$2,554,046.42	$334,430,445.80	$1,584,978.42
Speed management	6	$5,639,289.00	$1,409,822.25	$443,000.00	$221,500.00
Work Zone	13	$6,669,955.78	$513,073.52	$6,584,195.78	$506,476.60
Unknown	194	$149,059,277.47	$768,346.79	$86,080,703.88	$623,773.22
Total	**4468**	**$4,027,662,036.54**	**$1,011,467.11**	**$2,460,532,476.13**	**$631,877.88**

* Not all states provided cost data for all projects in a given improvement category.

Table 6: Number and Cost of Projects by Subcategory for Intersection Geometry

Subcategory	Number of Projects	Total Cost
Auxiliary lanes - add left-turn lane	141	$123,639,661.11
Auxiliary lanes - add right-turn lane	32	$25,433,446.39
Auxiliary lanes - other	49	$62,997,174.60
Intersection geometrics – modify skew angle	18	$20,869,394.10
Intersection geometrics – other/unknown	204	$161,588,327.42
Intersection geometrics – realignment to improve offset	14	$13,423,357.51
Total	**458**	**$407,951,361.13**

Table 7: Number and Cost of Projects by Subcategory for Intersection Traffic Control

Subcategory	Number of Projects	Total Cost
Intersection flashers and signing	84	$26,426,718.00
Intersection traffic control - other/unknown	190	$97,361,597.86
Modify control to roundabout	90	$87,550,632.90
Modify traffic signal	198	$139,339,091.16
Modify traffic signal timing or phasing	37	$15,946,733.00
Pavement markings	9	$4,248,008.75
Total	**608**	**$370,872,781.67**

Table 8: Number and Cost of Projects by Subcategory for Pedestrians and Bicyclists

Subcategory	Number of Projects	Total Cost
Install or modify crosswalk	26	$3,192,251.00
Install or modify pedestrian signal	53	$32,579,159.94
Install sidewalk	30	$4,856,324.00
Miscellaneous pedestrian and bicyclist improvements	71	$60,680,875.12
Total	**180**	**$101,308,610.06**

Table 9: Number and Cost of Projects by Subcategory for Roadway

Subcategory	Number of Projects	Total Cost
Pavement surface	100	$105,145,037.40
Roadway - other/unknown	704	$351,258,463.55
Roadway narrowing (road diet, roadway reconfiguration)	23	$78,680,798.50
Roadway widening	59	$423,937,644.13
Rumble strips	335	$140,327,388.34
Superelevation / cross slope	23	$7,638,694.64
Total	**1244**	**$1,106,988,026.56**

Table 10: Number and Cost of Projects by Subcategory for Roadside

Subcategory	Number of Projects	Total Cost
Barrier	282	$353,246,216.17
Barrier end treatments	59	$23,384,061.92
Curb and drainage improvements	1	$1,983,967.00
Removal of roadside objects	11	$2,785,050.00
Roadside grading	18	$2,969,227.00
Roadside – other/unknown	73	$75,404,832.81
Total	**444**	**$459,773,354.90**