Highway Safety Improvement Program 2018 National Summary Report

FHWA Safety Program

U.S. Department of Transportation
Federal Highway Administration

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16. Abstract

The Highway Safety Improvement Program (HSIP) 2018 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 2018 reporting cycle. The HSIP 2018 National Summary Report is not intended to compare States but 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 2018 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. In 2018, the States obligated approximately $4.5 billion for over 4,700 highway safety improvement projects.

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 2018 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' 2018 HSIP implementation efforts.

Project Types

- 27 States have roadway departure programs, compared to 24 States in 2017, whereas 26 States have intersection programs compared to 27 States in 2017.
- Similar to 2017, States continue to use crash frequency and crash rate to identify projects in a majority of their safety programs.
- Similar to 2017, States continue to use HSIP funds to address the predominant infrastructure-related crash types – roadway departure, intersection, and pedestrian crashes.
- Similar to 2017, about 75 percent of highway safety improvement projects occur on roads owned by the State Highway Agency.
- On average, States obligated 42 percent of HSIP funds to address systemic safety improvements, which is a slight increase from 40 percent in 2017.
- A majority (66 percent) of highway safety improvement projects falls into the following safety treatment categories: roadway, intersection traffic control, roadside, intersection geometry, and roadway signs and traffic control, compared to 73 percent in 2017.

Project Costs

- A majority, roughly 66 percent of all HSIP projects cost less than $500,000 each, compared to 64 percent in 2017.
- About 32 percent of all HSIP projects cost less than $100,000, compared to 33 percent in 2017.
- About 22 percent of HSIP projects would be considered high cost, coming in at over $1 million each, an increase from 18 percent in 2017. These projects often include widening shoulders, installing cable barrier, or other miscellaneous intersection geometry and roadway projects.
- Projects on rural principal arterial freeways and expressways had the highest average total cost per project of $3.54 million (a slight reduction from an average total cost per project of $3.6 million in 2017), whereas projects on urban minor collectors had the

lowest average total cost per project of $0.22 million (in 2017, projects on rural local roads or streets had the lowest average total cost per project of $0.19 million).

- Similar to 2017, there are fewer urban projects than rural projects, but the average total cost for urban projects is greater than that of rural projects.
- Railroad projects had the highest average total cost per project of $3.1 million. Projects on roads owned by City and Municipal Highway Agencies had the second highest average total cost per project of $1.2 million, while State Highway Agencies had the third highest average total cost per project of approximately $1.1 million.
- Interchange design, parking, and access management have the highest average cost per project; whereas roadway signs and traffic control, lighting, and speed management have the lowest average cost per project.

While the spending patterns do not change much from year to year, the number and cost of HSIP projects has continued to increase. There were 1,684 projects with a total cost of $1.61 billion in 2009, which rose to 4,713 projects with a total cost of $4.5 billion in 2018. Over the past ten years, States obligated $29.4 billion for more than 34,000 highway safety improvement projects. Based on a sample of 2018 HSIP projects, FHWA estimates that the benefits of these projects outweigh the costs on a scale ranging from 4.76 to 8.64.

Background

The 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, like other Federal-aid highway programs, is a Federally-funded, State-administered program. The FHWA establishes the HSIP requirements via 23 Code of Federal Regulations (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 (SHSP).
- Produce a program of projects or strategies to reduce identified safety problems.
- Evaluate the SHSP on a regularly recurring basis.[2]

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.[3] States prepared the 2018 reports using the HSIP Reporting Guidance, dated December 29, 2016.[4] The HSIP 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 outcomes and performance targets.
- Effectiveness of improvements.
- Compliance assessment.

The *HSIP 2018 National Summary Report* compiles and summarizes aggregate information related to the States progress in implementing HSIP projects during the 2018 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 2018 HSIP reports. The *HSIP 2018 National Summary Report* is not intended to compare States but 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 2018 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 previous year's reports page available on the HSIP Reports website.[5]

HSIP Funding Approach

The Fixing America's Surface Transportation (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.

The FAST Act (Section 1101) authorizes a total combined amount of $41.4 billion in FY 2018 in contract authority to fund six formula programs (including certain set-asides within the programs described below): [6]

- National Highway Performance Program (NHPP).
- Surface Transportation Block Grant Program (STBG).
- **HSIP.**
- Congestion Mitigation and Air Quality Improvement Program (CMAQ).
- Metropolitan Planning.
- National Highway Freight Program (NHFP).

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

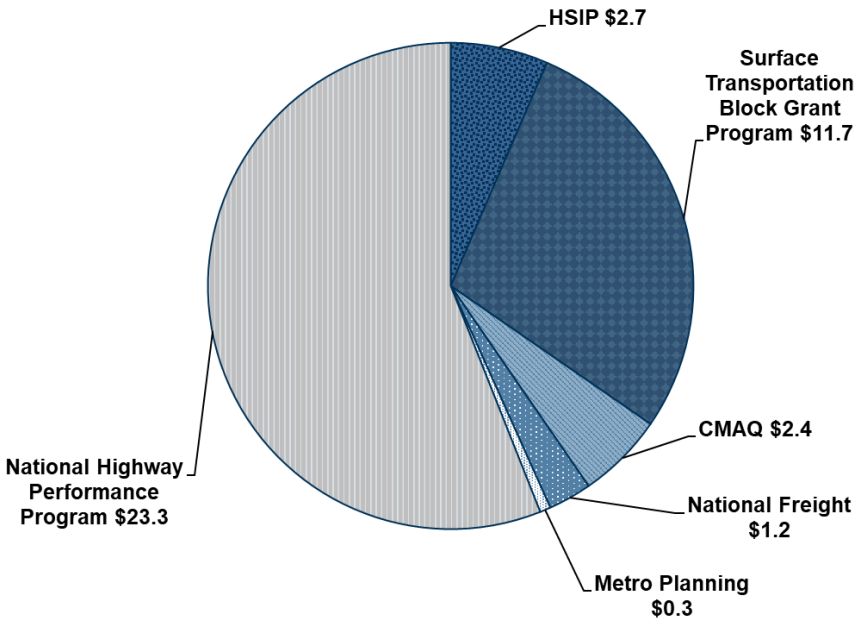

Figure 1. Chart. FAST Act annual program apportionments FY18 ($ billions).[7]

HSIP receives 7 percent of the States apportionment remaining after allocations to NHPP, 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 -- $235 million.[8]
- Two percent for State Planning and Research (SPR).[9]

In addition, if the High Risk Rural Roads Special (HRRR) rule applies to a State, then in the next fiscal year the State must obligate an amount at least equal to 200 percent of its FY 2009 HRRR

set-aside for high risk rural roads.[10] 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. Additionally, 'States' refer to all States, the District of Columbia, and Puerto Rico.

Data-Driven Safety Decision Making

The *HSIP National Summary Report* includes evaluation summary of how States are using data-driven safety decision making to support their HSIP. This includes the States' safety programs 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 42 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* defines a program as a group of projects (not necessarily similar in type or location) implemented to achieve a common highway safety goal.[11] 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 2018 reporting period. Most States have "Roadway Departure" (27 States) and "Intersection" (26 States) programs. Twenty-seven States selected 54 programs in the "Other" category. Examples of programs in the "Other" category are: "pavement marking improvements," "longitudinal rumble strips," and "vulnerable road users."

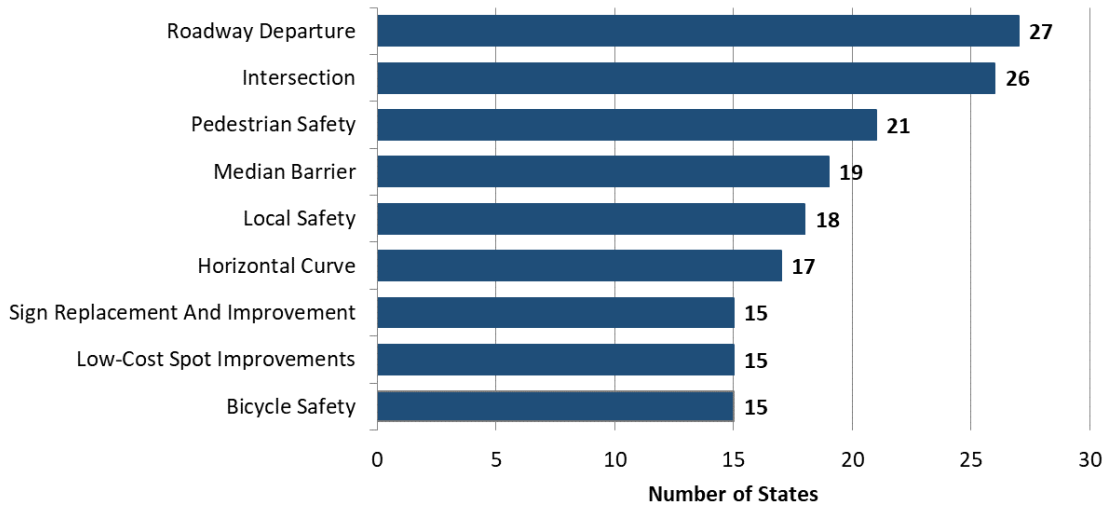

Figure 2. Graph. Number of State safety programs (top 9).

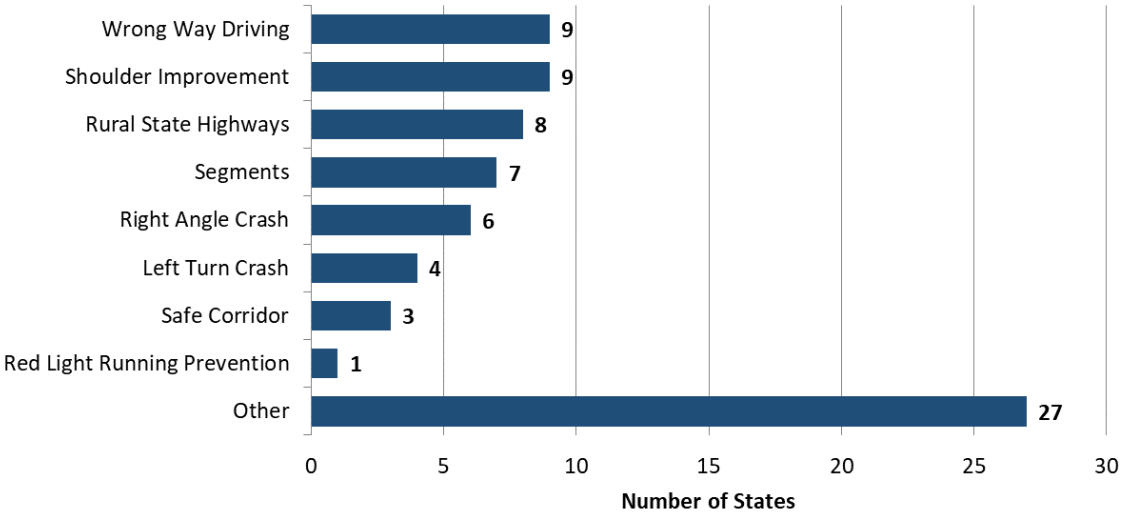

Figure 3. Graph. Number of State safety programs (bottom 9).

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*.[7] Figure 4 presents the number of times a particular PIM was selected by the States. It is important to note that a State can select more than one PIM for each safety program. "Crash frequency" was selected 218 times while "Excess expected crash frequency using methods of moments" was only selected one time. Examples of methodologies in the "Other" category are: "Collaboration with county engineers" and "Hierarchical Bayesian Model."

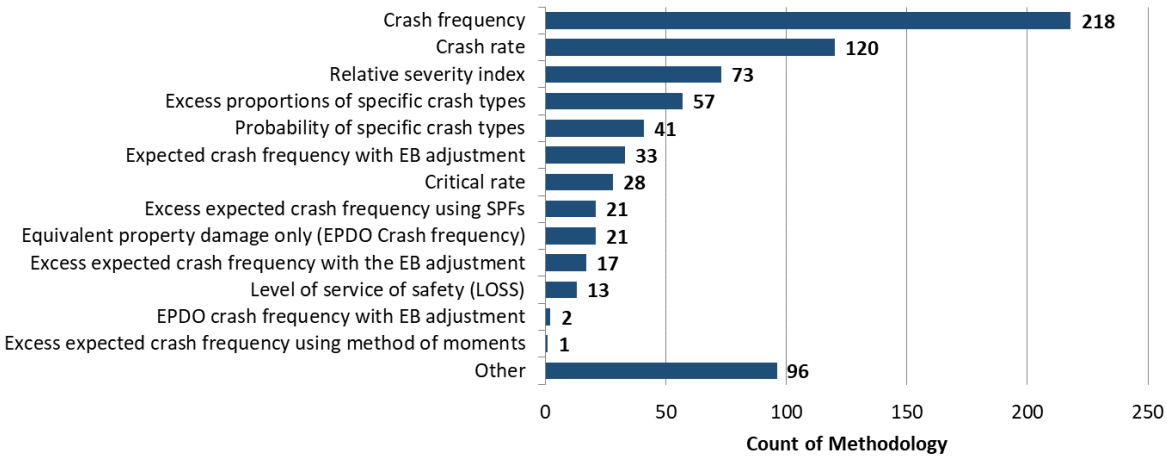

Figure 4. Graph. Count of PIM selected for programs administered under HSIP.

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 a calendar year, State fiscal year, or Federal fiscal year. For 2018, the States obligated $4.5 billion for 4,713 projects. These obligations utilized funds apportioned during the 2018 fiscal year as well as HSIP funds available from previous years' apportionments and other federal/state funds too.

As per the HSIP 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).
- Method for site selection (e.g. spot or systemic).
- Project cost.
- Funding category.
- Relationship to the State's SHSP (i.e. emphasis area, strategy).
- Roadway characteristics.

The following sections present various summaries of the nationwide HSIP project obligations for the 2018 reporting cycle. Not all States have included all of the above information for each project in their annual HSIP reports, so the analysis of the project information is limited. Full use of 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 larger in scope than others, countermeasure installations across multiple sites, or non-infrastructure projects (i.e. transportation safety planning, data improvements). Due to the fact that cost information was not included for every project, only 4,254 projects (90% of total) were used in the breakdown analysis. Nonetheless, the summaries in the following sections provide a broad scale analysis of HSIP spending for the 2018 reporting

cycle by project cost, functional classification and ownership, improvement categories and subcategories, and SHSP emphasis areas.

Project Cost

As stated above, projects reporting $0 costs or projects reporting deobligated funds were excluded from analysis (total of 459 projects). Costs ranged widely. Some projects were small in scope and cost, such as installing a pedestrian signal. Others were higher cost projects, such as resurfacing a highway or realigning a curve. Figure 5 shows the breakdown by project cost, grouped into general categories with breakpoints at $100,000, $500,000, and $1,000,000.

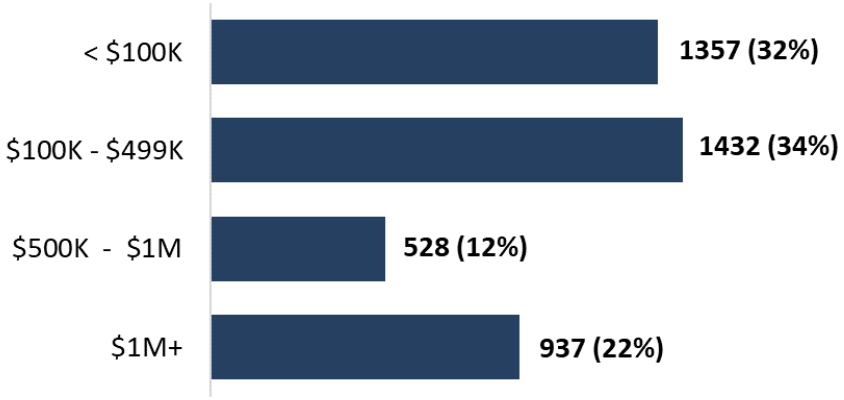

Figure 5. Chart. Number of projects by project cost.

Roughly 66 percent of the projects had costs less than $500,000. A small percentage (12 percent) fell into the $500,000 - $1 million category. The remaining 22 percent were higher cost projects totaling $1 million or more. The top five sub categories selected for these higher cost projects are as follows:

1. Roadway – other (71 projects).
2. Widen shoulder – paved or other (45 projects ranging from 0.43 to 29 miles treated).
3. Barrier – cable (35 projects ranging from 4.1 to 103 miles treated).
4. Barrier – other (28 projects ranging from 2.5 to 31 miles treated).
5. Modify control – two way stop to roundabout (26 projects).
5. Rumble strips – edge or shoulder (26 projects).

In 2017, the breakdowns were similar. Over two-thirds of the projects had costs less than $500,000, approximately 12 percent fell into the $500,000 - $1 million category, and about 19 percent were more than $1 million.

Functional Class and Ownership

Figure 6 through figure 10 illustrate the distribution of projects by road type. Figure 6 shows number of projects by functional class, following the Highway Performance Monitoring System (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 road ownership. Figure 10 shows average total cost of projects by road ownership. 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.

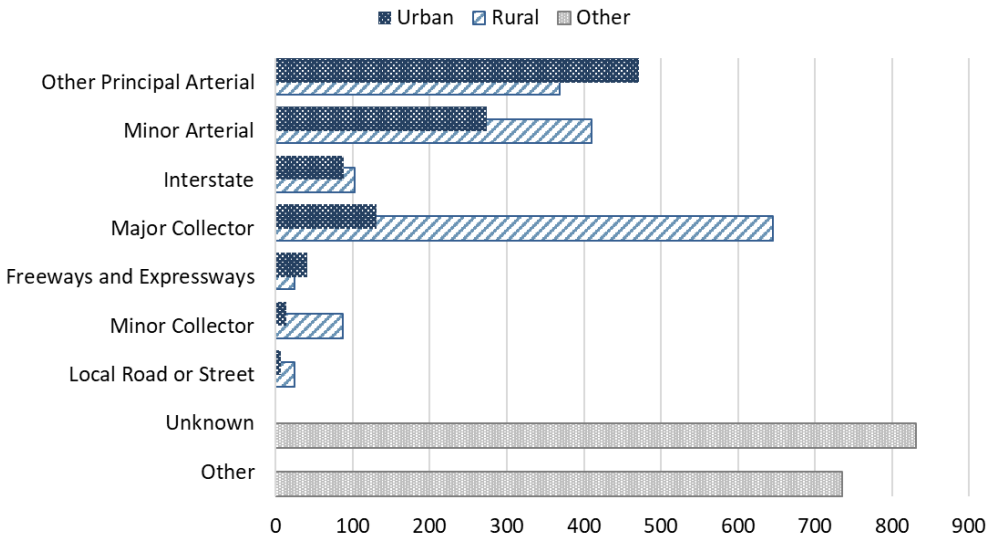

Figure 6. Chart. Number of projects by functional class.

Projects that were associated with a functional class were most often categorized as "Rural Major Collector" or "Urban Other Principal Arterial" (figure 6), compared to "Rural Major Collector" and "Rural Minor Arterial" in 2017. There were 831 projects categorized as "Unknown" indicating the State did not assign a functional classification to the project.

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 that had cost information available. Projects categorized as "Rural Principal Arterial – Freeways and Expressways" had the highest average total cost per project of $3.54 million and projects categorized as "Urban Minor Collector" had the lowest average total cost per project of $0.21 million.

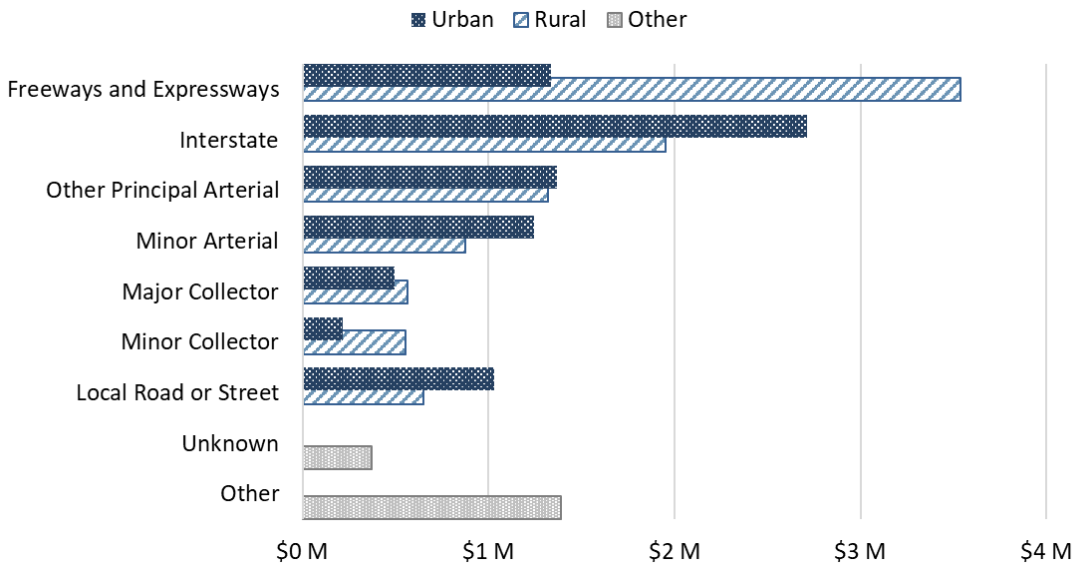

Figure 7. Chart. Average total cost of projects by functional class.

Figure 8 illustrates the number and average total cost of projects by urban/rural designation. As in 2017 and 2016, 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.

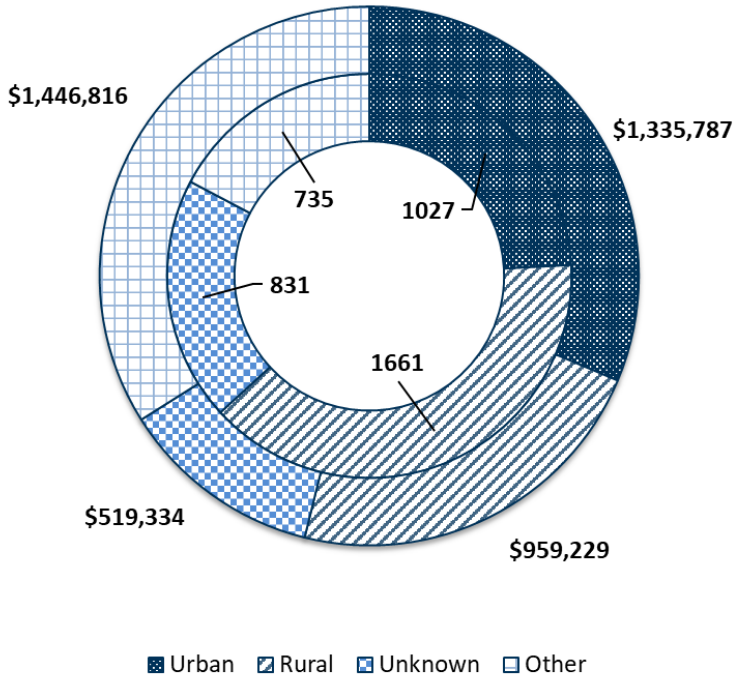

Figure 8. Chart. Number and average total cost of projects by urban/rural designation.

As in 2017 and 2016, States implement most projects on roads owned by a "State Highway Agency" (figure 9). There were 200 projects categorized as "Unknown" (indicating that the

State did not indicate road ownership for a particular project). There were 57 projects categorized as “Other” (mostly planning and design projects).

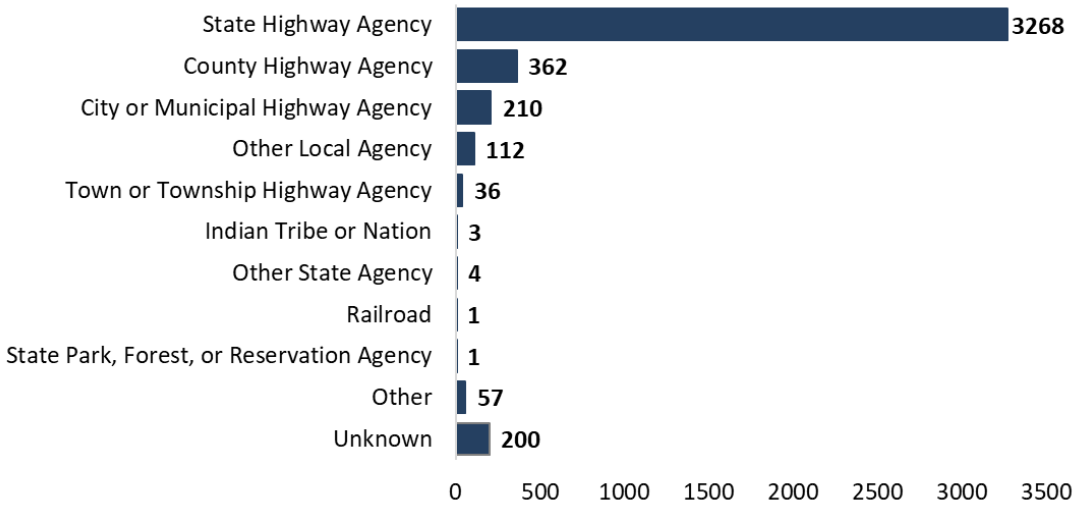

Figure 9. Chart. Number of projects by road ownership.

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 that had cost information available (excluding deobligated costs).

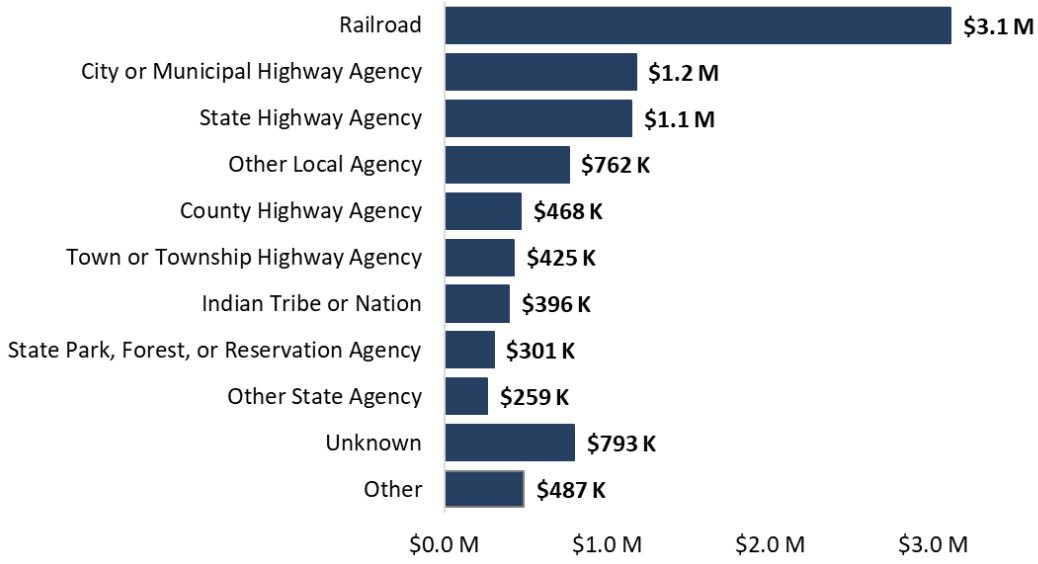

Figure 10. Chart. Average total cost of projects by road ownership.

Improvement Categories and Subcategories

Under the HSIP 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 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 average 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 general 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, "Auxiliary lanes – other" combines adding acceleration lanes, adding auxiliary through lanes, adding two way left turn lanes, and several other related subcategories.

Figure 11 shows the number of projects by improvement category (top 11) as classified in the HSIP Reporting Guidance. Based on the project information reported by the States, the top five improvement categories are roadway, intersection traffic control, roadside, intersection geometry, and roadway signs and traffic control. In 2017, the top five improvement categories were the same, as were the ranking of project categories.

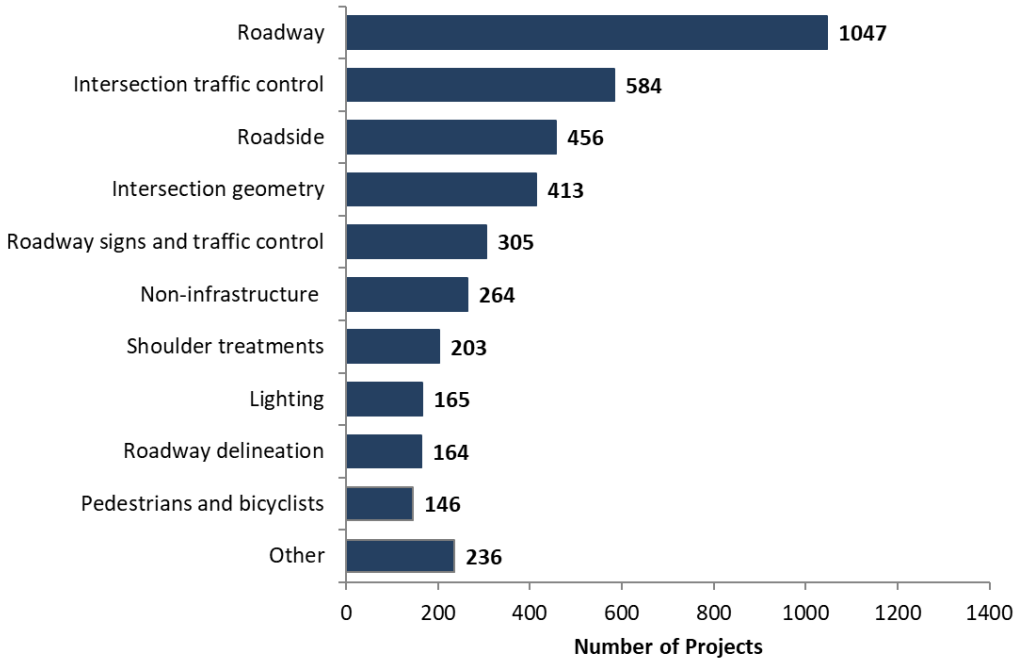

Figure 11. Chart. Number of projects by improvement category (top 11).

Figure 12 shows the number of projects by improvement category (bottom 8) as classified in the HSIP Reporting Guidance. Note that in 2018 there were no projects reported for work zone, multiple, or animal-related categories. There was about one-third as many alignment and railroad grade crossing projects compared to 2017. The remaining bottom-ranking categories were similar to 2017.

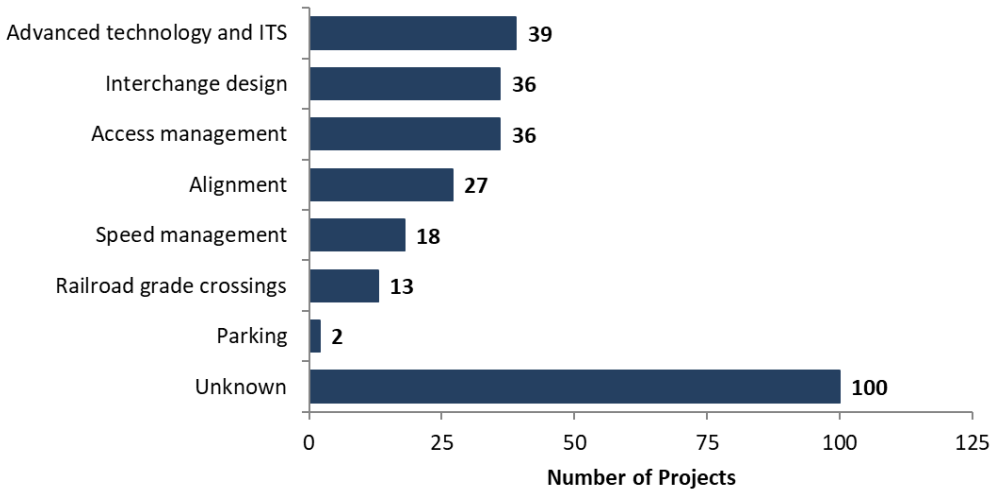

Figure 12. Chart. Number of projects by improvement category (bottom 8).

Figure 13 shows the average total cost of projects by improvement category (top 11). It is important to note that, similar to 2017, the average is based only on the number of projects with costs available (projects with deobligated costs and those reporting $0 cost were excluded). Some notable differences in average project costs are below.

- Interchange design – remains the top improvement category (decreased from $8.4 million in 2017 to $5.3 million in 2018).
- Parking – Two truck parking projects in 2018 made this the second-highest cost improvement category, moved from bottom 8 in 2017 to top 11 in 2018 (increased from $30,000 in 2017 to $5.0 million in 2018).
- Intersection traffic control – moved from the bottom 8 in 2017 to the top 11 in 2018 (increased from $560,000 in 2017 to $915,000 in 2018).
- Intersection geometry – moved from the top 11 in 2018 to bottom 8 in 2018 (however, average cost for this category remained the same).

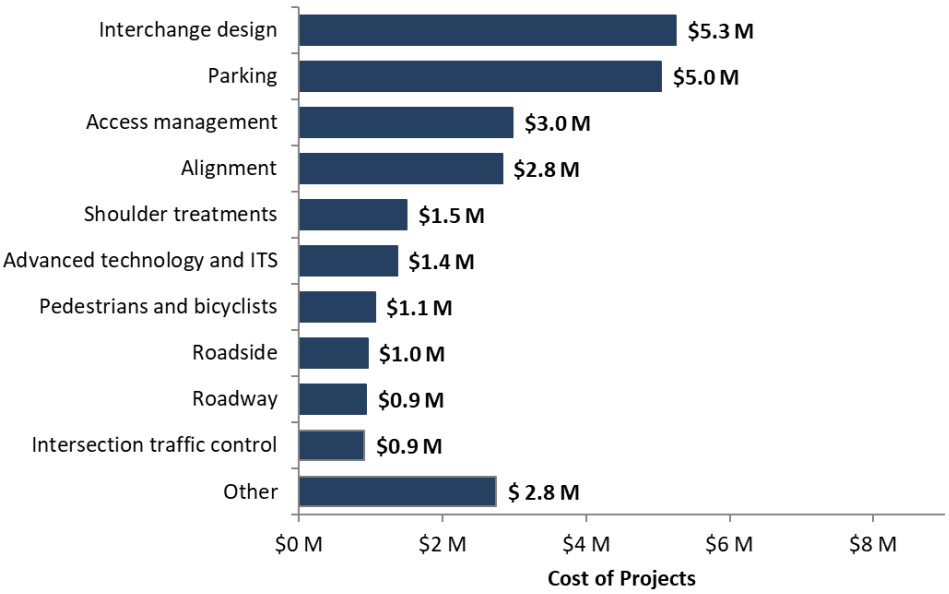

Figure 13. Chart. Average total cost of projects by improvement category (top 11).

Based on project information reported by the States (figure 14), the lowest average HSIP cost projects are in the following categories:

- Railroad grade crossings; 13 projects with cost information.
- Non-infrastructure; 264 projects with cost information.
- Roadway signs and traffic control; 305 projects with cost information.
- Lighting; 165 projects with cost information.
- Speed management; 18 projects with cost information.

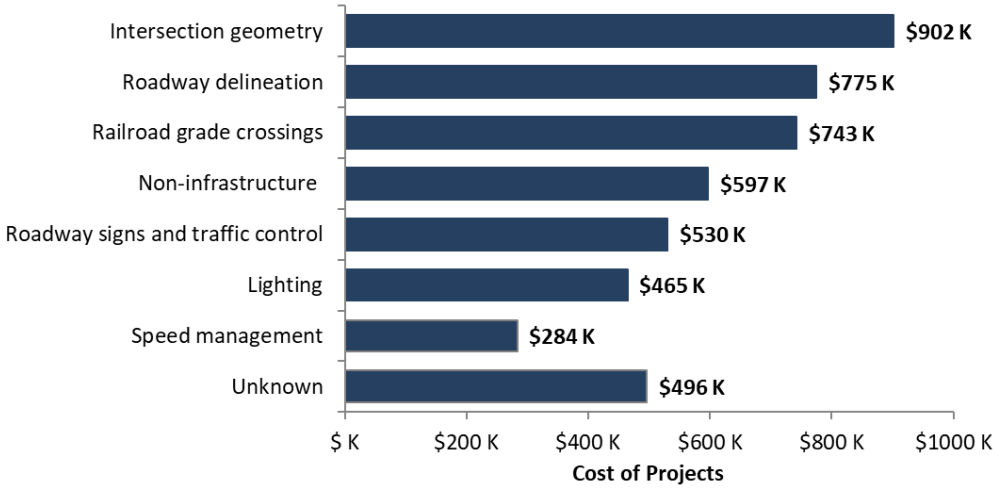

Figure 14. Chart. Average total cost of projects by improvement category (bottom 8).

The report highlights further evaluation of the intersection geometry and intersection traffic control categories because in 2018 (as in previous years) they 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.[12]

For the Intersection Geometry category in figure 15, most projects are sub categorized as "Intersection geometrics – other/unknown" (62 percent; 258 of 413 projects) or "Auxiliary lanes – add left-turn lane" (15 percent; 62 of 413 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.

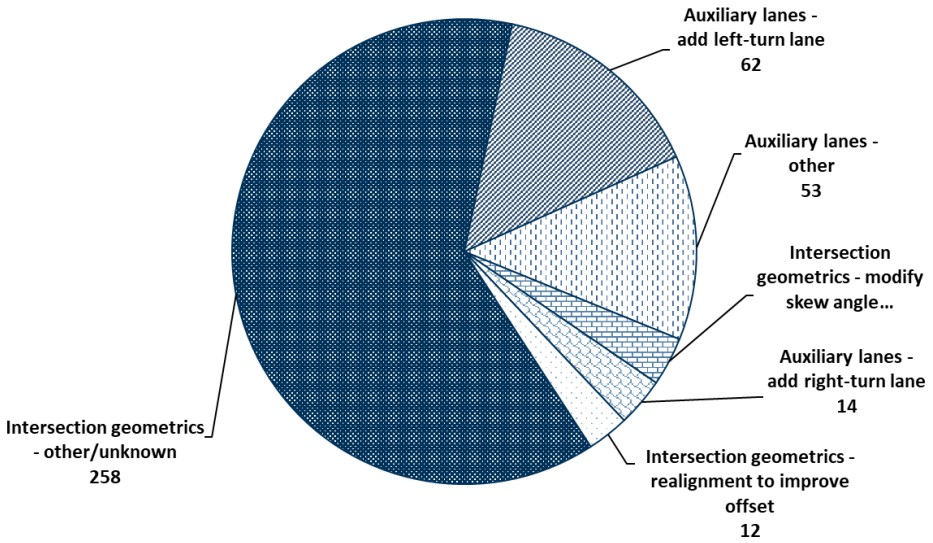

Figure 15. Chart. Number of intersection geometry projects by subcategory.

For the intersection traffic control category in figure 16, most projects are subcategorized as "Modify traffic signal" (30 percent; 173 of 583 projects), "Intersection traffic control – other/unknown" (25 percent; 148 of 583 projects), and "Modify control to roundabout" (21 percent; 123 of 583 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. Examples of projects in the "Modify traffic signal" category include modernization/replacement of traffic signal and adding flashing yellow arrow signals. The "Intersection traffic control – other/unknown" subcategory is predominately used without any project description; therefore, no other information is available for these projects.

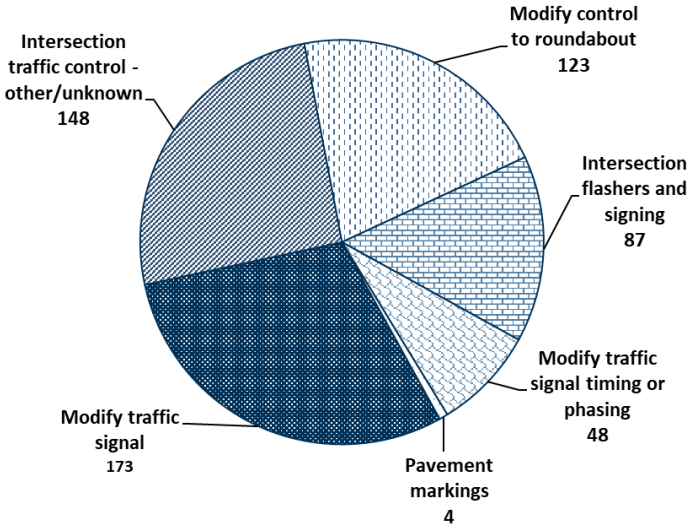

Figure 16. Chart. Number of traffic control projects by subcategory.

The report also highlights further evaluation of the pedestrian and bicycle category 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 in figure 17, most projects are subcategorized as "Miscellaneous pedestrian and bicyclist improvements" (64 percent; 90 of 141 projects) and "Install or modify pedestrian signal" (14 percent; 20 of 141 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.

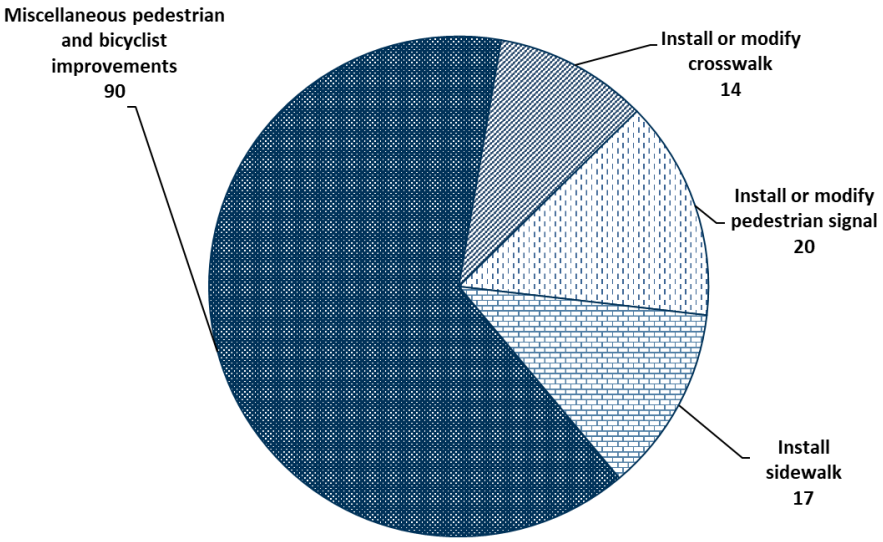

Figure 17. Chart. Number of pedestrian and bicyclist projects by subcategory.

The report also highlights further evaluation of the roadway and roadside categories because in 2018 (as in previous years) they ranked in the top five in terms of number of projects categories, with roadway category being the number one category associated with HSIP projects. FHWA has also identified roadway departure as one of three focus areas for the Focused Approach to Safety effort.

For the roadway category shown in figure 18, most projects were subcategorized as "Roadway – other/unknown" (53 percent; 557 of 1047 projects) and "Rumble strips" (30 percent; 313 of 1047 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."

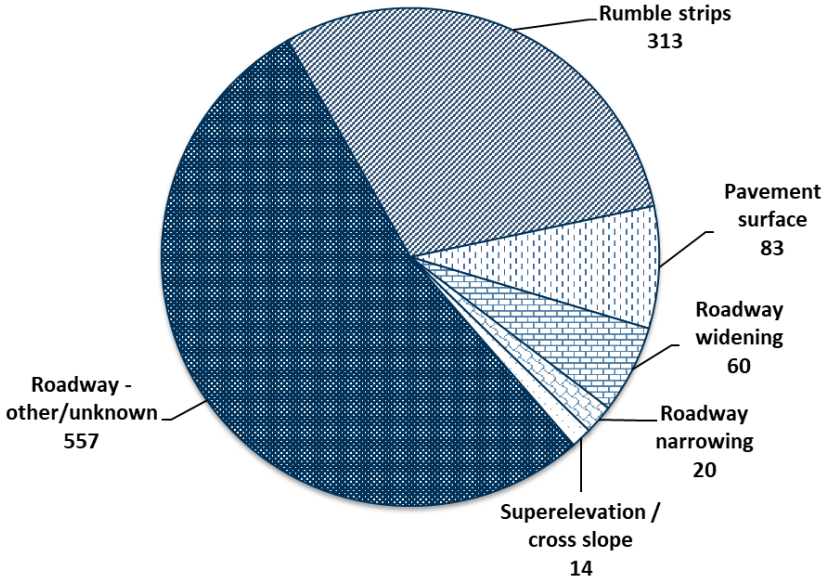

Figure 18. Chart. Number of roadway projects by subcategory.

For the roadside category in figure 19, most projects were subcategorized as "Barrier" (56 percent; 257 of 456 projects), "Removal of roadside objects" (21 percent; 94 of 456 projects), and "Roadside – other/unknown" (14 percent; 63 of 456 projects). Examples of two projects in the "Roadside – other/unknown" subcategory were "Barrier - removal" and "Fencing."

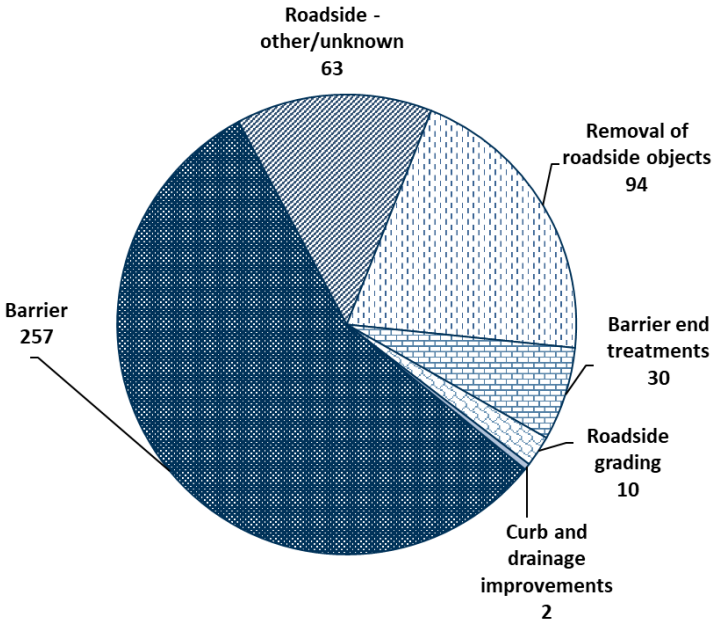

Figure 19. Chart. Number of roadside projects by subcategory.

FHWA Proven Safety Countermeasures

In 2008, FHWA began promoting certain infrastructure-oriented safety treatments and strategies, chosen based on proven effectiveness and benefits, to encourage widespread implementation by State, tribal, and local transportation agencies to reduce serious injuries and fatalities on American highways. This became known as the Proven Safety Countermeasures initiative.[(14)]

The Proven Safety Countermeasures includes a total of 20 treatments and strategies that practitioners can implement to successfully address roadway departure, intersection, and pedestrian and bicycle crashes. Among the 20 Proven Safety Countermeasures are several crosscutting strategies that address multiple safety focus areas.

Table 1 shows a summary of the number and costs of the 2018 HSIP projects by the most common FHWA Proven Safety Countermeasures. It is important to note that this information is based on the States' descriptions of each project. Some projects may have incorporated one or more of the Proven Safety Countermeasures without reporting it explicitly. Therefore, it is likely that these numbers are actually higher than the values shown in table 1.

Table 1. Total number and cost of 2018 projects by FHWA proven safety countermeasures.

FHWA Proven Countermeasure	2018 HSIP Projects	2018 Total Expenditures
Median Barrier*	81	$109.1M
Roundabouts	147	$199.0M
Rumble Strips**	326	$101.9M
Road Diet	24	$70.8M
High Friction Surface Treatment	73	$56.1M
Curve Warning Signs	57	$20.4M
Backplates with Retroreflective Borders	12	$6.4M
Systemic Application of Multiple Low-Cost Countermeasures at Stop-Controlled Intersections	4	$0.94M
Corridor Access Management	27	$76.3M
Left and Right-Turn Lanes at Stop-Controlled Intersections***	148	$123.6M
Medians and Pedestrian Crossing Islands in Urban and Suburban Areas	14	$16.4M
Pedestrian Hybrid Beacon	5	$1.9M
Walkways (install sidewalk)	24	$8.5M
Walkways (shoulder related projects)	193	$300M
Road Safety Audits	28	$15.1M

Note: * = cable median barriers only; ** = center line and edge line rumble strips only; *** = all auxiliary turn lane projects - both signalized and stop-controlled intersections.

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.

Approximately 37 percent of the projects were categorized as "Roadway Departure" (40 percent in 2016 and 39 percent in 2017), 30 percent were categorized as "Intersections" (29 percent in 2016 and 31 percent in 2017), 5 percent were categorized as "Pedestrians" (4 percent in 2016 and 2017), and 15 percent categorized as "Unknown/Other" (13 percent in 2016 and 10 percent in 2017). Examples of other categories used by the States include: "Highway Infrastructure," "Railroad," and "Lighting."

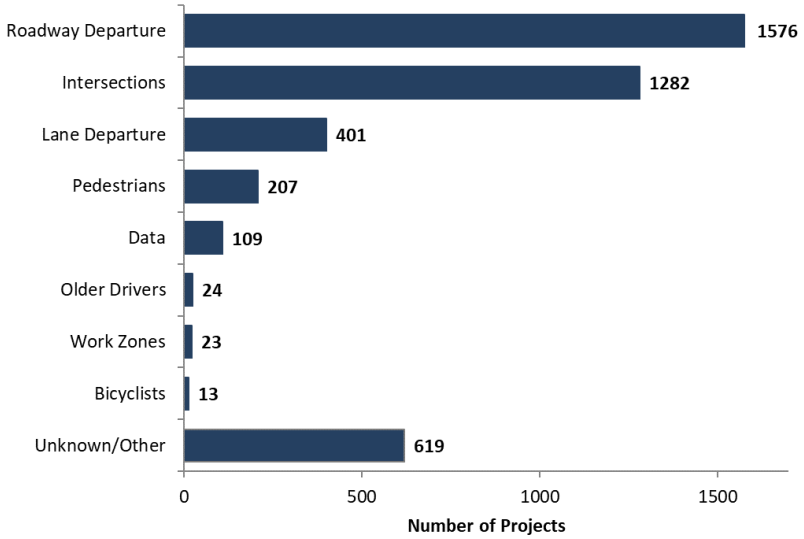

Figure 20. Chart. Number of projects by SHSP emphasis area.

2014-2018 Comparison

The number and cost of HSIP projects continues to increase each year. As shown in table 2, the total number of projects and cost of projects continues to increase each year from 2014 to 2017. For 2018, the total number of projects decreased by 200 projects over 2017, but the increasing trend in costs continued in 2018, with an increase of about $0.2 billion over 2017. However, the breakdown in project costs for various breakpoints was similar across years.

Table 3 shows the 2014 through 2018 comparison of the number of projects and average total cost of projects for various project types highlighted in this report (does not include projects with deobligated funds or projects where no value was reported or the value entered was $0). For most project types, the number and cost of projects has increased over the five-year period.

Table 2. Total number of projects and project cost breakdown, 2014-2018.

Year	2014	%	2015	%	2016	%	2017	%	2018	%
Number of projects	3,348	n/a	4,188	n/a	4,468	n/a	4,943	n/a	4,713	n/a
Number of projects (with cost info.)*	3,272	n/a	3,830	n/a	3,726	n/a	4,616	n/a	4,254	n/a
Cost of projects*	$3.10B	n/a	$3.90B	n/a	$4.03B	n/a	$4.3B	n/a	$4.5B	n/a
Average cost per project	$952K	n/a	$1.02M	n/a	$1.08M	n/a	$879K	n/a	$961K	n/a
Number of projects <$100K	1,011	30%	1,374	33%	1,106	25%	1,634	33%	1,357	29%
Number of projects $100K - $499K	1,054	31%	1,131	27%	1,246	28%	1,550	31%	1,432	30%
Number of projects $500K-$1M	450	13%	445	11%	478	11%	561	11%	528	11%
Number of projects $1M+	757	23%	880	21%	896	20%	871	18%	937	20%
Number of projects with deobligated funds	28	1%	146	3%	256	6%	285	6%	41	1%
Number of projects with $0 or blank	48	1%	212	5%	486	11%	42	1%	418	9%

Note: For 2017 and 2018, the number of projects with cost info and cost of projects do not include projects with deobligated funds or where the value entered was $0. 2017 and 2018 data includes PR HSIP projects. Therefore, comparisons with previous years should be made with caution.

Table 3. Number of projects and average total project cost for various project types, 2014-2018.

Project Type	Num. of Projects 2014	Avg. Cost 2014	Num. of Projects 2015	Avg. Cost 2015	Num. of Projects 2016	Avg. Cost 2016	Num. of Projects 2017	Avg. Cost 2017	Num. of Projects 2018	Avg. Cost 2018
Urban projects	954	$1.3M	1,236	$1.2M	1,277	$1.7M	1,179	$1.2M	1,027	$1.3M
Rural projects	1,361	$890K	1,847	$1.1M	1,683	$956K	1,920	$998k	1,661	$959K
Roadway projects	722	$955K	1,195	$671K	1,244	$1.1M	1,357	$1.1M	1,047	$940K
Intersection traffic control projects	505	$702k	615	$798K	608	$704K	751	$560K	583	$915K
Intersection geometry projects	379	$983K	559	$1.0M	458	$1.1M	439	$910K	413	$902K
Pedestrian/bicycle projects	118	$507K	122	$965K	180	$866K	182	$667K	141	$1.06M
Roadside projects	303	$810K	422	$893K	444	$1.2M	485	$896K	456	$960K

Note: For 2017 and 2018, the number of projects and average cost do not include projects with deobligated funds or where the value entered was zero. 2017 and 2018 data includes Puerto Rico HSIP projects. Therefore, comparisons with previous years should be made with caution.

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.[13] The information from the baseline report is summarized below with the purpose of comparing basic cost and project information to the 2013 through 2018 reports. Table 4 shows that States obligated $29.4 billion for approximately 34,000 projects over the 10-year period. These obligations include not only HSIP funds apportioned during the reporting period (2009-2018), but also HSIP funds available from previous years' apportionments.

Table 4. Total number and cost of projects by year.

Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Total
Num. of Projects	1,684	2,386	2,523	2,429	3,292	3,348	4,188	4,468	4,943	4,713	33,974
Num. of Projects (with cost info.)*	1,568	2,320	2,397	2,311	3,171	3,272	3,830	3,726	4,616	4,254	31,465
Cost of projects*	$1.61B	$1.46B	$1.78B	$1.65B	$3.09B	$3.10B	$3.90B	$4.03B	$4.3B	$4.5B	$29.4B
Avg. Cost Per Project*	$1.0M	$629K	$743K	$722K	$981K	$952K	$1.0M	$1.1M	$940K	$1.05M	$912K

Note: * = For 2017 and 2018, the number of projects with cost info and cost of projects do not include projects with deobligated funds or where the value entered was zero. 2017 and 2018 data includes Puerto Rico HSIP projects. Therefore, comparisons with previous years should be made with caution.

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 2018 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 program's 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 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. Puerto Rico was also excluded, given that road improvement project needs and costs deviate from those in the continental U.S. The following steps indicate how to apply the selected methodology for HSIP projects 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. The crash cost values in the 2018 analysis are based on the crash severity values recommended by Harmon et al. in a recent FHWA resource entitled "Crash Costs for Highway Safety Analysis."[15] The values for each combination of crash severities (e.g., K, KA, KAB, etc.) were calculated using information from Council et al. and the methodology reported in a memo written by Bhagwant Persaud to FHWA.[16,17]
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 946 segment and intersection-based projects, which is approximately 20 percent of the projects listed in the 2018 HSIP Project Database. Table 5 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 the bottom row of table 5 (ranging from 4.76 to 8.64) 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 ranges for the 2016 and 2017 HSIP project listings were 4.36 to 6.51 and 6.09 to 11.24, respectively.

Table 5. Weighted benefit-cost ratio for segment and intersection based projects (weight based on total project cost).

	Weighted B/C Ratio (min Service Life, 3% discount rate)	***Weighted B/C Ratio (max Service Life, 3% discount rate)***	***Weighted B/C Ratio (min Service Life, 7% discount rate)***	***Weighted B/C Ratio (max Service Life, 7% discount rate)***
685 Segment-based HSIP Projects (weighted on segment project cost)	7.02	10.50	5.61	7.59
261 Intersection-based HSIP Projects (weighted on intersection project cost)	3.46	3.75	2.55	2.70
946 Segment & Intersection-based HSIP Projects (weighted on segment & intersection project cost)	**6.03**	**8.64**	**4.76**	**6.24**

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 projects. The calculated benefit-cost ratio for each of the 946 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 performance-driven program that uses data and analysis to target safety resources. This *HSIP 2018 National Summary Report* shows that in 2018, 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 42 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 10-year period from 1,684 projects with a total cost of $1.61 billion in 2009 to 4,713 projects with a total cost of $4.5 billion in 2018. Based on a sample of 2018 HSIP projects, FHWA estimates that the benefits of the HSIP outweigh the costs on a scale ranging from 4.76 to 8.64.

Related Reports and Resources

FHWA, FAST Act Apportionment Fact Sheet
https://www.fhwa.dot.gov/fastact/factsheets/apportionmentfs.cfm

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

FHWA, HSIP FAST Act Fact Sheet
https://www.fhwa.dot.gov/fastact/factsheets/hsipfs.cfm

FHWA, HSIP Reporting Guidance, December 29, 2016
https://safety.fhwa.dot.gov/legislationandpolicy/fast/hsip_reporting_guidance.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

FHWA, HSIP 2016 National Summary Report
http://safety.fhwa.dot.gov/hsip/reports/pdf/2016/hsip_natl2016.pdf

FHWA, HSIP 2017 National summary Report
https://safety.fhwa.dot.gov/hsip/reports/pdf/2017/fhwasa18031.pdf

FHWA, 2018 State HSIP Reports
http://safety.fhwa.dot.gov/hsip/reports/

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

Table 6. HSIP improvement categories and subcategories.

Category	Subcategory
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 7. Number and cost of 2018 projects by improvement category.

Improvement Category	Number of Projects	Total Cost of Projects*	Average Total Cost*	Total HSIP Cost of Projects*	Average HSIP Cost*
Access Management	36	$107,313,140.81	$2,980,920.58	$37,833,493.64	$1,050,930.38
Advanced Technology and ITS	39	$53,290,759.44	$1,366,429.73	$33,091,283.49	$848,494.45
Alignment	27	$76,567,495.27	$2,835,833.16	$39,353,482.52	$1,457,536.39
Interchange Design	36	$189,100,014.94	$5,252,778.19	$79,281,548.71	$2,202,265.24
Intersection Geometry	413	$372,572,510.16	$902,112.62	$227,264,169.11	$554,302.85
Intersection Traffic Control	584	$534,407,246.61	$915,080.90	$311,909,695.91	$535,927.31
Lighting	165	$76,680,248.75	$464,728.78	$70,041,056.32	$427,079.61
Non-Infrastructure	264	$157,582,795.74	$596,904.53	$131,930,677.75	$517,375.21
Parking	2	$10,091,574.00	$5,045,787.00	$4,938,458.00	$2,469,229.00
Pedestrian and Bicyclists	146	$155,315,159.49	$1,063,802.46	$85,337,878.44	$651,434.19
Railroad Grade Crossings	13	$9,653,459.00	$742,573.77	$6,492,792.00	$499,445.54
Roadside	456	$437,880,982.93	$960,265.31	$339,921,173.27	$757,062.75
Roadway	1,047	$983,918,890.66	$939,750.61	$458,352,998.33	$441,999.03
Roadway Delineation	164	$127,153,590.93	$775,326.77	$104,641,771.76	$638,059.58
Roadway Signs and Traffic Control	305	$161,758,671.33	$530,356.30	$101,663,552.15	$340,011.88
Shoulder Treatments	203	$305,437,849.52	$1,504,619.95	$208,506,107.93	$1,032,208.46
Speed Management	18	$5,104,055.79	$283,558.66	$4,956,059.92	$275,336.66
Unknown/Other	336	$696,280,769.89	$3,220,761.32	$70,217,030.56	$895,204.40
Total	**4,254**	**$4,460,109,215.27**	**$1,048,450.69**	**$2,315,733,229,81**	**$575,909.78**

Note: * = not all States provided cost data for all projects in a given improvement category. Projects that reported $0 costs or deobligated funds were excluded.

Table 8. Number and cost of projects by subcategory for intersection geometry.

Subcategory	Number of Projects	Total Cost
Auxiliary lanes - add left-turn lane	62	$74,621,775.79
Auxiliary lanes - add right-turn lane	14	$8,782,386.00
Auxiliary lanes - other	53	$87,564,927.65
Intersection geometrics - modify skew angle	14	$5,644,987.56
Intersection geometrics - other/unknown	258	$161,637,548.70
Intersection geometrics - realignment to improve offset	12	$34,320,884.45
Total	**413**	**$372,572,510.20**

Note: Not all States provided cost data for all projects in a given improvement category. Projects that reported $0 costs or deobligated funds were excluded.

Table 9. Number and cost of projects by subcategory for intersection traffic control.

Subcategory	Number of Projects	Total Cost
Intersection flashers and signing	87	$21,521,889.00
Intersection traffic control - other/unknown	148	$149,518,515.50
Modify control to roundabout	123	$199,031,260.30
Modify traffic signal	173	$126,643,470.90
Modify traffic signal timing or phasing	48	$33,791,700.00
Pavement markings	4	$399,410.87
Total	**583**	**$531,207,246.60**

Note: Not all States provided cost data for all projects in a given improvement category. Projects that reported $0 costs or deobligated funds were excluded. One project with a blank subcategory was also excluded from table 7, but is included in table 5.

Table 10. Number and cost of projects by subcategory for pedestrians and bicyclists.

Subcategory	Number of Projects	Total Cost
Install or modify crosswalk	14	$6,650,914.19
Install or modify pedestrian signal	20	$19,296,452.35
Install sidewalk	17	$8,470,204.08
Miscellaneous pedestrian and bicyclist improvements	90	$80,743,437.87
Total	**141**	**$115,161,008.50**

Note: Not all States provided cost data for all projects in a given improvement category. Projects that reported $0 costs or deobligated funds were excluded. Five projects with blank subcategories were also excluded from table 8 but are included in table 5.

Table 11. Number and cost of projects by subcategory for roadway.

Subcategory	Number of Projects	Total Cost
Pavement surface	83	$199,829,278.00
Roadway - other/unknown	557	$433,695,938.40
Roadway narrowing (road diet, roadway reconfiguration)	20	$70,790,474.63
Roadway widening	60	$161,358,761.90
Rumble strips	313	$104,261,265.50
Superelevation / cross slope	14	$13,983,172.27
Total	**1,047**	**$983,918,890.70**

Note: Not all States provided cost data for all projects in a given improvement category. Projects that reported $0 costs or deobligated funds were excluded.

Table 12. Number and cost of projects by subcategory for roadside.

Subcategory	Number of Projects	Total Cost
Barrier	257	$279,560,113.80
Barrier end treatments	30	$28,766,681.61
Curb and drainage improvements	2	$324,013.00
Removal of roadside objects	94	$56,883,503.42
Roadside grading	10	$24,051,944.00
Roadside – other/unknown	63	$48,294,727.10
Total	**456**	**$437,880,982.90**

Note: Not all States provided cost data for all projects in a given improvement category. Projects that reported $0 costs or deobligated funds were excluded.

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