Alaska Department of Transportation and Public Facilities

Alaska Highway Safety Improvement Program

Handbook

Methodology for Identifying, Prioritizing and Evaluating Highway Safety Improvement Program Projects

12th Edition
March 21, 2013

To Be Used in Preparing:

FFY 2014 New Project Proposals	Due 7/15/13
FFY 2013 HSIP Annual Report	Due 8/15/13

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March 21, 2013

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HSIP Purpose:

To construct highway improvements that maximize lives saved and major injuries eliminated per dollar spent.

HSIP Tunnel Vision

Other DOT&PF program funds
address a wide variety of transportation needs.
In contrast, HSIP funds are targeted single-mindedly
at saving lives and reducing major injuries

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1. Introduction

1.1. What is the Alaska Highway Safety Improvement Program?

Alaska's Highway Safety Improvement Program (HSIP) is a federally-mandated program managed by the Alaska Department of Transportation and Public Facilities (DOT&PF). Its purpose is to reduce fatalities and major injuries due to crashes on Alaskan roads.

Prior to 2005 the HSIP was focused on engineering countermeasures. Congress broadened the scope of the HSIP in 2005 to include a Strategic Highway Safety Plan (SHSP), which covers all types of highway safety countermeasures, including enforcement, education, emergency services, and engineering (the "4 Es"). This broadening of HSIP scope resulted in a division of responsibility for HSIP delivery in Alaska. Headquarters Program Development staff developed the original Strategic Highway Safety Plan in 2007. The 2011 update, renamed the Strategic Traffic Safety Plan (STSP) was finalized in March 2012. The program to implement engineering countermeasures traditionally done under the HSIP continues to be managed by headquarters and regional traffic and safety engineers.

This Handbook defines the department's program to develop, implement, and evaluate engineering countermeasures. To maintain continuity with historical usage, this program will be referred to in this manual by its traditional name, the Highway Safety Improvement Program.

Although the HSIP and STSP are managed by different groups, they are coordinated to maximize crash reduction. The HSIP is used to address many of the goals of the STSP (when doing so is cost-beneficial) and program managers consider all of the 4 E's when addressing safety problems.

The HSIP is the only Alaska highway program that evaluates its own cost-effectiveness. Completed projects are evaluated by benefit cost analysis using before and after crash data. Alaska HSIP projects have an average benefit to cost ratio weighted by project cost of 3:1. Benefit cost ratio is computed using the most recent five years' projects with three years of post-project crash data and actual construction costs. Project Benefits are evaluated with current year crash costs and Project Costs are escalated to the current year. Alaska DOT&PF reports benefit cost ratio in the annual HSIP Report.

The following excerpts are from Title 23, Part 924 of the Code of Federal Regulations, which provides the legal basis for the HSIP:

924.5 Policy

a) Each State shall develop, implement, and evaluate on an annual basis a HSIP that has the overall objective of significantly reducing the occurrence of and the potential for fatalities and serious injuries resulting from crashes on all public roads.
b) In order for an eligible improvement to be funded with HSIP funds, States shall first consider whether the activity maximizes opportunities to advance safety. States shall fund safety projects or activities that are most likely to reduce the number of, or potential for, fatalities and serious injuries.

924.7 Program Structure

b) The HSIP shall include processes for the planning, implementation, and evaluation of the HSIP and SHSP.

1.2. How is the Alaska HSIP funded?

HSIP funding is apportioned every six years by Congress subject to annual obligation limits established by congressional finance committees. Since 2001, HSIP funding has been supplemented with "sanction" funding (23 U.S.C. Sections 154 and 164) which is a result of Alaska's non-conformance with federally recommended open container and repeat offender drunk driving laws. In FFY 2014, Alaska HSIP will receive funding provided under the following United States Code Title 23 Sections:

- 130: Railroad Safety
- 148: Highway Safety Improvement Program
- 154, 164: Sanction Funding

All HSIP highway projects are funded under a single "meta" project (Need ID 19217) in the State Transportation Improvement Program. See the diagram in Section 1.5 for additional information on HSIP funding.

1.3. How are HSIP projects selected and managed?

Regional Traffic and Safety Engineers in Alaska's three regions (Northern, Central and Southeast) identify potential project locations by the number and severity of crashes. Generally, projects are ranked by analyzing the benefit cost of specific safety-related improvements using estimated accident reduction factors and improvement costs. The regions submit the most cost effective proposed projects to the State Traffic and Safety Engineer for review.

HQ Traffic & Safety reviews the proposed new projects, works with regions to clarify project descriptions and scope, and submits recommended projects to the Federal Highway Administration for approval. Following FHWA approval of new HSIP projects, the State Traffic and Safety Engineer proposes a list of projects for funding and coordinates with HQ Project Development to prepare a funding plan for the coming federal fiscal year.

State Traffic and Safety personnel manage the federal funds for approved projects. Regional Traffic and Safety personnel work with preconstruction and construction personnel to ensure projects remain consistent with their HSIP scope throughout design and construction. The regions conduct follow-up studies to determine the effectiveness of completed projects. HQ Traffic & Safety summarizes the overall effectiveness of the statewide program in the annual HSIP Report.

1.4. How can we get the most out of the HSIP?

Highway infrastructure safety improvements are made under non-HSIP projects as well as HSIP projects. The greatest safety is achieved when both avenues have a strong safety focus. Proactively incorporating safety features in non-HSIP projects will eliminate the need for corrective HSIP projects

in the future and enable the HSIP to go further in addressing safety problems that are not reachable with non-HSIP projects. In general, HSIP effectiveness should not be diluted by diverting its funds to safety improvements that should be made under non-HSIP projects. However, HSIP participation may be considered on broader non-HSIP projects to provide safety countermeasures that are not routinely provided on similar projects.

The following excerpt from Part 924 of Title 23 of the Code of Federal Regulations supports this approach to safety project funding:

924.5 Policy

c) Other Federal-aid funds are eligible to support and leverage the safety program. Improvements to safety features that are routinely provided as part of a broader Federal-aid project should be funded from the same source as the broader project. States should address the full scope of their safety needs and opportunities on all roadway categories by using other funding sources such as Interstate Maintenance (IM), Surface Transportation Program (STP), National Highway System (NHS), and Equity Bonus (EB) funds in addition to HSIP funds.

Independently nominated and approved HSIP work that is outside the geographical limits of non-HSIP projects can be HSIP-funded and combined with those projects, when feasible, to achieve construction administration economies of scale.

HSIP funds may be used to fund construction of cost-effective safety improvements within the project limits of broader non-HSIP projects only if approved in advance. To be considered for approval, the HSIP nominated work should be limited to improvements that would otherwise not be constructed under the broader project because they are not required by design standards and are not routinely constructed on similar projects. The HSIP nomination should describe how combining HSIP work into the broader project will provide greater cost-effectiveness than if the HSIP work were completed as a standalone project.

1.5. Project funding

FHWA-Approved HSIP Projects

Includes all projects approved by the FHWA as eligible for HSIP funding within the past two years. Approved unfunded projects more than two years old need to be reevaluated and resubmitted.

Candidate new projects should be submitted to the Regional Traffic Engineer for consideration, analysis and possible inclusion in the annual statewide submittal to the FHWA.

HSIP projects are consistent with Alaska's Strategic Traffic Safety Plan (STSP) and correct or improve a hazardous road location or feature, or address a highway safety problem. HSIP funds are eligible to fund qualified projects on all public roads, including non-State-owned public roads and roads on tribal land.

Infrastructure Projects

Includes all projects for which funding has been allocated and obligated under an annual funding plan. Infrastructure projects result in a physical or operational change to the highway facility. Projects are ranked and prioritized for funding using the ADOT&PF HSIP process.

Individual projects are funded by the umbrella Statewide HSIP STIP project. Individual projects do not appear on the STIP.

Infrastructure projects must have prior FHWA approval in order to obligate safety funds.

Non-Infrastructure Activities

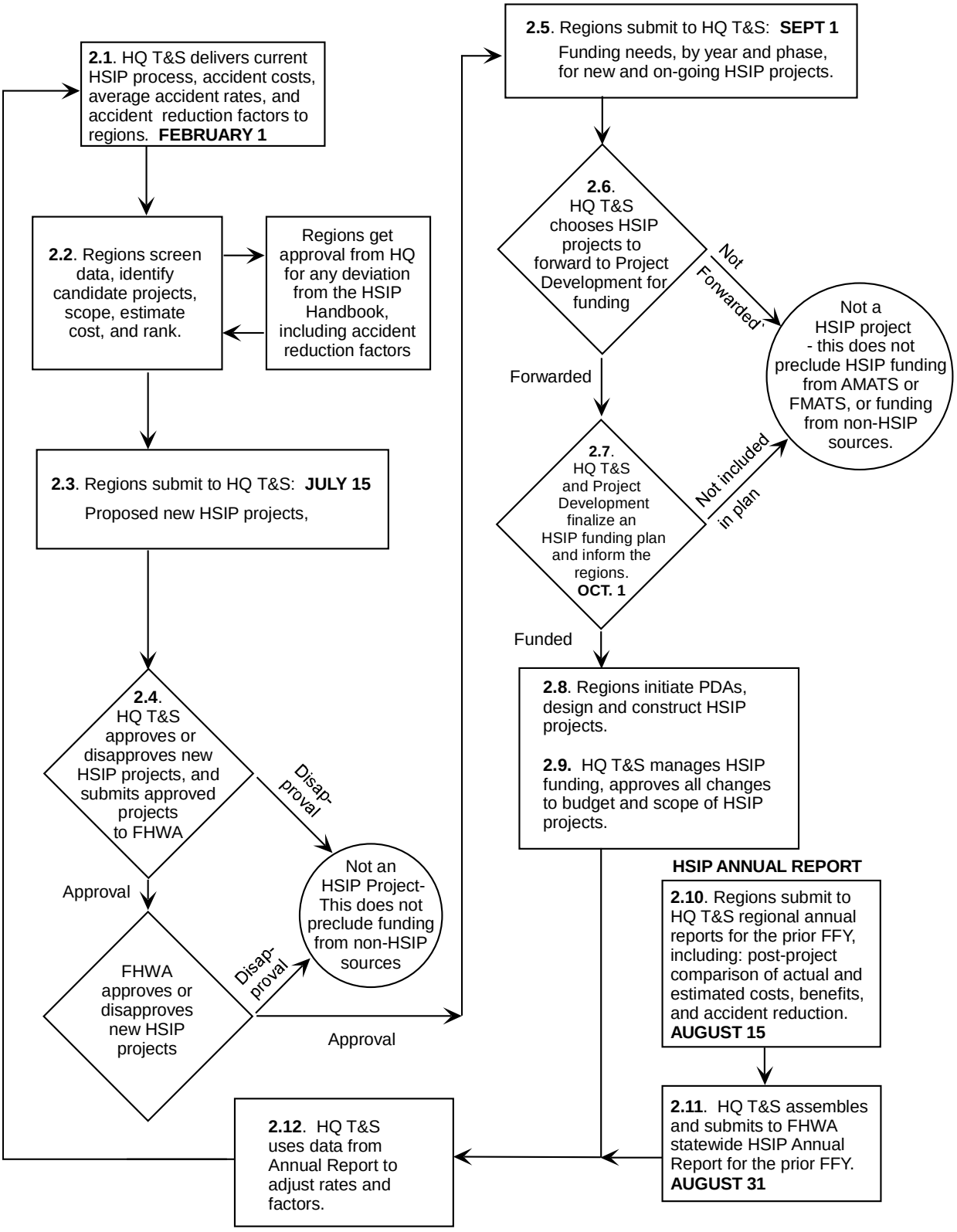
Includes non-infrastructure strategies or activities for which funding has been allocated and approved. Non-infrastructure strategies and activities do not result in a physical or operational change to the facility, and may include transportation safety planning; collection, analysis, or improvement of safety data; planning for work zone safety; road safety audits; enforcement; education; or other activities focused on reducing fatal and major injury crashes.

Individual activities are funded from HSIP apportionment. Individual projects do not appear on the STIP.

Non-infrastructure activities must have prior FHWA approval in order to obligate safety funds.

2. Process Steps (Keyed to the Flow Chart)

Annual HSIP Process Flow Chart



2.1. HQ provides guidance documents and crash data to Regions (February 1)

Guidance Documents – Headquarters Traffic and Safety section (HQ Traffic & Safety) publishes a revised HSIP Handbook containing current HSIP procedures, factors, average crash rates, crash costs, worksheets, etc.

Crash Data – HQ Project Development updates the Highway Analysis System (HAS), and makes crash data available on the DOT&PF Highway Data Port.

2.2. Regions identify, scope, estimate, and rank proposed new projects

Review all fatal or major injury (F&MI) crashes within the years that will be used for HSIP analysis. Determine the location of all F&MI crashes for which a location has not been provided and check, and correct if necessary, the location of those for which a location has been provided. Provide the necessary revisions to HQ Program Development so they can revise the HAS database.

After the HAS database has been updated as provided above, collect the most recent five years of regional crash data in the following reports:

- Named Intersection Report (HAS)
- Named Intersection Exception Report (HAS – lacking complete volume data). Estimate missing volume data.
- Named Segment Report (HAS)
- Named Segment Exception Report (HAS – lacking complete volume data). Estimate missing volume data.
- Sliding Spot Report – Fatal and Major Injuries Only (HAS Data analyzed using the Intersection Magic Program)

Identify high accident locations for potential new projects

i. Identify high accident Intersections (using five years of available accident data).

(1) Populate the "High Accident Location Screening–Intersections" spreadsheet (or other spreadsheet using the same logic and giving the same results) with all regional "Named Intersections" in the Highway Analysis System as well as other intersections of concern. Discard the locations with less than a threshold number of accidents (threshold to be set by the regions).

(2) Determine the number of intersections with a safety index (ratio of actual accident rate to critical accident rate) over 0.9, or a fatality or two major injuries. These are HSIP project candidates.

(3) If this number of candidates is too small or too large for a region to evaluate, the number can be changed by adjusting the statistical level of confidence.

(4) For all HSIP intersection project candidates identified under (2) above, explain what will be done to address the safety concern or, if nothing is planned, explain why not (this

may need to be revisited when more information becomes available later in the HSIP process). Put this information in the comment column of the "High Accident Location Screening–Intersections" spreadsheet. Note that this list will be the basis for the top five percent report that will be included in the HSIP annual report (see section 2.10).

ii. Identify High Accident Segments (using five years of available accident data).

(1) Populate the "High Accident Location Screening–Segments" spreadsheet (or other spreadsheet using the same logic and giving the same results).

(2) Segments with at least 1 fatal or 2 major injury crashes are HSIP project candidates.

(3) For all HSIP segment project candidates, explain what will be done to address the safety concern or, if nothing is planned, explain why not (this may need to be revisited when more information becomes available later in the HSIP process). Put this information in the comment column of the "High Accident Location Screening–Segments" spreadsheet.

iii. Check for missed high crash intersections or segments using the Sliding Spot Report from Intersection Magic or another method. High crash intersections or segments located using the Sliding Spot Report should be screened with other locations as described in section 2.2. New high crash intersections identified using the Sliding Spot Report should be added to the Named Intersection database.

iv. Consider high crash risk locations without crash data. Identify sites with a high potential for severe accidents that do not show up on the accident list. This is a judgment call, but some locations have evident safety problems without enough data to statistically prove it.

Scope potential new projects.

i. Identify crash patterns.

(1) Create accident diagrams for all intersections that remain on the list.

(2) Consider using tabular analysis methods such as Excel Pivot Tables for intersections and segments.

(3) Identify patterns and causes for intersections and segments.

(4) Discard locations that do not have clear patterns.

ii. Conduct field reviews.

iii. Determine which high-accident and potential high-accident locations have safety problems that are feasibly correctable.

iv. For traffic signal projects determine how many signal warrants are met in accordance with the Alaska Traffic Manual (do not submit traffic signal projects if warrants are not met).

Estimate project cost.

Rank potential new projects.

i. Decide whether projects should be ranked or non-ranked.

Projects should be ranked unless:

(a) There is no representative accident history, but the project improves a hazardous road location or addresses a highway safety problem, or

(b) There is no approved accident reduction factor for the proposed countermeasure, or

(c) Traffic volumes are too low for crash data to accurately represent hazard exposure.

Ranked projects generally have a better chance of being funded. The non-ranked category should not be used to promote projects that have little potential for cost-effective safety improvement.

ii. Compute a benefit/cost (B/C) ratio for each project using the "Pre-Project Ranking and Post-Project Evaluation" worksheet in Appendix A. Complete all of the worksheet for ranked projects and all or as much as possible for non-ranked projects. Use accident reduction factors from the Accident Cost Reduction Factors table in Appendix A or, if not available, get approval for other factors from the State Traffic and Safety Engineer. Apply the reduction factors only to the crashes that table lists as susceptible to correction by the planned countermeasure(s). Justify accident reduction factors not available in the HSIP Handbook Appendix A using information from the CMF Clearinghouse or from state-specific experience.

If a project is non-ranked because there is no approved accident reduction factor for planned countermeasures, perform a sensitivity analysis by computing two projected benefit-cost ratios assuming crash reduction factors of 5% and 100% for crashes susceptible to correction by the proposed countermeasure(s). Submit the results using both ratios. If a project is non-ranked because crash data is not available, a sensitivity analysis is not needed, but a narrative explaining the benefits of the project is required. Systemic corridor improvement projects may be advanced as non-ranked projects where insufficient crash experience reduces cost-effectiveness of known low-cost countermeasure improvements below the threshold for ranked projects.

Solicit input on high accident locations from municipalities, other agencies, regional planning, and M&O sections, as appropriate. Work with them to identify, scope, estimate, and rank projects within municipal city limits.

2.3. Regions submit proposed HSIP projects to HQ Traffic & Safety for approval (July 15)

In addition to new projects, regions may update and resubmit previously approved projects that are two or more years old and have not received funding (that is, have not had PDAs approved). Project approvals are good for only two years – after that crash, cost, and other pertinent data need to be updated. Approved projects that are one year old may be submitted for funding under section 2.5 without updated data.

Submit the following summary information (in both hard copy and electronic form) under cover of a memo signed by the regional preconstruction engineer:

i. Use the "High Accident Location Screening–Intersections" (or similar) spreadsheet to list all intersections with at least 1 fatal or 2 major injury crashes, or having a safety index of 0.9 or greater using a 95% level of confidence.

ii. Use the "High Accident Location Screening–Segments" (or similar) spreadsheet to list all one-mile segments with at least 1 fatal or 2 major injury crashes (see section 2.2).

iii. For inclusion in the Five Percent Report and for future reference (see sections 2.2 and 2.10), add a narrative to all locations on lists (i) and (ii), above, explaining how the safety concern will be addressed or, if not, why not.

iv. Use the "Regional Proposed Project Summary" spreadsheet to list ranked projects ordered by benefit/cost ratio followed by non-ranked projects.

(1) Projects should be numbered with a 5-digit number composed as follows:

(a) Last 2 digits of the first Federal Fiscal Year in which project design could start. For example, numbers of projects submitted in July 2011 would start with "12." (HSIP design funding for these projects would not be available until FFY 12 at the earliest.)

(b) Region (N, C, or S).

(c) Rankable or Non-rankable (R or N).

(d) A sequential number in order of computed benefit/cost for ranked projects and in order of estimated benefit/cost for non-ranked projects. Start the sequential numbers with one (1) for both the ranked and non-ranked categories.

Thus, the highest B/C Central Region project submitted in July of 2011 would be numbered 12CR1. The highest non-ranked CR project would be numbered 12CN1.

(2) Modify the project numbers of previously submitted projects for which data and computations have been updated by appending the next fiscal year to the original number. For example, an updated project previously submitted as 10CR21, may be resubmitted in the FFY 12 proposal as 10CR21(12). Note this only applies to projects that are otherwise unchanged. If a project has been substantially changed, assign a new project number.

<u>Submit the following information for each proposed project</u>:

i. For ranked projects, benefit/cost ratios based on safety and maintenance benefits. Do not submit ranked projects with a B/C ratio less than 0.2:1.

ii. For non-ranked projects, a narrative explaining why they are non-ranked and how they will cost-effectively save lives and eliminate injuries. This narrative will be considered when prioritizing projects for funding. If projects are non-ranked due to lack of reported crashes, include accident reduction factors for the selected countermeasures, if available, in the narrative. Also, if projects are non-ranked due to lack of accident reduction factors for planned countermeasures, submit the sensitivity analyses described under section 2.2. Do not submit non-ranked projects for consideration if the 100% sensitivity analysis results in a B/C ratio of less than 1:1.

iii. Safety Index for each treated intersection

iv. The number of fatal crashes and the number of major injury crashes.

v. Project Number

vi. Project Cost Estimate

vii. A project summary including sections labeled as follows:

(1) Location

(2) Safety Problem Description

(3) Safety Problem Solution

(4) Project Description

(5) Other Pertinent Information (including the potential for combining projects, scheduling concerns, and project benefits not described elsewhere that may affect a project's prospects for receiving funding).

viii. Project ranking worksheet (submit in Excel format as well as in print and Adobe format)

ix. Cost estimate worksheet

x. Sketch of improvement

xi. Accident diagram (intersection improvements only): Highlight the accidents susceptible to reduction by each of the proposed improvements. Use a different color to highlight accidents susceptible to correction by each improvement. Pivot Tables or other concise tabular means may be used to illustrate crash experience and identify crashes susceptible to correction by selected countermeasures.

xii. Expanded tabular crash data extract from the DataPort in Excel format. Analyze with pivot tables where appropriate. Use a different color to highlight crashes susceptible to correction by each improvement.

xiii. Signal warrant computations for intersections to be signalized

xiv. If the proposed safety work is to be included under a non-HSIP project, explain why it is not funded under that project. In general, safety work should be funded under projects that encompass them, rather than through the HSIP (see section 1.4).

2.4. HQ Traffic & Safety evaluates proposed projects and sends approved ones to FHWA for their approval (July 31)

HQ reviews regional projects, works with the regions to clarify any discrepancies, and asks for revisions as appropriate. If necessary, HQ will reject projects with little potential for cost-effective safety improvement.

HQ compiles a statewide list of ranked projects, ordered by benefit/cost ratio, and a list of non-rankable projects. HQ submits the lists to the FHWA for approval by July 31, or within two weeks of receiving the last regional submittal. HQ notifies regions on receipt of FHWA approval, which makes projects eligible to receive HSIP funding.

2.5. Regions submit HSIP funding request to HQ Traffic & Safety (September 1)

Submit candidate projects for HSIP funding (in both hard copy and electronic form) under cover of a memo signed by the regional preconstruction engineer. Provide this information by completing the "Regional Proposed Project Summary" posted on the HSIP web site. List previously initiated but not completed HSIP projects at the top, followed by ranked projects in order of B/C ratio, and non-ranked projects below. Provide estimated funding (by year and phase) needed for each project. Regional Traffic and Safety personnel should consult project managers about funding and scheduling of previously initiated projects.

This submittal differs from the July 15 submittal because, among other things, it includes up to date funding needs for on-going projects, while the July 15 submittal only addresses new projects.

2.6. HQ Traffic & Safety proposes funding plan to Project Development (September 15)

HQ Traffic & Safety submits the following to Project Development by September 15:

i. An HSIP project funding plan for the next federal fiscal year.

ii. Estimated project scheduling and funding for the two following federal fiscal years.

HQ Traffic & Safety will prioritize projects using criteria that include:

i. Lives saved and major injuries eliminated per dollar spent. On ranked projects, this is indicated by safety benefit-cost ratios. On non-ranked projects, this is a subjective judgment made after reviewing the narratives provided by the regions.

   (1) Ranked projects are given higher priority for funding than non-ranked projects. Two tiers of ranked projects will be considered with the first category taking precedence over the second:

      (a) projects with at least one fatal crash or 2 major injuries in 5 years

      (b) projects without at least one fatal crash or 2 major injuries in 5 years

   (2) Non-ranked projects are prioritized for funding after ranked projects. The State Traffic and Safety Engineer will prioritize the non-ranked projects based on their relative expected reduction in risk to road users.

ii. Project deliverability based on a jurisdictions' history in delivering projects.

iii. Project duration. Quicker projects start saving lives and eliminating injuries sooner.

iv. Whether project cost fits within remaining funding. For example, if there is $500,000 left after including higher priority projects and the next best project costs $2,000,000, it will be passed over for the next best project that costs $500,000 or less.

Project prioritization is competitive based on each year's available funding and quality of projects. There are no hard and fast benefit-cost or duration thresholds that determine which projects receive funding.

2.7. HQ Traffic & Safety and Project Development finalize a funding plan (October 1)

HQ Traffic & Safety will work with HQ Program Development to determine the amount of funding available and to craft the HSIP funding plan for the next federal fiscal year.

HQ Traffic & Safety will notify regional Traffic and Safety, Design, and Planning sections when Project Development approves the final funding plan.

2.8. Regions initiate Project Development Authorizations (PDAs), design, and construct HSIP projects

Regional traffic personnel work with project managers to keep HSIP projects targeted at safety improvement, cost efficient, and on schedule.

2.9. HQ Traffic and Safety manages statewide HSIP funding

HQ Traffic & Safety must approve all PDAs for HSIP projects. When there are deviations from the final funding plan, HQ Traffic & Safety will allocate HSIP funds to the regions on a project-by-project basis as follows:

i. Changes in available statewide funding:

   (1) Decreases will be allocated to regions in proportion to their share of the final funding plan.

   (2) Increases will be allocated based on project merit, rather than regional proportion. B/C ratio and the other factors listed in Section 2.6 will be considered when choosing projects to use the additional funds.

ii. Changes in regional requested or used funding:

   (1) Requests for additional funding:

      (a) Funding requests for over-runs of projects included in the final funding plan will be funded as long as funding is available within the region's allocation. Over-runs reduce funding available for the region's other projects. If Advance Construct funding is utilized, regional funding allocation for the following year will be adjusted accordingly.

      (b) Funding requests for projects not in the final funding plan but included in final funding plans in one of the previous 4 years and that have had PDAs approved will be granted as long as funding is available within the region's allocation. Projects in past funding plans *more* than 4 years old and that have had PDAs approved will be handled on a case by case basis.

      (c) Funding requests for projects approved by FHWA as HSIP-eligible but never funded (including projects from past funding plans that have not had PDAs approved) and

for which funding is available in the region's allocation will be handled on a case by case basis. (See Section 2.2 regarding ranking.)

(2) Funding not fully used – Because HSIP funding is allocated for projects rather than as a regional allocation, unused funding for projects included in the final funding plan is not reserved for that region. However, if the region has other HSIP projects in the current funding plan that have over-run, the funding may be used to cover those over-runs. If not, the funds may be reallocated to another region or reserved for future year programs.

Funding not fully used includes:

(a) funding allocated for project phases planned for the current year but unobligated because the funding was not needed to complete planned phases or a project or phase(s) was delayed into the future; and

(b) de-obligated project funding whether or not the project is included for funding in the current year funding plan. De-obligated funding usually must be re-obligated in the same federal fiscal year as de-obligation occurs.

The HSIP Funding Plan is a multi-year plan that allocates funding for the current federal fiscal year and forecasts future funding requirements and project schedules. When current year projects or phases become delayed and funding cannot be obligated from current year projects, all regions may propose advancement of project phases identified in the funding plan scheduled for future years. In the event that multiple projects or phases compete for unobligated funding, the ranking process of section 2.6 will be used to allocate the funds. Projects without prior headquarters and FHWA approval will not be considered for obligation. All projects must first be submitted for approval and accepted for funding as outlined in sections 2.3 through 2.5.

2.10. Regions submit Annual Reports for the prior Year (August 15)

Regional Traffic and Safety Engineers submit annual reports for the prior federal fiscal year to the State Traffic and Safety Engineer by August 15. The regional reports include:

i. HSIP Project Effectiveness Evaluation worksheet – Compute actual benefit cost and accident reduction factors for ranked HSIP projects for which there are three years of post-construction accident data available (use workbook 2: Pre-Project Ranking, Post-Project Evaluation). Use the most recent accident costs (see "Accident Cost Derivation" in Appendix A) for "before" as well as "after" accident data when computing total accidents costs. If "after" accidents deviated significantly from expectations, provide an explanation. B/C analysis is required for projects started before the current HSIP process (initiated in 1998) as well as those started after. When practical, actual benefit-costs and accident reduction factors should be computed for non-ranked as well as ranked projects. If this is not practical, include a statement explaining why not. Submit the Pre-Project Ranking, Post-Project Evaluation workbook electronically in Excel format with other report materials.

ii. Updated historical listing of all HSIP projects in the region.

iii. HSIP Project Effectiveness Summaries for HSIP projects that are addressed under:

(1) Section 148(g), including High Risk Rural Roads (HRRR); and

(2) Section 130(g) Railway-Highway Crossings.

Use the worksheets illustrated in Appendix A, which are available for downloading (workbook 4: Regional HSIP Annual Report Templates).

iv. Five Percent Report - A list of five percent of locations "exhibiting the most severe safety needs", as required by the SAFETEA-LU highway bill, 2005. Alaska has interpreted this to mean the top five percent of intersections with:

(1) at least one fatal crash or two major injury crashes in the last five years of crash data, and which

(2) approach or exceed computed "critical accident rates" or, in other words, have a safety index of 0.90 or more.

The top five percent shall be selected from a statewide list of intersections ordered by a weighted crash number computed by multiplying the number of fatal crashes by 2 and the number of major injury crashes by 1 and adding the two products together (use workbook 4: Regional HSIP Annual Report Templates). If two intersections have the same weighted crash number, rank the one with the higher safety index higher.

Regional Traffic and Safety Engineers shall provide a narrative for each intersection explaining what plans have been made to address the safety concerns or, if no improvements are planned, explain why not. Note that safety indices are computed each year during accident screening for new project proposals – they do not need to be computed independently for the Five Percent Report (see sections 2.2 and 2.3).

We currently report intersections only – we don't report high crash segments. However, we will be able to report segments in the future if we acquire a computer program that will:

1) Perform "sliding spot" analysis of crash locations,

2) Exclude "named intersections" from the analysis

3) Filter and report by crash severity

2.11. HQ Traffic & Safety publishes statewide HSIP Annual Report for the prior FFY (August 31)

HQ Traffic & Safety submits a statewide HSIP report for the prior federal fiscal year to the FHWA by August 31. The report consists of three parts with content as defined in the guidance memorandum of May 11, 2010 by Joseph Toole, FHWA Associate Administrator for Safety.

i. HSIP Report - Addresses intersections and road segments as required under 23 U.S.C. Section 148(g), and includes the High Risk Rural Roads Program (HRRRP). The report includes sections on progress in implementing HSIP projects; program effectiveness; project evaluation; a narrative addressing HRRRP implementation, methodology, and effectiveness; and an explanation of how HSIP projects tie in with Alaska's Strategic Traffic Safety Plan (STSP).

ii. Railroad-Highway Crossing Report – Addresses railroad-highway crossings as required under 23 U.S.C. 130(g). The report includes sections on: general program information; and project metrics.

iii. Five Percent Report - Lists the top five percent of hazardous locations in the state as required under 23 U.S.C. 148(c)(1)(D). The report includes sections on: potential remedies to the locations identified, estimated costs for the remedies, and impediments to implementation of remedies other than cost. The five percent report also describes the extent of coverage of the crash data system.

HQ Traffic & Safety publishes the HSIP Annual Report and the complete regional reports and the HSIP Handbook includes as appendices. They also archive and post HSIP documents on the web.

2.12. HQ Traffic & Safety uses evaluation data to adjust next year's factors

HQ Traffic & Safety analyzes crash reduction data from completed projects and uses the results to adjust the factors for the following year's HSIP.

Note on Electronic Document Transmittal

Submit all HSIP documents as electronic Adobe Acrobat PDF files, as well as on paper. Submit the Pre-Project Ranking, Post-Project Evaluation, Regional Proposed Project Summary, and Annual Report worksheets in Excel format, also.

Appendix A. HSIP Worksheets

HSIP Process Automation Tools and Submittal Templates (available online)

1. High Accident Location Screening
   - Formulas and Factors
   - Segment Screening
   - Intersection Screening

2. Pre-Project Ranking, Post-Project Evaluation
   - Pre-Project Ranking: Predicted Benefit Cost Ratio
   - Post-Project Evaluation: Computation of Actual B/C and Accident Reduction Factors-Input
   - Post-Project Evaluation: Actual Accident Reduction Factors - Results
   - Post-Project Effectiveness Evaluation: Actual Benefit Cost Ratios

3. Regional Proposed Project Summary

4. Regional HSIP Annual Report
   - HSIP Project Effectiveness Summary (Section 148)–Highways and High Risk Rural Roads
   - HSIP Project Categories
   - HSIP Project Effectiveness Summary (Section 130)–Railroad-Highway Crossings
   - Five Percent Report

HSIP Data (for use with the Pre-Project Ranking and Post-Project Evaluation spreadsheet)

- Accident Cost Reduction Factors
- Accident Cost Derivation
- Project Life and M&O Costs for Various Improvements

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High Accident Location Screening Process

Formulas and Factors

For the FFY '14 HSIP

Statewide Average Intersection Accident Rates

Type No	*Intersection Type*		*Rate*
1	Signalized	2 Approach*	1.13
2		3 Approach*	0.99
3		4 Approach*	1.47
4	All Way STOP	All	0.72
5	Two Way STOP	2 Approach*	0.46
6		3 Approach*	0.48
7		4 Approach*	0.56

Statewide Average Segment Accident Rates

Type No	*Segment Type*		*Rate*
1	Urban	2 Lane	1.43
2		4 or more undivided	1.83
3		4 or more divided	1.20
4		Freeway	0.88
5	Rural	2 Lane	2.0
6		4 or more undivided	1.7
7		4 or more divided	1.6
8		Freeway	1.1

***Approach:** A leg of an intersection that carries traffic approaching the intersection. For example, a 4-legged intersection of 2 one-way roads has 2 approaches as defined here.

SOURCE OF DATA:
AVERAGE ACCIDENT RATES: Intersection: AK Statewide HAS data 2006-10 for all intersection types. Segment: Urban - AK Statewide HAS data 2006-2010; Rural - NY State averages 2006-10.

ACCIDENT COSTS: Based on 2009 federal Value of Statistical Life (VSL) cost data inflated to current year. Accident Costs are weighted and proportioned using Alaska accident experience to smooth costs (see Accident Cost Derivation Spreadsheet).

FORMULA FOR CRITICAL ACCIDENT RATES:

Rc = Ra + k * (square root(Ra/M)) + 1/(2M)

Where Rc = The critical accident rate
Ra = The statewide average accident rate for the intersection or segment type
k = A probability constant (see table below)
M = Millions of entering vehicles (intersections) or Millions of vehicle-miles (segments).

Source: NorthWestern University Traffic Institute Workbook for the "Identification and Treatment of High Hazard Locations" Course given in Anchorage 2/24 - 2/26/98. Page 8 of Section 3442 RV (Tab 5). Originally from NCHRP 162.

"k" Factors

Confidence	*k*
90.0%	1.282
95.0%	1.645
99.5%	2.576
99.9%	3.090

Accident Costs (AK 2006-2010 Acc. Data)

Property Damage Only:	$14,000
Minor Injury:	$140,000
Major Injury:	$702,000
Fatality:	$1,404,000

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Highway Safety Improvement Program
High Accident Location Screening Process
Segments

Red fields are input fields. Black fields are fixed, computed, or derived.

Region:	**Central**	
Analysis Period:	Start:	1/1/2006
	End:	12/31/2010
Years in Period:		**5**
Form Completed By:		Joe Traffic
Date:		4/1/2013

Notes:
1. To expedite the screening process, the logic in this spreadsheet may be appended to a file of segment data obtained from the HAS "Named Segment" extract routine.
2. The segment screening process flags locations with one or more fatals and/or two or more major injury accidents for further study.
3. Only projects meeting criteria are shown on this template, All projects should be screened using this tool prior to eliminating projects that do not meet criteria.
4. Sort Value enumerates Fatal and Major Injury crashes by the following method: Fatal Cashes times 1 plus Major Injuriy Crashes times 0.001. Values in the column may be used for for quick visual assessment of crash data,and for sorting crash locations in order by number of Fatal and Major injuries.

Segment Location/Terminii																	(Note 4)	
CDS Route Number	**CDS Route Name**	**Mile Pt From**	**Street From**	**Mile Pt To**	**Street To**	**PDO**	**Min**	**Maj**	**Fat**	**ADT 5 Yr Avg**	**Segment Type**	**Segment Lgth**	**Mil Veh-Miles in Period**	**Total Accidents**	**Accident Rate**	**State Avg Rate**	**Severity Indicator**	**Comments**
	Moulin Route	16.250	Cross A	18.750	Cross B	60	35	15	1	17,000	2	2.50	77.56	111	1.43	1.83	1.015	
	Rocky Mtn High Way	0.000	Start St	2.000	End St	55	30	12	1	13,000	4	2.00	47.45	98	2.07	0.88	1.012	
	Diagon Alley	5.125	Intsctg Way A	6.125	Intsctg Way B	33	20	5	1	10,000	5	1.00	18.25	59	3.23	2.00	1.005	
	Haute Route	18.250	Trail 1	20.250	Trail 2	75	40	13		14,000	3	2.00	51.10	128	2.50	1.20	0.013	
	Grandiose Blvd	7.125	Highland Dr.	11.250	Lowland Way	30	12	10		16,000	4	4.13	120.45	52	0.43	0.88	0.010	
	Highliner's Highway	158.250	Salmon Creek	159.375	Cod Hole	45	24	8		8,000	1	1.13	16.43	77	4.69	1.43	0.008	
	Thoroughfare Lane	19.375	Crusin' Way	25.875	Draggin' Lane	18	12	7		10,000	3	6.50	118.63	37	0.31	1.20	0.007	
	Road to Nowhere	25.750	Here St	35.250	There St	26	12	4		5,000	6	9.50	86.69	42	0.48	1.70	0.004	
	High Road	14.750	Upper St	15.375	Lower St	12	5	3		13,000	2	0.63	14.83	20	1.35	1.83	0.003	
												0.00		0				
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Alaska DOT/PF
Highway Safety Improvement Program

High Accident Location Screening Process

Intersections

Red fields are input fields. Black fields are fixed, computed, or derived.

Region:	**Central**	
Analysis Period:	Start:	1/1/2006
	End:	12/31/2010
Years in Period:		***5***
Form Completed By:		Joe Traffic
Date:		4/11/2013

Level of Confidence:	95.0%
(Adjust Level of Confidence (90, 95, 99.5, or 99.9%) to get a manageable no of projects)	

Notes:
1. Explanations are required in the "Comments" column for all intersections with safety indices of 0.9 or over (with a 95% level of confidence), or where at least one fatal crash or two major injury crashes occurred, where improvements are not recommended.
2. To expedite the screening process, the logic in this spreadsheet may be appended to a file of intersection data obtained from the HAS "Named Intersection" extract routine.
3. Sort projects based on Safety Index initially. Discard projects with a Safety Index less than 0.90 and that do not have one fatal or two major injury crashes. Sort on Accident Cost Rate to prioritize projects during evaluation.
4. Accident Rate represents the Total Number of Accidents per 1 Million Entering Vehicles in the period. Accident Cost Rate represents the Average Accident Cost per 100 Million Entering Vehicles.
5. Only projects meeting criteria are shown on this template. All projects should be screened using this tool prior to eliminating projects that do not meet criteria.
6. Severity Indicator: Fatal Crashes times 1 plus Major Injury Crashes times 0.001. Values in the column may be used for for quick visual assessment of crash data,and for sorting crash locations in order by number of Fatal and Major injuries.

Intersection Location									Sort (3)						Sort (3)	(Note 6)	**Comments**
Street 1	**Street 2**	**PDO**	**Min**	**Maj**	**Fat**	**Entering ADT 5 Yr Avg**	**Int. Type**	**Total Accidents**	**Acc. Cost Rate**	**Mill. of Entering Veh in Period**	**Accident Rate**	**State Avg Acc. Rate**	**Critical Acc. Rate**	**Critical Rate Exceeded?**	**Safety Index (AR/CAR)**	**Severity Indicator**	
Bigwheel Lane	Red Wagon Pkwy	26	12	4		5,000	6	42	$5,317	9.125	4.60	0.48	0.92	Yes	**5.02**	0.004	
Uptown St	Downtown Ave	33	20	5	1	10,000	5	59	$4,480	18.250	3.23	0.46	0.75	Yes	**4.30**	1.005	
McKinley St	Fairweather Ave	75	40	13		14,000	1	128	$6,175	25.550	5.01	1.13	1.50	Yes	**3.34**	0.013	
Anaktuvuk Tr	Unalakleet Way	45	24	8		8,000	1	77	$6,579	14.600	5.27	1.13	1.63	Yes	**3.24**	0.008	
Bering St	Beaufort Hwy	30	12	10		16,000	4	52	$3,123	29.200	1.78	0.72	1.00	Yes	**1.78**	0.010	
Mainline Ave	Cross Street	55	30	12	1	13,000	1	98	$6,237	23.725	4.13	1.13	1.51	Yes	**2.73**	1.012	
Fifth St	G St	60	35	15	1	17,000	1	111	$5,697	31.025	3.58	1.13	1.46	Yes	**2.44**	1.015	
Hwy 2	Wayfarer Road	18	12	7		10,000	3	37	$3,751	18.250	2.03	1.47	1.96	Yes	**1.03**	0.007	
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Alaska DOT/PF

Highway Safety Improvement Program

Project Ranking Worksheet

Red fields are input fields.
Black fields are fixed, computed, or derived.

HSIP Project Name:	Test Intersection - Regional Project for the Betterment of All Mankind					
Analysis Period:	1/1/06	to	12/31/10	Form Completed by:	Joe Traffic	Date: 5/1/13

Miscellaneous Data

Rate of Return:	3%
No of years of accident analysis	5

Accident Cost Data

Accident Severity	Accident Cost
Property Damage Only:	$14,000
Minor Injury:	$140,000
Major Injury:	$702,000
Fatality:	$1,404,000

Predicted Change in Accidents due to Improvement(s)

Imprv Type Num	Improvement	Type of Accident Susceptible to Reduction or Increase due to Improvement	Reduction Factor (+ or -)	No of Acc.s Susceptible to Reduction or Increase			
				PDO	Min	Maj	Fat
108	Intersection Illumination	Night Accidents at unlighted intersections	-50%	6	2	1	
101.3	Install Lt Turn Pocket at Rural, Unsignalized Intersection (Major Road Approach Only)	Rear-ends and side-swipes involving turning cars making the target movement	-60%	5	2	2	
109	New Traffic Signal	Angle accidents Rear-end accidents (expected to increase)	-60% 25%	10 6	5 5	1	
		Total Accidents Susceptible to Reduction or Increase:		27	14	4	
		Predicted Change in Accidents:		-11	-4.0	-2.3	
		Predicted Change in Accident Cost ($1,000):		-147	-553	-1,615	

Benefit/Cost of Improvements (Safety and M&O Benefits Only)

Improvement	Total Proj Cost (K)	Ann M/O Cost (K)	Life of Impvt (yrs)	Predicted Change in Accidents				Predicted Change in Accident Cost	Annualized Safety and M&O Benefits	Annualized Constr. and M&O Costs	Benefit Cost (Safety and M&O Benefits only)
				PDO	Min	Maj	Fat				
Intersection Illumination	100	1.0	15	-3.0	-1.0	-0.5		-$533,000	**$106,600**	**$9,377**	**11.4 : 1**
Install Lt Turn Pocket at Rural, Unsignalized Intersection (Major Road Approach Only)	300	0.5	10	-3.0	-1.2	-1.2		-$1,052,400	**$210,480**	**$35,669**	**5.9 : 1**
New Traffic Signal	400	10.0	10	-4.5	-1.8	-0.6		-$729,200	**$145,840**	**$56,892**	**2.6 : 1**
Subtotals:				-10.5	-4.0	-2.3					
Totals/Averages:	**800**	**11.5**	**10.6**	**-16.8**				**-$2,314,600**	**$462,920**	**$101,938**	**4.54 : 1**

Benefit Cost Formula (Safety and M&O Benefits Only)

B/C Ratio = (Estimated Annual Reduction in Accident Cost)+(Decrease in Ann Maintenance Cost, 0 if increase) / (Annualized Construction cost)+(Increase in Ann Maintenance cost, 0 if decrease)

Combined Effects of Multiple Countermeasures

$$ARF_{combined} = \left[1 - \left(1 - \frac{ARF_1}{100}\right)\left(1 - \frac{ARF_2}{100}\right) \ldots \left(1 - \frac{ARF_n}{100}\right)\right] \times 100$$

Compute a combined Accident Reduction Factor only for crash types jointly influenced by dissimilar improvements at the location of interest. Consider limitations of this formula as discussed in TRB Special Report 214 Designing Safer Roads, 1987, pg. 253-255.

Alaska DOT/PF
Highway Safety Improvement Program

HSIP Project Evaluation Worksheet

Computation of Actual B/C and Accident Reduction Factors - INPUT

Red fields are input fields.
Black fields are fixed, computed, or derived.

HSIP Project Name:	***Test Intersection - Regional Project for the Betterment of All Mankind***	Form Completed by:	*Joe Traffic*	Date:	*7/15/2019*

Project Identification Data

Construction Project Name:	**Test Construction Project**
Federal Project Number:	**TEST-PROJ-1**
State (AKSAS) Proj. Number:	**12345**

Miscellaneous Data

Rate of Return:	3%
Intersection (I) or Segment (S)	I
If Segment, Length in Miles:	
Date Construction Began:	4/30/12
Date Project Accepted for Traffic:	11/1/13

Accident Cost Data

Accident Severity	*Accident Cost*
Property Damage Only:	$14,000
Minor Injury:	$140,000
Major Injury:	$702,000
Fatality:	$1,404,000

ACCIDENT HISTORY (All Accidents)

Period	Begin Date	End Date	No of Years	PDO	Min	Maj	Fat	Tot-al	Avg ADT
1) Before (HSIP Analysis Period)	1/1/06	12/31/10	5.0	29	12	6		47	10000
2) Before-Interim	1/1/11	12/31/14	2.0	12	3	3		18	10500
1 and 2 Combined	1/1/06	12/31/14	7.0	41	15	9		65	10143
3) After	1/1/15	12/31/17	3.0	13	6	2		21	11000

Accident Trend

Trend Control Area:	Mjr City / Borough
Accident Rate change from Before Period (1+2) to After Period (3)	**0.0%**

ACCIDENT HISTORY (Accidents Susceptible to Reduction or Increase)

Improvement	**Type of Accident Susceptible to Reduction or Increase Due to Improvement**	**BEFORE (1+2)** HSIP Analysis Period 1/1/2006 to 12/31/2010				Interim 1/1/2011 to 12/31/2014				Total No of Acc	Total Acc Cost ($K)	**AFTER (3)** 1/1/2015 to 12/31/2017				Total No of Acc	Total Acc Cost ($K)
		PDO	Min	Maj	Fat	PDO	Min	Maj	Fat			PDO	Min	Maj	Fat		
Intersection Illumination	Night Accidents at unlighted intersections	6	2	1		2		1		12	1796	2				2	28
Install Lt Turn Pocket at Rural, Unsignalized Intersection (Major Road Approach Only)	Rear-ends and side-swipes involving turning cars making the target movement	5	2	2		1	1	1		12	2610	1		1		2	716
New Traffic Signal	Angle accidents	10	5	1		6	2			24	1906	3	1			4	182
	Rear-end accidents (expected to increase)	6	5			2		1		14	1514	5	2	1		8	1052
	Totals / Averages:	27	14	4		11	3	3		62	7826	11	3	2		16	1978
	Total Accident Costs:	**$7,826,000**										**$1,978,000**					

**** The "Before – Interim" time period extends from the end of the HSIP analysis period to the start of construction. Only full data years should be used. Use of partial years will skew results.***
Set Trend to 0% in the absence of a significant change in area-wide crash rate between the Before/Interim period and the After period.

Alaska DOT/PF
Highway Safety Improvement Program
HSIP Project Evaluation Worksheet
Computation of Actual Accident Reduction Factors - RESULTS

Red fields are input fields.
Black fields are fixed, computed, or derived.

Project:	***Test Intersection - Regional Project for the Betterment of All Mankind***	Form Completed by:	*Joe Traffic*	Date:	*7/15/2019*

Change in Total Accidents

Period	Begin Date	End Date	No of Acci-dents	Accident Cost	Accident Rate	Accident Cost per Ent Veh or Veh-Mile	***Percent Change***			
							From - To	Accident Rate	Statistically Significant?	Accident Cost/Veh
1) Before (HSIP Analysis Period)	1/1/06	12/31/10	47	$6,298,000	2.58	$0.35	1 to 2	-8.8%	No	1.8%
2) Before-Interim	1/1/11	12/31/14	18	$2,694,000	2.35	$0.35	2 to 3	-25.8%	No	-42.7%
1 and 2 Combined	1/1/06	12/31/14	65	$8,992,000	2.51	$0.35	(1+2) to 3	**-30.5%**	Yes	**-42.0%**
3) After	1/1/15	12/31/17	21	$2,426,000	1.74	$0.20				

Change in Accidents Susceptible to Reduction or Increase

Improvement	**Type of Accident Susceptible to Reduction or Increase due to Improvement**	**BEFORE (1+2)**		**AFTER (3)**		**Accident RATE Reduction Factor**				**Acc COST Reduction Factor**		
		No of Acc per Year	Acc Cost /yr ($K)	No of Acc per Year	Acc Cost /yr ($K)	Change in acc/yr	Adj for Vol	Stat. Signif-icant?	Adj. for Trend	Change in acc cost/yr	Adj for Vol & Trend	Pre-dic-ted
Intersection Illumination	Night Accidents at unlighted intersections	***1.71***	257	***0.67***	9	-61%	-64.1%	YES	***-64.1%***	***-96%***	***-97%***	-50%
Install Lt Turn Pocket at Rural, Unsignalized Intersection (Major Road Approach Only)	Rear-ends and side-swipes involving turning cars making the target movement	***1.71***	373	***0.67***	239	-61%	-64.1%	YES	***-64%***	***-36%***	***-41%***	-60%
New Traffic Signal	Angle accidents	***3.43***	272	***1.33***	61	-61%	-64.1%	YES	***-64%***	***-78%***	***-79%***	-60%
	Rear-end accidents (expected to increase)	***2.00***	216	***2.67***	351	33%	22.9%	NO	***23%***	***62%***	***49%***	25%

Other Factors which may have impacted accident frequency - **(Provide explanation here if "After" accidents deviated significantly from those predicted):**

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Highway Safety Improvement Program

HSIP Project Effectiveness Evaluation

Computation of Actual Benefit/Cost Ratio

Red fields are input fields. Black fields are fixed, computed, or derived.

Use the same accident costs for both before and after accidents when comparing actual vs predicted B/C and accident reduction.

HSIP Project Name:	***Test Intersection - Regional Project for the Betterment of All Mankind***
Construction Project Name:	***Test Construction Project***
Const. Project Number (Federal):	***TEST-PROJ-1***
Const. Project Number (AKSAS):	***12345***
Form Completed by:	*Joe Traffic*
Date:	*7/15/2019*

Financial/Time Factors

Rate of Return (from Project Ranking worksheet):	3%
Average Life of Improvement (from Project Ranking worksheet):	10.6
Length of "After" evaluation period (years) (from Post Eval Input worksheet):	3.0

Actual B/C (Acc and M&O Benefits Only)

Total Project Development and Construction Cost:	$950,000
Annual M&O Cost or Saving (from HSIP Project Ranking worksheet):	$11,500
Annualized Construction and M&O Costs:	$117,241
Projected Accident Cost in "After" period at "Before" rate (susceptible accidents only):	$3,354,000
Actual Accident Cost during "After" period (susceptible accidents only):	$1,978,000
Unadjusted Accident Cost Reduction:	$1,376,000
Accident Cost Reduction adjusted for accident trend:	$1,376,000
Annualized Safety and M&O Benefits	$458,667
Actual Benefit Cost Ratio (Accident and M&O Costs Only):	***3.91 : 1***

Comparison of Actual vs Predicted

Total Project Development and Construction Cost:	Predicted:	$800,000	Difference:	***+19%***
	Actual:	$950,000		
Annualized Safety and M&O Benefits:	Predicted:	$462,920	Difference:	***-1%***
	Actual:	$458,667		
Project Benefit-Cost Ratio (Not Including Delay):	Predicted:	4.54 : 1	Difference:	***-13%***
	Actual:	3.91 : 1		

FFY 2014 Proposed HSIP Projects - _____ Region

	Project Name:	Project Type			AKSAS No.	HSIP Project Number	B/C	Safety Index	Acc. Susc. to Corr.				Region	Phase	Federal Fiscal Year			Constr by M&O?	Bundle?	Project Description
		New	FO	UFO					PDO	MIN	MJR	FAT			14	15	16			
1														2						
														3						
														4						
														7						
														Total	$ -	$ -	$ -			
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Alaska DOT/PF

HSIP Project Effectiveness Summary (Section 148)

Covering projects with 3 or more years of available post-project crash data & not previously reported

Section 148 HSIP Projects (not including HRRR)

Region	Location [1]	FHWA Rd Functional Classification [2]	Improvement Type [3]	Total Project Cost [4]	BEFORE & INTERIM Data (Years vary) [5]					AFTER Crash Data (3 years)				Evaluation Results (B/C Ratio) [6]
					Fatal	Serious Injury	Other Injury	PDO	Years	Fatal	Serious Injury	Other Injury	PDO	

Section 148 HSIP Projects - High Risk Rural Roads (HRRR) only

Region	Location [1]	FHWA Rd Functional Classification [2]	Improvement Type [3]	Total Project Cost [4]	BEFORE & INTERIM Data (Years vary) [5]					AFTER Crash Data (3 years)				Evaluation Results (B/C Ratio) [6]
					Fatal	Serious Injury	Other Injury	PDO	Years	Fatal	Serious Injury	Other Injury	PDO	

1. Location/identifier for project: basic information on where the project occurred
2. Use DOT&PF Data Port (http://dataport.dot.state.ak.us/), *Route Log and Attribute Report by CDS Route Number* to obtain route functional classification: principal arterials, minor arterial roads, collector roads and local streets. *(For reference, see FHWA Functional Classification Guidelines at http://www.fhwa.dot.gov/planning/fcsec2_1.htm)*
3. Type of improvement: coded based on the information in HSIP Project Categories. NOTE that four items from the SAFETEA-LU "included project list" for HSIP (Section 148 (a) (2)) are NOT included here (3 related to highway rail crossings and 1 related to high-risk rural roads) as these activities will be reported separately. If multiple improvements were encompassed in one project, use as many categories as necessary.
4. Cost of improvement: cost to implement the improvement
5. Includes crashes from before and "interim" time periods.
6. Enter actual benefit cost ratios from the Alaska HSIP post-project evaluation process.

Highway Safety Improvement Project Categories

The following is a complete extract from 23 USC Section 148 Highway Safety Improvement Program (a) Definitions, as amended by MAP-21 legislation under Section 1112 Highway Safety Improvement Program.

(4) HIGHWAY SAFETY IMPROVEMENT PROJECT.—

(A) IN GENERAL.—The term 'highway safety improvement project' means strategies, activities, and projects on a public road that are consistent with a State strategic highway safety plan and—

(i) correct or improve a hazardous road location or feature; or

(ii) address a highway safety problem.

(B) INCLUSIONS.—The term 'highway safety improvement project' includes, but is not limited to, a project for 1 or more of the following:

(i) An intersection safety improvement.

(ii) Pavement and shoulder widening (including addition of a passing lane to remedy an unsafe condition).

(iii) Installation of rumble strips or another warning device, if the rumble strips or other warning devices do not adversely affect the safety or mobility of bicyclists and pedestrians, including persons with disabilities.

(iv) Installation of a skid-resistant surface at an intersection or other location with a high frequency of crashes.

(v) An improvement for pedestrian or bicyclist safety or safety of persons with disabilities.

(vi) Construction and improvement of a railway-highway grade crossing safety feature, including installation of protective devices.

(vii) The conduct of a model traffic enforcement activity at a railway-highway crossing.

(viii) Construction of a traffic calming feature.

(ix) Elimination of a roadside hazard.

(x) Installation, replacement, and other improvement of highway signage and pavement markings, or a project to maintain minimum levels of retroreflectivity, that addresses a highway safety problem consistent with a State strategic highway safety plan.

(xi) Installation of a priority control system for emergency vehicles at signalized intersections.

(xii) Installation of a traffic control or other warning device at a location with high crash potential.

(xiii) Transportation safety planning.

(xiv) Collection, analysis, and improvement of safety data.

(xv) Planning integrated interoperable emergency communications equipment, operational activities, or traffic enforcement activities (including police assistance) relating to work zone safety.

(xvi) Installation of guardrails, barriers (including barriers between construction work zones and traffic lanes for the safety of road users and workers), and crash attenuators.

(xvii) The addition or retrofitting of structures or other measures to eliminate or reduce crashes involving vehicles and wildlife.

(xviii) Installation of yellow-green signs and signals at pedestrian and bicycle crossings and in school zones.

(xix) Construction and operational improvements on high risk rural roads.

(xx) Geometric improvements to a road for safety purposes that improve safety.

(xxi) A road safety audit.

(xxii) Roadway safety infrastructure improvements consistent with the recommendations included in the publication of the Federal Highway Administration entitled 'Highway Design Handbook for Older Drivers and Pedestrians' (FHWA–RD–01–103), dated May 2001 or as subsequently revised and updated.

(xxiii) Truck parking facilities eligible for funding under section 1401 of the MAP–21.

(xxiv) Systemic safety improvements.

Guidance from FHWA has not been issued at the data of this publication. When issued, FHWA guidance will supercede this direct quote from the federal statute.

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HSIP Project Effectiveness Summary (Section 130 -Railroad Crossings)

Covering projects with 3 or more years of available post-project crash data & not previously reported

Region	Project Number	Location (County/ Municipality, Highway)	USDOT Crossing Number	FHWA Roadway Functional Class [1]	Project Type and Description (using the suggested groupings below)	Crossing Protection (active, passive)	Crossing type (vehicle, pedestrian, etc)	Total Project Cost	Funding Type	Before & Interim Crash Data [2] (Years Vary)					After Crash Data (3 years)				Effectiveness [3]
										Fatal	Serious Injury	Other Injury	PDO	Years	Fatal	Serious Injury	Other Injury	PDO	

1. Use DOT&PF Data Port (http://dataport.dot.state.ak.us/), *Route Log and Attribute Report by CDS Route Number* to obtain route functional classification. *(For reference, see FHWA Functional Classification Guidelines at http://www.fhwa.dot.gov/planning/fcsec2_1.htm)*
2. Includes crashes from before and interim time periods.
3. Enter actual benefit cost ratios from the Alaska HSIP post-project evaluation process.

Suggested grouping by project type is listed below.

- Crossing Approach Improvements - Projects such as channelization, new or upgraded traffic signals and pre-signals[2], guardrail, pedestrian/bicycle path improvements near the crossing,. and illumination
- Crossing Warning Sign and. Pavement Marking Improvements - Projects such as signs, pavement markings and/or delineation where these project activities are the predominant safety improvements
- Active Grade Crossing Equipment Installation/Upgrade -Projects such as upgrade and/or additions of flashing lights and gates, track circuitry'; signal-related improvements (e. g., railway-highway signal interconnection and pre-emption);. and wayside horn systems
- Visibility Improvements -Projects such as sight distance improvements and vegetation clearance
- Roadway Geometry Improvements- Projects such as roadway horizontal and/or vertical alignment, sight distance, and elimination of high-profile ("humped") crossings
- Grade Crossing Elimination - Projects such as crossing elimination through closure, relocation, or construction/reconstruction of a grade separation structure
- Crossing Inventory Update - Projects such as efforts to update and manage the railway- highway grade crossing inventory. and development of a web-based inventory

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Intersections with the Greatest Safety Needs

(Top 5% of Intersections in Each Region with a Safety Index Greater than 0.9 and at least one Fatal crash or two Major Injury crashes)

Location	Region	Crashes		Ranking		Potential Remedies	Estimated Costs	Implementation Impediments	Comments
		Fatal	Major Injury	(Fx2 + MIx1)	Safety Index				
				0.00					
				0.00					
				0.00					
				0.00					
				0.00					
				0.00					
				0.00					
				0.00					
				0.00					
				0.00					

Primary Sort Value: (F x 2) + (MI x 1)
Secondary Sort Value: Safety Index (Actual Crash Rate / Critical Crash Rate).

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Accident Cost Reduction Factors

Applicable at Locations With Statistically High Rates of Target Accidents

Revised March 2013

Imprvmt Type Number	Type of Improvement / Accident Types Susceptible to Reduction	Acc. Cost Rdctn. Factor	Comments
100	**INTERSECTION AND TRAFFIC CONTROL**		
101	New Turn Lane		
101.1	Install Left-turn Lane at Rural, Unsignalized, 3-Leg Intersection (Major Road Approach, Only)	-55%	
101.2	Install Left-turn Lane at Urban, Unsignalized Intersection (Major Road Approach, Only)	-50%	
101.3	Install Left-turn Lane at Rural, Unsignalized Intersection (Major Road Approach, Only)	-60%	
101.4	Install Right-turn Lane at Urban, Signalized Intersection	-10%	
101.5	Install Right-turn Lane at Rural, Signalized Intersection	-20%	
101.6	Install Right-turn Lane at Urban, Unsignalized Intersection (Major Road Approach, Only)	-10%	
101.7	Install Right-turn Lane at Rural, Unsignalized Intersection (Major Road Approach, Only)	-25%	
101.8	Install Left-turn Lane at Rural or Urban Signalized Intersection	-15%	
	Rear-ends and side-swipes involving turning cars making the target movement (this does not include adding lanes to existing turn pockets or to adding lanes on approaches controlled by STOP signs)		
102	Increase Turn Lane Length		Intended for locations where the existing turn pocket is lengthened to accommodate the turning lane demand, eliminating turning traffic which backs up into the thru lanes.
	Rear-end accidents involving vehicles waiting to enter turn lane	-15%	
103	Install Two-Way Left Turn Lane	CLICK HERE for TWLTL Spreadsheet Solution	Best Practice is to treat CRF as a function as described in Research Results Digest 299.
	All accidents involving the target left turns: angle, sideswipe, and rear end. Only applies to accidents for which no turning lane currently exists.		
104	Acceleration lane for right turning traffic from side street		
	Multi-car accidents involving through traffic and vehicles making the target movement	-10%	
105	Improve Sight Distance at Intersection		
	Multi-car angle accidents involving vehicles on the limited sight distance approach	-10%	
106	Improvement 106 (Install Stop Ahead or Yield Ahead signs) removed from Accident Cost Reduction Factor table due to inconclusive study results.		
107	Change Two Way Stop to All-Way Stop Control		
	Angle accidents	-70%	
108	Intersection Illumination		
	Night Accidents at unlighted intersections	-50%	
109	New Traffic Signal		
	Angle Accidents	-60%	
	Rear-end Accidents (expected to increase)	+25%	

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Accident Cost Reduction Factors

Applicable at Locations With Statistically High Rates of Target Accidents

Revised March 2013

Imprvmt Type Number	Type of Improvement / Accident Types Susceptible to Reduction	Acc. Cost Rdctn. Factor	Comments
110	Enlarge 8 inch Traffic Signal Head to 12 inches		
	All rear end and right angle accidents	-10%	
111	Improve Signal Display		
111.1	Conversion of Side-Mounted Signals to Overhead Signals	-40%	Reductions are independent of number of signal heads converted or added.
111.2	Increase number of signal heads	-10%	
111.3	Add 3-inch yellow retroreflective sheeting to signal backplates	-15%	
	All rear end and angle accidents involving the target approach		
112	Left-Turn Phase Traffic Signal Modifications		
112.1	Permissive (green ball) to Permissive (flashing yellow arrow)	-20%	
112.2	Permissive (green ball) to Protected-Permissive (flashing yellow arrow)	-40%	
112.3	Protected-Permissive (5-section with green ball and arrows) to Protected-Permissive (flashing yellow arrow)	-30%	
112.4	Protected-Permissive (5-section with green ball and arrows) to Protected-Only (all arrows)	-60%	
	Angle accidents involving the target left turn movement		
113	Install Curb Bulb Across Intersection From Multi-Lane Approach with Mandatory Turning Lane		Intended to address accidents involving vehicle failing to make turn in mandatory turn lane.
	Accidents involving vehicle failing to make turn in mandatory turn lane to be blocked by curb bulb	-70%	
114	Install Overhead Lane Use Control Signs		Intended to address accidents involving vehicle failing to make turn in mandatory turn lane.
	Accidents involving vehicles that attempt to make a movement that is prohibited from their lane	-70%	
115	Rumble strips on approaches to intersections		
	Non ice/snow accidents on the target approach caused by cars failing to stop	-80%	
116	Active Advance Warning Flashers		
	Rear end and angle accidents involving vehicles on the target approach	-25%	
117	Install Intersection Flashing Beacon		
	All right angle accidents involving vehicles on target intersection approaches	-30%	
118	Install a Single-Lane Roundabout		
118.1	Replace Signal or Two-Way STOP-Controlled 4-Leg Intersections with a Single-Lane Roundabout	-75%	
118.2	Replace Signal or STOP-Controlled (on one approach) 3-Leg Intersections with a Single-Lane Roundabout	-30%	
118.3	Replace an All-Way Stop Control Intersection with a Single-Lane Roundabout	0%	No change in safety
	All Intersection accidents		
119	Improvement 119 has been intentionally left blank		

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Accident Cost Reduction Factors

Applicable at Locations With Statistically High Rates of Target Accidents

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Imprvmt Type Number	Type of Improvement / Accident Types Susceptible to Reduction	Acc. Cost Rdctn. Factor	Comments
120	Improvement 120 (Intersection Skid Reduction Treatments) was removed from Accident CRF Table because improvement of pavement traction is not easily quantifiable.		
200	**STRUCTURES**		
201	Replace or Widen Narrow Bridge Head-ons, Sideswipes, collisions with fixed objects on bridge or approaches	Use CRF computation: CRF = 9.20 − 8.93 W_{before} + 10.68 W_{after} The variable W_{before} is the bridge shoulder width (feet) before widening. The variable W_{after} is the final bridge shoulder width (feet). The resulting dependent variable CRF is in percent.	
202	Construct Interchange All intersection accidents	CLICK HERE for Interchange Safety Analysis Tool (ISAT) Spreadsheet	Detailed Analysis, CLICK HERE Interchange Safety Analysis Tool Manual
300	**ROADWAY AND ROADSIDE**		
301	Widen Shoulder Run-off-road, head-on, opposite-direction sideswipe, and same direction sideswipe accidents within the widened segment	CLICK HERE for Shoulder Width Spreadsheet Solution	Best Practice is to treat CRF as a function as described in FHWA-RD-99-207
302	Widen Travel Lanes to PreConstruction Manual Standard Run-off-road, head-on, opposite-direction sideswipe, and same direction sideswipe accidents within the widened segment	CLICK HERE for Lane Width Spreadsheet Solution	Best Practice is to treat CRF as a function as described in FHWA-RD-99-207
303	Install Median Barrier Accidents within the median or resulting from vehicles crossing the median in which there are major or fatal injuries	-90%	
304	Install Raised Median		
304.1	Install Raised Median on Undivided Street	-20%	
304.2	Install Raised Median to Replace Two Way Left Turn Lane Cross over and segment access-related vehicle collisions. Target crashes do not include vehicle-crossing pedestrian collisions (See Improvement 406 - Pedestrain Refuge Islands.)	-15%	
305	Close Median Opening REDUCES:Accidents involving vehicles making the movement(s) to be closed INCREASES: New accidents caused by diverted traffic *(Note: closing problem movements does not guarantee accident reduction. It is possible that more accidents will be caused by diversion than happened at the median opening.)*	-90% Increase Varies	Examine alternative routes, likely accident rates at intersections along those routes, estimate the number of accidents along those routes, and apply those accidents as an adjustment to the accidents expected to be reduced by -90% Submit documentation of assumptions and computations.
	Examine alternative routes for traffic diverted by the median closure. Estimate likely changes in volume at intersections along diversion routes. Using those volumes and existing accident rates, estimate the number of accidents at those intersections. Apply those accidents as an adjustment to the accidents at the project location which are expected to be reduced by CRF=-90%. Submit documentation of assumptions and computations with the project description and ranking worksheet.		
306	Install Rumble Strips on shoulders		
306.1	Two-lane rural highways (50 MPH and above)	-20%	
306.2	Four-lane rural highways (50 MPH and above) Non ice/snow run off the road accidents	-10%	

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Accident Cost Reduction Factors

Applicable at Locations With Statistically High Rates of Target Accidents

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Imprvmt Type Number	Type of Improvement / Accident Types Susceptible to Reduction	Acc. Cost Rdctn. Factor	Comments
307	Flatten Horizontal Curves All non-intersection accidents within the realigned segment	CLICK HERE for Horz Curve Spreadsheet Solution	Best Practice is to treat CRF as a function as described in FHWA-RD-99-207
308	Flatten Crest Vertical Curves All non-intersection accidents within the realigned segment	Use Formula from Appendix E, pg 265, of TRB Special report 214	
309 through 313	When applying roadside treatment improvements 309 through 313 individually, apply the Accident Cost Reduction Factor or computational method described for that improvement. When applying two or more roadside treatments in combination, use Roadside Safety Analysis Program (RSAP) to determine the crash cost reduction effectiveness. When using RSAP compare various treatment options against the no treatment option to find the percent change in crash cost.		
309	Relocate Non-Crashworthy Utility Poles from within to beyond clear zone. Collisions with the poles to be relocated	Varies: Use Roadside Safety Analysis Program	Create "no-build alternative" (existing conditions) and "relocate utility poles" alternative. Run program to estimate CCRF. Use HSIPHB severity costs.
310	Flatten or Regrade Side Slopes All Run-off-the-road accidents	CLICK HERE for Slope Flattening Spreadsheet Solution	Best Practice is to use before/after table presented in NCHRP 617
311	Install Shoulder Guardrail Single car run-off-the-road accidents that would have been contained by the rail and resulted in fatal, major, or minor injuries.	-45%	
312	Remove Obstacles Collisions with the obstacle to be removed	-100%	
313	Install Impact Attenuators on rigid objects Fatal and major injury collisions with the object to be shielded	-70%	
314	New Curve Warning Signs and Delineators All non-intersection accidents within the target curve	-20%	
315	Signs, markings, delineators at narrow bridges All Accidents on bridge and within 300 ft of bridge termini	-50%	
316	Install New Continuous Illumination Night Accidents on currently unlighted segments to receive lighting (exclude accidents at intersections that currently have street lights)	-25%	
317	Install Centerline Rumble Strips (50 MPH and above) All non-ice/snow head-on and sideswipe accidents on rural 2-lane roads.	-25%	
318	Install Safety Edge on shoulder edge of pavement All accidents on rural 2-lane roads.	-5%	
400	**PEDESTRIAN AND BICYCLE SAFETY**		
401	Construct Sidewalk Accidents between vehicles and pedestrians walking on shoulder	-75%	
402	Construct Pedestrian and Bicycle Overpass/Underpass Accidents between vehicles and bikes or pedestrians at the Xing the OP or UP will replace	-100%	Only apply the Acc. CRF to likely users of the underpass or overpass

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Applicable at Locations With Statistically High Rates of Target Accidents

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Imprvmt Type Number	Type of Improvement / Accident Types Susceptible to Reduction	Acc. Cost Rdctn. Factor	Comments
403	Install Countdown Timer Pedestrian Signals Accidents between vehicles and pedestrians crossing at the signal	-25%	
404	Install Mid-block Signal Controlled Pedestrian Crossings Target crashes between pedestrians and vehicles at the unsignalized location where the pedestrian crossing will be installed. Do not install too close to an existing traffic signal.	-12%	
405	Install Raised Pedestrian Crossings (Speed Tables) Target crashes between pedestrians and vehicles at the location where the raised pedestrian crossing it to be installed. Do not install too close to an existing traffic signal.	-12%	
406	Install Pedestrian Refuge Islands		
406.1	Install Raised Median as Refuge at Marked Crosswalk	-45%	
406.2	Install Raised Median as Refuge at Unmarked Crosswalk Target crashes between pedestrians and vehicles at an unsignalized pedestrian crossing.	-40%	
407	Install Dedicated Bicycle Lanes Target crashes between vehicles and cyclists on a roadway without a rideable shoulder or bike lane.	-10%	
408	Install Pedestrian Hybrid Beacon Target crashes between major street vehicles and pedestrains crossing uncontrolled major street locations within 150' location of proposed beacon.	-55%	
500	**RAILROAD-HIGHWAY CROSSINGS**		
501	Upgrade from RR signs to flashers Accidents involving trains and highway vehicles	-50%	
502	Upgrade from RR signs to gates & flashers Accidents involving trains and highway vehicles	-67%	
503	Upgrade from RR flashers to gates Accidents involving trains and highway vehicles	-45%	
504	Construct RR Grade Separation Accidents involving trains and highway vehicles	-100%	
505	Install RR Crossing Illumination Accidents involving trains and highway vehicles	-25%	
506	Improve RR Crossing Sight Distance Accidents involving trains and highway vehicles	-25%	25% Acc. CRF only used if full recommended sight distance is achieved with the improvement
900	**CUSTOM IMPROVEMENTS**		
999	Custom Improvement - Requires HQ Approval Accident Types by discussion with ST&SE	- %	Reduction factor(s) on approved basis

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Accident Cost Derivation
for Analysis of FFY '14 HSIP Projects

Updated 02/22/13

Accident Cost Source and Adjustment to 2013

Accident Category FHWA Memo 3/18/09	Accident Categories (AK)	Accident Costs: FHWA 03/18/09	Accident Costs: AK Categories Adj for fatals/crash	Accident Costs: Inflated to Current Yr	Proportion of PDO Cost (Actual)
Property Damage Only:	PDO:	$ 4,615	$ 5,077	$ 5,325	1
Possible Injury (C)		$ 43,846			
	Min Inj:		$ 69,808	$ 73,222	13.75
Non-Incapacitating Injury (B)		$ 83,077			
Incapacitating Injury (A)		$ 415,385			
	Maj Inj:		$ 456,923	$ 479,271	90
Fatality:	Fatality:	$ 6,000,000	$ 6,600,000	$ 6,922,806	1300

GDP Implicit Price Deflator	
09 GDP IPD ('09 dollars):	109.5
12 GDP IPD ('12 dollars):	114.9
Cost Inflation:	4.89%

GDP IDP: Gross Domestic Product Implicit Price Deflator. 2000=100.00

The GDP IPDs shown are 4-quarter averages.

Accident Cost Proportioning *(to reduce the impact of random severe crashes)*

Accident Category	Accident 5 Yr Avg (2006 - 2010)	Total Cost (Using Costs Inflated to 2012 from Above)	Proportion of PDO Cost (Input)	Adjusted Costs	Adjusted Costs-Rounded (Use for Analysis)
Property Damage Only:	8,368	$ 44,561,572		$ 14,044	$ 14,000
Minor Injury:	3,050	$ 223,327,073	10	$ 140,444	$ 140,000
Major Injury:	362	$ 173,496,180	50	$ 702,218	$ 702,000
Fatality:	65	$ 449,982,418	100	$ 1,404,436	$ 1,404,000
Total Accident Cost:	11845	$ 891,367,243		$ 891,367,243	$ 889,536,000

Adjust for Fatalities per Fatal Crash
1.10

Adjustment applied to FHWA Value for a Statistical Life, then distributed to other severity categories.

When past accident history is used to predict future accident costs at a location (as we do in the HSIP), adjustment to actual accident cost is necessary. If this is not done, rare and random severe accidents can attract a disproportionate share of safety funding even though they are not a good indicator of future accident experience. While the difference between a fatal accident and a property-damage-only accident might be measured in microseconds or depend on non-road-related factors such as driver health or vehicle condition, the ratio of actual cost between the two is 1300 to 1. Using the full cost of fatal and severe accidents would result in misallocation of highway safety funds. Accident cost adjustment should reduce, but not eliminate, the impact of severity on predicted future accident cost. Too much value assigned to severe accidents results in safety improvements where there is little likelihood of future accidents. Too little results in high speed roads with histories of severe accidents being given no more priority than low speed roads with no severe accidents.

We have adjusted the relative value of PDO, minor injury, major injury, and fatal accidents to correspond with pre-set proportions while still adding up to the same statewide total accident cost. PDO accidents are both the most common and least-reliably reported. Reporting can vary widely between communities and over time due to changes in reporting thresholds. Because of this and the low severity level, PDO accidents have been assigned a value 1/10 that of minor injury crashes. The SAFETEA-LU highway bill requires HSIP programs to be targeted at major injuries and fatals. This emphasis on severe crashes is provided by making major injury crashes 50 times and fatal crashes 100 times the value of a PDO, which strikes a balance between "Chasing fatals" (making the costs too high) and not weighing crash severity highly enough.

Adjusted accident costs need to be grounded in reality. Although we can re-allocate the cost between severity categories, we should not overstate or understate the total accident cost in the state. Aside from minor rounding, the adjusted costs shown here result in an exact match of total statewide accident costs using the average accident numbers from 2004 through 2008 (the latest five-year period available).

The FHWA's advisory memo dated March 18, 2009, "Treatment of the Economic Value of a Statistical Life in Departmental Analyses,--2009 Annual Revision" (an update of a Feb 5, 2008 memo) estimates the economic value of preventing a human fatality at $6.0 million dollars, and instructs that accident costs for injuries of varying severity should be estimated in accordance with percentages provided in FHWA's Technical Advisory T7570.2, October, 1994. On an annual basis, those costs are temporally adjusted using the Gross Domestic Product Implicit Price Deflator. Because the 2008 FHWA advisory gave the cost of a fatality rather than the cost of a fatal crash, we increased the cost to account for the fact that some fatal crashes have multiple fatalities. As of January 2011, the 2009 advisory memo has not been revised.

When accident costs are used to assess post-project accident reduction, the same accident costs should be used for both the before and after periods.

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Project Life and M&O Costs
for Various Improvements

Imprv. No.	*Type of Improvement*	*Project Life* (From 1996 HSIP Annual Report)	*M&O Cost* (From ADOT&PF Sources)	
			Amount	***per Unit***
INTERSECTION AND TRAFFIC CONTROL				
101	New Turning Lanes	10	$6,000.00	lane-mile/Year
102	Increase Turn Lane Length	10	$6,000.00	lane-mile/Year
103	Two-Way Left Turn Lane	10	$6,000.00	lane-mile/Year
104	Acceleration lane for right turning traffic from side street	10	$6,000.00	lane-mile/Year
105	Improve Sight Distance at Intersection	10	$0.00	
107	Change Two Way Stop to All-Way Stop Control	6	$80.00	sign/year
108	Intersection Illumination	15	$270.00	lum/year
109	New Traffic Signal	10	$10,000.00	each/year
110	Enlarge 8 inch Traffic Signal Head to 12 inches	10	$0.00	
111.1	Conversion of Side-Mounted Signals to Overhead Signals	10	$0.00	
111.2	Increase number of signal heads	10	$50.00	each/year
112	Left-Turn Phase Traffic Signal Modifications	10	$0.00	
113	Install Curb Bulb Across Intersection From Multi-Lane Approach with Mandatory Turning Lane	20	$1.00	linear ft/year
114	Install Overhead Lane Use Control Signs	6	$80.00	sign/year
115	Rumble strips on approaches to intersections	10	$0.00	
116	Active Advance Warning Flashers	10	$2,500.00	each/year
117	Install Intersection Flashing Beacon	10	$2,500.00	each/year
118	Replace a Signal or STOP controlled intersection with a Single-Lane Roundabout	20	$0.00	
	Channelization	10	$100.00	short median/yr
	Improve Sight Distance	10	$0.00	
	SmallTraffic Signs	6	$80.00	sign/year
	LargeTraffic Signs (over 50 sf)	6	$830.00	sign/year
	Replacement of existing large and small traffic signs.	6	$0.00	
	Pavement Markings	2	$0.00	
	Flexible Delineators	2	$10.00	delin./yar
STRUCTURES				
201	Replace Narrow Bridge	20	$0.00	
201	Widen Narrow Bridge	20	$0.25	square ft/year
202	Construct Interchange	30	$1,000.00	each/year
	Construct New Bridge (where there was none)	30	$0.25	square ft/year
	Replace or Improve Minor Structure	20	$0.00	
	Upgrade Bridge Rail	10	$0.00	
ROADWAY AND ROADSIDE				
301	Widen Shoulder	20	$500.00	per foot-mile/year
302	Widen Travel Lanes to PreConstruction Manual Standard	20	$500.00	per foot-mile/year
303	Install Median Barrier	20	$1.00	linear ft/year
304	Install Raised Median	20	$1.00	linear ft/year
305	Close Median Opening	10	$0.00	
306	Install Rumble Strips on shoulders	10	$0.00	
307	Flatten Horizontal Curves	20	$0.00	
308	Flatten Crest Vertical Curves	20	$0.00	
309	Relocate Non-Crashworthy Utility Poles from within to beyond clear zone.	20	$0.00	
310	Flatten or Regrade Side Slopes	20	$0.00	

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Project Life and M&O Costs
for Various Improvements

Imprv. No.	*Type of Improvement*	*Project Life* (From 1996 HSIP Annual Report)	*M&O Cost* (From ADOT&PF Sources)	
			Amount	***per Unit***
311	Install Shoulder Guardrail	10	$1.00	linear ft/year
312	Remove Obstacles	20	$0.00	
313	Install Impact Attenuators on rigid objects	10	$200.00	each/year
314	New Curve Warning Signs and Delineators	6	$80.00	sign/year
315	Signs, markings, delineators at narrow bridges	6	$80.00	sign/year
316	Install New Continuous Illumination	15	$270.00	lum/year
317	Install Centerline Rumble Strips (45 MPH and above)	10	$0.00	
	Add Lanes	20	$6,000.00	lane-mile/year
	Install Breakaway Sign Supports	10	$0.00	
	Install Breakaway Utility Poles	10	$0.00	
	Install Guardrail End Treatment	10	$100.00	each/year
	Upgrade Guardrail	10	$0.00	
	Upgrade Median Barrier	15	$0.00	
	Install Bridge Approach Guardrail Transition	10	$0.00	
PEDESTRIAN AND BICYCLE SAFETY				
401	Construct Sidewalk	20	$0.20	linear ft/year
402	Construct Pedestrian and Bicycle Overpass/Underpass	30	$0.25	square ft/year
403	Install Countdown Timer Pedestrian Signals	10	$0.00	
404	Install Mid-block Signal Controlled Pedestrian Crossings	10	$2,500.00	each/year
405	Install Raised Pedestrian Crossings (Speed Tables)	20	$0.00	
406	Install Pedestrian Refuge Islands	20	$1.00	linear ft/year
407	Install Dedicated Bicycle Lanes	20	$500.00	per foot-mile/year
	Install Fencing and Pedestrian Barrier	10	$0.20	linear ft/year
	Other Non-construction Bikeway Improvements	20	$0.00	
408	Install Pedestrian Hybrid Beacon	10	$2,000.00	each/year
RAILROAD-HIGHWAY CROSSINGS				
501	Upgrade from RR signs to flashers	10	$3,000.00	each/year
502	Upgrade from RR signs to gates & flashers	10	$6,000.00	each/year
503	Upgrade from RR flashers to gates	10	$3,000.00	each/year
504	Construct RR Grade Separation	30	$1,000.00	each/year
505	Install RR Crossing Illumination	10	$270.00	lum/year
506	Improve RR Crossing Sight Distance	10	$0.00	
	Install RR Signs and Markings Assbly where there was none	10	$200.00	each/year
	Install RR Crossbucks	10	$50.00	each/year
	Install New RR Track Circuitry	10	$0.00	
	Improve RR Crossing Surface	10	$0.00	
	Improve RR Crossing Alignment	10	$0.00	
	Relocate or Consolidate RR Crossings	30	$0.00	
	Relocate Highway to Eliminate RR Crossing	30	$0.00	