



# Highway Safety Improvement Program Guidelines

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*Traffic Safety Division*

*June 2020*

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# 2020 HSIP Program Highlights

## **2020 HSIP Program Timeline**

October 30, 2020	District Project Proposals Due for FY's 22-24 District Confirms FY 22 Projects (scope, estimate, schedule)
March 1, 2021	Project Selections Announced
March 29, 2021	CSJ's Due to TRF-TE-Safety

## **District Communications – Category 8**

The Traffic Safety Division (TRF) will coordinate approximately quarterly with districts to verify that all Category 8 traffic projects (Road to Zero (RTZ), Systemic Widening (SSW), and HSIP) are current in TxDOT CONNECT and TRF's systems, verifying project information such as letting date, project limits, scope, cost estimate, construction start and end dates, and final construction cost. Any changes to projects MUST be reviewed by the Traffic Engineering (TE) section of TRF for approval based on program requirements and funding. No changes may be made in TxDOT CONNECT until approved by TRF.

## **District Safety Plans**

The FY 2020 – FY 2023 Safety Plan will be prepared by the district and completed by April 20th, 2020, and submitted to [TRF-TE-Safety](#). They will be reviewed by staff from TRF, Design (DES), Bridge (BRG), Construction (CST), and Maintenance (MNT) divisions to provide feedback to the districts. These plans are divided into two parts: district systemic and district targeted. The district systemic section will focus on a proactive approach to reducing fatal and suspected serious injury crashes through a data driven approach of lowering high risk crash areas. District specific projects will be a reactive approach by using historical crash data provided by TRF to propose safety countermeasures that were identified as a crash contributing factor in the crash analysis.

Projects prepared for the RTZ initiative and HSIP will be captured within the safety plan but not limited to these funding categories. The FY 2020 – FY 2023 Safety Plan will be an umbrella to encompass project planning across all funding categories for the district that address specific safety needs.

TRF's Road to Zero Materials SharePoint site contains guidance required for the four-year safety plans, district crash maps, crash data, and example safety plans.

## **District HSIP Project Proposals**

District HSIP proposed programming levels will be provided for FY 2022 – FY 2024 on TRF's HSIP SharePoint site. By October 30, 2020, each district should submit an FY 2022 – FY 2024 HSIP project list including all projects already approved for HSIP funding as well as those being submitted for HSIP funding review. Each project requesting funding must include the items required for review as detailed under Project Proposals. It is recommended districts submit a list of projects for each FY in an amount of approximately 20% above the projected programming amount for each FY to allow for flexibility.

## **Contacts**

Contact [TRF-TE-Safety@txdot.gov](mailto:TRF-TE-Safety@txdot.gov) or Heather Lott, P.E., at [heather.lott@txdot.gov](mailto:heather.lott@txdot.gov).

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# Overview

## Introduction

Texas has approximately 314,319 miles of highway and streets of which the Texas Department of Transportation (TxDOT) maintains approximately 80,444 miles according to TxDOT's 2017 Roadway Inventory Annual Report published by TxDOT's Transportation Planning and Programming (TPP) Division.

The Texas Demographic Center projects population in Texas will increase from 29,677,772 in 2020 to 47,342,417 in 2050. The citizens and visitors, and businesses, depend on the state to provide facilities that safely and efficiently transport people and goods throughout Texas. This is emphasized in TxDOT's Goals and Objectives, "Promote Safety: Champion a culture of safety. Reduce crashes and fatalities by continuously improving guidelines and innovations along with increased targeted awareness and education."

### ***Texas Highway Safety Improvement Program***

The Department takes in account the needs of the citizens as TxDOT plans, designs, constructs, operates, and maintains transportation facilities. However, due to many factors, a road segment or intersection may experience crashes.

United States Code (UCS) Title 23, Chapter 1 Section 152, mandates each state shall conduct and systematically maintain an engineering survey of all public roads to identify hazardous locations, sections, and elements, including roadside obstacles and unmarked or poorly marked roads which may constitute a danger to motorists, bicyclists, and pedestrians, assign priorities for the correction of such locations, sections, and elements and establish and implement a schedule of projects for their improvement.

In compliance with Title 23 USC, the Texas Highway Safety Improvement Program (HSIP) is a federally mandated program managed by TxDOT. HSIP, directed by Texas' [Strategic Highway Safety Plan \(SHSP\)](#), works to achieve the main objective of significantly reducing traffic fatalities and serious injuries on all public roads by providing a standardized approach for identifying and reviewing specific traffic safety concerns throughout the state. Texas' SHSP identifies the emphasis areas and strategies that the HSIP will focus on to meet the state's objectives of reducing fatal and serious injury crashes in Texas.

The program requires a data-driven, strategic, results-focused approach to improving highway safety on all public roads, consistent with the SHSP. The HSIP implements the priorities identified in the SHSP and the goal is to achieve a significant reduction in fatalities and serious injuries on Texas roadways, including both on-system and off-system roads. The vision of zero deaths on Texas roadways is based on the belief that everyone, no matter how they travel, should be able to arrive at their destinations safely. The plan lists seven emphasis areas which have the greatest potential for reducing fatalities and injuries. The emphasis areas are distracted driving, impaired driving, intersection safety, older road users, pedestrian safety, roadway and lane departures, and speeding. Projects must address one of the seven emphasis areas and logically flow from the appropriate countermeasure(s) specified in the Texas SHSP. Funds are provided for construction and operational improvements for projects both on and off the state highway system (on- or off-system).

HSIP funded projects are also required to be evaluated for cost effectiveness. Completed projects are subject to cost/benefit analysis using three to five years of before and after crash data, average annual daily traffic for the years before and after the improvement, and actual construction costs.

To maximize the cost benefit of a safety improvement project, the process of planning, implementing, and evaluating HSIP projects requires partnering with all stakeholders at both the state and local level.

## HSIP Project Selection

All Texas public roadways are eligible for participation under HSIP provided the proposed safety highway improvement project addresses emphasis areas identified in the most current Texas SHSP. There are also some items of work that may address a serious crash type, but that are not eligible for HSIP funding. Some examples include bridge replacements and general maintenance projects of roadways, signs, signals, pavement markings, etc.

Consider the following when selecting HSIP projects

- Is the strategy, activity, or project consistent with the priorities of Texas' SHSP?
- Does the project address a serious crash risk such as a hot spot, systemic risk factor, road segment, or crash type that has been identified through a data driven process?
- Is the project likely to contribute to a significant reduction in fatalities and serious injuries?

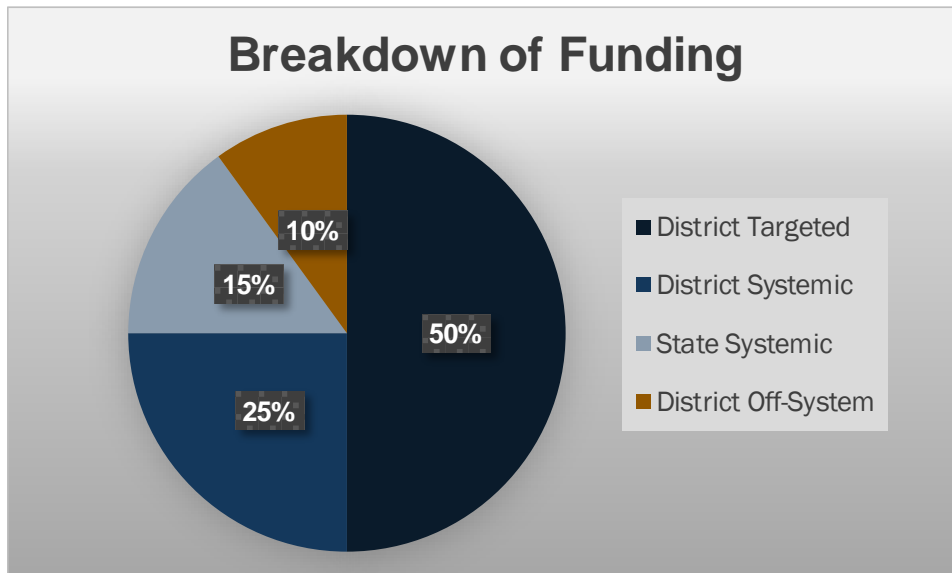
## Program Funding

The HSIP is federally funded. Program funds are eligible to cover 90 percent of project construction costs. State or local participation must cover the remaining 10 percent of project construction costs. Certain safety projects may qualify for increased federal share, Title 23, United States Code (23 U.S.C.), Section 120(c)(1), as designated by TRF. The HSIP is legislated under [Section 148 of Title 23, United States Code](#) (23 U.S.C. 148) and regulated under [Part 924 of Title 23, Code of Federal Regulations](#) (23 CFR Part 924).

The Texas HSIP provides funding for construction and operational safety improvements for locations both on and off the state highway system. HSIP is administered by the Texas Department of Transportation (TxDOT) Traffic Safety Division (TRF) and is part of the TxDOT Unified Transportation Program (UTP) (Category 8). When a potential highway safety project location is identified, it is important to work with your TxDOT District HSIP Coordinator.

Going forward, the program's UTP allocation will be programmed according to the following guidelines:

Table 1: Breakdown of Funding Programming



## Emphasis Areas from the SHSP

Distracted Driving  
Impaired Driving  
Intersection Safety  
Older Road Users  
Pedestrian Safety  
Roadway and Lane Departures  
Speeding

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## 50% District Targeted

Each District will be provided a proposed HSIP programming level which they should plan to spend each FY towards safety countermeasures supporting a reduction in fatal and serious injury crashes by 3.5% each year. The programmed funds are split:

- 60% based on difference between projected crashes and target, using 5 years of on-system KA crashes and a target of 3.5% reduction in KA crashes per year from a 2018 baseline; and,
- 40% based on the previous year's on-system fatalities for each district.

## 25% District Systemic

Systemic funding would provide for each District to target approximately \$3M towards district-wide systemic improvement projects utilizing proven safety countermeasures to reduce risk of fatal and serious injury crashes.

## 15% Statewide Systemic

Each FY TRF will advance statewide systemic projects such as the median barrier chosen in FY 19. FY 22 has less than a full funding year under the new implemented process. Therefore, the 15% statewide systemic is incorporated into the District Systemic percentage, increasing from 25% to 40%. FY 23 begins the normal percentages and full funding year.

## 10% District Off-System

Off-system funds will be programmed by district in the same manner as the On-System Targeted but using KA off-system crash data.

## Programming Summary

Each year, TRF will provide districts with their estimated program funding levels for the coming 4 years. Districts should provide lists of projects totalling approximately 20% over those programming levels, allowing flexibility for the event a project does not meet the requirements, awarded projects let at a lower cost than estimated, projects cancel, or additional funding becomes available. Projects under \$20,000 may not qualify for HSIP funds.

Additional funding requests will be reviewed and approved by TRF on a project by project basis.

## **Systemic Approach**

A systemic approach involves widely implementing improvements based on high-risk roadway features correlated with specific severe crash types. This approach provides a more comprehensive method for safety planning and implementation. It is an approach that broadens traffic safety efforts by considering risk and crash history when identifying where to make low-cost safety improvements. A systemic approach helps to identify sites for potential safety improvements that typically would not be identified using a traditional site analysis approach. Districts can also refer to the FHWA's [Systemic Safety Project Selection Tool](#) as a resource, or TxDOT staff may visit the TRF SharePoint to review the [FHWA Systemic Safety Webinar](#) files.

A systemic approach to safety:

- Identifies a “problem” based on systemwide data, such as a rural lane departure crashes, urban pedestrian crashes, or rural unsignalized intersection crashes. These crashes are often spread across the network with few or no locations experiencing a “cluster” of crashes during a given period of 3-5 years, but which still present a safety risk to the travelling public.

- Looks for characteristics (i.e. geometry, volume, or location) frequently present in severe crashes. These characteristics are referred to as risk factors.
- Focuses on promptly deploying one or more low-cost countermeasure to address the underlying circumstance contributing to crashes on most roads sharing a set of risk factors. By addressing crash types experiencing low densities (crashes per intersection or mile) but high aggregate numbers, program funds can be dedicated toward low-cost solutions deployed across the system, affecting many locations.
- Identifies and prioritizes locations across the roadway network for implementation.

Approved systemic safety countermeasures include:

- Intersections: Implement systemic signing and marking improvements at stop-controlled intersections
  - See [FHWA Proven Safety Countermeasures](#) for more information
  - Includes doubled up signs, oversize advance signs, street name plaques, enhanced pavement markings, stop ahead warning signs, retroreflective sheeting on signposts, stop bar, sight distance improvements, and two-direction large arrow sign at T Intersections
- Intersections: Urban intersection improvements
  - See [Solutions for Saving Lives on Texas Roads](#), page 15 for more information
  - Includes additional signal heads, protected left-turn signal phases, pavement markings, signing improvements, and signal-ahead warning signs.
- Intersections: Signal head backplates with reflective borders
- Roadway Lane Departure: Median Barrier
  - Installation of concrete or cable median barrier where no barrier of any kind currently exists;
  - Placed in the median separating opposing mainlines of traffic;
  - The existing median width must be less than or equal to 70ft; and
  - Cable median barriers are for use only on medians greater than 25ft in width; concrete median barriers can be used on all median widths.
  - Locations of projects will be prioritized in as follows:
    - By roadway type (Interstate, non-Interstate freeways, other principal arterials, all others)
    - 0-45' median widths in urban and rural areas
    - Greater than 45ft median widths in rural areas
    - Greater than 45ft median widths in urban areas
- Roadway Lane Departure: Roadway widening
  - See [Solutions for Saving Lives on Texas Roads](#), page 19 for more information.
  - Rural two-lane, two-way undivided highways with a paved surface width less than 24ft;
  - Widen to 28ft or more, add rumble strips

**Crash counts and SII calculations are not required** for the above systemic safety countermeasure project proposals, because they are proven effective including on roadways not experiencing clusters of crashes.

### ***Deadline for Letting***

Due to the nature of HSIP projects (safety), the project must be let to contract in a timely manner. Ensure the fiscal year chosen on the Submission Form is achievable. Once a project is approved for letting in a fiscal year, every effort must be made to meet this date. TRF reviews and approves all letting date changes. Any project requesting an accelerated letting date will be considered. However, projects requesting a delay in letting will not be allowed letting past the following three years from the time it was approved for funding. In either case,



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when a letting date changes outside of the approved FY, the district will need to show how it impacts HSIP funds in the requested FY. Federal safety funds not obligated by the federal lapse date are forfeited by the state.

## **Changes in Scope**

A request for a change in scope must be submitted as soon as the change is known and prior to PS&E submittal. Submit an email request to [TRF-TE-Safety@txdot.gov](mailto:TRF-TE-Safety@txdot.gov) for approval concerning changes in scope. Provide a detailed explanation for the change requested, including required documentation that would have been submitted at project submission. TRF will review the request and notify the District if the request has been approved.

Note: Requests for changes in scope that results in redefining the project location or deviating from the emphasis area or countermeasures specified in the original project proposal may result in the request being denied.

## **Requests for Additional Funds**

Off-system projects are not eligible to receive additional safety funds. The local government is responsible for all costs after the federal funding has reached its maximum programmed amount.

## **Overruns**

At the time of PS&E submittal, notify [TRF-TE-Safety@txdot.gov](mailto:TRF-TE-Safety@txdot.gov) when the engineer's final estimate exceeds the project's authorized funds by including the Cat 8 Overrun Justification Form. TRF will review the request and notify the District if the request has been approved.

If the whole contract is Category 8 funded, and the engineer's final estimate for the whole contract is under the total authorized amount for the contract, an overrun justification is not required, but if the engineer's final estimate for the whole contract exceeds the total authorized amount for the contract, then an overrun justification form will need to be filled out and submitted. It will need to include justification for each CSJ with an overrun on the form.

If the contract includes projects other than HSIP Category 8 projects, and one or more of the HSIP projects has an overrun, an overrun justification form will need to be filled out and submitted for that project(s).

## **Change Orders**

Submit an email request to [TRF-TE-Safety@txdot.gov](mailto:TRF-TE-Safety@txdot.gov) and include a copy of the Change Order Report from Site Manager along with all supporting documentation. TRF will review the request and notify the District if the request has been approved.

## **Development Authority (8DA)**

TxDOT's Administration established a safety development authority category in the Unified Transportation Plan. The development authority category (Category 8DA) allows districts to design the PS&E, purchase ROW if necessary, relocate utilities and obtain environmental clearance for planned safety projects. Category 8DA does not fund the construction of these safety projects. The District needs to continue to pursue construction funding from other categories including STP, Category 8 HSIP, Energy Sector, etc.

Category 8DA are approved by TRF; however, 8DA approval does not guarantee Category 8 construction funds nor does the project have to be funded with Category 8 funds.

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## Confidentiality of Data

Federal statute 23 U.S.C. 409 makes data and reports confidential if they are compiled for the purpose of evaluating safety of federal-aid highways. Data used in the HSIP should not be released. Any written request must be routed through the TxDOT Office of General Council (OGC).

## TRF Responsibilities

Table 2: TRF Responsibilities

Step	Action
1.	Analyze the proposed highway safety improvement projects for eligibility, data accuracy, and overall conformance with program requirements.
2.	Analyze each targeted/hot spot project's Safety Improvement Index (SII) and review systemic projects for eligibility.
3.	Place projects in the HSIP according to priority and program federal funding. Forward the districts the list of highway safety projects selected for funding through HSIP.
4.	Oversee overruns of project authorized funds at the divisional PS&E review stage in accordance with the current TxDOT policy. >> See Commission Minute Order 109864, November 18, 2004, or subsequent revisions.

### Reporting

TRF submits a statewide HSIP report for the prior federal fiscal year to the FHWA by August 31 of each year. The report addresses intersections and segments as required under 23 U.S.C. Section 148(g). The report includes sections on progress in implementing HSIP projects; program effectiveness; project evaluation; a narrative addressing methodology, and effectiveness; and an explanation of how HSIP projects link to Texas' Strategic Highway Safety Plan.

TRF will analyze the crash reduction data from completed projects and use the results to adjust the factors for the following year's HSIP.

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# Design

## Introduction

The design guidelines presented in this section are intended to aid in planning Highway Safety Improvement Program (HSIP) projects. Work types are assigned based on the information provided by the district during the project proposal process. Only work types programmed for the safety project will be considered “the scope.” The design guidelines reference portions of the [Roadway Design Manual](#) (RDM) and establish items of work not eligible for HSIP funding. These guidelines offer sufficient flexibility while retaining safety as the essential element of all HSIP projects.

## Design Guidelines

### ***Freeway, Non-Freeway “New Location or Reconstruction,” or Texas Highway Freight Network (THFN) Projects***

All roadway elements affected by the scope of the approved HSIP safety improvement must comply with the “[New Location and Reconstruction \(4R\) Design Criteria](#)” found in the RDM (Chapter 3). Enhancements to features outside the scope of the HSIP project are at the district’s option and are to be funded using district funds under a separate Control-Section Job ([CSJ](#)).

### ***Non-Freeway “Rehabilitation or Restoration” Projects***

All roadway elements affected by the scope of the approved HSIP safety improvement must comply with the “[Non-Freeway Rehabilitation \(3R\) Design Criteria](#)” found in the RDM (Chapter 4). Enhancements to features outside the scope of the HSIP project are at the district’s option and are to be funded using district funds under a separate [CSJ](#).

### ***“Safety Treat Fixed Objects” Projects***

Projects whose primary scope of work is “Safety Treat Fixed Objects” must comply with the “Clear Zone” (formerly “Horizontal Clearance”) criteria found in the “[Non-Freeway Rehabilitation \(3R\) Design Criteria](#)” of the RDM (Chapter 4). The designer should provide clearance greater than that required whenever reasonably practicable.

### ***Other Projects***

All projects not included in the above categories must retain the existing roadway conditions (lane widths, shoulder widths, etc.) as a minimum.

## Design Considerations

At the beginning of the HSIP project proposal process, highway designers should analyze crash data to identify the specific safety problems that might be corrected and follow the suggested design process in the RDM ([Chapter 4, Section 3](#)).

## Design Exceptions or Waivers

When the HSIP design guidelines cannot be met, the current design exception or design waiver process established in the RDM ([Chapter 1, Section 2](#)) must be followed.

# HSIP Project Submission Guidelines

As a condition of obligating Federal Highway Safety Improvement Program (HSIP) funds, a state is required to submit an annual report to the Federal Highway Administration (FHWA) that describes the progress on safety improvement projects and their contribution to reducing roadway fatalities, injuries, and crashes. To comply with these requirements and to maintain the integrity of the program-selection process, the following must be adhered to and considered prior to project proposal submission:

HSIP projects are not eligible for local letting. All HSIP projects must be let by TxDOT’s competitive bid process.

Off-system project proposals are required to be submitted through the local district office.

## HSIP Participant Responsibilities

Table 3: HSIP Project Submittal Guidelines

Step	Action
1.	Use the most current version of the SHSP to learn about the program safety emphasis areas. Conduct safety studies and identify potential project locations that qualify for improvements in the identified program emphasis areas using the three most current years of crash data. Evaluate each identified location to determine if the project is feasible and verify that appropriate countermeasures addressing the location’s safety needs are not already completed or scheduled.
2.	Coordinate with stakeholders to gather additional location information and to identify any potential locations that may have been excluded due to incomplete or inaccurate crash and roadway data.
3.	For projects determined to be feasible, conduct a field evaluation to determine the appropriate countermeasure and develop a detailed cost estimate for the entire construction cost of the project. Leveraging of project estimate is not allowed.  NOTE: Districts cannot add district funds to the requested amount in order to “leverage” the cost of the project. All items must be included in the submitted estimate.
4.	Identify the “Proposed Corrective Action” for each proposal. Provide a detailed description of all corrective actions to be performed.  Work is assigned based on the information provided. Only work programmed will be considered “in scope,” and is the only work that can be done as part of the safety project. Work considered incidental to the primary work type will not have a separate work code assigned, but the work will be allowed (for example, widening a roadway to install a left-turn lane or extend drainage structures, re-striping an overlay, etc.). If additional non-incidental work is required or desired, it will be considered “out of scope” and will be funded by the district under a separate CSJ.
5.	Perform a field evaluation to determine existing conditions at the proposed project site. This will avoid the submission of work that has already been constructed and provide the information necessary for a complete and accurate estimate. <b>Consult with the district’s planning office prior to submitting project proposals</b> to determine if the proposed improvement or another is already scheduled for construction under this program or any other.

6.	Project selection is based on the crash history, traffic volumes, and roadway geometrics at the specified location. Accurately identify project parameters for the project to be programmed correctly. When defining project parameters, consideration should be given to including distance for project approaches and tapers, as necessary. HSIP projects are not eligible for non-site-specific contracts.
7.	Complete and submit HSIP project containing requested data to TxDOT's Traffic Safety Division, Traffic Engineering/Safety Engineering team, through the District's HSIP point of contact, along with the necessary backup data (typical sections, layouts, maps, photographs of existing site conditions, etc.) in response to the program call.
8.	Set projects up in TxDOT CONNECT in the assigned work program and may include qualifying projects in the Transportation Improvement Program (TIP) as appropriate.
9.	Notify TRF of potential overrun of an HSIP project's authorized funds prior to Plans, Specifications and Estimates (PS&E) submittal.
10.	Submits PS&E for HSIP projects to TRF in accordance with standard PS&E submission schedule.

## Project Documentation

The project proposals will be submitted electronically with each project being a separate Adobe Acrobat (PDF) file consisting of the following required documentation:

- HSIP Submission Form - The HSIP Submission Form summarizes each project proposal. The form will serve as a one-page summary and aid in tracking changes for each project. The HSIP Submission Form is located on the TxDOT's [Highway Safety Engineering](#) website and TRF's SharePoint site. Detailed instructions are found within this document.
- Location Map – Include a Google maps satellite overview of the location(s) of work. This does not replace the in-person field evaluation (Table 3 item 5).
- SII Report - The SII reports for districts to use with the project submissions have been updated in CRIS. All crash data used in the SII calculation will be queried using Beginning and Ending Distance From Origins (DFO's). The required SII reports are located in the MicroStrategy component of CRIS at the following location:
  - CRIS -TX DOT> Shared Reports > HSIP Call > On-System SII Submission Reports

Detailed instructions on how to run the SII reports for on-system projects are provided within this document. SII reports are not available for off-system projects through the same method; instructions for calculating SIIs for off-system projects are also below.
- Estimate - The estimate must be for the entire cost of constructing the project and must include all items, priced using the **district [average bid prices](#)** published by TxDOT. If a detailed estimate is not provided, the project may not be considered for funding and may be eliminated from the call. Each bid item must include:
  - Complete Descriptive Codes
  - Quantities
  - District Average Unit Prices
  - Total price for each item

- Existing and Proposed Typical Sections - Existing and proposed typical sections are required for any projects that involve widening the roadway, adding lanes, or converting from 4-lane to Super 2 with paved shoulders.
- Intersection Layouts – Intersection layouts are required for any intersection improvement project.
- Warrants – Traffic signal warrants are required for any project using WC 107- Install Traffic Signal.
- District Project Proposal Summary - Each district will be provided a template spreadsheet to fill in with the list of proposed on-system and off-system projects. Be sure this list matches the project proposals sent using TxDOT Dropbox. Email the District Project Proposal Summary to [TRF-TE-Safety@txdot.gov](mailto:TRF-TE-Safety@txdot.gov) which will confirm and notify TRF that project proposals have been submitted.

## Submittal Form Instructions

Use the following instructions for completing the [2020 HSIP Project Submission](#) form.

Table 4: Submittal Form Instructions

Proposal Information	
District	Use the 3-letter district abbreviation or the district name.
County	Enter the County or Counties in which the segment or intersection is located.
Comments	Please provide any information need to adequately evaluate this proposal – missing crash IDs, local driver behaviors, etc. For work codes involving lighting, include a count of luminaires. For work codes with variable maintenance costs, include the keyword associated with that cost according to the HSIP work codes table (Appendix B).
Supervised By	Please enter the name of the area or district team member who will likely make decisions regarding the project. All communication regarding HSIP projects will still go to the district HSIP POC.
File Name	Enter the file name for the project according to the guidelines below.
Roadway Information	
Primary Roadway	Enter the highway system and number (four digits including zeros) or road name as it appears in TxDOT CONNECT.
Control-Section(s)	Enter the Control-Section or group of control sections on the primary roadway. If more than one control section is affected, please separate using commas ONLY, e.g.: 1234-12-123, 5678-56-567, 0000-00-000
Limits From/To	Enter the physical description of the project limits for segment projects. Please only use roadways and distances from roadways, not city limits, ramps, etc.
DFOs*	Enter the DFO's that correspond with the limits entered. The DFO's must be obtained from the Map application of CRIS in order to correlate with crash counts. For Off-System roads, enter the Lat/Long pairs corresponding to the Limits From/To. For single intersection projects, determine the DFO of the priority highway at the intersection and calculate the distance on each side of the intersection needed for the project (maximum of ½ mile on each side)

	If all the work is being performed in one intersection, use 0.1 mile on each side of the intersection (including the cross streets). For off-system roads, please enter lat/long coordinate pairs instead of DFOs.
Length	Enter the project length in miles to the 3 <sup>rd</sup> decimal.
Current AADT	Enter the most current AADT for the roadway or intersecting roadway. This information is required for on and off-system projects.
Intersecting Roadway	Enter the highway system and number (four digits including zeros) or road name as it appears in TxDOT CONNECT.
Speed Limit	Enter the most current regulatory speed limit for roadway or the intersecting roadway.

Project Information	
Work Code(s)	Enter the work code(s) that apply to the project. A current list of all work codes and combination of work codes is provided with this program call.
Reduction Factor	Enter the reduction factor for the work code or combination of work codes.
Service Life	Enter the service life for the work code or combination of work codes.
Maintenance Cost	Enter the maintenance cost for the work code or combination of work codes.
SII	Enter the SII. This information will be shown on the SII report for on-system projects. Leave this field blank for off-system projects. TRF will calculate the SII for off-system projects. For Systemic projects, please list KAB for reference but no need to calculate SII.
Crashes	Enter the number of preventable crashes for each category (K, A & B). This information will be shown on the SII report for on-system projects. Please list your count of KAB crashes for off-system projects & systemic projects. TRF will refer to this information when evaluating projects.
Preferred Letting	Enter the preferred letting month and year for the project, e.g. 9/2021

Estimate	
Bid Items	Enter bid item codes, bid item descriptions, unit of measure, and quantity.
ROW	If required, the total estimated ROW cost. HSIP does not cover ROW but we are required to include it in the totals when calculating cost/benefit.
M&B	Enter the amount estimated for M&B, at least 8% of the bid items total.
Safety	Enter the amount estimated for safety work items, which should be between 2% and 5% of the bid items total.
Inflation	Enter an amount equal to at least 10% of the bid items total.
Total	Sum the above items to calculate the total project cost.

## Project File Naming Convention

Please name your project files according to these instructions:

<p><b>On-System Projects</b></p> <ul style="list-style-type: none"> <li>▪ District Abbreviation_</li> <li>▪ Highway System and Number (four digits)_</li> <li>▪ Sequence Number (if necessary)</li> </ul>	<ul style="list-style-type: none"> <li>▪ E.g.:</li> <li>▪ AUS_FM0487_1</li> <li>▪ AUS_FM0487_2</li> <li>▪ AUS_US0183</li> </ul>
<p><b>Off-System City Projects</b></p> <ul style="list-style-type: none"> <li>▪ District Abbreviation_</li> <li>▪ Road Name_</li> <li>▪ City Name_</li> <li>▪ Sequence Number (if necessary)</li> </ul>	<ul style="list-style-type: none"> <li>▪ E.g.:</li> <li>▪ AUS_LamarBlvd_Austin_1</li> <li>▪ AUS_LamarBlvd_Austin_2</li> <li>▪ AUS_LittigRd_Elgin</li> </ul>
<p><b>Off-System County Projects</b></p> <ul style="list-style-type: none"> <li>▪ District Abbreviation_</li> <li>▪ Road Name_</li> <li>▪ County Name_</li> <li>▪ Sequence Number (if necessary)</li> </ul>	<ul style="list-style-type: none"> <li>▪ E.g.:</li> <li>▪ AUS_HamiltonPoolRd_Travis_1</li> <li>▪ AUS_HamiltonPoolRd_Travis_2</li> <li>▪ AUS_OldHwy290_Hays</li> </ul>

## Submission Instructions

After completing the analysis and determining the appropriate corrective action(s) for an identified location, complete the “HSIP Submission Form.”

Once you have compiled all the required materials, use the “Combine Files” option in Adobe Acrobat to combine the following files and any others the district deems necessary, creating a single PDF for each project:

- HSIP Submission Form;
- Location Map;
- SII Report for on-system projects;
- Detailed Estimate;
- Existing and Proposed Typical Sections (if applicable);
- Intersection Layouts (if applicable);
- Department Warrant Form TFF-TSCA, “Traffic Survey – Count Analysis” and Form TFF-TSAR, “Traffic Signal Authorization Form” (if applicable)
- Any other required documents or explanatory materials.

Name the file using the naming convention described above. Submit a separate PDF file for each project proposal. Once you have generated a single PDF for each project, please create a single zip file containing all the PDFs.

By the deadline, upload and send the single ZIP file containing all of the project PDFs using TxDOT [Dropbox](#) (send to Heather Lott, heather.lott@txdot.gov) and email the completed District Project Summary spreadsheet to [TRF-TE-Safety@txdot.gov](mailto:TRF-TE-Safety@txdot.gov).



# Calculating and Using the SII

## Introduction

Each eligible proposed highway safety project is subjected to a benefit-cost analysis. The formula used for this purpose is the Safety Improvement Index (SII).

## SII Formula

In its most basic form, the SII is the ratio of the cost of preventable crashes that have occurred at a location to the cost of constructing the proposed improvement. The SII incorporates adjustments to provide additional benefit for:

- locations experiencing increasing traffic over the project life
- improvements that will reduce maintenance costs
- projects expected to have long service lives over which construction costs can be amortized.

The SII formula is as follows:

$S = \frac{R(CfF + CiI)}{Y} - M$	$Q = \left( \frac{Aa - Ab}{Ab} \div L \right) S$
$B = \frac{S + \frac{1}{2}Q}{1.06} + \sum_{i=2}^L \left[ \frac{\left( S + \frac{1}{2}Q \right) + (i-1)Q}{(1.06)^i} \right]$	
$SII = \frac{B}{C}$	

where:

- S = annual savings in preventable crash costs (equal to crash cost savings per year less annual maintenance costs), as determined by the above formula
- R = crash reduction factor (see following subsection for explanation)
- F = number of preventable fatal and incapacitating injury crashes (see following subheading for explanation)
- Cf = cost of a fatal or incapacitating injury crash (see following subheading for explanation)
- I = number of preventable non-incapacitating injury crashes (see following subheading for explanation)
- Ci = cost of a non-incapacitating injury crash (see following subheading for explanation)
- Y = number of years of crash data
- M = change in annual maintenance costs for the proposed project relative to the existing situation
- Q = annual change in crash cost savings, as determined by the above formula
- Aa = projected average annual Average Daily Traffic (ADT) at the end of the project service life
- Ab = average annual ADT during the year before the project is implemented
- L = project service life (see following subheading for explanation)
- B = present worth of project benefits over its service life, as determined by the above formula
- C = initial cost of the project.

## Obtaining SII Data

Before calculating the SII, the “Proposed Corrective Action” must be translated into “work codes.” The HSIP Work Codes Table (contained in Appendix B of this manual) provides the work codes that correspond to various descriptions of work. The table also provides associated definitions, reduction factors, service lives, applicable maintenance cost, and preventable crash codes (see following explanation).

The data necessary to calculate each project’s SII can be obtained from the sources shown in the following table.

Table 2: Sources for SII Data

Data Item	How It Is Obtained
<p>R – Crash Reduction Factor</p> <p>NOTE: The reduction factor represents the percentage reduction in crash costs or severity of the applicable crash types that can be expected as a result of the improvement.</p>	<p>From the Highway Safety Improvement Program (HSIP) Work Codes Table (Appendix B).</p> <p>NOTE: If the scope of work includes more than one work code, TRF program administrators derive a composite reduction factor.</p>
<p>F – Number of fatal and incapacitating injury crashes</p> <p>I – Number of non-incapacitating injury crashes</p>	<p>The HSIP Work Codes Table shows “Preventable Crash” codes. Preventable crashes are those with defined characteristics that may be affected by the proposed improvement as described by the work code. The codes correspond to numeric codes assigned in the Crash Records Information System (CRIS) to the indicated variable. Information is collected from the peace officer’s crash report and converted into a coded format. The Preventable Crash Decoding Table (Appendix C) can be used to interpret the codes and determine the number of each type of crash, using three years of preventable crash data. The program call specifies the years used.</p>
<p>C<sub>f</sub> – Cost of a fatal or incapacitating injury crash</p> <p>C<sub>i</sub> – Cost of a non-incapacitating injury crash</p>	<p>The average cost of each type of crash is based on the comprehensive cost figures provided by the National Safety Council.</p> <p>The program call provides the cost figures used each year.</p>
<p>L – Project service life</p>	<p>From the HSIP Work Codes Table found in Appendix B of this manual.</p> <p>NOTE: If the project is represented by more than one work code, TRF program administrators base the project service life on the primary work.</p>

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## SII Results

A project with an SII greater than or equal to 1.0 is considered cost effective. Projects with an SII of less than 1.0 will not be considered for funding.

NOTE: The SII does not establish the need or lack of a need for a project. The SII formula is a mathematical representation of the ratio of costs of preventable crashes to costs of construction; it provides no evaluation of the appropriateness of the type of construction.

The SII was designed as a comparison device for project prioritization and should **not** be used as a measure for independent projects.

## SII Calculator Available

An Excel-based program for approximating a project's SII is on TxDOT's [Highway Safety Engineering](#) website.

## SII Report Instructions for On System Projects

To generate an On-System SII Submission Report:

1. Log in to the Crash Records Information System (CRIS) at <https://cris.txdot.gov>
2. Click on the MicroStrategy link on the right side of the CRIS landing page
3. Click on the "CRIS - TX DOT" project link
4. In the "Shared Reports" folder, select the "HSIP Call" folder
5. In the "HSIP Call" folder, select the "On-System SII Submission Reports" folder
6. Select the appropriate report for the proposed counter measure (Work Code):
  - Safety Project SII Calculator for Signing and Signal Projects (100 Series) by Hwy/DFO
  - Safety Project SII Calculator for Roadside Obstacles and Barrier Projects (200 Series) by Hwy/DFO
  - Safety Project SII Calculator for Resurfacing and Roadway Lighting Projects (300 Series) by Hwy/DFO
  - Safety Project SII Calculator for Pavement Marking Projects (400 Series) by Hwy/DFO
  - Safety Project SII Calculator for Roadway Work Projects (500 Series) by Hwy/DFO
  - Safety Project SII Calculator for Combination Work Code Projects by Hwy/DFO\*

\*If a proposed combination does not exist, e-mail the new combination request to [TRF-TE-Safety@txdot.gov](mailto:TRF-TE-Safety@txdot.gov) for evaluation by TRF. If approved, a crash reduction factor and service life will be calculated. The deadline to get a new combination calculated is 8 weeks prior to the project submission deadline. After the deadline, the SII of any work code combinations not in the report will have to be calculated by hand and may not be done in time for the project to be included in the current call.

7. Complete the required prompted fields:
  - Project Parameters – Enter the physical description of the project limits
  - Year Group – Select Years
  - Work Code – Select the appropriate work code. For projects with multiple proposed work codes, use the "Safety Project SII Calculator for Combination Work Code Projects by Hwy/DFO" report and select from the available combination work codes.
  - Part of Roadway (optional) – Leave blank.
  - Project Cost – Enter the Total Construction Cost (Bid Items + ROW + Mobilization and Barricades + Safety Contingency + Inflation).
  - Annual Maintenance Cost – Enter the maintenance cost as defined in the Work Codes Table of this document, including per luminaire or overhead vs. roadside modifiers, etc.
  - First Highway – Select the Highway from the drop-down list or search box.

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- Beginning DFO – Enter the Beginning DFO for the project parameters. The DFO’s must be obtained using the LRS Readout tool in the Map application of CRIS. Detailed instructions on using the Map application can be found on the TRF website at [http://crossroads/org/trf/TRFCDA/MAP\\_User\\_Guide\\_v2.pdf](http://crossroads/org/trf/TRFCDA/MAP_User_Guide_v2.pdf)
  - Ending DFO – Enter the Ending DFO for the project parameters. See above instructions for obtaining DFO’s. The Ending DFO must be greater than the Beginning DFO.
  - Second Highway – Select the Highway from the drop-down list or search box if the project is an intersection project with another highway or the project spans multiple segments on the same highway. Up to four intersection legs or segments with Beginning and Ending DFO’s may be entered.
8. Click on the “Export” button at the bottom left of the screen.
  9. Click on the “Add to History List” option.
  10. Click on the report once the processing is complete.
  11. Save the report as a PDF file.

## **SII for Off System Projects**

At this time, there is no easy way to generate SII reports for Off System projects. If you know the crash counts for your project, please use the Excel-based SII calculator. Or, leave the crash and SII fields blank, and TRF staff will calculate applicable counts and criteria for each off-system project.

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# Crash Data

## Overview

The Crash Records Information System (CRIS) is the official state database for traffic crashes occurring in Texas. CRIS contains spatial and reporting components designed to be used by TxDOT personnel to obtain and analyze crash data. Each district has personnel licensed to have access to CRIS. TxDOT district offices are encouraged to work closely with TxDOT Area Offices and local municipalities to identify locations with the highest need for safety improvements. Crash data for the past 3 years will be used for an HSIP Program Call and any crashes occurring in years other than these years will not be used in the SII calculation.

The crash reports that are provided for each district contain fatal (K) and severe injury (A) crashes only. Non-incapacitating (B) crashes are still used in the Safety Improvement Index (SII) calculation, but for screening purposes, only K and A crashes are provided in the crash reports. The following crash reports will be provided to each district:

- On-System KA Crashes by Control-Section
- On-System KA Crashes on Curves
- On-System KA Crashes on Rural 4-Lane Undivided Highways without Paved Shoulders
- On-System KA Crashes Work Code 541 Preventable Rural 2-Lane Highways < 24ft. and  $\geq$  400 ADT
- Pedestrian Involved KA Crashes

The Texas A&M Transportation Institute has provided individual District CAVS data to enhance the process of selecting safety projects to submit for HSIP funding consideration. Crash data and crash attributes for all K and A crashes will be compiled into a spreadsheet, analyzed for each crash to determine whether that crash could be prevented by the type of work and then mapped. The maps can be filtered to only show crashes that apply to a particular type of work.

## Crash Cost

As of this publication, the cost per crash will be \$3,600,000 for K or A crashes and \$500,000 for B crashes. Only preventable KAB crashes are used to calculate each proposal's SII. Please refer to the current program call (if applicable) to verify the current crash costs.

## Appendix A – Definitions

Terminology	Definition
A Crash	Suspected serious injury crash
B Crash	Non-incapacitating injury crash
C Crash	Possible injury crash
Change Orders	Work that is added or deleted from the original scope of a contract that alters the original contract amount.
Countermeasure	A roadway-based strategy intended to reduce risk at a site
Crash	A set of events that results in injury, or property damage due to the collision of at least one motorized vehicle and may involve collision with another motorized vehicle, bicyclist, a pedestrian or an object
Crash frequency	The basic measure of crashes in the HSM, number of crashes occurring at a particular site, facility, or network per year (expressed for a location/ site or per mile depending on the context)
CRIS	Crash Records Information System
FHWA	Federal Highway Administration
District	A geographical area managed by a district engineer, in which TxDOT conducts its primary work activities
Highway Safety Improvement Project	Is a project on a public road that implements countermeasures consistent with the Texas Strategic Highway Safety Plan, and improves road conditions or roadway features.
K Crash	fatal crash
Off-system Roadways	Roadway not designated on the State Highway System and not maintained by TxDOT (i.e. city street, county road).
On-system Roadways	Roadway designated on the State Highway System and maintained by TxDOT.
Overruns	The difference between the engineer's final estimate and the original amount programmed for a specific HSIP project.
Preventable Crash	Crashes with defined characteristics that may be affected by the proposed improvement as described by the work code.
Road User	Means a motorist, passenger, public transportation operator or user, truck driver, bicyclist, motorcyclist, or pedestrian, including a person with disabilities.
SII	Safety Improvement Index
Safety Study	An analysis of roadway, traffic, and crash-related data to determine the probable cause of an identified crash pattern at an intersection or highway section. The safety study also provides alternative countermeasures meant to mitigate predominate crash pattern(s).
Systemic Safety Improvement	An improvement that is widely implemented based on high-risk roadway features that are correlated with particular crash types, rather than crash frequency.
Traffic Engineering Section	A section in the Traffic Safety Division whose primary responsibility relates to traffic engineering.
Traffic Safety Division	The division within the Texas Department of Transportation, headquartered in Austin, whose primary responsibility relates to traffic operations.

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## Appendix B - HSIP Work Codes Table

The work codes are grouped into five categories, as shown in the following table.

Code	Item
100	Signing and Signals
200	Roadside Obstacles and Barriers
300	Resurfacing and Roadway Lighting
400	Pavement Markings
500	Roadway Work

Work codes are listed by number within each group. Preventable Crash Decoding is in Appendix C of this document.

## 100 - Signing and Signals

101 Install Warning/Guide Signs	
Definition:	Provide advance signing for unusual or unexpected roadway features where no signing existed previously.
Reduction Factor (%):	20%
Service Life (Years):	6
Maintenance Cost:	N/A
Preventable Crash:	(Vehicle Movements/Manner of Collision = 20-22 or 30) OR (Roadway Related = 2, 3 or 4)
105 Install Intersection Flashing Beacon	
Definition:	Provide an overhead flashing beacon at an intersection where a beacon did not exist previously.
Reduction Factor (%):	14%
Service Life (Years):	10
Maintenance Cost:	\$2,100 (overhead) \$1,300 (roadside mounted)
Preventable Crash:	[(Intersection Related = 1 or 2) AND (Vehicle Movements/Manner of Collision = 10-19)]
107 Install Traffic Signal	
Definition:	Provide a traffic signal where none existed previously.
Reduction Factor (%):	35%
Service Life (Years):	10
Maintenance Cost:	\$3,400 (Isolated) \$3,900 (Interconnected) \$5,400 (Diamond Interchange)
Preventable Crash:	[(Intersection Related = 1 or 2) AND (Vehicle Movements/Manner of Collision = 10-39)] OR (First Harmful Event = 1 or 5)
108 Improve Traffic Signals	
Definition:	Improve existing intersection signals to current design standards.
Reduction Factor (%):	24%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	[(Intersection Related = 1 or 2) AND (Vehicle Movements/Manner of Collision = 10-39)] OR (First Harmful Event = 1 or 5)
110 Install Pedestrian Signal	
Definition:	Provide a pedestrian signal at an existing signalized location where no pedestrian phase exists, but pedestrian crosswalks are existing. Refer to W.C. 403 for installation of pedestrian crosswalks.
Reduction Factor (%):	34%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	First Harmful Event = 1



<b>111 Interconnect Signals</b>	
Definition:	Provide a communication link between two or more adjacent signals in a corridor. Specify all signalized intersections to be included in the interconnection.
Reduction Factor (%):	10%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	All
<b>113 Install Delineators</b>	
Definition:	Install post-mounted delineators to provide guidance.
Reduction Factor (%):	12%
Service Life (Years):	7
Maintenance Cost:	N/A
Preventable Crash:	(Roadway Related = 2 , 3 or 4) AND (Light Condition = 3, 4 or 6)
<b>114 Install School Zones</b>	
Definition:	Place school zones to include flashers, signing and/or pavement markings where none existed previously. Refer to W.C. 403 for pedestrian crosswalk markings.
Reduction Factor (%):	20%
Service Life (Years):	5
Maintenance Cost:	N/A
Preventable Crash:	All
<b>118 Replace Flashing Beacon with a Traffic Signal</b>	
Definition:	Replace an existing flashing beacon at an intersection with a traffic signal.
Reduction Factor (%):	25%
Service Life (Years):	10
Maintenance Cost:	1300
Preventable Crash:	[(Intersection Related = 1 or 2) AND (Vehicle Movements/Manner of Collision = 10-39)] OR (First Harmful Event = 1 or 5)
<b>119 Install Overhead Signs</b>	
Definition:	Install overhead advance regulatory, warning or guide signing for unusual or unexpected roadway features where no signing existed previously.
Reduction Factor (%):	20%
Service Life (Years):	6
Maintenance Cost:	N/A
Preventable Crash:	Vehicle Movements/Manner of Collision = 20-29
<b>122 Install Advanced Warning Signals (Intersection - Existing Warning Signs)</b>	
Definition:	Provide flasher units in advance of an intersection where none previously existed but where advance warning signs already exist.
Reduction Factor (%):	10%
Service Life (Years):	10
Maintenance Cost:	\$1,300 per approach
Preventable Crash:	Intersection Related = 1 or 2

<b>123 Install Advanced Warning Signals (Curve- Existing Warning Signs)</b>	
Definition:	Provide flasher units in advance of a curve where none previously existed. Advance warning signs already exist.
Reduction Factor (%):	10%
Service Life (Years):	10
Maintenance Cost:	\$1,300 per approach
Preventable Crash:	(Roadway Related = 2, 3 or 4) OR (Vehicle Movements/Manner of Collision= 20-24 or 30)
<b>124 Install Advanced Warning Signals and Signs (Intersection)</b>	
Definition:	Provide flasher units and signs in advance of an intersection where none previously existed. Refer to W.C. 105 for overhead intersection flashing beacon.
Reduction Factor (%):	27%
Service Life (Years):	10
Maintenance Cost:	\$1,300 per approach
Preventable Crash:	Intersection Related = 1 or 2
<b>125 Install Advanced Warning Signals and Signs (Curve)</b>	
Definition:	Provide flasher units and signs in advance of a curve where none previously existed.
Reduction Factor (%):	15%
Service Life (Years):	10
Maintenance Cost:	\$1,300 per approach
Preventable Crash:	(Roadway Related = 2, 3 or 4) OR (Vehicle Movements/Manner of Collision = 20-24 or 30)
<b>128 Install Advanced Warning Signs (Intersection)</b>	
Definition:	Provide signs in advance of an intersection where none previously existed.
Reduction Factor (%):	5%
Service Life (Years):	6
Maintenance Cost:	N/A
Preventable Crash:	Intersection Related = 1 or 2
<b>130 Install Advanced Warning Signs (Curve)</b>	
Definition:	Provide signs in advance of a curve where none previously existed.
Reduction Factor (%):	5%
Service Life (Years):	6
Maintenance Cost:	N/A
Preventable Crash:	(Roadway Related = 2, 3 or 4) OR (Vehicle Movements/Manner of Collision = 20-24 or 30)
<b>131 Improve Pedestrian Signals</b>	
Definition:	Bring existing pedestrian signal units into conformance with current standards.
Reduction Factor (%):	10%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	First Harmful Event = 1

<b>132 Install Advance Warning Signals and Signs</b>	
Definition:	Provide flasher units and signs in advance of hazard where none previously existed.
Reduction Factor (%):	10%
Service Life (Years):	10
Maintenance Cost:	\$1,300 per approach
Preventable Crash:	To be determined
<b>133 Improve School Zone</b>	
Definition:	Improve an existing school zone by upgrading signing, pavement markings or signals.
Reduction Factor (%):	5%
Service Life (Years):	5
Maintenance Cost:	N/A
Preventable Crash:	All
<b>136 Install LED Flashing Chevrons (Curve)</b>	
Definition:	Install LED flashing chevrons on curve to provide guidance.
Reduction Factor (%):	35%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	(Roadway Related = 2, 3, or 4) OR (Vehicle Movements/Manner of Collision = 20 - 24, or 30)
<b>137 Install Chevrons (Curve)</b>	
Definition:	Install chevrons on curve to provide guidance.
Reduction Factor (%):	25%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	(Roadway Related = 2, 3, or 4) OR (Vehicle Movements/Manner of Collision = 20 - 24, or 30)
<b>138 Install Flashing Yellow Arrow</b>	
Definition:	Improve existing intersection signals by adding a flashing yellow arrow indication and install the LEFT TURN YIELD ON FLASHING YELLOW ARROW (R10-17T) sign. Refer to W.C. 108 for improvement of traffic signal.
Reduction Factor (%):	41%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	(Intersection Related = 1 or 2) AND (Vehicle Movements/Manner of Collision = 34)
<b>139 Install Surface Mounted Delineators on Centerline</b>	
Definition:	Install surface mounted delineators on centerline.
Reduction Factor (%):	12%
Service Life (Years):	7
Maintenance Cost:	N/A
Preventable Crash:	(Vehicle Movements/Manner of Collision = 21 or 30) OR (Roadway Related = 2 or 3)

<b>140 Wrong Way Driver Warning Signs</b>	
Definition:	Provide warning signs to warn wrong way drivers at freeway entrances.
Reduction Factor (%):	35%
Service Life (Years):	6
Maintenance Cost:	N/A
Preventable Crash:	Contributing factor = 71
<b>141 Wrong Way Driver Warning Markings</b>	
Definition:	Provide markings (lane direction arrows) to warn wrong way drivers at freeway entrances.
Reduction Factor (%):	40%
Service Life (Years):	4
Maintenance Cost:	N/A
Preventable Crash:	Contributing factor = 71
<b>142 Wrong Way Driver Advanced Technologies</b>	
Definition:	Provide advanced technologies to detect and warn wrong way drivers at freeway entrances.
Reduction Factor (%):	TBD
Service Life (Years):	8
Maintenance Cost:	25000
Preventable Crash:	Contributing factor = 71
<b>143 Pedestrian Hybrid Beacon</b>	
Definition:	Provide pedestrian hybrid beacon at established crosswalk.
Reduction Factor (%):	15%
Service Life (Years):	10
Maintenance Cost:	2100
Preventable Crash:	First Harmful Event = 1

## 200 - Roadside Obstacles and Barriers

201 Install Median Barrier	
Definition:	Construct a concrete or cable safety system median barrier where none existed previously.
Reduction Factor (%):	75%
Service Life (Years):	20
Maintenance Cost:	N/A
Preventable Crash:	Vehicle Movements/Manner of Collision = 30
203 Install Raised Median	
Definition:	Install a roadway divider using barrier curb
Reduction Factor (%):	25%
Service Life (Years):	20
Maintenance Cost:	N/A
Preventable Crash:	(Part of Roadway No. 1 Involved = 1) AND (Vehicle Movements/Manner of Collision = 10, 14, 20-22, 24, 26, 28-30, 34 or 38)
204 Flatten Side Slope	
Definition:	Provide an embankment side slope of 6:1 or flatter.
Reduction Factor (%):	5%
Service Life (Years):	20
Maintenance Cost:	N/A
Preventable Crash:	Roadway Related = 3
209 Safety Treat Fixed Objects	
Definition:	Remove, relocate or safety treat all fixed objects including the installation of guardrail for safety treatment of a fixed object or drainage structures within the project limits, to include both point and continuous objects.
Reduction Factor (%):	50%
Service Life (Years):	20
Maintenance Cost:	N/A
Preventable Crash:	(Roadway Related = 2, 3 or 4) OR (Object Struck = 20-26, 29-36, 40-42, 56-58, 60, 62, or 63)
217 Install Impact Attenuation System	
Definition:	Provide any of a variety of impact attenuators where none existed previously.
Reduction Factor (%):	60%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	(Object Struck = 20, 30, 40 or 42)
218 Widen Bridge	
Definition:	Provide additional width across an existing structure, either by rehabilitation or replacement. Specify existing bridge width, existing approach roadway width and roadway type (2 lane, 4 lane undivided, etc.)
Reduction Factor (%):	55%
Service Life (Years):	20
Maintenance Cost:	N/A
Preventable Crash:	(Bridge Detail is not blank) OR (Vehicle Movements/Manner of Collision = 20, 21, or 30) OR (Roadway Related = 2, 3 or 4)

## 300 - Resurfacing and Roadway Lighting

303 Resurfacing	
Definition:	Provide a new roadway surface to increase pavement skid numbers on all the lanes.
Reduction Factor (%):	30%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	Surface Condition = 2, 5, 6 or 9 (Skid Value must be less than 20)
304 Safety Lighting	
Definition:	Provide roadway lighting, either partial or continuous, where either none existed previously or major improvements are being made. Refer to W.C. 305 for intersection lighting.
Reduction Factor (%):	49%
Service Life (Years):	15
Maintenance Cost:	\$100 per Luminaire
Preventable Crash:	Light Condition = 3, 4 or 6
305 Safety Lighting at Intersection	
Definition:	Install lighting at an intersection where either none existed previously or major improvements are proposed. Refer to W.C. 304 for general lighting.
Reduction Factor (%):	13%
Service Life (Years):	15
Maintenance Cost:	\$100 per Luminaire
Preventable Crash:	Light Condition = 3, 4 or 6 AND Intersection Related = 1 or 2
306 High Friction Surface Treatment (Curve)	
Definition:	Provide a high friction surface treatment on a curve.
Reduction Factor (%):	45%
Service Life (Years):	5
Maintenance Cost:	N/A
Preventable Crash:	(Roadway Related = 2, 3, or 4) OR (Surface Condition = 2, 5, 6 or 9)
307 High Friction Surface Treatment (Intersection)	
Definition:	Provide a high friction surface treatment at an intersection approach.
Reduction Factor (%):	20%
Service Life (Years):	5
Maintenance Cost:	N/A
Preventable Crash:	Intersection Related = 1 or 2

## 400 - Pavement Markings

401 Install Pavement Markings	
Definition:	Place complete pavement markings, excluding crosswalks, in accordance with the TMUTCD where either no markings or nonstandard markings exist. Refer to W.C. 402 for edge marking, W.C. 403 for pedestrian crosswalks, W.C. 404 for centerline striping.
Reduction Factor (%):	20%
Service Life (Years):	4 (Product used must meet 4 year service life.)
Maintenance Cost:	N/A
Preventable Crash:	(Roadway Related = 2, 3 or 4) OR (Vehicle Movements/Manner of Collision = 21 or 30) OR (First Harmful Event = 3)
402 Install Edge Marking	
Definition:	Place edge lines where none existed previously.
Reduction Factor (%):	25%
Service Life (Years):	4 (Product used must meet 4 year service life.)
Maintenance Cost:	N/A
Preventable Crash:	Roadway Related = 2, 3 or 4
403 Install Pedestrian Crosswalk	
Definition:	Place pedestrian crosswalk markings where none existed previously. Refer to W.C. 114 for school zones, and W.C. 110 for pedestrian signal.
Reduction Factor (%):	10%
Service Life (Years):	4 (Product used must meet 4 year service life.)
Maintenance Cost:	N/A
Preventable Crash:	First Harmful Event = 1
404 Install Centerline Striping	
Definition:	Provide centerline striping where either no markings or nonstandard markings existed previously. Refer to W.C. 401 for complete pavement markings.
Reduction Factor (%):	65%
Service Life (Years):	4 (Product used must meet 4 year service life.)
Maintenance Cost:	N/A
Preventable Crash:	Vehicle Movements/Manner of Collision = 30
407 Install Sidewalks	
Definition:	Install sidewalks where none existed previously.
Reduction Factor (%):	65%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	First Harmful Event = 1 or 5

## 500 - Roadway Work

<b>502 Widen Lane(s)</b>	
Definition:	Provide additional width to the lane(s). Refer to W.C. 517 if adding a through lane.
Reduction Factor (%):	30%
Service Life (Years):	20
Maintenance Cost:	N/A
Preventable Crash:	(Roadway Related = 2, 3 or 4) OR (Vehicle Movements/Manner of Collision = 13, 21, 23, 30 or 33)
<b>503 Widen Paved Shoulder (to 5 ft. or less)</b>	
Definition:	Extend the existing paved shoulder to achieve desirable shoulder width. Refer to W.C. 504 or 537 for constructing a paved shoulder.
Reduction Factor (%):	25%
Service Life (Years):	20
Maintenance Cost:	N/A
Preventable Crash:	(Roadway Related = 2, 3 or 4) OR (First Harmful Event = 4)
<b>504 Construct Paved Shoulders (1-4 ft.)</b>	
Definition:	Provide paved shoulders of 1- to 4-foot width where no shoulders existed previously. Refer to W.C. 503 or 536 for widening paved shoulders.
Reduction Factor (%):	25%
Service Life (Years):	20
Maintenance Cost:	N/A
Preventable Crash:	(Roadway Related = 2, 3 or 4) OR (Vehicle Movements/Manner of Collision = 20, 23-24 or 30) OR (First Harmful Event = 4)
<b>505 Improve Vertical Alignment</b>	
Definition:	Reconstruct the roadway to improve sight distance.
Reduction Factor (%):	50%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	(Roadway Related = 2, 3 or 4) OR (Vehicle Movements/Manner of Collision = 20-24, 30, 32 or 34)
<b>506 Improve Horizontal Alignment</b>	
Definition:	Flatten existing curves. Refer to W.C. 507 for providing superelevation, and W.C. 508 for intersection realignment.
Reduction Factor (%):	55%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	(Roadway Related = 2, 3 or 4) OR (Vehicle Movements/Manner of Collision = 20-24 or 30)
<b>507 Increase Superelevation</b>	
Definition:	Provide increased superelevation on an existing curve.
Reduction Factor (%):	65%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	(Roadway Related = 2, 3 or 4) OR (Vehicle Movements/Manner of Collision = 30)



<b>508 Realign Intersection</b>	
Definition:	Improve an existing intersection by partial or complete relocation of the roadway(s). Refer to W.C. 509 for channelization, and W.C. 506 for improving horizontal alignments.
Reduction Factor (%):	TBD
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	Will be determined from supplied diagram
<b>509 Channelization</b>	
Definition:	Install islands and/or pavement markings to control or prohibit vehicular movements. A sketch of the proposed channelization should be provided. Refer to W.C. 508 for intersection realignment.
Reduction Factor (%):	TBD
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	Will be determined from supplied diagram
<b>510 Construct Turn Arouds</b>	
Definition:	Provide turnarounds at an intersection where none existed previously.
Reduction Factor (%):	40%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	(Intersection Related = 1 or 2) AND (Vehicle Movements/Manner of Collision = 12, 14, 18, 20, 22, 24, 26, 28, 29, or 34)
<b>514 Grade Separation</b>	
Definition:	Construct vertical separation of intersecting roadways.
Reduction Factor (%):	80%
Service Life (Years):	30
Maintenance Cost:	N/A
Preventable Crash:	Intersection Related = 1 or 2
<b>515 Construct Interchange</b>	
Definition:	Construct vertical separation of intersecting roadways to include interconnecting ramps.
Reduction Factor (%):	65%
Service Life (Years):	30
Maintenance Cost:	N/A
Preventable Crash:	Intersection Related = 1 or 2
<b>516 Close Crossover</b>	
Definition:	Permanently close an existing crossover.
Reduction Factor (%):	50%
Service Life (Years):	20
Maintenance Cost:	N/A
Preventable Crash:	(Part of Roadway Involved = 1) AND (Vehicle Movements/Manner of Collision = 10, 14, 20-22, 24, 26, 28-30, 34 or 38)

<b>517 Add Through Lane</b>	
Definition:	Provide an additional travel lane.
Reduction Factor (%):	28%
Service Life (Years):	20
Maintenance Cost:	N/A
Preventable Crash:	Vehicle Movements/Manner of Collision = 20-24, 26-27, 29-30
<b>518 Install Continuous Turn Lane</b>	
Definition:	Provide a continuous two-way left turn lane where none existed previously.
Reduction Factor (%):	50%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	Vehicle Movements/Manner of Collision = 20-22, 24, 26, 28-30, 34 or 38
<b>519 Add Left Turn Lane</b>	
Definition:	Provide an exclusive left turn lane where none existed previously. The affected intersection approaches must be specified.
Reduction Factor (%):	25%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	Vehicle Movements/Manner of Collision = 20-22, 24, 26, 28-30, 34 or 38 AND Intersection Related != 4
<b>520 Lengthen Left Turn Lane</b>	
Definition:	Provide additional length to an existing exclusive left turn lane. Affected intersection approaches must be specified.
Reduction Factor (%):	40%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	Vehicle Movements/Manner of Collision = 20-22 AND Intersection Related != 4
<b>521 Add Right Turn Lane</b>	
Definition:	Provide an exclusive right turn lane where none existed previously. Affected intersection approaches must be specified.
Reduction Factor (%):	25%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	Vehicle Movements/Manner of Collision = 20-23, 25-27, 33 or 36 AND Intersection Related != 4
<b>522 Lengthen Right Turn Lane</b>	
Definition:	Provide additional length to an existing exclusive right turn lane. Affected intersection approaches must be specified.
Reduction Factor (%):	40%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	Vehicle Movements/Manner of Collision = 20-22 AND Intersection Related != 4
<b>523 Construct Pedestrian Over/Under Pass</b>	
Definition:	Construct a pedestrian crossover where none existed previously.
Reduction Factor (%):	95%
Service Life (Years):	20
Maintenance Cost:	N/A
Preventable Crash:	First Harmful Event = 1

<b>524 Increase Turning Radius</b>	
Definition:	Provide an increased turning radius at an existing intersection.
Reduction Factor (%):	10%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	[(Vehicle Body Style = 87 or 91) AND (First Harmful Event = 7)] OR (Vehicle Movements/Manner of Collision = 13, 20-21, 30 or 33)
<b>525 Convert to One Way Frontage Roads</b>	
Definition:	Convert two-way frontage roads to one-way operation.
Reduction Factor (%):	68%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	Part of Roadway Involved = 2
<b>532 Milled Edgeline Rumble Strips</b>	
Definition:	Install continuous milled depressions (rumble stripes or rumble strips) along the edgeline. Stand-alone edgeline rumble strip project proposals will not be accepted.
Reduction Factor (%):	15%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	(Roadway Related = 2, 3 or 4) OR (Vehicle Movements/Manner of Collision = 30)
<b>533 Profile Edgeline Markings</b>	
Definition:	Install profile edgeline markings.
Reduction Factor (%):	7%
Service Life (Years):	5
Maintenance Cost:	N/A
Preventable Crash:	(Roadway Related = 2, 3 or 4) OR (Vehicle Movements/Manner of Collision = 30) OR (Surface Condition = 2, 5, 6 or 9)
<b>534 Raised Edgeline Rumble Strips</b>	
Definition:	Install non-reflective raised traffic buttons (yellow or white) along the edgeline. Stand-alone edgeline rumble strip project proposals will not be accepted.
Reduction Factor (%):	17%
Service Life (Years):	2
Maintenance Cost:	N/A
Preventable Crash:	(Roadway Related = 2, 3 or 4) OR (Vehicle Movements/Manner of Collision = 30) OR (Surface Condition = 2, 5, 6 or 9)
<b>536 Widen Paved Shoulders (to &gt;5 ft.)</b>	
Definition:	Extend the existing paved shoulder to greater than 5 ft. Refer to W.C. 504 or 537 for constructing a paved shoulder.
Reduction Factor (%):	31%
Service Life (Years):	20
Maintenance Cost:	N/A
Preventable Crash:	(Roadway Related = 2, 3 or 4) OR (First Harmful Event = 4)

<b>537 Construct Paved Shoulders (&gt;= 5ft.)</b>	
Definition:	Provide paved shoulders 5 feet or greater where no shoulders existed previously. Refer to W.C. 503 or 536 for widening paved shoulders.
Reduction Factor (%):	40%
Service Life (Years):	20
Maintenance Cost:	N/A
Preventable Crash:	(Roadway Related = 2, 3 or 4) OR (Vehicle Movements/Manner of Collision = 20, 23-24 or 30) OR (First Harmful Event = 4)
<b>538 Convert 2 Lane Facility to 4 Lane Divided</b>	
Definition:	Convert an existing 2-lane facility to a 4-lane divided facility.
Reduction Factor (%):	45%
Service Life (Years):	20
Maintenance Cost:	N/A
Preventable Crash:	(Roadway Related = 2, 3 or 4) OR (Vehicle Movements/Manner of Collision = 10, 13, 14, 20, 21, 22, 24 or 30)
<b>540 Install Passing Lanes on 2 Lane Road</b>	
Definition:	Install passing lanes on a 2-lane roadway where none currently exist.
Reduction Factor (%):	25%
Service Life (Years):	15
Maintenance Cost:	N/A
Preventable Crash:	(Roadway Related = 2 or 3) OR (Vehicle Movements/Manner of Collision = 20-24 or 30)
<b>541 Provide Additional Paved Surface Width</b>	
Definition:	Provide additional paved surface width with appropriate subsurface to each side of two lane, two-way roadways with existing paved surface width less than 24' to a maximum width of 28'.
Reduction Factor (%):	30%
Service Life (Years):	20
Maintenance Cost:	N/A
Preventable Crash:	(Roadway Related = 2,3 or 4) OR (Vehicle Movements/Manner of Collision = 21 or 30) OR First Harmful Event = 10)
<b>542 Milled Centerline Rumble Strips</b>	
Definition:	Install milled centerline rumble strips along the centerline.
Reduction Factor (%):	26%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	(Vehicle Movements/Manner of Collision = 21 or 30) OR (Roadway Related = 2 or 3)
<b>543 Profile Centerline Markings</b>	
Definition:	Install profile centerline markings and preformed thermoplastic strips along the centerline.
Reduction Factor (%):	7%
Service Life (Years):	5
Maintenance Cost:	N/A
Preventable Crash:	(Vehicle Movements/Manner of Collision = 21 or 30) OR (Roadway Related = 2 or 3) OR (Surface Condition = 2, 5, 6 or 9)

<b>544 Raised Centerline Rumble Strips</b>	
Definition:	Install non-reflective raised traffic buttons (yellow or black) and preformed thermoplastic strips along the centerline.
Reduction Factor (%):	17%
Service Life (Years):	4
Maintenance Cost:	N/A
Preventable Crash:	(Vehicle Movements/Manner of Collision = 21 or 30) OR (Roadway Related = 2 or 3) OR (Surface Condition = 2, 5, 6 or 9)
<b>545 Transverse Rumble Strips</b>	
Definition:	Install transverse or in-lane rumble strips in advance of a high incident and special geometric location.
Reduction Factor (%):	15%
Service Life (Years):	5
Maintenance Cost:	N/A
Preventable Crash:	Intersection Related = 1 or 2
<b>547 Construct a Roundabout</b>	
Definition:	Convert an existing intersection to a single lane roundabout design
Reduction Factor (%):	40%
Service Life (Years):	10
Maintenance Cost:	N/A
Preventable Crash:	Intersection Related = 1 or 2

## Work Codes and Work Code Combinations in MicroStrategy

Work Code (Combo)	Description	Reduction Factor	Service Life
101	Install Warning/Guide Signs	20%	6
105	Install Intersection Flashing Beacon	14%	10
107	Install Traffic Signal	35%	10
108	Improve Traffic Signals	24%	10
110	Install Pedestrian Signal	34%	10
111	Interconnect Signals	10%	10
113	Install Delineators	12%	7
114	Install School Zones	20%	5
118	Replace Flashing Beacon with a Traffic Signal	25%	10
119	Install Overhead Signs	20%	6
122	Install Advanced Warning Signals (Intersection - Existing Warning Signs)	10%	10
123	Install Advanced Warning Signals (Curve- Existing Warning Signs)	10%	10
124	Install Advanced Warning Signals and Signs (Intersection)	27%	10
125	Install Advanced Warning Signals and Signs (Curve)	15%	10
128	Install Advanced Warning Signs (Intersection)	5%	6
130	Install Advanced Warning Signs (Curve)	5%	6
131	Improve Pedestrian Signals	10%	10
132	Install Advance Warning Signals and Signs	10%	10
133	Improve School Zone	5%	5
136	Install LED Flashing Chevrons (Curve)	35%	10
137	Install Chevrons (Curve)	25%	10
138	Install Flashing Yellow Arrow	41%	10
139	Install Surface Mounted Delineators on Centerline	12%	7
140	Wrong Way Driver Warning Signs	35%	6
141	Wrong Way Driver Warning Markings	40%	4
142	Wrong Way Driver Advanced Technologies	TBD	8
143	Pedestrian Hybrid Beacon	15%	10
201	Install Median Barrier	75%	20
203	Install Raised Median	25%	20
204	Flatten Side Slope	5%	20
209	Safety Treat Fixed Objects	50%	20
217	Install Impact Attenuation System	60%	10
218	Widen Bridge	55%	20
303	Resurfacing	30%	10
304	Safety Lighting	49%	15
305	Safety Lighting at Intersection	13%	15
306	High Friction Surface Treatment (Curve)	45%	5
307	High Friction Surface Treatment (Intersection)	20%	5
401	Install Pavement Markings	20%	4
402	Install Edge Marking	25%	4
403	Install Pedestrian Crosswalk	10%	4
404	Install Centerline Striping	65%	4
407	Install Sidewalks	65%	10

Work Code (Combo)	Description	Reduction Factor	Service Life
502	Widen Lane(s)	30%	20
503	Widen Paved Shoulder (to 5 ft. or less)	25%	20
504	Construct Paved Shoulders (1-4 ft.)	25%	20
505	Improve Vertical Alignment	50%	10
506	Improve Horizontal Alignment	55%	10
507	Increase Superelevation	65%	10
508	Realign Intersection	TBD	10
509	Channelization	TBD	10
510	Construct Turn Arounds	40%	10
514	Grade Separation	80%	30
515	Construct Interchange	65%	30
516	Close Crossover	50%	20
517	Add Through Lane	28%	20
518	Install Continuous Turn Lane	50%	10
519	Add Left Turn Lane	25%	10
520	Lengthen Left Turn Lane	40%	10
521	Add Right Turn Lane	25%	10
522	Lengthen Right Turn Lane	40%	10
523	Construct Pedestrian Over/Under Pass	95%	20
524	Increase Turning Radius	10%	10
525	Convert to One Way Frontage Roads	68%	10
532	Milled Edgeline Rumble Strips	15%	10
533	Profile Edgeline Markings	7%	5
534	Raised Edgeline Rumble Strips	17%	2
536	Widen Paved Shoulders (to >5 ft.)	31%	20
537	Construct Paved Shoulders (>= 5ft.)	40%	20
538	Convert 2 Lane Facility to 4 Lane Divided	45%	20
540	Install Passing Lanes on 2 Lane Road	25%	15
541	Provide Additional Paved Surface Width	30%	20
542	Milled Centerline Rumble Strips	26%	10
543	Profile Centerline Markings	7%	5
544	Raised Centerline Rumble Strips	17%	4
545	Transverse Rumble Strips	15%	5
547	Construct a Roundabout	40%	10
101, 136, 533, 543	Install Warning/Guide Signs, Install LED Flashing Chevrons (Curve), Profile Edgeline Markings, Profile Centerline Markings	27%	10
101, 137, 401	Install Warning/Guide Signs, Install Chevrons (Curve), Install Pavement Markings	36%	10
101, 401	Install Warning/Guide Signs, Install Pavement Markings	24%	6
105, 122	Install Intersection Flashing Beacon, Install Advanced Warning Signals (Intersection - Existing Warning Signs)	16%	10

Work Code (Combo)	Description	Reduction Factor	Service Life
105, 122, 305	Install Intersection Flashing Beacon, Install Advanced Warning Signals (Intersection - Existing Warning Signs), Safety Lighting at Intersection	19%	15
105, 122, 305, 401, 520	Install Intersection Flashing Beacon, Install Advanced Warning Signals (Intersection - Existing Warning Signs), Safety Lighting at Intersection, Install Pavement Markings, Lengthen Left Turn Lane	19%	15
105, 122, 545	Install Intersection Flashing Beacon, Install Advanced Warning Signals (Intersection - Existing Warning Signs), Transverse Rumble Strips	19%	10
105, 124	Install Intersection Flashing Beacon, Install Advanced Warning Signals and Signs (Intersection)	20%	10
105, 124, 305	Install Intersection Flashing Beacon, Install Advanced Warning Signals and Signs (Intersection), Safety Lighting at Intersection	22%	15
105, 124, 305, 545	Install Intersection Flashing Beacon, Install Advanced Warning Signals and Signs (Intersection), Safety Lighting at Intersection, Transverse Rumble Strips	20%	15
105, 124, 307	Install Intersection Flashing Beacon, Install Advanced Warning Signals and Signs (Intersection), High Friction Surface Treatment (Intersection)	24%	10
105, 124, 401	Install Intersection Flashing Beacon, Install Advanced Warning Signals and Signs (Intersection), Install Pavement Markings	24%	10
105, 124, 545	Install Intersection Flashing Beacon, Install Advanced Warning Signals and Signs (Intersection), Transverse Rumble Strips	23%	10
105, 305	Install Intersection Flashing Beacon, Safety Lighting at Intersection	17%	15
105, 305, 519	Install Intersection Flashing Beacon, Safety Lighting at Intersection, Add Left Turn Lane	33%	15
105, 305, 519, 521	Install Intersection Flashing Beacon, Safety Lighting at Intersection, Add Left Turn Lane, Add Right Turn Lane	38%	15
105, 305, 521	Install Intersection Flashing Beacon, Safety Lighting at Intersection, Add Right Turn Lane	33%	15
105, 307	Install Intersection Flashing Beacon, High Friction Surface Treatment (Intersection)	18%	10



Work Code (Combo)	Description	Reduction Factor	Service Life
105, 307, 524	Install Intersection Flashing Beacon, High Friction Surface Treatment (Intersection), Increase Turning Radius	26%	10
105, 519	Install Intersection Flashing Beacon, Add Left Turn Lane	30%	10
105, 519, 521	Install Intersection Flashing Beacon, Add Left Turn Lane, Add Right Turn Lane	29%	10
105, 545	Install Intersection Flashing Beacon, Transverse Rumble Strips	20%	10
107, 111	Install Traffic Signal, Interconnect Signals	22%	10
107, 122	Install Traffic Signal, Install Advanced Warning Signals (Intersection - Existing Warning Signs)	38%	10
107, 122, 305, 545	Install Traffic Signal, Install Advanced Warning Signals (Intersection - Existing Warning Signs), Safety Lighting at Intersection, Transverse Rumble Strips	39%	15
107, 124	Install Traffic Signal, Install Advanced Warning Signals and Signs (Intersection)	55%	10
107, 124, 305, 545	Install Traffic Signal, Install Advanced Warning Signals and Signs (Intersection), Safety Lighting at Intersection, Transverse Rumble Strips	39%	15
107, 128	Install Traffic Signal, Install Advanced Warning Signs (Intersection)	36%	10
107, 305	Install Traffic Signal, Safety Lighting at Intersection	37%	15
107, 519	Install Traffic Signal, Add Left Turn Lane	43%	10
107, 521	Install Traffic Signal, Add Right Turn Lane	43%	10
108, 110, 407	Improve Traffic Signals, Install Pedestrian Signal, Install Sidewalks	42%	10
108, 111	Improve Traffic Signals, Interconnect Signals	28%	10
108, 111, 122	Improve Traffic Signals, Interconnect Signals, Install Advanced Warning Signals (Intersection - Existing Warning Signs)	30%	10

Work Code (Combo)	Description	Reduction Factor	Service Life
108, 111, 122, 138	Improve Traffic Signals, Interconnect Signals, Install Advanced Warning Signals (Intersection - Existing Warning Signs), Install Flashing Yellow Arrow	32%	10
108, 111, 128, 401, 403	Improve Traffic Signals, Interconnect Signals, Install Advanced Warning Signs (Intersection), Install Pavement Markings, Install Pedestrian Crosswalk	31%	10
108, 111, 138	Improve Traffic Signals, Interconnect Signals, Install Flashing Yellow Arrow	32%	10
108, 111, 138, 203, 305	Improve Traffic Signals, Interconnect Signals, Install Flashing Yellow Arrow, Install Raised Median, Safety Lighting at Intersection	36%	20
108, 111, 138, 305	Improve Traffic Signals, Interconnect Signals, Install Flashing Yellow Arrow, Safety Lighting at Intersection	42%	15
108, 111, 203	Improve Traffic Signals, Interconnect Signals, Install Raised Median	27%	20
108, 111, 305	Improve Traffic Signals, Interconnect Signals, Safety Lighting at Intersection	19%	15
108, 122, 138	Improve Traffic Signals, Install Advanced Warning Signals (Intersection - Existing Warning Signs), Install Flashing Yellow Arrow	35%	10
108, 124, 305, 545	Improve Traffic Signals, Install Advanced Warning Signals and Signs (Intersection), Safety Lighting at Intersection, Transverse Rumble Strips	32%	15
108, 128	Improve Traffic Signals, Install Advanced Warning Signs (Intersection)	26%	10
108, 128, 305	Improve Traffic Signals, Install Advanced Warning Signs (Intersection), Safety Lighting at Intersection	28%	15
108, 128, 401, 403	Improve Traffic Signals, Install Advanced Warning Signs (Intersection), Install Pavement Markings, Install Pedestrian Crosswalk	30%	10

Work Code (Combo)	Description	Reduction Factor	Service Life
108, 128, 403	Improve Traffic Signals, Install Advanced Warning Signs (Intersection), Install Pedestrian Crosswalk	28%	10
108, 131	Improve Traffic Signals, Improve Pedestrian Signals	26%	10
108, 131, 305, 403	Improve Traffic Signals, Improve Pedestrian Signals, Safety Lighting at Intersection, Install Pedestrian Crosswalk	28%	15
108, 131, 403	Improve Traffic Signals, Improve Pedestrian Signals, Install Pedestrian Crosswalk	28%	10
108, 131, 407	Improve Traffic Signals, Improve Pedestrian Signals, Install Sidewalks	38%	10
108, 138	Improve Traffic Signals, Install Flashing Yellow Arrow	32%	10
108, 138, 305	Improve Traffic Signals, Install Flashing Yellow Arrow, Safety Lighting at Intersection	34%	15
108, 305	Improve Traffic Signals, Safety Lighting at Intersection	26%	15
108, 401, 403	Improve Traffic Signals, Install Pavement Markings, Install Pedestrian Crosswalk	30%	10
108, 403	Improve Traffic Signals, Install Pedestrian Crosswalk	26%	10
108, 519	Improve Traffic Signals, Add Left Turn Lane	34%	10
108, 519, 521	Improve Traffic Signals, Add Left Turn Lane, Add Right Turn Lane	42%	10
108, 519, 522, 524	Improve Traffic Signals, Add Left Turn Lane, Lengthen Right Turn Lane, Increase Turning Radius	41%	10
108, 521	Improve Traffic Signals, Add Right Turn Lane	34%	10
110, 403	Install Pedestrian Signal, Install Pedestrian Crosswalk	36%	10
111, 138	Interconnect Signals, Install Flashing Yellow Arrow	19%	10
111, 518	Interconnect Signals, Install Continuous Turn Lane	29%	10
111, 519	Interconnect Signals, Add Left Turn Lane	17%	10

Work Code (Combo)	Description	Reduction Factor	Service Life
113, 122, 519, 521	Install Delineators, Install Advanced Warning Signals (Intersection - Existing Warning Signs), Add Left Turn Lane, Add Right Turn Lane	38%	10
113, 533	Install Delineators, Profile Edgeline Markings	10%	7
122, 305	Install Advanced Warning Signals (Intersection - Existing Warning Signs), Safety Lighting at Intersection	13%	15
122, 307	Install Advanced Warning Signals (Intersection - Existing Warning Signs), High Friction Surface Treatment (Intersection)	22%	10
122, 519	Install Advanced Warning Signals (Intersection - Existing Warning Signs), Add Left Turn Lane	27%	10
123, 136	Install Advanced Warning Signals (Curve- Existing Warning Signs), Install LED Flashing Chevrons (Curve)	38%	10
123, 136, 306	Install Advanced Warning Signals (Curve- Existing Warning Signs), Install LED Flashing Chevrons (Curve), High Friction Surface Treatment (Curve)	39%	10
123, 136, 306, 532	Install Advanced Warning Signals (Curve- Existing Warning Signs), Install LED Flashing Chevrons (Curve), High Friction Surface Treatment (Curve), Milled Edgeline Rumble Strips	56%	10
123, 136, 306, 532, 542	Install Advanced Warning Signals (Curve- Existing Warning Signs), Install LED Flashing Chevrons (Curve), High Friction Surface Treatment (Curve), Milled Edgeline Rumble Strips, Milled Centerline Rumble Strips	56%	10
123, 136, 306, 533	Install Advanced Warning Signals (Curve- Existing Warning Signs), Install LED Flashing Chevrons (Curve), High Friction Surface Treatment (Curve), Profile Edgeline Markings	55%	10
123, 136, 306, 533, 543	Install Advanced Warning Signals (Curve- Existing Warning Signs), Install LED Flashing Chevrons (Curve), High Friction Surface Treatment (Curve), Profile Edgeline Markings, Profile Centerline Markings	55%	10
123, 136, 532, 542	Install Advanced Warning Signals (Curve- Existing Warning Signs), Install LED Flashing Chevrons (Curve), Milled Edgeline Rumble Strips, Milled Centerline Rumble Strips	41%	10
123, 137	Install Advanced Warning Signals (Curve- Existing Warning Signs), Install Chevrons (Curve)	29%	10

Work Code (Combo)	Description	Reduction Factor	Service Life
123, 137, 209, 504, 532, 542	Install Advanced Warning Signals (Curve- Existing Warning Signs), Install Chevrons (Curve), Safety Treat Fixed Objects, Construct Paved Shoulders (1-4 ft.), Milled Edgeline Rumble Strips, Milled Centerline Rumble Strips	38%	20
123, 137, 209, 532, 537, 542	Install Advanced Warning Signals (Curve- Existing Warning Signs), Install Chevrons (Curve), Safety Treat Fixed Objects, Milled Edgeline Rumble Strips, Construct Paved Shoulders (>= 5ft.), Milled Centerline Rumble Strips	50%	20
123, 137, 209, 532, 541, 542	Install Advanced Warning Signals (Curve- Existing Warning Signs), Install Chevrons (Curve), Safety Treat Fixed Objects, Milled Edgeline Rumble Strips, Provide Additional Paved Surface Width, Milled Centerline Rumble Strips	42%	20
123, 137, 306	Install Advanced Warning Signals (Curve- Existing Warning Signs), Install Chevrons (Curve), High Friction Surface Treatment (Curve)	36%	10
123, 137, 306, 532	Install Advanced Warning Signals (Curve- Existing Warning Signs), Install Chevrons (Curve), High Friction Surface Treatment (Curve), Milled Edgeline Rumble Strips	54%	10
123, 137, 306, 532, 542	Install Advanced Warning Signals (Curve- Existing Warning Signs), Install Chevrons (Curve), High Friction Surface Treatment (Curve), Milled Edgeline Rumble Strips, Milled Centerline Rumble Strips	55%	10
123, 137, 306, 533	Install Advanced Warning Signals (Curve- Existing Warning Signs), Install Chevrons (Curve), High Friction Surface Treatment (Curve), Profile Edgeline Markings	54%	10
123, 137, 306, 533, 543	Install Advanced Warning Signals (Curve- Existing Warning Signs), Install Chevrons (Curve), High Friction Surface Treatment (Curve), Profile Edgeline Markings, Profile Centerline Markings	54%	10
123, 137, 533, 543	Install Advanced Warning Signals (Curve- Existing Warning Signs), Install Chevrons (Curve), Profile Edgeline Markings, Profile Centerline Markings	23%	10

Work Code (Combo)	Description	Reduction Factor	Service Life
123, 209, 504, 532, 542	Install Advanced Warning Signals (Curve- Existing Warning Signs), Safety Treat Fixed Objects, Construct Paved Shoulders (1-4 ft.), Milled Edgeline Rumble Strips, Milled Centerline Rumble Strips	64%	20
123, 209, 532, 537, 542	Install Advanced Warning Signals (Curve- Existing Warning Signs), Safety Treat Fixed Objects, Milled Edgeline Rumble Strips, Construct Paved Shoulders (>= 5ft.), Milled Centerline Rumble Strips	71%	20
123, 209, 532, 541, 542	Install Advanced Warning Signals (Curve- Existing Warning Signs), Safety Treat Fixed Objects, Milled Edgeline Rumble Strips, Provide Additional Paved Surface Width, Milled Centerline Rumble Strips	41%	20
123, 306	Install Advanced Warning Signals (Curve- Existing Warning Signs), High Friction Surface Treatment (Curve)	48%	10
123, 401	Install Advanced Warning Signals (Curve- Existing Warning Signs), Install Pavement Markings	15%	10
123, 532, 541, 542	Install Advanced Warning Signals (Curve- Existing Warning Signs), Milled Edgeline Rumble Strips, Provide Additional Paved Surface Width, Milled Centerline Rumble Strips	42%	20
123, 533	Install Advanced Warning Signals (Curve- Existing Warning Signs), Profile Edgeline Markings	12%	10
123, 533, 543	Install Advanced Warning Signals (Curve- Existing Warning Signs), Profile Edgeline Markings, Profile Centerline Markings	13%	10
123, 543	Install Advanced Warning Signals (Curve- Existing Warning Signs), Profile Centerline Markings	38%	10
124, 305	Install Advanced Warning Signals and Signs (Intersection), Safety Lighting at Intersection	29%	15
125, 136	Install Advanced Warning Signals and Signs (Curve), Install LED Flashing Chevrons (Curve)	40%	10
125, 136, 306	Install Advanced Warning Signals and Signs (Curve), Install LED Flashing Chevrons (Curve), High Friction Surface Treatment (Curve)	41%	10
125, 136, 306, 532	Install Advanced Warning Signals and Signs (Curve), Install LED Flashing Chevrons (Curve), High Friction Surface Treatment (Curve), Milled Edgeline Rumble Strips	58%	10
125, 136, 306, 532, 542	Install Advanced Warning Signals and Signs (Curve), Install LED Flashing Chevrons (Curve), High Friction Surface Treatment (Curve), Milled Edgeline Rumble Strips, Milled Centerline Rumble Strips	58%	10

Work Code (Combo)	Description	Reduction Factor	Service Life
125, 136, 306, 533	Install Advanced Warning Signals and Signs (Curve), Install LED Flashing Chevrons (Curve), High Friction Surface Treatment (Curve), Profile Edgeline Markings	58%	10
125, 136, 306, 533, 543	Install Advanced Warning Signals and Signs (Curve), Install LED Flashing Chevrons (Curve), High Friction Surface Treatment (Curve), Profile Edgeline Markings, Profile Centerline Markings	59%	10
125, 137	Install Advanced Warning Signals and Signs (Curve), Install Chevrons (Curve)	31%	10
125, 137, 209, 541	Install Advanced Warning Signals and Signs (Curve), Install Chevrons (Curve), Safety Treat Fixed Objects, Provide Additional Paved Surface Width	65%	20
125, 137, 306	Install Advanced Warning Signals and Signs (Curve), Install Chevrons (Curve), High Friction Surface Treatment (Curve)	37%	10
125, 137, 306, 503, 532, 542	Install Advanced Warning Signals and Signs (Curve), Install Chevrons (Curve), High Friction Surface Treatment (Curve), Widen Paved Shoulder (to 5 ft. or less), Milled Edgeline Rumble Strips, Milled Centerline Rumble Strips	56%	10
125, 137, 306, 503, 533, 543	Install Advanced Warning Signals and Signs (Curve), Install Chevrons (Curve), High Friction Surface Treatment (Curve), Widen Paved Shoulder (to 5 ft. or less), Profile Edgeline Markings, Profile Centerline Markings	56%	10
125, 137, 306, 532	Install Advanced Warning Signals and Signs (Curve), Install Chevrons (Curve), High Friction Surface Treatment (Curve), Milled Edgeline Rumble Strips	56%	10
125, 137, 306, 532, 536, 542	Install Advanced Warning Signals and Signs (Curve), Install Chevrons (Curve), High Friction Surface Treatment (Curve), Milled Edgeline Rumble Strips, Widen Paved Shoulders (to >5 ft.), Milled Centerline Rumble Strips	56%	10
125, 137, 306, 532, 542	Install Advanced Warning Signals and Signs (Curve), Install Chevrons (Curve), High Friction Surface Treatment (Curve), Milled Edgeline Rumble Strips, Milled Centerline Rumble Strips	56%	10

Work Code (Combo)	Description	Reduction Factor	Service Life
125, 137, 306, 533	Install Advanced Warning Signals and Signs (Curve), Install Chevrons (Curve), High Friction Surface Treatment (Curve), Profile Edgeline Markings	56%	10
125, 137, 306, 533, 543	Install Advanced Warning Signals and Signs (Curve), Install Chevrons (Curve), High Friction Surface Treatment (Curve), Profile Edgeline Markings, Profile Centerline Markings	56%	10
125, 137, 306, 534, 544	Install Advanced Warning Signals and Signs (Curve), Install Chevrons (Curve), High Friction Surface Treatment (Curve), Raised Edgeline Rumble Strips, Raised Centerline Rumble Strips	56%	10
125, 137, 402	Install Advanced Warning Signals and Signs (Curve), Install Chevrons (Curve), Install Edge Marking	31%	10
125, 306, 533, 543	Install Advanced Warning Signals and Signs (Curve), High Friction Surface Treatment (Curve), Profile Edgeline Markings, Profile Centerline Markings	33%	10
125, 306, 534, 544	Install Advanced Warning Signals and Signs (Curve), High Friction Surface Treatment (Curve), Raised Edgeline Rumble Strips, Raised Centerline Rumble Strips	34%	10
130, 136, 533	Install Advanced Warning Signs (Curve), Install LED Flashing Chevrons (Curve), Profile Edgeline Markings	16%	10
130, 137	Install Advanced Warning Signs (Curve), Install Chevrons (Curve)	27%	10
130, 137, 209, 504, 532, 542	Install Advanced Warning Signs (Curve), Install Chevrons (Curve), Safety Treat Fixed Objects, Construct Paved Shoulders (1-4 ft.), Milled Edgeline Rumble Strips, Milled Centerline Rumble Strips	64%	20
130, 137, 209, 532, 537, 542	Install Advanced Warning Signs (Curve), Install Chevrons (Curve), Safety Treat Fixed Objects, Milled Edgeline Rumble Strips, Construct Paved Shoulders (>= 5ft.), Milled Centerline Rumble Strips	71%	20



Work Code (Combo)	Description	Reduction Factor	Service Life
130, 137, 209, 532, 541, 542	Install Advanced Warning Signs (Curve), Install Chevrons (Curve), Safety Treat Fixed Objects, Milled Edgeline Rumble Strips, Provide Additional Paved Surface Width, Milled Centerline Rumble Strips	59%	20
130, 137, 304	Install Advanced Warning Signs (Curve), Install Chevrons (Curve), Safety Lighting	35%	15
130, 137, 532, 542	Install Advanced Warning Signs (Curve), Install Chevrons (Curve), Milled Edgeline Rumble Strips, Milled Centerline Rumble Strips	29%	10
130, 137, 533, 543	Install Advanced Warning Signs (Curve), Install Chevrons (Curve), Profile Edgeline Markings, Profile Centerline Markings	29%	10
130, 306	Install Advanced Warning Signs (Curve), High Friction Surface Treatment (Curve)	46%	6
131, 403, 407	Improve Pedestrian Signals, Install Pedestrian Crosswalk, Install Sidewalks	67%	10
131, 407	Improve Pedestrian Signals, Install Sidewalks	66%	10
131, 521	Improve Pedestrian Signals, Add Right Turn Lane	29%	10
133, 407	Improve School Zone, Install Sidewalks	65%	10
136, 209, 303, 502, 504, 533, 543	Install LED Flashing Chevrons (Curve), Safety Treat Fixed Objects, Resurfacing, Widen Lane(s), Construct Paved Shoulders (1-4 ft.), Profile Edgeline Markings, Profile Centerline Markings	49%	20
136, 209, 502, 504, 533, 543	Install LED Flashing Chevrons (Curve), Safety Treat Fixed Objects, Widen Lane(s), Construct Paved Shoulders (1-4 ft.), Profile Edgeline Markings, Profile Centerline Markings	49%	20
136, 306	Install LED Flashing Chevrons (Curve), High Friction Surface Treatment (Curve)	55%	10
136, 306, 532, 542	Install LED Flashing Chevrons (Curve), High Friction Surface Treatment (Curve), Milled Edgeline Rumble Strips, Milled Centerline Rumble Strips	56%	10

Work Code (Combo)	Description	Reduction Factor	Service Life
136, 306, 533, 543	Install LED Flashing Chevrons (Curve), High Friction Surface Treatment (Curve), Profile Edgeline Markings, Profile Centerline Markings	32%	10
136, 533	Install LED Flashing Chevrons (Curve), Profile Edgeline Markings	23%	10
136, 533, 543	Install LED Flashing Chevrons (Curve), Profile Edgeline Markings, Profile Centerline Markings	25%	10
136, 542	Install LED Flashing Chevrons (Curve), Milled Centerline Rumble Strips	32%	10
137, 304	Install Chevrons (Curve), Safety Lighting	34%	15
137, 306	Install Chevrons (Curve), High Friction Surface Treatment (Curve)	52%	10
137, 306, 532, 542	Install Chevrons (Curve), High Friction Surface Treatment (Curve), Milled Edgeline Rumble Strips, Milled Centerline Rumble Strips	54%	10
137, 306, 533	Install Chevrons (Curve), High Friction Surface Treatment (Curve), Profile Edgeline Markings	35%	10
137, 306, 533, 543	Install Chevrons (Curve), High Friction Surface Treatment (Curve), Profile Edgeline Markings, Profile Centerline Markings	53%	10
137, 306, 537	Install Chevrons (Curve), High Friction Surface Treatment (Curve), Construct Paved Shoulders (>= 5ft.)	50%	20
137, 503, 507	Install Chevrons (Curve), Widen Paved Shoulder (to 5 ft. or less), Increase Superelevation	45%	20
137, 504	Install Chevrons (Curve), Construct Paved Shoulders (1-4 ft.)	30%	20
137, 507	Install Chevrons (Curve), Increase Superelevation	67%	10
137, 533, 543	Install Chevrons (Curve), Profile Edgeline Markings, Profile Centerline Markings	20%	10
137, 541	Install Chevrons (Curve), Provide Additional Paved Surface Width	34%	20
137, 543	Install Chevrons (Curve), Profile Centerline Markings	51%	10
201, 204	Install Median Barrier, Flatten Side Slope	76%	20

Work Code (Combo)	Description	Reduction Factor	Service Life
201, 303	Install Median Barrier, Resurfacing	83%	20
201, 303, 532	Install Median Barrier, Resurfacing, Milled Edgeline Rumble Strips	80%	20
201, 304	Install Median Barrier, Safety Lighting	81%	20
201, 306	Install Median Barrier, High Friction Surface Treatment (Curve)	78%	20
201, 516	Install Median Barrier, Close Crossover	69%	20
201, 532	Install Median Barrier, Milled Edgeline Rumble Strips	77%	20
201, 533	Install Median Barrier, Profile Edgeline Markings	76%	20
203, 407	Install Raised Median, Install Sidewalks	37%	20
203, 517	Install Raised Median, Add Through Lane	37%	20
203, 533	Install Raised Median, Profile Edgeline Markings	28%	20
203, 533, 543	Install Raised Median, Profile Edgeline Markings, Profile Centerline Markings	31%	20
209, 218	Safety Treat Fixed Objects, Widen Bridge	64%	20
209, 218, 541	Safety Treat Fixed Objects, Widen Bridge, Provide Additional Paved Surface Width	69%	20
209, 303, 502, 503, 518, 533	Safety Treat Fixed Objects, Resurfacing, Widen Lane(s), Widen Paved Shoulder (to 5 ft. or less), Install Continuous Turn Lane, Profile Edgeline Markings	68%	20
209, 303, 503	Safety Treat Fixed Objects, Resurfacing, Widen Paved Shoulder (to 5 ft. or less)	63%	20
209, 303, 532, 540, 542	Safety Treat Fixed Objects, Resurfacing, Milled Edgeline Rumble Strips, Install Passing Lanes on 2 Lane Road, Milled Centerline Rumble Strips	61%	20
209, 306	Safety Treat Fixed Objects, High Friction Surface Treatment (Curve)	56%	20

Work Code (Combo)	Description	Reduction Factor	Service Life
209, 306, 507	Safety Treat Fixed Objects, High Friction Surface Treatment (Curve), Increase Superelevation	70%	20
209, 502	Safety Treat Fixed Objects, Widen Lane(s)	65%	20
209, 502, 503	Safety Treat Fixed Objects, Widen Lane(s), Widen Paved Shoulder (to 5 ft. or less)	63%	20
209, 502, 503, 518, 533	Safety Treat Fixed Objects, Widen Lane(s), Widen Paved Shoulder (to 5 ft. or less), Install Continuous Turn Lane, Profile Edgeline Markings	51%	20
209, 502, 503, 532, 542	Safety Treat Fixed Objects, Widen Lane(s), Widen Paved Shoulder (to 5 ft. or less), Milled Edgeline Rumble Strips, Milled Centerline Rumble Strips	49%	20
209, 502, 503, 533	Safety Treat Fixed Objects, Widen Lane(s), Widen Paved Shoulder (to 5 ft. or less), Profile Edgeline Markings	49%	20
209, 502, 503, 533, 543	Safety Treat Fixed Objects, Widen Lane(s), Widen Paved Shoulder (to 5 ft. or less), Profile Edgeline Markings, Profile Centerline Markings	49%	20
209, 502, 504	Safety Treat Fixed Objects, Widen Lane(s), Construct Paved Shoulders (1-4 ft.)	63%	20
209, 502, 504, 532, 542	Safety Treat Fixed Objects, Widen Lane(s), Construct Paved Shoulders (1-4 ft.), Milled Edgeline Rumble Strips, Milled Centerline Rumble Strips	49%	20
209, 502, 536	Safety Treat Fixed Objects, Widen Lane(s), Widen Paved Shoulders (to >5 ft.)	64%	20
209, 503	Safety Treat Fixed Objects, Widen Paved Shoulder (to 5 ft. or less)	56%	20
209, 503, 518	Safety Treat Fixed Objects, Widen Paved Shoulder (to 5 ft. or less), Install Continuous Turn Lane	78%	20

Work Code (Combo)	Description	Reduction Factor	Service Life
209, 503, 518, 532, 542	Safety Treat Fixed Objects, Widen Paved Shoulder (to 5 ft. or less), Install Continuous Turn Lane, Milled Edgeline Rumble Strips, Milled Centerline Rumble Strips	58%	20
209, 503, 532	Safety Treat Fixed Objects, Widen Paved Shoulder (to 5 ft. or less), Milled Edgeline Rumble Strips	58%	20
209, 503, 540	Safety Treat Fixed Objects, Widen Paved Shoulder (to 5 ft. or less), Install Passing Lanes on 2 Lane Road	62%	20
209, 504	Safety Treat Fixed Objects, Construct Paved Shoulders (1-4 ft.)	63%	20
209, 504, 532, 542	Safety Treat Fixed Objects, Construct Paved Shoulders (1-4 ft.), Milled Edgeline Rumble Strips, Milled Centerline Rumble Strips	64%	20
209, 504, 542	Safety Treat Fixed Objects, Construct Paved Shoulders (1-4 ft.), Milled Centerline Rumble Strips	65%	20
209, 506	Safety Treat Fixed Objects, Improve Horizontal Alignment	64%	20
209, 516	Safety Treat Fixed Objects, Close Crossover	63%	20
209, 517	Safety Treat Fixed Objects, Add Through Lane	64%	20
209, 518	Safety Treat Fixed Objects, Install Continuous Turn Lane	75%	20
209, 518, 536	Safety Treat Fixed Objects, Install Continuous Turn Lane, Widen Paved Shoulders (to >5 ft.)	68%	20
209, 519	Safety Treat Fixed Objects, Add Left Turn Lane	56%	20
209, 519, 521	Safety Treat Fixed Objects, Add Left Turn Lane, Add Right Turn Lane	62%	20
209, 532	Safety Treat Fixed Objects, Milled Edgeline Rumble Strips	54%	20
209, 532, 536, 542	Safety Treat Fixed Objects, Milled Edgeline Rumble Strips, Widen Paved Shoulders (to >5 ft.), Milled Centerline Rumble Strips	61%	20
209, 532, 537, 542	Safety Treat Fixed Objects, Milled Edgeline Rumble Strips, Construct Paved Shoulders (>= 5ft.), Milled Centerline Rumble Strips	71%	20

Work Code (Combo)	Description	Reduction Factor	Service Life
209, 532, 540, 542	Safety Treat Fixed Objects, Milled Edgeline Rumble Strips, Install Passing Lanes on 2 Lane Road, Milled Centerline Rumble Strips	35%	15
209, 532, 541	Safety Treat Fixed Objects, Milled Edgeline Rumble Strips, Provide Additional Paved Surface Width	49%	20
209, 532, 541, 542	Safety Treat Fixed Objects, Milled Edgeline Rumble Strips, Provide Additional Paved Surface Width, Milled Centerline Rumble Strips	37%	20
209, 533, 541, 543	Safety Treat Fixed Objects, Profile Edgeline Markings, Provide Additional Paved Surface Width, Profile Centerline Markings	53%	20
209, 533, 542	Safety Treat Fixed Objects, Profile Edgeline Markings, Milled Centerline Rumble Strips	55%	20
209, 536	Safety Treat Fixed Objects, Widen Paved Shoulders (to >5 ft.)	58%	20
209, 537	Safety Treat Fixed Objects, Construct Paved Shoulders (>= 5ft.)	70%	20
209, 540	Safety Treat Fixed Objects, Install Passing Lanes on 2 Lane Road	63%	20
209, 541	Safety Treat Fixed Objects, Provide Additional Paved Surface Width	65%	20
209, 541, 542	Safety Treat Fixed Objects, Provide Additional Paved Surface Width, Milled Centerline Rumble Strips	67%	20
209, 542	Safety Treat Fixed Objects, Milled Centerline Rumble Strips	53%	20
303, 503, 542	Resurfacing, Widen Paved Shoulder (to 5 ft. or less), Milled Centerline Rumble Strips	47%	20
303, 518, 533	Resurfacing, Install Continuous Turn Lane, Profile Edgeline Markings	58%	10
303, 519, 533	Resurfacing, Add Left Turn Lane, Profile Edgeline Markings	49%	10
303, 532	Resurfacing, Milled Edgeline Rumble Strips	35%	10
303, 532, 540	Resurfacing, Milled Edgeline Rumble Strips, Install Passing Lanes on 2 Lane Road	39%	15

Work Code (Combo)	Description	Reduction Factor	Service Life
303, 533	Resurfacing, Profile Edgeline Markings	32%	10
303, 533, 536	Resurfacing, Profile Edgeline Markings, Widen Paved Shoulders (to >5 ft.)	42%	20
303, 533, 536, 543	Resurfacing, Profile Edgeline Markings, Widen Paved Shoulders (to >5 ft.), Profile Centerline Markings	41%	20
303, 533, 543	Resurfacing, Profile Edgeline Markings, Profile Centerline Markings	19%	10
303, 542	Resurfacing, Milled Centerline Rumble Strips	42%	10
304, 407	Safety Lighting, Install Sidewalks	74%	15
305, 307, 519	Safety Lighting at Intersection, High Friction Surface Treatment (Intersection), Add Left Turn Lane	31%	15
305, 514	Safety Lighting at Intersection, Grade Separation	56%	30
305, 515	Safety Lighting at Intersection, Construct Interchange	51%	30
305, 519	Safety Lighting at Intersection, Add Left Turn Lane	27%	15
305, 519, 521	Safety Lighting at Intersection, Add Left Turn Lane, Add Right Turn Lane	37%	15
306, 307	High Friction Surface Treatment (Curve), High Friction Surface Treatment (Intersection)	56%	5
306, 502	High Friction Surface Treatment (Curve), Widen Lane(s)	38%	20
306, 503	High Friction Surface Treatment (Curve), Widen Paved Shoulder (to 5 ft. or less)	45%	20
306, 503, 532	High Friction Surface Treatment (Curve), Widen Paved Shoulder (to 5 ft. or less), Milled Edgeline Rumble Strips	46%	20
306, 506, 532, 536, 542	High Friction Surface Treatment (Curve), Improve Horizontal Alignment, Milled Edgeline Rumble Strips, Widen Paved Shoulders (to >5 ft.), Milled Centerline Rumble Strips	52%	20
306, 507	High Friction Surface Treatment (Curve), Increase Superelevation	69%	10
306, 532	High Friction Surface Treatment (Curve), Milled Edgeline Rumble Strips	49%	10

Work Code (Combo)	Description	Reduction Factor	Service Life
306, 532, 542	High Friction Surface Treatment (Curve), Milled Edgeline Rumble Strips, Milled Centerline Rumble Strips	33%	10
306, 533	High Friction Surface Treatment (Curve), Profile Edgeline Markings	25%	5
306, 533, 541, 543	High Friction Surface Treatment (Curve), Profile Edgeline Markings, Provide Additional Paved Surface Width, Profile Centerline Markings	47%	20
306, 533, 543	High Friction Surface Treatment (Curve), Profile Edgeline Markings, Profile Centerline Markings	16%	5
306, 534, 544	High Friction Surface Treatment (Curve), Raised Edgeline Rumble Strips, Raised Centerline Rumble Strips	52%	5
306, 541	High Friction Surface Treatment (Curve), Provide Additional Paved Surface Width	38%	20
307, 519	High Friction Surface Treatment (Intersection), Add Left Turn Lane	29%	10
401, 532, 536	Install Pavement Markings, Milled Edgeline Rumble Strips, Widen Paved Shoulders (to >5 ft.)	43%	20
502, 503	Widen Lane(s), Widen Paved Shoulder (to 5 ft. or less)	36%	20
502, 503, 518	Widen Lane(s), Widen Paved Shoulder (to 5 ft. or less), Install Continuous Turn Lane	63%	20
502, 503, 542	Widen Lane(s), Widen Paved Shoulder (to 5 ft. or less), Milled Centerline Rumble Strips	42%	20
502, 504	Widen Lane(s), Construct Paved Shoulders (1-4 ft.)	36%	20
502, 504, 518	Widen Lane(s), Construct Paved Shoulders (1-4 ft.), Install Continuous Turn Lane	63%	20
502, 504, 542	Widen Lane(s), Construct Paved Shoulders (1-4 ft.), Milled Centerline Rumble Strips	42%	20
502, 518	Widen Lane(s), Install Continuous Turn Lane	58%	20
502, 537	Widen Lane(s), Construct Paved Shoulders (>= 5ft.)	49%	20
503, 518	Widen Paved Shoulder (to 5 ft. or less), Install Continuous Turn Lane	63%	20



Work Code (Combo)	Description	Reduction Factor	Service Life
503, 532, 542	Widen Paved Shoulder (to 5 ft. or less), Milled Edgeline Rumble Strips, Milled Centerline Rumble Strips	35%	20
503, 540	Widen Paved Shoulder (to 5 ft. or less), Install Passing Lanes on 2 Lane Road	34%	20
503, 542	Widen Paved Shoulder (to 5 ft. or less), Milled Centerline Rumble Strips	32%	20
504, 506	Construct Paved Shoulders (1-4 ft.), Improve Horizontal Alignment	46%	20
504, 506, 507	Construct Paved Shoulders (1-4 ft.), Improve Horizontal Alignment, Increase Superelevation	63%	20
504, 507	Construct Paved Shoulders (1-4 ft.), Increase Superelevation	49%	20
504, 518	Construct Paved Shoulders (1-4 ft.), Install Continuous Turn Lane	63%	20
504, 519	Construct Paved Shoulders (1-4 ft.), Add Left Turn Lane	34%	20
505, 516	Improve Vertical Alignment, Close Crossover	63%	20
506, 507, 537	Improve Horizontal Alignment, Increase Superelevation, Construct Paved Shoulders (>= 5ft.)	64%	20
507, 532	Increase Superelevation, Milled Edgeline Rumble Strips	68%	10
507, 536	Increase Superelevation, Widen Paved Shoulders (to >5 ft.)	53%	20
507, 537	Increase Superelevation, Construct Paved Shoulders (>= 5ft.)	50%	20
507, 537, 532, 542	Increase Superelevation, Construct Paved Shoulders (>= 5ft.), Milled Edgeline Rumble Strips, Milled Centerline Rumble Strips	61%	20
514, 516	Grade Separation, Close Crossover	85%	30
517, 518	Add Through Lane, Install Continuous Turn Lane	46%	20
517, 518, 533	Add Through Lane, Install Continuous Turn Lane, Profile Edgeline Markings	48%	20
517, 522	Add Through Lane, Lengthen Right Turn Lane	42%	20
518, 532	Install Continuous Turn Lane, Milled Edgeline Rumble Strips	54%	10
518, 533	Install Continuous Turn Lane, Profile Edgeline Markings	52%	10

Work Code (Combo)	Description	Reduction Factor	Service Life
518, 536	Install Continuous Turn Lane, Widen Paved Shoulders (to >5 ft.)	66%	20
518, 537	Install Continuous Turn Lane, Construct Paved Shoulders (>= 5ft.)	70%	20
519, 521	Add Left Turn Lane, Add Right Turn Lane	34%	10
519, 521, 524	Add Left Turn Lane, Add Right Turn Lane, Increase Turning Radius	38%	10
519, 532	Add Left Turn Lane, Milled Edgeline Rumble Strips	36%	10
532, 536, 542	Milled Edgeline Rumble Strips, Widen Paved Shoulders (to >5 ft.), Milled Centerline Rumble Strips	40%	20
532, 537	Milled Edgeline Rumble Strips, Construct Paved Shoulders (>= 5ft.)	42%	20
532, 537, 542	Milled Edgeline Rumble Strips, Construct Paved Shoulders (>= 5ft.), Milled Centerline Rumble Strips	46%	20
532, 540	Milled Edgeline Rumble Strips, Install Passing Lanes on 2 Lane Road	28%	15
532, 540, 542	Milled Edgeline Rumble Strips, Install Passing Lanes on 2 Lane Road, Milled Centerline Rumble Strips	35%	15
532, 541	Milled Edgeline Rumble Strips, Provide Additional Paved Surface Width	33%	20
532, 541, 542	Milled Edgeline Rumble Strips, Provide Additional Paved Surface Width, Milled Centerline Rumble Strips	37%	20
532, 542	Milled Edgeline Rumble Strips, Milled Centerline Rumble Strips	26%	10
533, 537	Profile Edgeline Markings, Construct Paved Shoulders (>= 5ft.)	41%	20
533, 541, 543	Profile Edgeline Markings, Provide Additional Paved Surface Width, Profile Centerline Markings	34%	20
533, 542	Profile Edgeline Markings, Milled Centerline Rumble Strips	19%	10
533, 543	Profile Edgeline Markings, Profile Centerline Markings	31%	5
533, 544	Profile Edgeline Markings, Raised Centerline Rumble Strips	15%	5
534, 544	Raised Edgeline Rumble Strips, Raised Centerline Rumble Strips	24%	4
541, 542	Provide Additional Paved Surface Width, Milled Centerline Rumble Strips	36%	20

## Appendix C – Preventable Crash Decoding

### Introduction

The Preventable Crash Decoding Table in this section can be used to interpret the codes in the Highway Safety Improvement Program (HSIP) Work Codes Table.

Part of Roadway No. 1 Involved:			
1	Main Proper Lane	5	Connector/Flyover
2	Service/Frontage Road	6	Detour
3	Entrance/On Ramp	7	Transitway
4	Exit/Off Ramp	8	Transitway Ramp
Roadway Related:			
1	On roadway	3	Shoulder
2	Off roadway	4	Median
Intersection Related:			
1	Intersection	3	Driveway access
2	Intersection related	4	Non-intersection

First Harmful Event			
Collision of a motor vehicle with:			
1	Pedestrian	5	Pedalcyclist
2	Another motor vehicle in transport	6	Animal
3	RR train	7	Fixed object
4	Parked car	8	Other object
Other than a collision:			
9	Other non-collision	10	Overturn

Vehicle Movements & Manner of Collision			
Two motor vehicles approaching at an angle:			
10	Both going straight	15	Both right turn
11	One straight, one backing	16	One right turn, one left turn
12	One straight, one stopped	17	One right turn, one stopped
13	One straight, one right turn	18	Both left turn
14	One straight, one left turn	19	One left turn, one stopped
Two motor vehicles going same direction:			
20	Both going straight - rear end	25	Both right turn
21	Both going straight - sideswipe	26	One right turn, one left turn
22	One straight, one stopped	27	One right turn, one stopped
23	One straight, one right turn	28	Both left turn
24	One straight, one left turn	29	One left turn, one stopped

Two motor vehicles going opposite directions:			
30	Both going straight	35	One backing, one stopped
31	One straight, one backing	36	One right turn, one left turn
32	One straight, one stopped	37	One right turn, one stopped
33	One straight, one right turn	38	Both left turn
34	One straight, one left turn	39	One left turn, one stopped
Two motor vehicles – other:			
40	One straight, one entering or leaving parking space		
41	One right turn, one entering or leaving parking space		
42	One left turn, one entering or leaving parking space		
43	One entering or leaving parking space, one stopped		
44	Both entering or leaving parking space		
45	Both vehicles backing		
46	All others		
Movement of Vehicle in Other Than Motor-with-Motor Crashes:			
1	Vehicle going straight		
2	Vehicle turning right		
3	Vehicle turning left		
4	Vehicle backing		
5	Other		

Object Struck			
0	No code shown is applicable	40	Vehicle hit end of bridge (abutment or rail end)
1	Vehicle overturned	41	Vehicle hit side of bridge (bridge rail)
2	Vehicle hit hole in road	42	Vehicle hit pier or support at underpass, tunnel or overhead sign bridge
3	Vehicle jackknifed	43	Vehicle hit top of underpass or tunnel
4	Person fell or jumped from vehicle	44	Vehicle hit bridge crossing gate
9	Vehicle hit train on tracks parallel to road - no crossing	45	Vehicle hit attenuation device
10	Vehicle hit train moving forward	49	Vehicle hit by falling/blowing rocks from a truck
11	Vehicle hit train backing	50	Vehicle hit fallen trees or debris on road
12	Vehicle hit train standing still	51	Vehicle hit object from another vehicle in road
13	Vehicle hit train - action unknown	52	Vehicle hit previously wrecked vehicle
20	Vehicle hit highway sign	53	Vehicle hit toll booth
21	Vehicle hit curb	54	Vehicle hit other machinery
22	Vehicle hit culvert - headwall	55	Vehicle hit other object
23	Vehicle hit guardrail	56	Vehicle hit concrete traffic barrier
24	Vehicle hit railroad signal pole or post	57	Vehicle hit delineator or marker post
25	Vehicle hit railroad crossing gates	58	Vehicle hit retaining wall
26	Vehicle hit traffic signal pole or post	59	Vehicle hit HOV lane gate
27	Vehicle hit overhead signal light, wires, sign, etc.	60	Vehicle hit guard post
28	Vehicle hit work zone barricade, cones, signs or material	61	Fire hydrant
29	Vehicle hit luminaire pole	62	Ditch (long narrow excavation dug in earth)
30	Vehicle hit utility pole	63	Embankment (a raised strip of land or berm)
31	Vehicle hit mailbox	64	Not Applicable
32	Vehicle hit tree or shrub	65	Not Reported
33	Vehicle hit fence		
34	Vehicle hit house, building or building fixture		
35	Vehicle hit commercial sign		
36	Vehicle hit other fixed object		
37	Vehicle hit bus stop structure		
38	Vehicle hit work zone machinery or stockpiled materials		
39	Vehicle hit median barrier		
<b>Bridge Detail:</b>			
1	Vehicle retained on bridge or overpass	6	Structure not hit
2	Vehicle went through rail	7	Result Unknown
3	Vehicle went over rail	8	Not Applicable
4	Crash involved underpass	9	Not Reported
5	Vehicle went between parallel structures		

Other Factors:			
0	No code shown is applicable	10	One car parked improper location
1	Lost control or skidded (icy or slick road, etc.)	11	One car forward from parking
2	Passenger interfered with driver	12	One car backward from parking
3	Attention diverted from driving (delayed perception or lack of alertness)	13	One car entering driveway
4	Open door or object projecting from vehicle	14	One car leaving driveway
5	Foot slipped off clutch or brake	54	Not Applicable
6	Gusty winds	55	Not Reported
7	Vehicle passing or attempting to pass on left	56	Road rage
8	Vehicle passing or attempting to pass on right		
9	Vehicle changing lanes		
Vision obstructed by:			
16	Standing or parked vehicle	21	Headlight or sun glare
17	Moving vehicle	22	Hillcrest
18	Embankment or ledge	23	Trees, shrubs, weeds, etc.
19	Commercial sign	24	Other visual obstructions
20	Highway sign		
Vehicle swerved or veered from intended course:			
25	Reason not specified	31	Avoiding vehicle stopped or moving slowly in traffic lane
26	For surface or visibility	32	Avoiding vehicle entering road
27	For officer, watchman, flagman, or traffic control device (unable to stop, etc.)	33	Avoiding vehicle from opposite direction in wrong lane
28	Avoiding pedestrian, pedal cyclist, etc. in road	34	Avoiding previous crash
29	Avoiding animal in road	35	Avoiding vehicle passing, changing lanes
30	Avoiding object in road		

Vehicle slowing, stopping, or stopped on road:			
36	Reason not specified		
37	Because of surface or visibility		
38	For officer, watchman, flagman, or traffic control device		
39	For pedestrian, pedalcyclist, etc. in road		
40	For animal in road		
41	For object in road		
42	For traffic		
43	To avoid vehicle entering road		
44	To avoid vehicle from opposite direction in wrong lane		
45	To avoid previous crash		
46	To make right turn		
47	To make left turn		
School bus related crash:			
48	School bus related crash		
Construction related:			
49	Within posted road construction zone (not related to crash)		
50	Within posted road construction zone (related to crash)		
51	In other construction maintenance area (not related to crash)		
52	In other construction maintenance area (related to crash)		
Beach related:			
53	Crash occurred on a beach		
Light Condition:			
0	Unknown	4	Darkness - lighted
1	Daylight	5	Dusk
2	Dawn	6	Darkness, unknown lighting
3	Darkness - not lighted	8	Other
Surface Condition:			
0	Unknown	6	Ice
1	Dry	7	Muddy
2	Wet	8	Other
3	Standing Water	9	Snow
4	Snow/Icy	10	Sand, Mud, Dirt
5	Slush		
Vehicle Body Style:			
87	Truck - tractor	91	Semitrailer