APPENDIX E

HSIP ANALYZER TOOLS

HSIP ANALYZER

Cost Estimate, Crash Data and Benefit Cost Ratio (BCR) Calculation for Highway Safety Improvement Program (HSIP) Application

Important: Review and follow the step-by-step instructions in "Manual for HSIP Analyzer". Completing the HSIP Analyzer without referencing to the manual may result in an application with fatal flaws that will be disqualified from the ranking and selection process.

All yellow highlighted fields must be filled in. The gray fields are calculated and read-only. This is a dynamic form (later steps vary depending on the data entered in earlier steps). If any error messages in red appear, fix the errors prior to proceeding to the next steps.

1. Application ID, Project Location and Project Description (copy from the HSIP Application Form):

Application ID:
> **Loc1_2_8**

Save this file using the Application ID plus "Calc" as the file name (e.g. "07-Los Angeles-01Calc.pdf").

Project Location:
(limited to 250 characters)

Project Description:
(limited to 250 characters)

2. Application Category (Check one):

Application Categories that require a Benefit Cost Ratio (BCR):

☒ Common BCR Application   ☐ Set-aside for High Friction Surface Treatment

Application Categories that do NOT require a Benefit Cost Ratio (BCR):

☐ Set-aside for Guardrail Upgrades   ☐ Set-aside for Horizontal Curve Signing

☐ Set-aside for Pedestrian Crossing Enhancements   ☐ Set-aside for Tribes

> **Dual consideration?**
> ☐ If an Application Category that does not require a BCR is selected above, check this box to indicate your desire that this application will be considered as a Common BCR Application as well in case it does not get selected for funding under the set-aside category. If this box is checked, a benefit cost analysis is required so the project will have a BCR.

A safety benefit cost analysis is required for this application. This tool will guide through cost estimate, safety benefit evaluation and Benefit Cost Ratio (BCR) calculation.

Section I. Construction Cost Estimate and Cost Breakdown

The purpose of this section is to:
- o Provide detailed engineer's estimate (for construction items only). The costs for other phases (PE, ROW, and CE) will be included in Section II.
- o Test if countermeasures (CMs) (up to 3) are eligible for being used in the project benefit calculation. For a CM to be used in the project benefit calculation, the construction cost of the CM must be at least 15% of the project's total construction cost, unless an exception is requested. And
- o Determine the project's maximum Federal Reimbursement Ratio (FRR).

I.1 Select up to 3 countermeasures (CMs) to be tested in the Engineer's Estimate:

Number of CMs to be used in this project: 3

CM No. 1:	S2: Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number
CM No. 2:	S20: Install pedestrian crossing (S.I.)
CM No. 3:	

I.2 Detailed Engineer's Estimate for Construction Items:

Cost breakdown by CMs. For each item, enter a cost percentage for each of the CMs and "Other Safety-Related" (OS) components. (e.g. enter 10 for 10%). The cost % for "Non-Safety-Related" (NS) components is calculated.

	No.	Item Description	Unit	Quantity	Unit Cost	Total	% for CM#1 (S2)	% for CM#2 (S20)	% for CM#3 (NA)	% for OS*	% for NS**
+/-	1	Signal hardware upgrades	ea	62	$1093.00	67,766	100%	0%	0%	0%	0
+/-	2	New continental crosswalks	ea	8	$2940.00	23,520	0%	100%	0%	0%	0
+/-	3	All other construction items	ls	1	$8820.00	8,820	%	%	%	100%	0
+/-	4	Mobilization	ls	1	$10011.00	10,011	33%	33%	0%	34%	0
+/-	5	Traffic control	ls	1	$10011.00	10,011	33%	33%	0%	34%	0
		Weighted Average (%)					62%	25%		13%	
		Total ($)				$120,128					

* % for OS: Cost % for Other Safety-Related components;
** % for NS: Cost % for Non Safety-Related components.

Contingencies, as % of the above "Total" of the construction items: 20 % $24,026
(e.g. enter 10 for 10%)

Total Construction Cost (Con Items & Contingencies): $144,200
(Rounded up to the nearest hundreds)

I.3 Summary

2 CM(s) are eligible to be used in the project benefit calculation.

Countermeasure ID	Federal Funding Eligibility (FFE)	Cost %	Eligible to be used in benefit calculation?	Request exception to the 15% rule*
S2	100%	61.91%	Yes (>=15% cost)	☐
S20	100%	25.08%	Yes (>=15% cost)	☐

*By requesting an exception to the 15% rule, the CM with less than 15% of the construction cost will then be eligible to be used in the benefit calculation. if an exception is requested for any CM(s) above, please provide the reason (low cost treatment with significant safety benefits, etc.):

Project's Maximum Federal Reimbursement Ratio =   100.0%

The project's Maximum Federal Reimbursement Ratio is calculated as the least of the FFEs of the above countermeasures, minus the percentage of the non-safety related costs in excess of 10%. **This is the maximum value allowed to be entered in "HSIP/Total (%)" column in Section II (Project Cost Estimate).**

Section II. Project Cost Estimate

All project costs, **for all phases and by all funding sources**, must be accounted for on this form.

  i. "**Total Cost**": Round all costs up to the nearest hundred dollars.
  ii. "**HSIP/Total (%)**": The maximum allowed is the project's Federal Reimbursement Ratio (FRR) as determined in Section I. Click the button to assign the maximum to all, OR enter if not the maximum.
  iii. "**HSIP Funds**" and "**Local/Other Funds**" are calculated.

 Pay attention to the interactive warning/error messages below the table. The messages, if any, must be fixed, or exceptions should be justified in Question No. 5 in Section II of the HSIP Application Form.

Project's maximum Federal Reimbursement Ratio (FRR)
(from Section I, rounded up to integer) | 100 | %

To set all "HSIP/Total (%)" in the below table
to the above maximum FRR, click "Set": | Set |

Description	Total Cost	HISP/Total (%)	HSIP Funds	Local/Other Funds
Preliminary Engineering (PE) Phase				
Environmental	$10,100	100 %	$10,100	$0
PS&E	$15,200	100 %	$15,200	$0
Subtotal - PE	**$25,300**	**100 %**	**$25,300**	**$0**
Right of Way (ROW) Phase				
Right of Way Engineering	$0	100 %	$0	$0
Appraisals, Acquisitions & Utilities	$0	100 %	$0	$0
Subtotal - Right of Way (ROW)	**$0**	**%**	**$0**	**$0**
Construction (CON) Phase				
Construction Engineering (CE)	$15,200	100 %	$15,200	$0
Construction Items	$144,200 (Read only - from Section I)	100 %	$144,200	$0
Subtotal - Construction	**$159,400**	**100 %**	**$159,400**	**$0**
PROJECT TOTAL	**$184,700**	**100 %**	**$184,700**	**$0**

☐   Agency does NOT request **HSIP** funds for PE Phase (automatically checked if PE - HSIP funds is $0).

Interactive Warning/Error Messages:
If there are any messages in the below box, please fix OR explain justification for exceptions in Question No 5, Section II in the HSIP Application.

Section III. Project Location Groups, Countermeasures and Crash Data

The benefit of an HSIP safety project is achieved by reducing potential future crashes due to the application of the safety countermeasures (CMs). In this section, you will need to provide information regarding the project's safety CMs and historical crash data at the project sites. The data will be used to estimate the project benefit in Section IV.

1. Divide the project locations into groups.

It is quite often that an HSIP project has multiple locations. Theoretically the benefit for every single location may be calculated separately and then sum them up. However, that may be time consuming or almost impossible when there are a lot of locations. It is more efficient that the project locations with exactly the same safety countermeasures are combined into a group. The benefits of the locations in the same group can then be calculated at once.

<u>When only one group is needed:</u>

If your project consists of only one location or multiple locations that have similar features, address similar safety issues and utilize the same countermeasure(s). The crash data of all the locations can be combined and only one group is needed.

<u>When multiple groups are needed:</u>

If your project include multiple locations that have various safety issues and the proposed safety improvements (countermeasures) are not exactly the same for all the locations. The locations must be divided into different groups. The project benefits are then calculated multiple times, once for each location group. The project total benefit is the sum of the benefits from the different groups.

It should be noted that within a group, all locations should be of the same type: Signalized Intersection (S), Non-Signalized Intersection (NS), or Roadway (R).

If necessary, you may explain the location grouping for your project in details in Question No. 3 (Crash Data Evaluation), Section II in the HSIP Application Form.

2. After the number of location groups is entered, one subform will be populated for each location group. For each location group:

1) First, select the applicable CMs. *Note: If a Roundabout CM (S18 or NS4A or NS4B) is selected, additional information is required.*

For each group, only the CMs of the same type as the group location type can be used. For example, if a group consists of 5 signalized intersections, only "Signalized Intersection" CMs may be used for this group.

2) Based on the selected CMs, crash data tables of the required types are displayed for data entry.

Different CMs will reduce crashes of different types during the life of the safety improvements. Depending on the selected CMs for the group, you will be required to fill in one or more crash data tables, for any combination of the five crash types (datasets): "All" , "Night" , Ped & Bike", "Emergency Vehicle", and "Animal" (Each of the later four datasets is a sub-dataset of the "All" dataset.)

For more information regarding grouping project locations and examples, please refer to the Manual for HSIP Analyzer.

III.1 List of Project Locations and Location Groups

List all locations/sites included in this project by groups. The locations entered in Table III.1 below will be automatically populated in the crash data tables in III.2.

Based on the criteria described on the last page, the locations/sites need to be divided into [2] groups.

Table III.1 List of Project Locations by Groups

Highlighted fields must be filled in. For each group:
 1) Must select a Location Type;
 2) Initially each group has one location line. Click "+"/"-" to add a new line/delete an existing line;
 3) Enter location description for each line. The same descriptions will be auto-populated in III.2.

*Note: If your project has a large number of locations, please aggregate some locations into one description, e.g. 10 stop controlled intersections, 5 horizontal curves, etc., as long as they have similar features and the safety improvements to be implemented are the same.

	No.	No. in Group	Location Description (Intersection Name or Road Limit or General Description)	
GROUP 1			Select Location Type:	S (Signalized Intersections)
+ -	1	G1-1	Locations 2, 8	
GROUP 2			Select Location Type:	S (Signalized Intersections)
+ -	2	G2-1	Locations 1, 2, 8	

III.2: Countermeasures and Crash Data
(Repeats for each location group)

Countermeasures and Crash Data -Location Group No. 1 of 2   [Hide Group Details]

Step 1: Select countermeasure(s) to be applied to this location group

This group's location type: S (Signalized Intersections)

Please check the CMs for this location group. All the CMs that have passed the test in Section I AND match the location type of this group are listed below.

	No.	Countermeasure (CM) Name	CM Type*	Crash Reduction Factor (CRF)	Expected Life (Years)	Crash Type	Federal Funding Eligibility
☐	1	S2: Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number	S	0.15	10	All	100%
☒	2	S20: Install pedestrian crossing (S.I.)	S	0.25	20	Ped & Bike	100%
	*CM Type: S-Signalized Intersection; NS-Non-Signalized Intersection; R-Roadway.						

Step 2: Provide crash data.

2.1 Crash Data Period: must be between 3 and 5 years.

from (MM/DD/YYYY): 01/01/2013   To (MM/DD/YYYY): 12/31/2017   Crash Data Period (years) =   5

2.2 Fill out the crash data table(s) for the crash type(s) as required by the selected countermeasure(s) in Step 1.

Based on the countermeasures selected in Step 1 , the crash data types to be provided are:
  (1) Ped & Bike

	Crash Data Table for Crash Type: Pedestrians and Bicyclists Involved (P&B)					
No.	Location (from Table III.1)	Fatal (P&B)	Severe Injury (P&B)	Other Visible Injury (P&B)	Complaint of Pain (P&B)	PDO (P&B)	Total
1	Locations 2, 8	0	0	1	4	1	6
	Total	0	0	1	4	1	6

III.2: Countermeasures and Crash Data
(Repeats for each location group)

Countermeasures and Crash Data - Location Group No. 2 of 2 [Hide Group Details]

Step 1: Select countermeasure(s) to be applied to this location group

This group's location type: S (Signalized Intersections)

Please check the CMs for this location group. All the CMs that have passed the test in Section I AND match the location type of this group are listed below.

	No.	Countermeasure (CM) Name	CM Type*	Crash Reduction Factor (CRF)	Expected Life (Years)	Crash Type	Federal Funding Eligibility
☒	1	S2: Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number	S	0.15	10	All	100%
☐	2	S20: Install pedestrian crossing (S.I.)	S	0.25	20	Ped & Bike	100%
	*CM Type: S-Signalized Intersection; NS-Non-Signalized Intersection; R-Roadway.						

Step 2: Provide crash data.

2.1 Crash Data Period: must be between 3 and 5 years.

from (MM/DD/YYYY): [01/01/2013]   To (MM/DD/YYYY): [12/31/2017]   Crash Data Period (years) = 5

2.2 Fill out the crash data table(s) for the crash type(s) as required by the selected countermeasure(s) in Step 1.

Based on the countermeasures selected in Step 1 , the crash data types to be provided are:
(1) All

			Crash Data Table for Crash Type: ALL				
No.	Location (from Table III.1)	Fatal (ALL)	Severe Injury (ALL)	Other Visible Injury (ALL)	Complaint of Pain (ALL)	PDO (ALL)	Total
1	Locations 1, 2, 8	1	4	13	64	158	240
	Total	1	4	13	64	158	240

Section IV. Calculation and Results

Click the "Calculate" button to calculate. The script will first check if there are any errors or inconsistencies in the countermeasure selections and crash data. If errors are detected and displayed below, the errors must be fixed first before you click the "Calculate" button again. If no errors are displayed, the calculation results are provided in this section. Please refer to the Manual for HSIP Analyzer for details regarding possible errors.

Calculate

Project Summary Information:

Project Total Cost: 184700
2 countermeasures are eligible in benefit calculation. (S2 S20)
Project location(s) are divided into 2 group(s) for calculating the benefits.

IV.1 Benefit Summary by location groups

Group No.	Group Info/Data*	Benefit from CM #1	Benefit from CM #2	Benefit from CM #3	Total Benefit of the group
1	Location type: S (Signalized Intersections) Number of location(s): 1 Number of selected countermeasure(s): 1 (S20) Crash Data Information: Crash data period (years): 5 Number of crashes(F/SI/OVI/I-CP/PDO)*: Ped & Bike: 0,0,1,4,1	$0	$425,900	$0	$425,900
2	Location type: S (Signalized Intersections) Number of location(s): 1 Number of selected countermeasure(s): 1 (S2) Crash Data Information: Crash data period (years): 5 Number of crashes(F/SI/OVI/I-CP/PDO)*: All: 1,4,13,64,158	$4,623,151	$0	$0	$4,623,151
Sum		$4,623,151	$425,900	$0	$5,049,051

*Number of crashes: five crash numbers are for Fatal (F), Severe Injury (SI), Other Visible Injury (OVI), Injury - Complaint of Pain (I-CP), and Property Damage Only (PDO), respectively.

IV.2. Project Benefit and BCR Summary

No.	Countermeasure Name	Benefit	Cost	Resulting B/C
1	S2	$4,623,151	$131,451	35.2
2	S20	$425,900	$53,249	8
3		$0	$0	0
	Entire Project	**$5,049,051**	**$184,700**	**27.3**

Data to be transferred to the HSIP Application Form

This section is generated automatically once the data entry and calculation have been completed. Transfer the data on this page to Section III of the HSIP Application Form.

Safety Countermeasure Information

Number of countermeasures: 2

S2: Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number

S20: Install pedestrian crossing (S.I.)

Cost, FRR, Benefit and BCR:

Total Project Cost:	$184,700
HSIP Funds Requested:	$184,700
Max. Federal Reimbursement Ratio (FRR):	100%
Total Expected Benefit:	$5,049,051
Benefit Cost Ratio:	27.34

HSIP ANALYZER

Cost Estimate, Crash Data and Benefit Cost Ratio (BCR) Calculation
for Highway Safety Improvement Program (HSIP) Application

Important: Review and follow the step-by-step instructions in "Manual for HSIP Analyzer". Completing the HSIP Analyzer without referencing to the manual may result in an application with fatal flaws that will be disqualified from the ranking and selection process.

All yellow highlighted fields must be filled in. The gray fields are calculated and read-only. This is a dynamic form (later steps vary depending on the data entered in earlier steps). If any error messages in red appear, fix the errors prior to proceeding to the next steps.

1. Application ID, Project Location and Project Description (copy from the HSIP Application Form):

Application ID:

Loc3_11_12

Save this file using the Application ID plus "Calc" as the file name (e.g. "07-Los Angeles-01Calc.pdf").

Project Location:
(limited to 250 characters)

Project Description:
(limited to 250 characters)

2. Application Category (Check one):

Application Categories that require a Benefit Cost Ratio (BCR):

☒ Common BCR Application   ☐ Set-aside for High Friction Surface Treatment

Application Categories that do NOT require a Benefit Cost Ratio (BCR):

☐ Set-aside for Guardrail Upgrades   ☐ Set-aside for Horizontal Curve Signing

☐ Set-aside for Pedestrian Crossing Enhancements   ☐ Set-aside for Tribes

Dual consideration?
☐ If an Application Category that does not require a BCR is selected above, check this box to indicate your desire that this application will be considered as a Common BCR Application as well in case it does not get selected for funding under the set-aside category. If this box is checked, a benefit cost analysis is required so the project will have a BCR.

A safety benefit cost analysis is required for this application. This tool will guide through cost estimate, safety benefit evaluation and Benefit Cost Ratio (BCR) calculation.

Section I. Construction Cost Estimate and Cost Breakdown

The purpose of this section is to:
- o Provide detailed engineer's estimate (for construction items only). The costs for other phases (PE, ROW, and CE) will be included in Section II.
- o Test if countermeasures (CMs) (up to 3) are eligible for being used in the project benefit calculation. For a CM to be used in the project benefit calculation, the construction cost of the CM must be at least 15% of the project's total construction cost, unless an exception is requested. And
- o Determine the project's maximum Federal Reimbursement Ratio (FRR).

I.1 Select up to 3 countermeasures (CMs) to be tested in the Engineer's Estimate:

Number of CMs to be used in this project:	3

CM No. 1:	S6: Provide protected left turn phase (left turn lane already exists)
CM No. 2:	S2: Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number
CM No. 3:	

I.2 Detailed Engineer's Estimate for Construction Items:

 Cost breakdown by CMs. For each item, enter a cost percentage for each of the CMs and "Other Safety-Related" (OS) components. (e.g. enter 10 for 10%). The cost % for "Non-Safety-Related" (NS) components is calculated.

	No.	Item Description	Unit	Quantity	Unit Cost	Total	% for CM#1 (S6)	% for CM#2 (S2)	% for CM#3 (NA)	% for OS*	% for NS**
+/-	1	Signal modification to convert protected/permissive to protected lefts on two approaches	ea	3	150,000	450,000	100%	%	%	%	0
+/-	2	Signal hardware upgrades	ea	45	$1093.00	49,185	%	100%	%	%	0
+/-	3	All other construction items	ls	1	$60580.00	60,580	%	%	%	100%	0
+/-	4	Mobilization	ls	1	$55977.00	55,977	33%	33%	0%	34%	0
+/-	5	Traffic Control	ls	1	$55977.00	55,977	33%	33%	0%	34%	0
		Weighted Average (%)					72%	13%		15%	
		Total ($)				$671,719					

* % for OS: Cost % for Other Safety-Related components;
** % for NS: Cost % for Non Safety-Related components.

Contingencies, as % of the above "Total" of the construction items:
(e.g. enter 10 for 10%)

20 %	$134,344

Total Construction Cost (Con Items & Contingencies):
(Rounded up to the nearest hundreds)

	$806,100

I.3 Summary

2 CM(s) are eligible to be used in the project benefit calculation.

Countermeasure ID	Federal Funding Eligibility (FFE)	Cost %	Eligible to be used in benefit calculation?	Request exception to the 15% rule*
S6	100%	72.49%	Yes (>=15% cost)	☐
S2	100%	12.82%	Yes (<15% cost) (Exception being requested)	☒

*By requesting an exception to the 15% rule, the CM with less than 15% of the construction cost will then be eligible to be used in the benefit calculation. if an exception is requested for any CM(s) above, please provide the reason (low cost treatment with significant safety benefits, etc.):

Project's Maximum Federal Reimbursement Ratio =   100.0%

The project's Maximum Federal Reimbursement Ratio is calculated as the least of the FFEs of the above countermeasures, minus the percentage of the non-safety related costs in excess of 10%. **This is the maximum value allowed to be entered in "HSIP/Total (%)" column in Section II (Project Cost Estimate).**

Section II. Project Cost Estimate

All project costs, **for all phases and by all funding sources**, must be accounted for on this form.

i. "**Total Cost**": Round all costs up to the nearest hundred dollars.

ii. "**HSIP/Total (%)**": The maximum allowed is the project's Federal Reimbursement Ratio (FRR) as determined in Section I. Click the button to assign the maximum to all, OR enter if not the maximum.

iii. "**HSIP Funds**" and "**Local/Other Funds**" are calculated.

Pay attention to the interactive warning/error messages below the table. The messages, if any, must be fixed, or exceptions should be justified in Question No. 5 in Section II of the HSIP Application Form.

Project's maximum Federal Reimbursement Ratio (FRR) (from Section I, rounded up to integer) **100 %**

To set all "HSIP/Total (%)" in the below table to the above maximum FRR, click "Set": **Set**

Description	Total Cost	HISP/Total (%)	HSIP Funds	Local/Other Funds
Preliminary Engineering (PE) Phase				
Environmental	$56,100	100 %	$56,100	$0
PS&E	$84,100	100 %	$84,100	$0
Subtotal - PE	$140,200	100 %	$140,200	$0
Right of Way (ROW) Phase				
Right of Way Engineering	$0	100 %	$0	$0
Appraisals, Acquisitions & Utilities	$0	100 %	$0	$0
Subtotal - Right of Way (ROW)	$0	%	$0	$0
Construction (CON) Phase				
Construction Engineering (CE)	$84,100	100 %	$84,100	$0
Construction Items	$806,100 (Read only - from Section I)	100 %	$806,100	$0
Subtotal - Construction	$890,200	100 %	$890,200	$0
PROJECT TOTAL	$1,030,400	100 %	$1,030,400	$0

☐ Agency does NOT request **HSIP** funds for PE Phase (automatically checked if PE - HSIP funds is $0).

Interactive Warning/Error Messages:
If there are any messages in the below box, please fix OR explain justification for exceptions in Question No 5, Section II in the HSIP Application.

Section III. Project Location Groups, Countermeasures and Crash Data

The benefit of an HSIP safety project is achieved by reducing potential future crashes due to the application of the safety countermeasures (CMs). In this section, you will need to provide information regarding the project's safety CMs and historical crash data at the project sites. The data will be used to estimate the project benefit in Section IV.

1. Divide the project locations into groups.

It is quite often that an HSIP project has multiple locations. Theoretically the benefit for every single location may be calculated separately and then sum them up. However, that may be time consuming or almost impossible when there are a lot of locations. It is more efficient that the project locations with exactly the same safety countermeasures are combined into a group. The benefits of the locations in the same group can then be calculated at once.

When only one group is needed:

If your project consists of only one location or multiple locations that have similar features, address similar safety issues and utilize the same countermeasure(s). The crash data of all the locations can be combined and only one group is needed.

When multiple groups are needed:

If your project include multiple locations that have various safety issues and the proposed safety improvements (countermeasures) are not exactly the same for all the locations. The locations must be divided into different groups. The project benefits are then calculated multiple times, once for each location group. The project total benefit is the sum of the benefits from the different groups.

It should be noted that within a group, all locations should be of the same type: Signalized Intersection (S), Non-Signalized Intersection (NS), or Roadway (R).

If necessary, you may explain the location grouping for your project in details in Question No. 3 (Crash Data Evaluation), Section II in the HSIP Application Form.

2. After the number of location groups is entered, one subform will be populated for each location group. For each location group:

1) First, select the applicable CMs. *Note: If a Roundabout CM (S18 or NS4A or NS4B) is selected, additional information is required.*

For each group, only the CMs of the same type as the group location type can be used. For example, if a group consists of 5 signalized intersections, only "Signalized Intersection" CMs may be used for this group.

2) Based on the selected CMs, crash data tables of the required types are displayed for data entry.

Different CMs will reduce crashes of different types during the life of the safety improvements. Depending on the selected CMs for the group, you will be required to fill in one or more crash data tables, for any combination of the five crash types (datasets): "All" , "Night" , Ped & Bike", "Emergency Vehicle", and "Animal" (Each of the later four datasets is a sub-dataset of the "All" dataset.)

For more information regarding grouping project locations and examples, please refer to the Manual for HSIP Analyzer.

III.1 List of Project Locations and Location Groups

List all locations/sites included in this project by groups. The locations entered in Table III.1 below will be automatically populated in the crash data tables in III.2.

Based on the criteria described on the last page, the locations/sites need to be divided into ☐ 1 ☐ groups.

Table III.1 List of Project Locations by Groups

Highlighted fields must be filled in. For each group:
 1) Must select a Location Type;
 2) Initially each group has one location line. Click "+"/"-" to add a new line/delete an existing line;
 3) Enter location description for each line. The same descriptions will be auto-populated in III.2.

*Note: If your project has a large number of locations, please aggregate some locations into one description, e.g. 10 stop controlled intersections, 5 horizontal curves, etc., as long as they have similar features and the safety improvements to be implemented are the same.

	No.	No. in Group	Location Description (Intersection Name or Road Limit or General Description)	
GROUP 1			Select Location Type:	S (Signalized Intersections)
+ -	1	G1-1	Locations 3, 12, 13	

III.2: Countermeasures and Crash Data
(Repeats for each location group)

Countermeasures and Crash Data -Location Group No. 1 of 1 [Hide Group Details]

Step 1: Select countermeasure(s) to be applied to this location group

This group's location type: S (Signalized Intersections)

Please check the CMs for this location group. All the CMs that have passed the test in Section I AND match the location type of this group are listed below.

	No.	Countermeasure (CM) Name	CM Type*	Crash Reduction Factor (CRF)	Expected Life (Years)	Crash Type	Federal Funding Eligibility
☒	1	S6: Provide protected left turn phase (left turn lane already exists)	S	0.3	20	All	100%
☒	2	S2: Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number	S	0.15	10	All	100%
		*CM Type: S-Signalized Intersection; NS-Non-Signalized Intersection; R-Roadway.					

Step 2: Provide crash data.

2.1 Crash Data Period: must be between 3 and 5 years.

from (MM/DD/YYYY): [01/01/2013]   To (MM/DD/YYYY): [12/31/2017]   Crash Data Period (years) = 5

2.2 Fill out the crash data table(s) for the crash type(s) as required by the selected countermeasure(s) in Step 1.

Based on the countermeasures selected in Step 1 , the crash data types to be provided are:
(1) All

			Crash Data Table for Crash Type: <u>ALL</u>				
No.	Location (from Table III.1)	Fatal (ALL)	Severe Injury (ALL)	Other Visible Injury (ALL)	Complaint of Pain (ALL)	PDO (ALL)	Total
1	Locations 3, 12, 13	2	4	33	63	125	227
	Total	2	4	33	63	125	227

Section IV. Calculation and Results

Click the "Calculate" button to calculate. The script will first check if there are any errors or inconsistencies in the countermeasure selections and crash data. If errors are detected and displayed below, the errors must be fixed first before you click the "Calculate" button again. If no errors are displayed, the calculation results are provided in this section. Please refer to the Manual for HSIP Analyzer for details regarding possible errors.

<div align="center">

Calculate

</div>

Project Summary Information:

Project Total Cost: 1030400
2 countermeasures are eligible in benefit calculation. (S6 S2)
Project location(s) are divided into 1 group(s) for calculating the benefits.

IV.1 Benefit Summary by location groups

Group No.	Group Info/Data*	Benefit from CM #1	Benefit from CM #2	Benefit from CM #3	Total Benefit of the group

1	Location type: S (Signalized Intersections)
	Number of location(s): 1
	Number of selected countermeasure(s): 2 (S6 S2)
	Crash Data Information:
	   Crash data period (years): 5
	   Number of crashes(F/SI/OVI/I-CP/PDO)*:
	    All: 2,4,33,63,125
		$21,590,689	$5,113,585	$0	$26,704,274

Sum		**$21,590,689**	**$5,113,585**	**$0**	**$26,704,274**

*Number of crashes: five crash numbers are for Fatal (F), Severe Injury (SI), Other Visible Injury (OVI), Injury - Complaint of Pain (I-CP), and Property Damage Only (PDO), respectively.

IV.2. Project Benefit and BCR Summary

No.	Countermeasure Name	Benefit	Cost	Resulting B/C
1	S6	21,590,689	$875,537	**24.7**
2	S2	$5,113,585	$154,863	**33**
3		$0	$0	**0**
	Entire Project	**26,704,274**	**$1,030,400**	**25.9**

Data to be transferred to the HSIP Application Form

This section is generated automatically once the data entry and calculation have been completed. Transfer the data on this page to Section III of the HSIP Application Form.

Safety Countermeasure Information

Number of countermeasures: 2
S6: Provide protected left turn phase (left turn lane already exists)
S2: Improve signal hardware: lenses, back-plates with retroreflective borders, mounting, size, and number

Cost, FRR, Benefit and BCR:

Total Project Cost:	$1,030,400
HSIP Funds Requested:	$1,030,400
Max. Federal Reimbursement Ratio (FRR):	100%
Total Expected Benefit:	26,704,274
Benefit Cost Ratio:	25.92

HSIP ANALYZER

Cost Estimate, Crash Data and Benefit Cost Ratio (BCR) Calculation for Highway Safety Improvement Program (HSIP) Application

Important: Review and follow the step-by-step instructions in "Manual for HSIP Analyzer". Completing the HSIP Analyzer without referencing to the manual may result in an application with fatal flaws that will be disqualified from the ranking and selection process.

All yellow highlighted fields must be filled in. The gray fields are calculated and read-only. This is a dynamic form (later steps vary depending on the data entered in earlier steps). If any error messages in red appear, fix the errors prior to proceeding to the next steps.

1. Application ID, Project Location and Project Description (copy from the HSIP Application Form):

Application ID:

> **Loc4_5_7**

Save this file using the Application ID plus "Calc" as the file name (e.g. "07-Los Angeles-01Calc.pdf").

Project Location:
(limited to 250 characters)

Project Description:
(limited to 250 characters)

2. Application Category (Check one):

Application Categories that require a Benefit Cost Ratio (BCR):

☒ Common BCR Application   ☐ Set-aside for High Friction Surface Treatment

Application Categories that do NOT require a Benefit Cost Ratio (BCR):

☐ Set-aside for Guardrail Upgrades   ☐ Set-aside for Horizontal Curve Signing

☐ Set-aside for Pedestrian Crossing Enhancements   ☐ Set-aside for Tribes

> **Dual consideration?**
> ☐ If an Application Category that does not require a BCR is selected above, check this box to indicate your desire that this application will be considered as a Common BCR Application as well in case it does not get selected for funding under the set-aside category. If this box is checked, a benefit cost analysis is required so the project will have a BCR.

A safety benefit cost analysis is required for this application. This tool will guide through cost estimate, safety benefit evaluation and Benefit Cost Ratio (BCR) calculation.

Section I. Construction Cost Estimate and Cost Breakdown

The purpose of this section is to:
- o Provide detailed engineer's estimate (for construction items only). The costs for other phases (PE, ROW, and CE) will be included in Section II.
- o Test if countermeasures (CMs) (up to 3) are eligible for being used in the project benefit calculation. For a CM to be used in the project benefit calculation, the construction cost of the CM must be at least 15% of the project's total construction cost, unless an exception is requested. And
- o Determine the project's maximum Federal Reimbursement Ratio (FRR).

I.1 Select up to 3 countermeasures (CMs) to be tested in the Engineer's Estimate:

Number of CMs to be used in this project: 3

CM No. 1:	NS8: Install flashing beacons as advance warning (NS.I.)
CM No. 2:	NS10: Improve sight distance to intersection (Clear Sight Triangles)
CM No. 3:	R37: Install sidewalk/pathway (to avoid walking along roadway)

I.2 Detailed Engineer's Estimate for Construction Items:

Cost breakdown by CMs. For each item, enter a cost percentage for each of the CMs and "Other Safety-Related" (OS) components. (e.g. enter 10 for 10%). The cost % for "Non-Safety-Related" (NS) components is calculated.

	No.	Item Description	Unit	Quantity	Unit Cost	Total	% for CM#1 (NS8)	% for CM#2 (NS10)	% for CM#3 (R37)	% for OS*	% for NS**
+/−	1	NS8 - Add LED lights to stop signs with solar power	ea	8	$3000.00	24,000	100%	%	%	%	0
+/−	2	Striping curb extensions to improve sight lines	lf	3,220	$3.00	9,660	%	100%	%	%	0
+/−	3	New sidewalk	sf	8,075	$43.00	347,225	%	%	100%	%	0
+/−	4	All other construction items	ls	1	$41457.00	41,457	%	%	%	100%	0
+/−	5	Mobilization	ls	1	$42234.00	42,234	25%	25%	25%	25%	0
+/−	6	Traffic control	ls	1	$42234.00	42,234	25%	25%	25%	25%	0
		Weighted Average (%)					9%	6%	73%	12%	
		Total ($)				$506,810					

* % for OS: Cost % for Other Safety-Related components;
** % for NS: Cost % for Non Safety-Related components.

Contingencies, as % of the above "Total" of the construction items: 20 % $101,362
(e.g. enter 10 for 10%)

Total Construction Cost (Con Items & Contingencies): $608,200
(Rounded up to the nearest hundreds)

I.3 Summary

3 CM(s) are eligible to be used in the project benefit calculation.

Countermeasure ID	Federal Funding Eligibility (FFE)	Cost %	Eligible to be used in benefit calculation?	Request exception to the 15% rule*
NS8	100%	8.90%	Yes (<15% cost) (Exception being requested)	☒
NS10	90%	6.07%	Yes (<15% cost) (Exception being requested)	☒
R37	90%	72.68%	Yes (>=15% cost)	☐

*By requesting an exception to the 15% rule, the CM with less than 15% of the construction cost will then be eligible to be used in the benefit calculation. if an exception is requested for any CM(s) above, please provide the reason (low cost treatment with significant safety benefits, etc.):

Project's Maximum Federal Reimbursement Ratio =   90.0%

The project's Maximum Federal Reimbursement Ratio is calculated as the least of the FFEs of the above countermeasures, minus the percentage of the non-safety related costs in excess of 10%. **This is the maximum value allowed to be entered in "HSIP/Total (%)" column in Section II (Project Cost Estimate).**

Section II. Project Cost Estimate

All project costs, **for all phases and by all funding sources**, must be accounted for on this form.

i. "**Total Cost**": Round all costs up to the nearest hundred dollars.

ii. "**HSIP/Total (%)**": The maximum allowed is the project's Federal Reimbursement Ratio (FRR) as determined in Section I. Click the button to assign the maximum to all, OR enter if not the maximum.

iii. "**HSIP Funds**" and "**Local/Other Funds**" are calculated.

 Pay attention to the interactive warning/error messages below the table. The messages, if any, must be fixed, or exceptions should be justified in Question No. 5 in Section II of the HSIP Application Form.

Project's maximum Federal Reimbursement Ratio (FRR)
(from Section I, rounded up to integer)   90 %

To set all "HSIP/Total (%)" in the below table
to the above maximum FRR, click "Set":   Set

Description	Total Cost	HISP/Total (%)	HSIP Funds	Local/Other Funds
Preliminary Engineering (PE) Phase				
Environmental	$42,400	90 %	$38,160	$4,240
PS&E	$63,600	90 %	$57,240	$6,360
Subtotal - PE	$106,000	90 %	$95,400	$10,600
Right of Way (ROW) Phase				
Right of Way Engineering	$0	90 %	$0	$0
Appraisals, Acquisitions & Utilities	$38,900	90 %	$35,010	$3,890
Subtotal - Right of Way (ROW)	$38,900	90 %	$35,010	$3,890
Construction (CON) Phase				
Construction Engineering (CE)	$63,600	90 %	$57,240	$6,360
Construction Items	$608,200 (Read only - from Section I)	90 %	$547,380	$60,820
Subtotal - Construction	$671,800	90 %	$604,620	$67,180
PROJECT TOTAL	$816,700	90 %	$735,030	$81,670

☐   Agency does NOT request **HSIP** funds for PE Phase (automatically checked if PE - HSIP funds is $0).

Interactive Warning/Error Messages:
If there are any messages in the below box, please fix OR explain justification for exceptions in Question No 5, Section II in the HSIP Application.

Section III. Project Location Groups, Countermeasures and Crash Data

The benefit of an HSIP safety project is achieved by reducing potential future crashes due to the application of the safety countermeasures (CMs). In this section, you will need to provide information regarding the project's safety CMs and historical crash data at the project sites. The data will be used to estimate the project benefit in Section IV.

1. Divide the project locations into groups.

It is quite often that an HSIP project has multiple locations. Theoretically the benefit for every single location may be calculated separately and then sum them up. However, that may be time consuming or almost impossible when there are a lot of locations. It is more efficient that the project locations with exactly the same safety countermeasures are combined into a group. The benefits of the locations in the same group can then be calculated at once.

<u>When only one group is needed:</u>

If your project consists of only one location or multiple locations that have similar features, address similar safety issues and utilize the same countermeasure(s). The crash data of all the locations can be combined and only one group is needed.

<u>When multiple groups are needed:</u>

If your project include multiple locations that have various safety issues and the proposed safety improvements (countermeasures) are not exactly the same for all the locations. The locations must be divided into different groups. The project benefits are then calculated multiple times, once for each location group. The project total benefit is the sum of the benefits from the different groups.

It should be noted that within a group, all locations should be of the same type: Signalized Intersection (S), Non-Signalized Intersection (NS), or Roadway (R).

If necessary, you may explain the location grouping for your project in details in Question No. 3 (Crash Data Evaluation), Section II in the HSIP Application Form.

2. After the number of location groups is entered, one subform will be populated for each location group. For each location group:

1) First, select the applicable CMs. *Note: If a Roundabout CM (S18 or NS4A or NS4B) is selected, additional information is required.*

For each group, only the CMs of the same type as the group location type can be used. For example, if a group consists of 5 signalized intersections, only "Signalized Intersection" CMs may be used for this group.

2) Based on the selected CMs, crash data tables of the required types are displayed for data entry.

Different CMs will reduce crashes of different types during the life of the safety improvements. Depending on the selected CMs for the group, you will be required to fill in one or more crash data tables, for any combination of the five crash types (datasets): "All" , "Night" , Ped & Bike", "Emergency Vehicle", and "Animal" (Each of the later four datasets is a sub-dataset of the "All" dataset.)

For more information regarding grouping project locations and examples, please refer to the Manual for HSIP Analyzer.

III.1 List of Project Locations and Location Groups

List all locations/sites included in this project by groups. The locations entered in Table III.1 below will be automatically populated in the crash data tables in III.2.

Based on the criteria described on the last page, the locations/sites need to be divided into [4] groups.

Table III.1 List of Project Locations by Groups

Highlighted fields must be filled in. For each group:
1) Must select a Location Type;
2) Initially each group has one location line. Click "+"/"-" to add a new line/delete an existing line;
3) Enter location description for each line. The same descriptions will be auto-populated in III.2.

*Note: If your project has a large number of locations, please aggregate some locations into one description, e.g. 10 stop controlled intersections, 5 horizontal curves, etc., as long as they have similar features and the safety improvements to be implemented are the same.

	No.	No. in Group	Location Description (Intersection Name or Road Limit or General Description)	
GROUP 1			Select Location Type:	NS (Non-signalized Intersections)
+ −	1	G1-1	Location 4	
GROUP 2			Select Location Type:	NS (Non-signalized Intersections)
+ −	2	G2-1	Location 5	
GROUP 3			Select Location Type:	NS (Non-signalized Intersections)
+ −	3	G3-1	Location 7	
GROUP 4			Select Location Type:	R (Roadways)
+ −	4	G4-1	Locations 4 and 7	

III.2: Countermeasures and Crash Data
(Repeats for each location group)

Countermeasures and Crash Data -Location Group No. 1 of 4   Hide Group Details

Step 1: Select countermeasure(s) to be applied to this location group

This group's location type: NS (Non-signalized Intersections)

Please check the CMs for this location group. All the CMs that have passed the test in Section I AND match the location type of this group are listed below.

	No.	Countermeasure (CM) Name	CM Type*	Crash Reduction Factor (CRF)	Expected Life (Years)	Crash Type	Federal Funding Eligibility
☒	1	NS8: Install flashing beacons as advance warning (NS.I.)	NS	0.3	10	All	100%
☒	2	NS10: Improve sight distance to intersection (Clear Sight Triangles)	NS	0.2	10	All	90%
		*CM Type: S-Signalized Intersection; NS-Non-Signalized Intersection; R-Roadway.					

Step 2: Provide crash data.

2.1 Crash Data Period: must be between 3 and 5 years.

from (MM/DD/YYYY): 01/01/2013   To (MM/DD/YYYY): 12/31/2017   Crash Data Period (years) = 5

2.2 Fill out the crash data table(s) for the crash type(s) as required by the selected countermeasure(s) in Step 1.

Based on the countermeasures selected in Step 1 , the crash data types to be provided are:
(1) All

Crash Data Table for Crash Type: ALL							
No.	Location (from Table III.1)	Fatal (ALL)	Severe Injury (ALL)	Other Visible Injury (ALL)	Complaint of Pain (ALL)	PDO (ALL)	Total
1	Location 4	0	1	3	3	2	9
	Total	0	1	3	3	2	9

III.2: Countermeasures and Crash Data
(Repeats for each location group)

Countermeasures and Crash Data - Location Group No. 2 of 4 [Hide Group Details]

Step 1: Select countermeasure(s) to be applied to this location group

This group's location type: NS (Non-signalized Intersections)

Please check the CMs for this location group. All the CMs that have passed the test in Section I AND match the location type of this group are listed below.

	No.	Countermeasure (CM) Name	CM Type*	Crash Reduction Factor (CRF)	Expected Life (Years)	Crash Type	Federal Funding Eligibility
☒	1	NS8: Install flashing beacons as advance warning (NS.I.)	NS	0.3	10	All	100%
☐	2	NS10: Improve sight distance to intersection (Clear Sight Triangles)	NS	0.2	10	All	90%
		*CM Type: S-Signalized Intersection; NS-Non-Signalized Intersection; R-Roadway.					

Step 2: Provide crash data.

2.1 Crash Data Period: must be between 3 and 5 years.

from (MM/DD/YYYY): [01/01/2013]   To (MM/DD/YYYY): [12/31/2017]   Crash Data Period (years) = 5

2.2 Fill out the crash data table(s) for the crash type(s) as required by the selected countermeasure(s) in Step 1.

Based on the countermeasures selected in Step 1 , the crash data types to be provided are:
(1) All

	Crash Data Table for Crash Type: ALL					
No.	Location (from Table III.1)	Fatal (ALL)	Severe Injury (ALL)	Other Visible Injury (ALL)	Complaint of Pain (ALL)	PDO (ALL)	Total
1	Location 5	2	0	0	0	0	2
	Total	2	0	0	0	0	2

III.2: Countermeasures and Crash Data
(Repeats for each location group)

Countermeasures and Crash Data -Location Group No. 3 of 4 ⬚ Hide Group Details

Step 1: Select countermeasure(s) to be applied to this location group

This group's location type: NS (Non-signalized Intersections)

Please check the CMs for this location group. All the CMs that have passed the test in Section I AND match the location type of this group are listed below.

	No.	Countermeasure (CM) Name	CM Type*	Crash Reduction Factor (CRF)	Expected Life (Years)	Crash Type	Federal Funding Eligibility
☐	1	NS8: Install flashing beacons as advance warning (NS.I.)	NS	0.3	10	All	100%
☒	2	NS10: Improve sight distance to intersection (Clear Sight Triangles)	NS	0.2	10	All	90%
		*CM Type: S-Signalized Intersection; NS-Non-Signalized Intersection; R-Roadway.					

Step 2: Provide crash data.

2.1 Crash Data Period: must be between 3 and 5 years.

from (MM/DD/YYYY): 01/01/2013   To (MM/DD/YYYY): 12/31/2017   Crash Data Period (years) = 5

2.2 Fill out the crash data table(s) for the crash type(s) as required by the selected countermeasure(s) in Step 1.

Based on the countermeasures selected in Step 1 , the crash data types to be provided are:
(1) All

			Crash Data Table for Crash Type: ALL				
No.	Location (from Table III.1)	Fatal (ALL)	Severe Injury (ALL)	Other Visible Injury (ALL)	Complaint of Pain (ALL)	PDO (ALL)	Total
1	Location 7	1	0	0	0	3	4
	Total	1	0	0	0	3	4

III.2: Countermeasures and Crash Data
(Repeats for each location group)

Countermeasures and Crash Data -Location Group No. 4 of 4 [Hide Group Details]

Step 1: Select countermeasure(s) to be applied to this location group

This group's location type: R (Roadways)

Please check the CMs for this location group. All the CMs that have passed the test in Section I AND match the location type of this group are listed below.

	No.	Countermeasure (CM) Name	CM Type*	Crash Reduction Factor (CRF)	Expected Life (Years)	Crash Type	Federal Funding Eligibility
☒	1	R37: Install sidewalk/pathway (to avoid walking along roadway)	R	0.8	20	Ped & Bike	90%
	*CM Type: S-Signalized Intersection; NS-Non-Signalized Intersection; R-Roadway.						

Step 2: Provide crash data.

2.1 Crash Data Period: must be between 3 and 5 years.

from (MM/DD/YYYY): | 01/01/2013 | To (MM/DD/YYYY): | 12/31/2017 | Crash Data Period (years) =   5

2.2 Fill out the crash data table(s) for the crash type(s) as required by the selected countermeasure(s) in Step 1.

Based on the countermeasures selected in Step 1 , the crash data types to be provided are:
(1) Ped & Bike

		Crash Data Table for Crash Type: Pedestrians and Bicyclists Involved (P&B)					
No.	Location (from Table III.1)	Fatal (P&B)	Severe Injury (P&B)	Other Visible Injury (P&B)	Complaint of Pain (P&B)	PDO (P&B)	Total
1	Locations 4 and 7	1	1	3	3	5	13
	Total	1	1	3	3	5	13

Section IV. Calculation and Results

Click the "Calculate" button to calculate. The script will first check if there are any errors or inconsistencies in the countermeasure selections and crash data. If errors are detected and displayed below, the errors must be fixed first before you click the "Calculate" button again. If no errors are displayed, the calculation results are provided in this section. Please refer to the Manual for HSIP Analyzer for details regarding possible errors.

<div align="center">

Calculate

</div>

Project Summary Information:

Project Total Cost: 816700
3 countermeasures are eligible in benefit calculation. (NS8 NS10 R37)
Project location(s) are divided into 4 group(s) for calculating the benefits.

IV.1 Benefit Summary by location groups

Group No.	Group Info/Data*	Benefit from CM #1	Benefit from CM #2	Benefit from CM #3	Total Benefit of the group

1	Location type: NS (Non-signalized Intersections)
	Number of location(s): 1
	Number of selected countermeasure(s): 2 (NS8 NS10)
	Crash Data Information:
	  Crash data period (years): 5
	  Number of crashes(F/SI/OVI/I-CP/PDO)*:
	    All: 0,1,3,3,2
		$1,546,407	$1,030,938	$0	$2,577,345

2	Location type: NS (Non-signalized Intersections)
	Number of location(s): 1
	Number of selected countermeasure(s): 1 (NS8)
	Crash Data Information:
	  Crash data period (years): 5
	  Number of crashes(F/SI/OVI/I-CP/PDO)*:
	    All: 2,0,0,0,0
		$2,772,001	$0	$0	$2,772,001

3	Location type: NS (Non-signalized Intersections)
	Number of location(s): 1
	Number of selected countermeasure(s): 1 (NS10)
	Crash Data Information:
	  Crash data period (years): 5
	  Number of crashes(F/SI/OVI/I-CP/PDO)*:
	    All: 1,0,0,0,3
		$0	$938,160	$0	$938,160

4	Location type: R (Roadways)
	Number of location(s): 1
	Number of selected countermeasure(s): 1 (R37)
	Crash Data Information:
	  Crash data period (years): 5
	  Number of crashes(F/SI/OVI/I-CP/PDO)*:
	    Ped & Bike: 1,1,3,3,5
		$0	$0	$14,893,440	$14,893,440

Sum		$4,318,408	$1,969,098	$14,893,440	$21,180,946

*Number of crashes: five crash numbers are for Fatal (F), Severe Injury (SI), Other Visible Injury (OVI), Injury - Complaint of Pain (I-CP), and Property Damage Only (PDO), respectively.

IV.2. Project Benefit and BCR Summary

No.	Countermeasure Name	Benefit	Cost	Resulting B/C
1	NS8	$4,318,408	$82,945	**52.1**
2	NS10	$1,969,098	$56,582	**34.8**
3	R37	14,893,440	$677,174	**22**
	Entire Project	**21,180,946**	**$816,700**	**25.9**

Data to be transferred to the HSIP Application Form

This section is generated automatically once the data entry and calculation have been completed. Transfer the data on this page to Section III of the HSIP Application Form.

Safety Countermeasure Information

Number of countermeasures: 3
- NS8: Install flashing beacons as advance warning (NS.I.)
- NS10: Improve sight distance to intersection (Clear Sight Triangles)
- R37: Install sidewalk/pathway (to avoid walking along roadway)

Cost, FRR, Benefit and BCR:

Total Project Cost:	$816,700
HSIP Funds Requested:	$735,030
Max. Federal Reimbursement Ratio (FRR):	90%
Total Expected Benefit:	21,180,946
Benefit Cost Ratio:	25.93

HSIP ANALYZER

Cost Estimate, Crash Data and Benefit Cost Ratio (BCR) Calculation
for Highway Safety Improvement Program (HSIP) Application

Important: Review and follow the step-by-step instructions in "Manual for HSIP Analyzer". Completing the HSIP Analyzer without referencing to the manual may result in an application with fatal flaws that will be disqualified from the ranking and selection process.

All yellow highlighted fields must be filled in. The gray fields are calculated and read-only. This is a dynamic form (later steps vary depending on the data entered in earlier steps). If any error messages in red appear, fix the errors prior to proceeding to the next steps.

1. Application ID, Project Location and Project Description (copy from the HSIP Application Form):

Application ID:

Loc6_9_10

Save this file using the Application ID plus "Calc" as the file name (e.g. "07-Los Angeles-01Calc.pdf").

Project Location:
(limited to 250 characters)

Project Description:
(limited to 250 characters)

2. Application Category (Check one):

Application Categories that require a Benefit Cost Ratio (BCR):

☒ Common BCR Application　　　☐ Set-aside for High Friction Surface Treatment

Application Categories that do NOT require a Benefit Cost Ratio (BCR):

☐ Set-aside for Guardrail Upgrades　　　☐ Set-aside for Horizontal Curve Signing

☐ Set-aside for Pedestrian Crossing Enhancements　　　☐ Set-aside for Tribes

Dual consideration?
☐ If an Application Category that does not require a BCR is selected above, check this box to indicate your desire that this application will be considered as a Common BCR Application as well in case it does not get selected for funding under the set-aside category. If this box is checked, a benefit cost analysis is required so the project will have a BCR.

A safety benefit cost analysis is required for this application. This tool will guide through cost estimate, safety benefit evaluation and Benefit Cost Ratio (BCR) calculation.

Section I. Construction Cost Estimate and Cost Breakdown

The purpose of this section is to:
- o Provide detailed engineer's estimate (for construction items only). The costs for other phases (PE, ROW, and CE) will be included in Section II.
- o Test if countermeasures (CMs) (up to 3) are eligible for being used in the project benefit calculation. For a CM to be used in the project benefit calculation, the construction cost of the CM must be at least 15% of the project's total construction cost, unless an exception is requested. And
- o Determine the project's maximum Federal Reimbursement Ratio (FRR).

I.1 Select up to 3 countermeasures (CMs) to be tested in the Engineer's Estimate:

Number of CMs to be used in this project: 3

CM No. 1:	NS18: Install pedestrian crossing at uncontrolled locations (with enhanced safety features)
CM No. 2:	R36: Install bike lanes
CM No. 3:	NS5: Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs

I.2 Detailed Engineer's Estimate for Construction Items:

 Cost breakdown by CMs. For each item, enter a cost percentage for each of the CMs and "Other Safety-Related" (OS) components. (e.g. enter 10 for 10%). The cost % for "Non-Safety-Related" (NS) components is calculated.

	No.	Item Description	Unit	Quantity	Unit Cost	Total	% for CM#1 (NS18)	% for CM#2 (R36)	% for CM#3 (NS5)	% for OS*	% for NS**
+/−	1	RRFB	ea	1	$40000.00	40,000	100%	%	%	%	0
+/−	2	Bike lanes	lf	4,360	$12.00	52,320	%	100%	%	%	0
+/−	3	Post mounted signs	ea	4	$1100.00	4,400	%	%	100%	%	0
+/−	4	All other construction items	ls	1	$42618.00	42,618	%	%	%	100%	0
+/−	5	Mobilization	ls	1	$13934.00	13,934	25%	25%	25%	25%	0
+/−	6	Traffic control	ls	1	$13934.00	13,934	25%	25%	25%	25%	0
		Weighted Average (%)					28%	35%	7%	30%	
		Total ($)				$167,206					

* % for OS: Cost % for Other Safety-Related components;
** % for NS: Cost % for Non Safety-Related components.

Contingencies, as % of the above "Total" of the construction items: 20 % $33,441
(e.g. enter 10 for 10%)

Total Construction Cost (Con Items & Contingencies): $200,700
(Rounded up to the nearest hundreds)

I.3 Summary

<u>3 CM(s) are eligible to be used in the project benefit calculation.</u>

Countermeasure ID	Federal Funding Eligibility (FFE)	Cost %	Eligible to be used in benefit calculation?	Request exception to the 15% rule*
NS18	100%	28.09%	Yes (>=15% cost)	☐
R36	90%	35.46%	Yes (>=15% cost)	☐
NS5	100%	6.80%	Yes (<15% cost) (Exception being requested)	☒

*By requesting an exception to the 15% rule, the CM with less than 15% of the construction cost will then be eligible to be used in the benefit calculation. if an exception is requested for any CM(s) above, please provide the reason (low cost treatment with significant safety benefits, etc.):

<u>Project's Maximum Federal Reimbursement Ratio =</u>   <u>90.0%</u>

The project's Maximum Federal Reimbursement Ratio is calculated as the least of the FFEs of the above countermeasures, minus the percentage of the non-safety related costs in excess of 10%. **This is the maximum value allowed to be entered in "HSIP/Total (%)" column in Section II (Project Cost Estimate).**

Section II. Project Cost Estimate

All project costs, **for all phases and by all funding sources**, must be accounted for on this form.

    i. "**Total Cost**": Round all costs up to the nearest hundred dollars.

    ii. "**HSIP/Total (%)**": The maximum allowed is the project's Federal Reimbursement Ratio (FRR) as determined in Section I. Click the button to assign the maximum to all, OR enter if not the maximum.

    iii. "**HSIP Funds**" and "**Local/Other Funds**" are calculated.

Pay attention to the interactive warning/error messages below the table. The messages, if any, must be fixed, or exceptions should be justified in Question No. 5 in Section II of the HSIP Application Form.

Project's maximum Federal Reimbursement Ratio (FRR)
(from Section I, rounded up to integer) | 90 | %

To set all "HSIP/Total (%)" in the below table
to the above maximum FRR, click "Set":   [Set]

Description	Total Cost	HISP/Total (%)	HSIP Funds	Local/Other Funds
Preliminary Engineering (PE) Phase				
Environmental	$14,200	90 %	$12,780	$1,420
PS&E	$21,100	90 %	$18,990	$2,110
Subtotal - PE	**$35,300**	90 %	**$31,770**	**$3,530**
Right of Way (ROW) Phase				
Right of Way Engineering	$0	90 %	$0	$0
Appraisals, Acquisitions & Utilities	$0	90 %	$0	$0
Subtotal - Right of Way (ROW)	**$0**	90 %	**$0**	**$0**
Construction (CON) Phase				
Construction Engineering (CE)	$21,100	90 %	$18,990	$2,110
Construction Items	$200,700 (Read only - from Section I)	90 %	$180,630	$20,070
Subtotal - Construction	**$221,800**	90 %	**$199,620**	**$22,180**
PROJECT TOTAL	**$257,100**	90 %	**$231,390**	**$25,710**

☐   Agency does NOT request **HSIP** funds for PE Phase (automatically checked if PE - HSIP funds is $0).

Interactive Warning/Error Messages:
If there are any messages in the below box, please fix OR explain justification for exceptions in Question No 5, Section II in the HSIP Application.

Section III. Project Location Groups, Countermeasures and Crash Data

The benefit of an HSIP safety project is achieved by reducing potential future crashes due to the application of the safety countermeasures (CMs). In this section, you will need to provide information regarding the project's safety CMs and historical crash data at the project sites. The data will be used to estimate the project benefit in Section IV.

1. Divide the project locations into groups.

It is quite often that an HSIP project has multiple locations. Theoretically the benefit for every single location may be calculated separately and then sum them up. However, that may be time consuming or almost impossible when there are a lot of locations. It is more efficient that the project locations with exactly the same safety countermeasures are combined into a group. The benefits of the locations in the same group can then be calculated at once.

When only one group is needed:

If your project consists of only one location or multiple locations that have similar features, address similar safety issues and utilize the same countermeasure(s). The crash data of all the locations can be combined and only one group is needed.

When multiple groups are needed:

If your project include multiple locations that have various safety issues and the proposed safety improvements (countermeasures) are not exactly the same for all the locations. The locations must be divided into different groups. The project benefits are then calculated multiple times, once for each location group. The project total benefit is the sum of the benefits from the different groups.

It should be noted that within a group, all locations should be of the same type: Signalized Intersection (S), Non-Signalized Intersection (NS), or Roadway (R).

If necessary, you may explain the location grouping for your project in details in Question No. 3 (Crash Data Evaluation), Section II in the HSIP Application Form.

2. After the number of location groups is entered, one subform will be populated for each location group. **For each location group:**

1) First, select the applicable CMs. *Note: If a Roundabout CM (S18 or NS4A or NS4B) is selected, additional information is required.*

For each group, only the CMs of the same type as the group location type can be used. For example, if a group consists of 5 signalized intersections, only "Signalized Intersection" CMs may be used for this group.

2) Based on the selected CMs, crash data tables of the required types are displayed for data entry.

Different CMs will reduce crashes of different types during the life of the safety improvements. Depending on the selected CMs for the group, you will be required to fill in one or more crash data tables, for any combination of the five crash types (datasets): "All" , "Night" , Ped & Bike", "Emergency Vehicle", and "Animal" (Each of the later four datasets is a sub-dataset of the "All" dataset.)

For more information regarding grouping project locations and examples, please refer to the Manual for HSIP Analyzer.

III.1 List of Project Locations and Location Groups

List all locations/sites included in this project by groups. The locations entered in Table III.1 below will be automatically populated in the crash data tables in III.2.

Based on the criteria described on the last page, the locations/sites need to be divided into [2] groups.

Table III.1 List of Project Locations by Groups

Highlighted fields must be filled in. For each group:
1) Must select a Location Type;
2) Initially each group has one location line. Click "+"/"-" to add a new line/delete an existing line;
3) Enter location description for each line. The same descriptions will be auto-populated in III.2.

*Note: If your project has a large number of locations, please aggregate some locations into one description, e.g. 10 stop controlled intersections, 5 horizontal curves, etc., as long as they have similar features and the safety improvements to be implemented are the same.

	No.	No. in Group	Location Description (Intersection Name or Road Limit or General Description)	
GROUP 1			Select Location Type:	NS (Non-signalized Intersections)
+ -	1	G1-1	Location 6	
GROUP 2			Select Location Type:	R (Roadways)
+ -	2	G2-1	Location 6	

III.2: Countermeasures and Crash Data
(Repeats for each location group)

Countermeasures and Crash Data -Location Group No. 1 of 2   (Hide Group Details)

Step 1: Select countermeasure(s) to be applied to this location group

This group's location type: NS (Non-signalized Intersections)

Please check the CMs for this location group. All the CMs that have passed the test in Section I AND match the location type of this group are listed below.

	No.	Countermeasure (CM) Name	CM Type*	Crash Reduction Factor (CRF)	Expected Life (Years)	Crash Type	Federal Funding Eligibility
☒	1	NS18: Install pedestrian crossing at uncontrolled locations (with enhanced safety features)	NS	0.35	20	Ped & Bike	100%
☒	2	NS5: Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs	NS	0.15	10	All	100%
		*CM Type: S-Signalized Intersection; NS-Non-Signalized Intersection; R-Roadway.					

Step 2: Provide crash data.

2.1 Crash Data Period: must be between 3 and 5 years.

from (MM/DD/YYYY): [01/01/2013]   To (MM/DD/YYYY): [12/31/2017]   Crash Data Period (years) = 5

2.2 Fill out the crash data table(s) for the crash type(s) as required by the selected countermeasure(s) in Step 1.

Based on the countermeasures selected in Step 1 , the crash data types to be provided are:
(1) All (2) Ped & Bike

Crash Data Table for Crash Type: <u>ALL</u>

No.	Location (from Table III.1)	Fatal (ALL)	Severe Injury (ALL)	Other Visible Injury (ALL)	Complaint of Pain (ALL)	PDO (ALL)	Total
1	Location 6	1	0	1	5	8	15
	Total	1	0	1	5	8	15

Crash Data Table for Crash Type: <u>Pedestrians and Bicyclists Involved (P&B)</u>

No.	Location (from Table III.1)	Fatal (P&B)	Severe Injury (P&B)	Other Visible Injury (P&B)	Complaint of Pain (P&B)	PDO (P&B)	Total
1	Location 6	0	0	0	4	1	5
	Total	0	0	0	4	1	5

III.2: Countermeasures and Crash Data
(Repeats for each location group)

Countermeasures and Crash Data -Location Group No. 2 of 2   [Hide Group Details]

Step 1: Select countermeasure(s) to be applied to this location group

This group's location type: R (Roadways)

Please check the CMs for this location group. All the CMs that have passed the test in Section I AND match the location type of this group are listed below.

	No.	Countermeasure (CM) Name	CM Type*	Crash Reduction Factor (CRF)	Expected Life (Years)	Crash Type	Federal Funding Eligibility
☒	1	R36: Install bike lanes	R	0.35	20	Ped & Bike	90%
	*CM Type: S-Signalized Intersection; NS-Non-Signalized Intersection; R-Roadway.						

Step 2: Provide crash data.

2.1 Crash Data Period: must be between 3 and 5 years.

from (MM/DD/YYYY): | 01/01/2013 | To (MM/DD/YYYY): | 12/31/2017 | Crash Data Period (years) =   5

2.2 Fill out the crash data table(s) for the crash type(s) as required by the selected countermeasure(s) in Step 1.

Based on the countermeasures selected in Step 1 , the crash data types to be provided are:
(1) Ped & Bike

		Crash Data Table for Crash Type: Pedestrians and Bicyclists Involved (P&B)					
No.	Location (from Table III.1)	Fatal (P&B)	Severe Injury (P&B)	Other Visible Injury (P&B)	Complaint of Pain (P&B)	PDO (P&B)	Total
1	Location 6	0	0	0	4	1	5
	Total	0	0	0	4	1	5

Section IV. Calculation and Results

Click the "Calculate" button to calculate. The script will first check if there are any errors or inconsistencies in the countermeasure selections and crash data. If errors are detected and displayed below, the errors must be fixed first before you click the "Calculate" button again. If no errors are displayed, the calculation results are provided in this section. Please refer to the Manual for HSIP Analyzer for details regarding possible errors.

<div align="center">

Calculate

</div>

Project Summary Information:

Project Total Cost: 257100
3 countermeasures are eligible in benefit calculation. (NS18 R36 NS5)
Project location(s) are divided into 2 group(s) for calculating the benefits.

IV.1 Benefit Summary by location groups

Group No.	Group Info/Data*	Benefit from CM #1	Benefit from CM #2	Benefit from CM #3	Total Benefit of the group

1	Location type: NS (Non-signalized Intersections)
	Number of location(s): 1
	Number of selected countermeasure(s): 2 (NS18 NS5)
	Crash Data Information:
	  Crash data period (years): 5
	  Number of crashes(F/SI/OVI/I-CP/PDO)*:
	    All: 1,0,1,5,8
	    Ped & Bike: 0,0,0,4,1
		$387,723	$0	$867,121	$1,254,844

2	Location type: R (Roadways)
	Number of location(s): 1
	Number of selected countermeasure(s): 1 (R36)
	Crash Data Information:
	  Crash data period (years): 5
	  Number of crashes(F/SI/OVI/I-CP/PDO)*:
	    Ped & Bike: 0,0,0,4,1
		$0	$419,161	$0	$419,161

Sum		$387,723	$419,161	$867,121	$1,674,005

*Number of crashes: five crash numbers are for Fatal (F), Severe Injury (SI), Other Visible Injury (OVI), Injury - Complaint of Pain (I-CP), and Property Damage Only (PDO), respectively.

IV.2. Project Benefit and BCR Summary

No.	Countermeasure Name	Benefit	Cost	Resulting B/C
1	NS18	$387,723	$102,662	3.8
2	R36	$419,161	$129,592	3.2
3	NS5	$867,121	$24,846	34.9
	Entire Project	**$1,674,005**	**$257,100**	**6.5**

Data to be transferred to the HSIP Application Form

This section is generated automatically once the data entry and calculation have been completed. Transfer the data on this page to Section III of the HSIP Application Form.

Safety Countermeasure Information

Number of countermeasures: 3
    NS18: Install pedestrian crossing at uncontrolled locations (with enhanced safety features)
    R36: Install bike lanes
    NS5: Install/upgrade larger or additional stop signs or other intersection warning/regulatory signs

Cost, FRR, Benefit and BCR:

Total Project Cost:	$257,100
HSIP Funds Requested:	$231,390
Max. Federal Reimbursement Ratio (FRR):	90%
Total Expected Benefit:	$1,674,005
Benefit Cost Ratio:	6.51