

# USER GUIDE

UF Transportation Institute UNIVERSITY of FLORIDA

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## Introduction

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#### Acknowledgements

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## **Getting Started**

### **Getting Started**

To begin, click on File then New (or the "New File..." button on the Start page).

Normal Windows keyboard and mouse functions are available. Tabbing, clicking to a new field, or pressing the Enter key will trigger a recalculation and update the report.

## **General Controls**

#### Menu Items

**New** – Creates a new HSS file (\*.xhz) and starts a new analysis project based on one of the selections below; shortcut is Ctrl+N

Segment - Creates a new HSS file (\*.xhz) and starts a new Segment analysis project

Intersection - Creates a new HSS file (\*.xhz) and starts a new Intersection analysis project

Rural Facility – Creates a new HSS file (\*.xhz) and starts a new Rural Facility analysis project

Urban Facility – Creates a new HSS file (\*.xhz) and starts a new Urban Facility analysis project

**Freeway and Ramp Facility** – Creates a new HSS file (\*.xhz) and starts a new Freeway and Ramp Facility analysis project

**Open** – Opens an existing HSS file (\*xhz); shortcut is Ctrl+O

Example Folder – Opens folder with HSS examples in File Explorer

Save - Saves an open HSS file (\*.xhz) using the current file name; shortcut is Ctrl+S

Save As... - Saves an open HSS file (\*.xhz) using a specified file name; shortcut is F12

Close - Closes an existing HSS file (\*.xhz); shortcut is Ctrl+W

Units

USC Units – Changes the units of the current file to U.S. Customary

Metric Units - Changes the units of the current file to Metric

Print - Brings up printer selection and prints an HSS report to the printer or specified file type; shortcut is Ctrl+P

Print Preview – Displays preview of current report before printing; shortcut is Ctrl+F2

View

Page View - Changes the view to display inputs and report by pages; shortcut is F9

Full View

**Report -> Right** – Changes the view to display both the input screen and report simultaneously; the report is displayed on the right portion of the screen; shortcut is F10

#### Report

Formatted Report – Displays formatted report including the most important values; shortcut is F4

Text Report – Displays text report with input, intermediary, and final results; shortcut is F6

#### **Parameter Template**

**View/Edit Template** – Displays all Segment and Intersection Common Parameters for every Facility Type on the General page, including the Economic Analysis Common Parameters, for editing; all other pages and navigation buttons will be disabled until editing is finished; during editing, 'View/Edit Template' changes to 'To Normal Mode', which can be selected after editing is finished

**Export Template** – Opens a Save As dialog box for user to save the exported template as an HSS Template File (\*.xhzt)

**Import Template** – Displays a popup indicating the template was successfully imported; all parameters for the file will update according to values saved in the imported template

**Export to CSV** – Opens a Save As dialog box for the user to save exported results as an HSS CSV file (\*.csv); results saved in exported file are dependent on the Analysis Type of the dataset

**Default Settings** – Opens a dialog box for the user to input defaults for Analyst, Agency, Jurisdiction, and Default Template (which allows the user to add a default path to a saved template), which will be applied to all new files; also allows selection of USC or SI units, which will be applied to all new files; shortcut is Alt+F

#### Help

**Contents** – Provides access to glossary, acknowledgements, copyrights, and information on the HSS procedures; shortcut is Ctrl+F1

Index – Allows user to search keywords within the glossary

**Search** – Allows user to search for any word within the glossary

User Guide - Opens a comprehensive user guide in PDF format; shortcut is Ctrl+G

**HSS Updates** – Sends the HSS version number anonymously without any personally identifiable information to McTrans to check for a newer version

**HSM/HSS Training** – Opens the McTrans Training Page in the default web browser to view the latest training opportunities

#### Support

**Frequently Asked Questions** – Opens the McTrans support page for HSS in the default web browser

HSS on the Web – Opens the McTrans HSS Overview page in the default web browser

McTrans on the Web – Opens the McTrans home page in the default web browser

**E-mail McTrans** – Composes a new e-mail addressed to McTrans in the default e-mail client with registration number, serial key, module, and version number already populated in the Subject field

**About HCS** – Opens an about window with software version information, EULA, general acknowledgements, contact information, and other relevant links

Exit - Exits the HCS Highway Safety Software module; shortcut is Alt+F

## **Highway Safety**

### **Highway Safety Manual**

The Highway Safety Software (HSS) is designed to determine the predicted number of crashes for segments and intersections following the Predictive Method found in the AASHTO Highway Safety Manual (HSM). The basis of the Predictive Method is calculating a Safety Performance Function (SPF) and applying Crash Modification Factors (CMFs) based on certain geometric and safety feature data in the intersection/segment. The Predictive Method is explained in the HSM Part C and the HSM Supplement in the following chapters:

- Chapter 10 Rural Two-Lane, Two-Way Roads
- Chapter 11 Rural Multilane Highways
- Chapter 12 Urban and Suburban Arterials
- Chapter 18 Freeways
- Chapter 19 Ramps

#### **Initial Steps**

When creating a new file in HSS from the Start page, a prompt appears asking for the Analysis Type, as shown below:



The process for user inputs is very similar between all six available Analysis Types. Once Analysis Type is selected, it cannot be changed. A new file must be created if the user wishes to change the Analysis Type.

### **Segment Analysis**

Once Segment is selected as the Analysis Type, the user will be brought to the General page, which includes sections for Project Properties and Parameters. The Project Properties section includes general information about the project, which include: Analyst, Agency, Date, Jurisdiction, Analysis Year, Project Description, Empirical Bayes Analysis, Number of Years of Observed Crashes, Facility Type, Section Type, and Area Type. Section Type will be set to Segment and cannot be changed. However, the user can switch between different Facility Types. The five choices of Facility Type include: Rural Two-Lane, Rural Multilane, Urban, Freeway, and Ramp. If the Facility Type selected is Rural Two-Lane or Rural Multilane, the Area Type will automatically be set to Rural. If the Facility Type selected is Urban, the Area Type will automatically be set to Urban. If the Facility Type selected is Freeway or Ramp, a drop down menu will be enabled for Area Type, allowing a selection between Rural and Urban. An Empirical Bayes (EB) Analysis checkbox is provided for the user to indicate whether or not to use the EB analysis, which is a method used to combine observed crash frequency data for a given site with predicted crash frequency data from many similar sites to estimate its expected crash frequency. Checking this will also enable the Number of Years of Observed Crashes input on the General page and the Observed Crashes inputs on the Details page.

The Parameters section only includes Economic Analysis Common Parameters. Other parameters are included on the Details page under the Parameters section. The Facility Type selected on the General page will determine which segment parameters to show.

Rural Two-Lane Segment Common Parameters include:

- Calibration Factor, C
- Proportion of Related Crashes, Pra
- Proportion of Nighttime Crashes that Involve a Fatality or Injury, Pinr
- Proportion of Nighttime Crashes that Involve Property Damage, Ppnr
- Proportion of Crashes that Occur at Night, Pnr
- Crash distribution proportions for Total, Fatal-and-Injury, and Property-Damage-Only crashes:
  - Single-Vehicle Crashes
    - Collision with Animal
    - Collision with Bicycle
    - Collision with Pedestrian
    - Overturned
    - Ran Off Road
    - Other Single-Vehicle Collision
    - Multiple-Vehicle Crashes
      - Angle Collision
      - Head-On Collision
      - Rear-End Collision
      - Sideswipe Collision
      - Other Multiple-Vehicle Collision

Rural Multilane Segment Common Parameters include:

• Calibration Factor, C

0

- Proportion of Related Crashes, Pra
- Proportion of Nighttime Crashes for Unlighted Segment that Involve a Fatality or Injury, Pinr
- Proportion of Nighttime Crashes for Unlighted Segment that Involve Property Damage, Ppnr
- Proportion of Crashes for Unlighted Segment that Occur at Night, Pnr
- Crash distribution proportions for Total, Fatal-and-Injury, Fatal-and-Injury KAB, and Property-Damage-Only crashes:
  - Head-On Collision
  - Sideswipe Collision
  - Rear-End Collision
  - Angle Collision

- o Single-Vehicle Crashes
- Other Multiple-Vehicle Crashes

Urban Segment Common Parameters include:

- Calibration Factor, C
- Proportion of Nighttime Crashes that Involve a Fatality or Injury, Pinr
- Proportion of Nighttime Crashes that Involve Property Damage, Ppnr
- Proportion of Crashes that Occur at Night, Pnr
- Pedestrian Crash Adjustment Factor, fpedr
- Bicycle Crash Adjustment Factor, fbiker
- Crash distribution proportions for Fatal-and-Injury and Property-Damage-Only crashes:
  - Single-Vehicle Crashes
    - Collision with Animal
    - Collision with Fixed Object
    - Collision with Other Object
    - Other Single-Vehicle Collisions
  - Multiple-Vehicle Crashes
    - Rear-End Collisions
    - Head-On Collisions
    - Angle Collisions
    - Sideswipe, Same Direction
    - Sideswipe, Opposite Direction
    - Other Multiple-Vehicle Collision

Freeway Segment Common Parameters include:

- Calibration Factor for Multiple-Vehicle Fatal-and-Injury Crashes, Cmv,fi
- Calibration Factor for Multiple-Vehicle Property-Damage-Only Crashes, Cmv,pdo
- Calibration Factor for Single-Vehicle Fatal-and-Injury Crashes, Csv,fi
- Calibration Factor for Single-Vehicle Property-Damage-Only Crashes, Csv,pdo

Ramp Segment Common Parameters include:

- Calibration Factor for Multiple-Vehicle Fatal-and-Injury Crashes, Cmv,fi
- Calibration Factor for Multiple-Vehicle Property-Damage-Only Crashes, Cmv,pdo
- Calibration Factor for Single-Vehicle Fatal-and-Injury Crashes, Csv,fi
- Calibration Factor for Single-Vehicle Property-Damage-Only Crashes, Csv,pdo

The Economic Analysis Common Parameters include Societal Crash Costs by Crash Severity:

- Fatal/Injury, \$
- Property Damage Only, \$

Below is an example of the General page:

		Properties				
Analyst			Jurisdiction			
Agency			Analysis Year	2019		
Date	7/30/2019		Project Description			
Empirical Bayes Analysis			Number of Years of Observed Crashes	1		
Facility Type	Rural Two-Lane		Section Type	Segment		
Area Type	Rural					
Conomic Analysis Common Parameters						
Societal Crash Costs by Crash Severity						
Fatal/Injury, S	158200					
Property Damage Only, S	7400					

On the Details page, four sections are provided: Segment, Input, Parameters, and Output. Depending on the Facility Type selected, there could also be an additional Observed Crashes section if Empirical Bayes Analysis is selected on the General page. The Segment section states the Facility Type selected on the General page and provides a drop down menu for selecting the Model Type based on the Facility Type selected. Inputs available are based on

the Facility Type and Model Type selected. Parameters shown are also dependent on the Facility Type selected on the General page. Outputs include the Safety Performance Functions (SPFs), the various Crash Modification Factors (CMFs), and the Predicted Crash Frequencies.

Below is an example of the Details page for a Rural Two-Lane Facility Type and an Undivided Roadway Segment (2U) Model Type, with Empirical Bayes Analysis checked on the General page:

Facility Type	Rural Two-Lane	Model Type	Two-Lane Undivided Segment (20)	
		Imput		
AADT, veh/day	1000	Length, mi	1.000	
Lane Width. ft	12.0	Shoulder Width, ft	6	1
Shoulder Type	Paved	- Horizontal Curve		
Horizontal Curve Length, mi	1.000	Horizontal Curve Radius, ft	100.	
Spiral Transition	Present	Superelevation Variance, ft/ft	(0.010)	
Grade, %	0.0	Number of Driveways	0	
Centerline Rumble Strips		Passing Lanes	No Passing or Climbing Lanes	-
Two-Way Left-Turn Lanes		Roadside Hazard Rating	3	
Lighting		Automated Speed Enforcement		
Observed Crashes	0			
		Parameters		
)		2010		
		Output		
Safety Performance Function (SPF)	0.267	Predicted Crash Frequency (Npredicted)	0.267	
CMF1 (Lane Width)	1.000	(CMF2 (Shoulders)	1.000	
CMF3 (Horizontal Curves)	1.000	CMF4 (Horizontal Curves: Superelevation)	1.000	
CMP5 (Grades)	1.000	CMF6 (Driveway Density)	1.000	
CMF7 (Centerline Rumble Strips)	1.000	CMF8 (Passing Lanes)	1,000	
CMF9 (Two-Way Left-Turn Lanes)	1.000	CMF10 (Roadside Design)	1.000	
CMF11 (Lighting)	1.000	CMF12 (Automated Speed Enforcement)	1.000	

#### **Intersection Analysis**

Once Intersection is selected as the Analysis Type, the user will be brought to the General page, which includes sections for Project Properties and Parameters. The Project Properties section includes general information about the project, which include: Analyst, Agency, Date, Jurisdiction, Analysis Year, Project Description, Empirical Bayes Analysis, Number of Years of Observed Crashes, Facility Type, Section Type, and Area Type. Section Type will be set to Intersection and cannot be changed. However, the user can switch between different Facility Types. The five choices of Facility Type include: Rural Two-Lane, Rural Multilane, Urban, Freeway, and Ramp. If the Facility Type selected is Rural Two-Lane or Rural Multilane, the Area Type will automatically be set to Rural. If the Facility Type selected is Urban, the Area Type will automatically be set to Urban. If the Facility Type selected is Freeway or Ramp, a drop down menu will be enabled for Area Type, allowing a selection between Rural and Urban. An Empirical Bayes (EB) Analysis checkbox is provided for the user to indicate whether or not to use the EB analysis, which is a method used to combine observed crash frequency data for a given site with predicted crash frequency data from many similar sites to estimate its expected crash frequency. Checking this will also enable the Number of Years of Observed Crashes input on the General page and the Observed Crashes inputs on the Details page.

The Parameters section only includes Economic Analysis Common Parameters. Other parameters are included on the Details page under the Parameters section. The Facility Type selected on the General page will determine which intersection parameters to show.

Rural Two-Lane Intersection Common Parameters include:

- Calibration Factor, C
- Proportion of Total Crashes for Unlighted Intersections that Occur at Night, Pni
- Proportion of Fatal
- Proportion of Incapacitating Injury
- Proportion of Nonincapacitating Injury
- Proportion of Possible Injury
- Crash distribution proportions for Total, Fatal-and-Injury, and Property-Damage-Only crashes:
  - Single-Vehicle Crashes
    - Collision with Animal
    - Collision with Bicycle

- Collision with Pedestrian
- Overturned
- Ran Off Road
- Other Single-Vehicle Collision
- Multiple-Vehicle Crashes
  - Angle Collision
  - Head-On Collision
  - Rear-End Collision
  - Sideswipe Collision
  - Other Multiple-Vehicle Collision

Rural Multilane Intersection Common Parameters include:

- Calibration Factor, C
- Proportion of Total Crashes for Unlighted Intersections that Occur at Night, Pni
- Crash distribution proportions for Total, Fatal-and-Injury, Fatal-and-Injury KAB, and Property-Damage-Only crashes:
  - Head-On Collision
  - Sideswipe Collision
  - Rear-End Collision
  - Angle Collision
  - Single-Vehicle Crashes
  - o Other Multiple-Vehicle Crashes

Urban Intersection Common Parameters include:

- Calibration Factor, C
- Proportion of Total Crashes for Unlighted Intersections that Occur at Night, Pni
- Daily Pedestrian Volumes (pedestrians/day), PedVol
- Pedestrian Crash Adjustment Factor, fpedi
- Bicycle Crash Adjustment Factor, f<sub>bikei</sub>
- Proportion of Multiple-Vehicle Crashes Represented by Right-Angle Collisions, Pramv
- Proportion of Multiple-Vehicle Crashes Represented by Rear-End Collisions, Premv
- Proportion of Fatal-and-Injury Crashes for Combined Sites, fbisv
- Crash distribution proportions for Fatal-and-Injury and Property-Damage-Only crashes:
  - Single-Vehicle Crashes
    - Collision with Parked Vehicle
    - Collision with Animal
    - Collision with Fixed Object
    - Collision with Other Object
    - Other Single-Vehicle Collision
    - Noncollision
    - Multiple-Vehicle Crashes
      - Rear-End Collision
      - Head-On Collision
      - Angle Collision
      - Sideswipe
      - Other Multiple-Vehicle Collision

Speed Change Lanes Intersection Common Parameters include:

- Calibration Factor for Fatal-and-Injury Crashes, Cfi
- Calibration Factor for Property-Damage-Only Crashes, C<sub>pdo</sub>

Ramp Terminal Intersection Common Parameters include:

- Calibration Factor for Stop Control Fatal-and-Injury Crashes, CST,fi
- Calibration Factor for Stop Control Property-Damage-Only Crashes, C<sub>ST,pdo</sub>
- Calibration Factor for Signal Control Fatal-and-Injury Crashes, C<sub>SG,fi</sub>

• Calibration Factor for Signal Control Property-Damage-Only Crashes, C<sub>SG,pdo</sub> The Economic Analysis Common Parameters include Societal Crash Costs by Crash Severity:

- Fatal/Injury, \$
- Property Damage Only, \$

Below is an example of the General page:

		Project Properties	
Analyst Agency		Jurisdiction Analysis Year	2019
Date	7/30/2019	Project Description	
Empirical Bayes Analysis		Number of Years of Observed Crashes	1
Facility Type	Urban	- Section Type	IMerdaction
Area Type	Urban		
🛞 Economic Analysis Common Paramete	15		
Societal Crash Costs by Crash Se	verity		
Fatal/Injury, S	158200		
Property Damage Only, S	7400		

On the Details page, four sections are provided: Intersection, Input, Parameters, and Output. Depending on the Facility Type selected, there could also be an additional Observed Crashes section if Empirical Bayes Analysis is selected on the General page. The Intersection section states the Facility Type selected on the General page and provides a drop down menu for selecting the Model Type based on the Facility Type selected. Inputs available are based on the Facility Type and Model Type selected. Additional input sections may also appear depending on the Facility Type and/or Model Type selected. Parameters shown are also dependent on the Facility Type selected on the General page. Outputs include the Safety Performance Functions (SPFs), the various Crash Modification Factors (CMFs), and the Predicted Crash Frequencies.

Below is an example of the Details page for an Urban Facility Type and a Four Approach Stop (4ST) Model Type, with Empirical Bayes Analysis checked on the General page:

		Intersection		
Facility Type	Urban	Model Type	Four Approach Stop (4ST)	-
		Input		
AADT (maj), veh/day	1000	AADT (min), veh/day	1000	
Approaches with Left-Turn Lanes	٥	Approaches with Right-Turn Lanes	0	
Lighting				
		Parameters		
0				
		Observed Crashes		
Multiple Vehicle	0	Single Vehicle	0	
		Output		
Safety Performance Function (SPF)	0.330	Predicted Crash Frequency (Npredicted)	0.347	
CMF1 (Left-Turn Lanes)	1.000	CMF2 (Left-Turn Phases)	4.000	
CMF3 (Right-Turn Lanes)	1.000	CMF4 (Right-Turn on Red)	1.000	
CMF5 (Lighting)	1.000	CME6 (Red Light Running Cameras)	1.000	

### **Rural Facility Analysis**

Once Rural Facility is selected as the Analysis Type, the user will be brought to the General page, which includes sections for Project Properties, Facility Data, and Parameters. The Project Properties section includes general information about the project, which include: Analyst, Agency, Date, Jurisdiction, Analysis Year, Project Description, Empirical Bayes Analysis, and Number of Years of Observed Crashes. An Empirical Bayes (EB) Analysis checkbox is provided for the user to indicate whether or not to use the EB analysis, which is a method used to combine observed crash frequency data for a given site with predicted crash frequency data from many similar sites to estimate its expected crash frequency. Checking this will also enable the Number of Years of Observed Crashes input on the General page and the Observed Crashes input on the Details page.

The Facility Data section includes a table that specifies details for individual sections within a rural facility. When a new Rural Facility analysis is created, the table will have one row of section data already added to the table. The user can choose to keep this section or delete it by selecting the row and clicking the button 'Delete Section'. If there are multiple rows of data the user wishes to delete, consecutive rows can be selected at a time and then deleted together using the same button. To add a section, two buttons are provided: 'Add Section' and 'Insert Section'. 'Add Section' will add a new row of section data at the end of the table. 'Insert Section' will add a new row

of section data before the selected row. Before adding or inserting a section, the user can specify the Facility Type and Section Type of the new section being added. The New Section Facility Types include: Rural Two-Lane and Rural Multilane. The New Section Types include: Segment and Intersection. The row of data added to the table includes: Section Type; Facility Type; Name; Model Type; AADT, veh/day; Details; N(spf); and N(predicted). Observed Crashes and N(expected) are also included in the table if Empirical Bayes Analysis is checked. Clicking on Details will bring the user to the corresponding Details page. N(spf), N(predicted), Observed Crashes, and N(expected) are determined by the inputs found on the Details page. Under the table, the total number of predicted crashes, which is the summation of N(predicted) for all sections, is specified.

The Parameters section gives the option of using Project-Level Parameters or Section-Level Parameters. A checkbox is provided to indicate this. If Project-Level Parameters is checked, the Parameters section on the General page will include Segment Common Parameters and Intersection Common Parameters for Rural Two-Lane and Rural Multilane facilities, along with corresponding crash distribution proportions; and Economic Analysis Common Parameters will display on the General page. Corresponding section-level parameters will display on the Details page of each of the sections.

Rural Two-Lane Segment Common Parameters include:

- Calibration Factor, C
- Proportion of Related Crashes, Pra
- Proportion of Nighttime Crashes that Involve a Fatality or Injury, Pinr
- Proportion of Nighttime Crashes that Involve Property Damage, Ppnr
- Proportion of Crashes that Occur at Night, Pnr
- Crash distribution proportions for Total, Fatal-and-Injury, and Property-Damage-Only crashes:
  - Single-Vehicle Crashes
    - Collision with Animal
    - Collision with Bicycle
    - Collision with Pedestrian
    - Overturned
    - Ran Off Road
    - Other Single-Vehicle Collision
    - Multiple-Vehicle Crashes
      - Angle Collision
      - Head-On Collision
      - Rear-End Collision
      - Sideswipe Collision
      - Other Multiple-Vehicle Collision

Rural Multilane Segment Common Parameters include:

• Calibration Factor, C

0

- Proportion of Related Crashes, Pra
- Proportion of Nighttime Crashes for Unlighted Segment that Involve a Fatality or Injury, Pinr
- Proportion of Nighttime Crashes for Unlighted Segment that Involve Property Damage, Ppnr
- Proportion of Crashes for Unlighted Segment that Occur at Night, Pnr
- Crash distribution proportions for Total, Fatal-and-Injury, Fatal-and-Injury KAB, and Property-Damage-Only crashes:
  - o Head-On Collision
  - o Sideswipe Collision
  - Rear-End Collision
  - o Angle Collision
  - Single-Vehicle Crashes
  - Other Multiple-Vehicle Crashes

Rural Two-Lane Intersection Common Parameters include:

• Calibration Factor, C

- Proportion of Total Crashes for Unlighted Intersections that Occur at Night, Pni
- Proportion of Fatal
- Proportion of Incapacitating Injury
- Proportion of Nonincapacitating Injury
- Proportion of Possible Injury
  - Crash distribution proportions for Total, Fatal-and-Injury, and Property-Damage-Only crashes:
    - Single-Vehicle Crashes
      - Collision with Animal
      - Collision with Bicycle
      - Collision with Pedestrian
      - Overturned
      - Ran Off Road
      - Other Single-Vehicle Collision
    - Multiple-Vehicle Crashes
      - Angle Collision
      - Head-On Collision
      - Rear-End Collision
      - Sideswipe Collision
      - Other Multiple-Vehicle Collision

Rural Multilane Intersection Common Parameters include:

- Calibration Factor, C
- Proportion of Total Crashes for Unlighted Intersections that Occur at Night, Pni
- Crash distribution proportions for Total, Fatal-and-Injury, Fatal-and-Injury KAB, and Property-Damage-Only crashes:
  - o Head-On Collision
  - o Sideswipe Collision
  - o Rear-End Collision
  - Angle Collision
  - o Single-Vehicle Crashes
  - Other Multiple-Vehicle Crashes

The Economic Analysis Common Parameters include Societal Crash Costs by Crash Severity:

- Fatal/Injury, \$
- Property Damage Only, \$

#### Below is an example of the General page:

									Project Pro	oportion.				
nalyst									_	Jurisdiction				
gency			1							Analysis Year			2019	1
Date			7/29/2019							Project Desci	iption			
Empirical Bayes	Anabaria		2								ears of Observed	Cenebor	1	
cripinear bayes	, Minarysis		1 M								cars of observed	Ciasiles	- 12	
-	_		-						Facility					
Add Secto	ari k	ment Section	New Se	ction Facility Type	Rural Multil	ine - 1	New Section Ty	pe Intersectio	n v	Delete S	rction			
Section Type Segment	Facility Type Rural Two-Lane	Name	Model Typ	e Individed Segment (2	AADT, weh	day Lén 1.00		etais C etais 0	bserved Crashe	N(sp0 0.267	N(predicted) 0.267	N(expected) 0.251		
Intersection	Rucal Two-Lane			ach Stop (4ST)				Itails: Q		0.817	0.817	0.683		
s Segment	Rural Multilane		Divided		1000	1.00	100	etails 0		0,169	0,769	0,163	_	
intersection	Rural Multilane		Four Appro	ach Signal (45G)	1	_	(De	naris 0		1.143	1,143	0.868		
														The total number of predicted crashes is : 2.596-
									Paran	reters.				
	rmon Parameters vo-Làne		Ø											
Rural Tw     Rural M     Calibra	amon Parameters vo-Lane luitilane ation Factor, C		I		Undivided	1.00								
Segment Com Rural Tw Rural M Calibra Propor	amon Parameters vo-Lane- lutiliane ation Factor, C rtion of Related Cr				1.00 0.270	1.00								
Segment Com Rural Tw Rural M Calibra Propor	amon Parameters vo-Lane luitilane ation Factor, C			Perr	1.00	1.00								
Segment Com Rural Tw Rural M Calibra Propor Propor	amon Parameters vo-Lane- lutiliane ation Factor, C rtion of Related Cr	Crashes that	t Involve a FL T		1.00 0.270	1.00								
Segment Com Rural Tw Rural Tw Calibra Propor Propor Propor	nmon Parameters vo-Lane ultiliane ation Factor, C rtion of Related Cr rtion of Nighttime ction of Nighttime	Crashes that Crashes that	t Involve a FI. T		1.00 0.270 0.361 0.639	1.00 0.500 0.323								
<ul> <li>Segment Com</li> <li>Rural Tw</li> <li>Rural M</li> <li>Calibra</li> <li>Propor</li> <li>Propor</li> </ul>	amon Parameters vo-Lane- lutiliane ation Factor, C rtion of Related Cr rtion of Nighttime ction of Nighttime ction of Crashes fo	Crashes that Crashes that or Unlighted S	t Involve a FI. T	Ppnr	1.00 0.270 0.361 0.639 0.255	1.00 0.500 0.323 0.677		Dwided						
Segment Com Rural Tw Rural M Calibra Propor Ptopor Propor	nmon Parameters vo-Lane ultiliane ation Factor, C rtion of Related Cr rtion of Nighttime ction of Nighttime	Crashes that Crashes that or Unlighted S	t Involve a FI. T	Ppnr Occur at Night. Pn Undivide	1.00 0.270 0.361 0.639 0.255	1.00 0.500 0.323 0.677			KAB P	DO				
Segment Com Rural Tw Rural M Calibra Propor Ptopor Propor	amon Parameters vo-Lane- lutiliane ation Factor, C rtion of Related Cr rtion of Nighttime ction of Nighttime ction of Crashes fo	Crashes that Crashes that or Unlighted S pe	t Involve a FL I t Involve PDO. Segment that i	Ppnr Occur at Night. Pn Undivide	1.00 0.270 0.361 0.639 0.255 d	1.00 0.500 0.323 0.677 0.426	Total							
Segment Com Rural Tw Rural Tw Calibra Propor Propor Propor	amon Parameters vo-Lan- ultiliane ation Factor, C rtion of Related Cr rtion of Nighttime ction of Nighttime ttion of Crashes fo Collision Tyy	Crashes that Crashes that or Unlighted 3 pe ision	t involve a Fl. I t involve PDO. Segment that Total	Ppnr Occur at Night. Pn Undivide FI F	1.00 0.270 0.361 0.639 0.255 d I- KAB 143 0.0	1.00 0.500 0.323 0.677 0.426	Total 0.006 0.	FI FI-	8 0.00	2				
<ul> <li>Segment Com</li> <li>Rural Tw</li> <li>Rural M</li> <li>Calibra</li> <li>Propor</li> <li>Propor</li> </ul>	amon Parameters vo-Lane- utiliane ation Factor, C rtion of Related Cr rtion of Nighttime ction of Nighttime ttion of Crashes fo Collision Tyy Head-On Colli	e Crashes that I Crashes that or Unlighted S pe Ision	I Involve a Fl. 1 I Involve PDO. Segment that I Total 0.009	Ppnr Occur at Night. Pn Undivide Fi F 0.029 0.1	1.00 0.270 0.361 0.639 0.255 d l- KAB 443 0.0	1.00 0.500 0.323 0.677 0.426 2DO 01 20	Total 0.006 0. 0.043 0.	FI FI-	8 0.00	2				

On the Details page, three sections are provided: Section Data, Input, and Output. If Project-Level Parameters is not checked on the General page, a fourth section (Parameters) will appear on the Details page after the Input section. Section Data allows the user to select which section details to display. It also specifies the Facility Type, Section Type, and Model Type of the section. Inputs available are based on the Facility Type, Section Type, and Model Type selected on the General page. Section-level parameters display in the Parameters section according to the Facility, Section, and Model Type of the section displayed. Outputs include the Safety Performance Function (SPF), the various Crash Modification Factors (CMFs), and the Predicted Crash Frequency (N<sub>predicted</sub>).

Below is an example of the Details page for a Rural Multilane Facility Type, Segment Section Type, and Divided Model Type combination, with Empirical Bayes Analysis checked and Project-Level Parameters not checked on the General page:

			150	etten Data		
Section	3>			Facility Type	Rural Multilane	
Section Type	Segment			Madel Type	Drvided	
				Unnull		
AADI, veh/day	1000			Length, mi	1.000	
Lane Width ft	12.0			Paved Right Shoulder Width. ft.	8	
Median Barriers	V			Median Width, ft	30.	
Lighting				Automated Speed Enforcement		
Observed Crashee	:0:					
			R	arameters		
0						
Calibration Factor, C		1.00				
Proportion of Related Crashes. Pra		0.500				
Proportion of Nighttime Crashes that In	volve a Fatality or Injury, Pinr	0.323				
Proportion of Nighttime Crashes that In	volve Property Damage, Ppnr	0.677				
Proportion of Crashes that Occur at Nig	ht. Pnr	0.426				
				Output		
Safety Performance Function (SPF)	0.169			Predicted Crash Frequency (Npredicted)	0.169	
CMF1 (Lane Width)	1.000			CMF2 (Shoulders)	1.000	
CMF3 (Median Width)	1.000			CMF4 (Lighting)	1.000	
CMF5 (Automated Speed Enforcement)	1.000					

### **Urban Facility Analysis**

Once Urban Facility is selected as the Analysis Type, the user will be brought to the General page, which includes sections for Project Properties, Facility Data, and Parameters. The Project Properties section includes general information about the project, which include: Analyst, Agency, Date, Jurisdiction, Analysis Year, Project Description,

Empirical Bayes Analysis, and Number of Years of Observed Crashes. An Empirical Bayes (EB) Analysis checkbox is provided for the user to indicate whether or not to use the EB analysis, which is a method used to combine observed crash frequency data for a given site with predicted crash frequency data from many similar sites to estimate its expected crash frequency. Checking this will also enable the Number of Years of Observed Crashes input on the General page and the Observed Crashes input on the Details page.

The Facility Data section includes a table that specifies details for individual sections within an urban facility. When a new Urban Facility analysis is created, the table will have one row of section data already added to the table. The user can choose to keep this section or delete it by selecting the row and clicking the button 'Delete Section'. If there are multiple rows of data the user wishes to delete, consecutive rows can be selected at a time and then deleted together using the same button. To add a section, two buttons are provided: 'Add Section' and 'Insert Section'. 'Add Section' will add a new row of section data at the end of the table. 'Insert Section' will add a new row of section data before the selected row. Before adding or inserting a section, the user can specify the Section Type of the new section being added. The New Section Types include: Segment and Intersection. The row of data added to the table includes: Section Type; Facility Type; Name; Model Type; AADT, veh/day; Length; Details; N(spf); and N(predicted). Observed Crashes and N(expected) are also included in the table if Empirical Bayes Analysis is checked. Clicking on Details will bring the user to the corresponding Details page. N(spf), N(predicted), Observed Crashes, and N(expected) are determined by the inputs found on the Details page. Under the table, the total number of predicted crashes, which is the summation of N(predicted) for all sections, is specified.

The Parameters section gives the option of using Project-Level Parameters or Section-Level Parameters. A checkbox is provided to indicate this. If Project-Level Parameters is checked, the Parameters section on the General page will include Segment Common Parameters and Intersection Common Parameters for an Urban facility, along with corresponding crash distribution proportions; and Economic Analysis Common Parameters. If Project-Level Parameters is not checked, only Economic Analysis Common Parameters will display on the General page. Corresponding section-level parameters will display on the Details page of each of the sections.

Urban Segment Common Parameters include:

- Calibration Factor, C
- Proportion of Nighttime Crashes that Involve a Fatality or Injury, Pinr
- Proportion of Nighttime Crashes that Involve Property Damage, Ppnr
- Proportion of Crashes that Occur at Night, Pnr
- Pedestrian Crash Adjustment Factor, fpedr
  - Bicycle Crash Adjustment Factor, fbiker
- Crash distribution proportions for Fatal-and-Injury and Property-Damage-Only crashes:
  - Single-Vehicle Crashes
    - Collision with Animal
    - Collision with Fixed Object
    - Collision with Other Object
    - Other Single-Vehicle Collisions
  - Multiple-Vehicle Crashes
    - Rear-End Collisions
    - Head-On Collisions
    - Angle Collisions
    - Sideswipe, Same Direction
    - Sideswipe, Opposite Direction
    - Other Multiple-Vehicle Collision

Urban Intersection Common Parameters include:

- Calibration Factor, C
- Proportion of Total Crashes for Unlighted Intersections that Occur at Night, Pni
- Daily Pedestrian Volumes (pedestrians/day), PedVol
- Pedestrian Crash Adjustment Factor, fpedi
- Bicycle Crash Adjustment Factor, fbikei
- Proportion of Multiple-Vehicle Crashes Represented by Right-Angle Collisions, Pramv

- Proportion of Multiple-Vehicle Crashes Represented by Rear-End Collisions, Premv
- Proportion of Fatal-and-Injury Crashes for Combined Sites, fbisv
- Crash distribution proportions for Fatal-and-Injury and Property-Damage-Only crashes:
  - o Single-Vehicle Crashes
    - Collision with Parked Vehicle
    - Collision with Animal
    - Collision with Fixed Object
    - Collision with Other Object
    - Other Single-Vehicle Collision
    - Noncollision
  - o Multiple-Vehicle Crashes
    - Rear-End Collision
    - Head-On Collision
    - Angle Collision
    - Sideswipe
    - Other Multiple-Vehicle Collision

The Economic Analysis Common Parameters include Societal Crash Costs by Crash Severity:

- Fatal/Injury, \$
- Property Damage Only, \$

Below is an example of the General page:

								140	ed Propert	25.		
malyst									Junsdi	tion		
igency									Analys	s Year		2019
			7/29/2019				1.1.1					
late							Description					
mpincal Bayes	Analysis		V						Numb	er of Years of Observed (	Crashes	1
									Facility Man	a)		
Add Sectio		inant Section	New Section Type	Intersectio		Delete Se	where a					
			_			_						
Section Type	Facility Type	Name	Model Type		AADT, veh/day	Length	Details	Obser	ed Crashe N(spl		N(expected)	<u>6.0</u>
Segment	Urban	-	Two-Lane Undwided Seg		1000	1.000	Details	i a	0.228		0.208	
Intersection	Urban	-	Four Approach Stop (457 Three-Lane Segment Incl		1000	1.000	Details	0	0.330		0.190	
Segment Intersection	Urban	-	Four Approach Signal (45			1490	Details	0	0.204		0.210	-
Segment	Urban	-	Four-Lane Undivided Seg		1000	1.000	Denaily	0	0.100		0.169	-
Intersection	Urban	1	Three Approach Stop (75		-		Details	0	0.170		0.160	-
Segment	Urban	+	Four-Lane Divided Segmi		1000	1.000	Detailo	0	0.217		0.207	-
Intersection	Urban		Three Approach Signal (3	ISG)			Details	0	0.104	0.148	0.144	-
Segment	Urban	1	Five-Larie Segment Inclus	ding a cente	1000	1,000	Details	0	0.535	0.577	0.468	-
( Intersection	Urban		Roundabout (R)				Octails	0	0.712	0.709	0.320	
oject-Level Pa ) Segment Com () Urban	arameters mon Parameters		2						Parameters			
-				Speed	20	3T	4U	4D	ST:			
Calibra	tion Factor, C			<=30	1.00	1.00	1.00	1.00	1.00			
				>30	1.00	1.00	1.00	1.00	1.00			
and the second second	rtion of Nighttime	Crashes that	Involve a FL Pinn		0.424	0.429	0.517	0.364	0.432			
Propor												
	tion of Nighttime	Crashes that	Involve PDO, Ppnr		0.576	0.571	0.483	0.635	0.568			
Propor	ition of Nighttime tion of Crashes t				0.576	0.571	0.483	0.635	0.568			
Propor Propor	tion of Crashes th	sat Occur at N	light. Pnr	<=30	0.316							
Proper		sat Occur at N	light. Pnr	<=30 >30	0.316	0.304	0.365	0.410	0.274			
Propor Propor Pedest	rtion of Crashes th	nat Occur at N ment Factor, f	light. Phr		0.316 0.036 0.005	0.304	0.365	0.410	0.274			
Propor Propor Pedest	tion of Crashes th	nat Occur at N ment Factor, f	light. Phr	×30	0.316 0.036 0.005	0.304 0.041 0.013	0.365	0.410 0.067 0.019	0.274 0.030 0.023			

On the Details page, three sections are provided: Section Data, Input, and Output. If Project-Level Parameters is not checked on the General page, an extra section (Parameters) will appear on the Details page after the Input section. If Empirical Bayes Analysis is checked on the General page, an extra section (Observed Crashes) will appear on the Details page before the Output section. Section Data allows the user to select which section details to display. It also specifies the Facility Type, Section Type, and Model Type of the section. Inputs available are based on the Facility Type, Section Type, and Model Type selected on the General page. Section-level parameters display in the Parameters section according to the Facility, Section, and Model Type of the section displayed. Observed Crashes inputs are based on the Section Type selected. Outputs include the Safety Performance Functions (SPFs), the various Crash Modification Factors (CMFs), and the Predicted Crash Frequencies.

Below is an example of the Details page for an Urban Facility Type, Intersection Section Type, and Three Approach Stop (3ST) Model Type combination, with Empirical Bayes Analysis checked and Project-Level Parameters not checked on the General page:

			Se	ction Data		
Section	6>		4	Facility Type	Urban	
Section Type	Intersection			Model Type	Three Approach Stop (3ST)	
				linnu		
ADT (maj). veh/day	1000			AADT (min). veh/day	1000	
opproaches with Left-Turn Lanes	0			Approaches with Right-Turn Lanes	0	
ighting						
			0	namelers		
9						
Calibration Factor, C		1.00				
Proportion of Total Crashes that Occur at Night	L Poi	0.238.				
Pedestrian Crash Adjustment Factor, fpedi		0.036				
Bicycle Crash Adjustment Factor, fbikei		0.016				
Proportion of Fatal-and-Injury Crashes for Com	bined Sites. fbisv	0.31				
			Obse	rved Crashes		
Multiple Vehicle	٥			Single Vehicle	٥	
				Output		
Safety Performance Function (SPF)	0.170			Predicted Crash Frequency (Npredicted)	0.179	
CMF1 (Left-Turn Lanes)	1.000			CMF2 (Left-Turn Phases)	1.000	
CMF3 (Right-Turn Lanes)	1.000			CMF4 (Right-Turn on Red)	1.000	
CMFS (Lighting)	1.000			CMF6 (Red Light Running Cameras)	1.000	

### **Freeway and Ramp Facility Analysis**

Once Freeway and Ramp Facility is selected as the Analysis Type, the user will be brought to the General page, which includes sections for Project Properties, Facility Data, and Parameters. The Project Properties section includes general information about the project, which include: Analyst, Agency, Date, Jurisdiction, Analysis Year, Project Description, Area Type, Empirical Bayes Analysis, and Number of Years of Observed Crashes. An Empirical Bayes (EB) Analysis checkbox is provided for the user to indicate whether or not to use the EB analysis, which is a method used to combine observed crash frequency data for a given site with predicted crash frequency data from many similar sites to estimate its expected crash frequency. Checking this will also enable the Number of Years of Observed Crashes input on the General page and the Observed Crashes input on the Details page.

The Facility Data section includes a table that specifies details for individual sections within a freeway facility. When a new Freeway and Ramp Facility analysis is created, the table will have one row of section data already added to the table. The user can choose to keep this section or delete it by selecting the row and clicking the button 'Delete Section'. If there are multiple rows of data the user wishes to delete, consecutive rows can be selected at a time and then deleted together using the same button. To add a section, two buttons are provided: 'Add Section' and 'Insert Section'. 'Add Section' will add a new row of section data at the end of the table. 'Insert Section' will add a new row of section Type of the new section being added. The New Section Types include: Segment and Intersection. The row of data added to the table includes: Section Type; Facility Type; Name; Model Type; AADT, veh/day; Length; Details; N(spf); and N(predicted). Observed Crashes and N(expected) are also included in the table if Empirical Bayes Analysis is checked. Clicking on Details will bring the user to the corresponding Details page. N(spf), N(predicted), Observed Crashes, which is the summation of N(predicted) for all sections, is specified.

The Parameters section gives the option of using Project-Level Parameters or Section-Level Parameters. A checkbox is provided to indicate this. If Project-Level Parameters is checked, the Parameters section on the General page will include Segment Common Parameters and Intersection Common Parameters for Freeway Segment and Ramp Segment, and Speed Change Lanes and Ramp Terminal, respectively; and Economic Analysis Common Parameters. If Project-Level Parameters is not checked, only Economic Analysis Common Parameters will display on the General page. Corresponding section-level parameters will display on the Details page of each of the sections.

Freeway Segment Common Parameters include:

- Calibration Factor for Multiple-Vehicle Fatal-and-Injury Crashes, Cmv,fi
- Calibration Factor for Multiple-Vehicle Property-Damage-Only Crashes, Cmv,pdo
- Calibration Factor for Single-Vehicle Fatal-and-Injury Crashes, Csv,fi
- Calibration Factor for Single-Vehicle Property-Damage-Only Crashes, C<sub>sv,pdo</sub>

Ramp Segment Common Parameters include:

- Calibration Factor for Multiple-Vehicle Fatal-and-Injury Crashes, Cmv,fi
- Calibration Factor for Multiple-Vehicle Property-Damage-Only Crashes, Cmv,pdo
- Calibration Factor for Single-Vehicle Fatal-and-Injury Crashes, Csv,fi
- Calibration Factor for Single-Vehicle Property-Damage-Only Crashes, Csv,pdo

Speed Change Lanes Intersection Common Parameters include:

- Calibration Factor for Fatal-and-Injury Crashes, Cfi
- Calibration Factor for Property-Damage-Only Crashes, Cpdo

Ramp Terminal Intersection Common Parameters include:

- Calibration Factor for Stop Control Fatal-and-Injury Crashes, CST,fi
- Calibration Factor for Stop Control Property-Damage-Only Crashes, CST,pdo
- Calibration Factor for Signal Control Fatal-and-Injury-Crashes, CsG,fi
- Calibration Factor for Signal Control Property-Damage-Only Crashes, CSG,pdo

The Economic Analysis Common Parameters include Societal Crash Costs by Crash Severity:

- Fatal/Injury, \$
- Property Damage Only, \$

#### Below is an example of the General page:

				Project Pr	operties				
Analyst					Jurisdiction				
Agency					Analysis Year		2021		
Date		12/3/2	2021		Project Descriptio	n			
Empirical Bayes Ana	alucie					of Observed Crashes	t		
	alysis			*	Truthber of reals	or Coserved Crashes			
Area Type		Rural			(Dates				
					y Data				
Add Section	Insert	Section	amp  Vew Section Type Ramp Ter	rminal 🤟	Delete Section				
Section Type	Facility Type	Name	Model Type	AADT, veh/day	Length, mi	Details	N(spf)	N(predicted)	
1 Freeway Segment	Freeway		Freeway Segment	1000	1.000	Details	-	0.292	
2 Speed Change Lanes 3 Ramp Segment	Ramp	-	Speed Change Lanes Ramp Segment	1000	1.000	Details	1	0.026	
4 Ramp Terminal	Ramp	-	Signal-Controlled	-	1,000	Details	-	0.765	
13	1	1		-			tal number of pr	edicted crashes is : 1.387	
				Paran	neters	110. 1	nul number of pr		
Project-Level Param	neters	1		al al al al	indicate.				
( Segment Common		-							
Freeway Segr									
-				1.00					
Calibration	Hactor for Multip	le-Vehicle Fatal-a	nd-Injury Crashes, Cmv,fi	1.00					
Calibration	Factor for Multip	le-Vehicle Propert	ty-Damage-Only Crashes, Cmv,pdo	1.00					
Calibration	Factor for Single-	Vehicle Fatal-and	I-Injury Crashes, Csv,fi	1.00					
Calibration	Factor for Single-	Vehicle Property	Damage-Only Crashes, Csv,pdo	1.00					
		reiner riebend	enninge only ensured endpose	1000					
Ramp Segme	ent								
Calibration	Factor for Multip	le-Vehicle Fatal-a	nd-Injury Crashes, Cmv,fi	1.00					
Calibration	Factor for Multip	le-Vehicle Propert	ty-Damage-Only Crashes, Cmv,pdo	1.00					
			l-Injury Crashes, Csv,fi	1.00					
Calibration	Factor for Single-	Vehicle Property-	Damage-Only Crashes, Csv,pdo	1.00					
0									
Intersection Comm     Speed Chang									
Calibration	Factor for Fatal-a	nd-Injury Crashes	s, Cfi	1.00					
Calibration	Factor for Proper	ty-Damage-Only	Crashes, Cpdo	1.00					
Ramp Termin	sal								
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1									
Calibration	Factor for Stop C	ontrol Fatal-and-	Injury Crashes, CST, fi	1.00					
Calibration	Factor for Stop C	ontrol Property-D	amage-Only Crashes, CST,pdo	1.00					
Calibration	Factor for Signal	Control Fatal-and	I-Injury Crashes, CSG,fi	1.00					
			Damage-Only Crashes, CSG,pdo	1.00					
Calibration	ractor for signal	Control Property-	Damage-Only Crashes, CSG,pdo	1.00					
Economic Analysis	Common Parameter	-							
in the state of th									
Societal Crash C	Costs by Crash Sev	enty							
Fatal/Injury, \$		158200							
		la contra c							
Property Damaç	ge Only, \$	7400							

On the Details page, three sections are provided: Section Data, Input, and Output. If Project-Level Parameters is not checked on the General page, an extra section (Parameters) will appear on the Details page after the Input section. If Empirical Bayes Analysis is checked on the General page, an extra section (Observed Crashes) will appear on the Details page before the Output section. Section Data allows the user to select which section details to display. It also specifies the Facility Type, Section Type, and Model Type of the section. Inputs available are based on the Facility Type, Section Type, and Model Type selected on the General page. Section-level parameters display in the Parameters section according to the Facility, Section, and Model Type of the section displayed. Observed Crashes inputs are based on the Section Type selected. Outputs include the Safety Performance Functions (SPFs), the various Crash Modification Factors (CMFs), and the Predicted Crash Frequencies.

Below is an example of the Details page for a Freeway Facility Type, Intersection Section Type, and Speed Change Lanes Model Type combination, with Empirical Bayes Analysis checked and Project-Level Parameters not checked on the General page:

2.2. ·		Section Data	A second s		
Section	4>	- Facility Type	Freeway		
Section Type	Speed Change Lanes	Model Type	Speed Change Lanes		
		Input			
VADT, veh/day	1000	AADT Volume of Ramp (AADTr), veh/day	1000		
ength of Ramp Entrance. mi	1.000	Ramp Type	Entrance -		
rimary Direction Lanes	3	Secondary Direction Lanes	3		
nclude Honzontal Curves		Is Left Side Ramp			
ane Width, ft	12.0	Median Width (Wm). ft	60		
nside Shoulder Width (Wis). ft	6	Distance from Inside Shoulder to Barrier (Wich), ft	10.00		
Proportion of Median Barrier Length (Pib)	0.000	Proportion of AADT during High Volume Hours (Phv)			
		Parameters			
) )					
Calibration Factor for Fatal-and-Injury Crashes, Cfi	(1.00				
Calibration Factor for Property-Damage-Only Crashes. Cpdb	1.00				
		Observed Crashes			
atal/injury	0	Property Damage Only	ρ.		
		Daiput			
N (SPF. fi)	0.007	N (SPF. pdo)	0.019		
MF Combined (fr)	1.032	CMF Combined (pdo)	1.026		
Predicted Crashes (fi)		Predicted Crashes (pdo)			

### Report

The report page shows a formatted version of the analysis in a dynamic form, reacting to changes in the General and Details pages. All or a portion can be copied to the Windows clipboard for insertion into other files by right-clicking into the report and selecting Copy.

Both formatted and text reports are available for viewing (through the Report tab or Print Preview) and printing. The formatted report provides data and results that are most important to the user, and are displayed in a clean and more presentable fashion. The text report provides more details to the user, rather than a summary. A drop down menu is provided for section selection for both formatted and text reports. Reports can be displayed based on the specific individual section selected or all sections can be displayed together.

## How To

#### **Create a New File**

1. From the Start screen, there are three options for creating a new file:



Note: A new file can be created if an existing file is already open; you do not need to start from the Start screen.

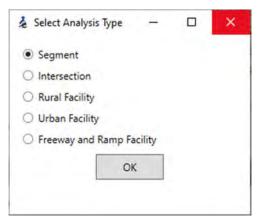
a. Selecting *File > New* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen, hovering over "New", and then selecting one of the analysis types.

New	Ctri+N +	Segment	
Open Example Folder	Ctrl+O	Intersection Rural Facility	
Save Save As	G101-5. 112	Urban Facility Freeway and Ramp Facility.	
Close	XIO+W		Help
Units			Topics
Print Print Preview	Chief.2		HCS Updates
View		HSS	HSS on the Web
Report		HSS	McTrans on the Web
Parameter Template Exputi to CSV			HSM/HSS Training E-mail McTrans
Default Settings	Alt+F		About HCS
Help			1.00.003.1.1.000
Exit	Alt+F4		
Help		E HEEDODD	
		MCS2022	
		UF Transportation Institute Mc7	rans

b. Selecting "New File..." from the Start screen; this can be found below in the red box. A Select New File Type dialog box will pop up after selecting "New File..." which allows you to choose the desired analysis type.



c. Using the keyboard shortcut "Ctrl+N", selecting one of the analysis types from the Select New File Type dialog box, and clicking "OK"



2. Once a new file is created, you will be brought to the General page of the selected analysis type.

			Proj	ect Properties					
Analyst				Jurisdiction					
Agency				Analysis Year	r		2021		
Date		11/30/2	2021	Project Desc	ription				
Empirical Bayes	Analysis			Number of Y	lears of Observed	Crashes	1		
				Facility Data					
Add Sectio	n Insert	Section Nev	v Section Facility Type Rural Two-Lar	ne ~ New Section	Type Segment		Delete Section		
Section Type 1 Segment	Facility Type Rural Two-Lane	Name	Model Type Two-Lane Undivided Segment (2U)	AADT, veh/day	Length, mi	Details Details	N(spf)	N(predicted)	
[ wegenere	1.000 000	-	Interest strained segment (re)	1			icted crashes is : 0.2		_
				Parameters	1114 (0101)	number of pred			
Project-Level Pa	irameters								
	irameters lysis Common Parameters								
Economic Anal									
<ul> <li>Economic Anal</li> <li>Societal Cras</li> </ul>	lysis Common Parameters sh Costs by Crash Sev	s erity							
Economic Anal	lysis Common Parameters sh Costs by Crash Sev								
<ul> <li>Economic Anal</li> <li>Societal Cras</li> <li>Fatal/Injury.</li> </ul>	lysis Common Parameters sh Costs by Crash Sev	s erity							
<ul> <li>Economic Anal</li> <li>Societal Cras</li> <li>Fatal/Injury.</li> </ul>	lysis Common Parameten sh Costs by Crash Sev S	s erity 158200							
<ul> <li>Economic Anal</li> <li>Societal Cras</li> <li>Fatal/Injury.</li> </ul>	lysis Common Parameten sh Costs by Crash Sev S	s erity 158200							
<ul> <li>Economic Anal</li> <li>Societal Cras</li> <li>Fatal/Injury.</li> </ul>	lysis Common Parameten sh Costs by Crash Sev S	s erity 158200							

### **Open an Existing File**

1. From the Start screen, there are six options for opening an existing file:

a Highway Safety Software	- 🗆 X
Start New File Open File Example Folder Recent	Help Topics HCS Updates HSS on the Web McTrans on the Web HSM/HSS Training E-mail McTrans About HCS
MCS2022	1
UF Transportation Institute McTrans	
Copyright © 2021 University of Florida. All Rights Reserved.	HSS™ Version 2022

Note: A file can be opened even if another file is currently open; you do not need to start from the Start screen.

a. Selecting *File > Open* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen and then selecting "Open"

New	Ctrl+N +	and the second sec	
Open	Ctrl+O	1 1 1	
example Folder			
iave ave As	Ctri+\$ F12		
llose	Cttl+W		Help
Inits			Topics
rint	Ctri+P		HCS Updates
Pont Preview	Chtl+F2		HSS on the Web
/iew		HSS	McTrans on the Web
leport Parameter Templat			HSM/HSS Training
anameter templat opport to CSV			E-mail McTrans
efault Settings	Alt+F		About HCS
telp	*		
brit	Alt+F4		
		A HCS2022	
		UF Transportation Institute McTrans	1 1

b. Selecting "Open File..." from the Start screen; this can be found below in the red box

🔏 Highway Safety Software		- o x
Start New File Open File Example Folder Recent	HSS	Help Topics HCS Updates HSS on the Web McTrans on the Web HSM/HSS Training E-mail McTrans About HCS
	A HCS2022	11
	UF Transportation Institute McTrans	181
Copyright © 2021 University of Florida. All Rights Reserved.		HSS™ Version 2022

c. Using the keyboard shortcut "Ctrl+O"

d. Selecting a file under the Recent files list from the Start screen; this can be found below in the red box

hway Safety Software	- 0
Start	Help
New File	
Open File	HCS Opdates
Example Folder	HSS HSS on the Web
Recent	McTrans on the Web
HSS10-1 RuralTwoLan	HSM/HSS Training
HSS11-1 RuralMultila	E-mail McTrans
HSS12-1 UrbanThreeL	About HCS
HSS18-1 TangentSixL	
HSS19-1 OneLaneUrb	1
	<b>CS</b> 2022
UT Transportation I	LORIDA MCTrans
ht @ 2021 University of Florida. All Rights Reserved.	HSS™ Version 2022

e. Selecting *File > Example Folder* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen and then selecting "Example Folder". Opening the example folder will open the path of the HSS example files in File Explorer. The desired example file can be double-clicked or right-clicked and selecting 'Open', which will open the example file in the Highway Safety Software program.



f. Selecting "Example Folder..." from the Start screen; this can be found below in the red box. Opening the example folder will open the path of the HSS example files in File Explorer. The desired example file can be double-clicked or right-clicked and selecting 'Open', which will open the example file in the Highway Safety Software program.

A Highway Safety Software		- 🗆 X
Start New File Open File Example Folder Recent	<b>H</b> SS	Help Topics HCS Updates HSS on the Web McTrans on the Web HSM/HSS Training E-mail McTrans About HCS
	A HCS2022	111
U	Transportation Institute MCTrans	181
Copyright © 2021 University of Florida. All Rights Reserved.		HSS™ Version 2022

2. Once an existing file is opened, you will be brought to the General page

				Project	Properties					
Analyst					Jurisdiction	n.				
Agency					Analysis Ye	ar		2017		
Date			12/20/2017		Project Des	scription		HSM Ch	apter 12: Sample Pr	roblem 5
impirical Bayes	Analysis		2		Number of	Years of Obse	rved Crashes	1		
				Pac	lity Data					
Add Sectio	n	Insert Section	New Section Type Segmen		Delete Section					
Section Type	Facility Type	Name	Model Type	AADT, veh/day	Length, mi	Details	Observed Crashe	N(spf)	N(predicted)	N(expected)
Segment	Urban	1	Three-Lane Segment Including a ce	n 11000	1.500	Details	13	4.274	4.104	8.958
Segment	Urban		Four-Lane Divided Segment (4D)	23000	0.750	Details	0	3.509	3.430	1.161
Intersection	Urban		Three Approach Stop (3ST)	-		Details	5	2.241	1.579	2.652
Intersection	Urban		Four Approach Signal (4SG)	7		Details	6	4.324	3.396	4.946
						The tot	tal number of predict	ted crashes	is: 12.510	
				Par	ameters					
Project-Level Pa	rameters		4							
Segment Com	mon Parameters									
Intersection Co	ommon Paramete	s								
Economic Ana	lysis Common Par	ameters								
Societal Cra	sh Costs by Cra	sh Severity								
Fatal/Injury,		1	158200							

- a ×

#### Save a File

- 1. There are five options for saving an open file:
  - a. Selecting *File* > *Save* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen and then selecting "Save"

	Ctrl+N +									
				Phaji	ert Properties					
Open Example Folder	CH+D				Jurisdiction					
	Chillis				Analysis Year	0		2021		
	Ft2	1	11/30/2	2021	Project Descr	ription		1		
Close	Ctrl+W				Number of Y	ears of Observed O	rashes	1		
Jnits					Facility Data					
	Ctrl+P Ctrl+F2	insert Sectio	n Nev	w Section Facility Type Rural Two-Lar		Type Segment ~	1	Delete Section		
View		Na	ame	Model Type	AADT, veh/day	Length, mi	Details	N(spf)	N(predicted)	
Report		ne		Two-Lane Undivided Segment (2U)	1000	1.000	Details	0.267	0.267	
	Alt+F				Parameters			dicted crashes is : 0.2		(
Help		meters.								
Exit	Alt+Fd	h Severity								
Fatal/Injury. S			158200							
Property Damage										
	Only, 5		7400							

b. Selecting *File > Save As...* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen and then selecting "Save As..."

Vew	Ctrl+N +	-									
Open	Chi+D			kraj	ect Properties						
ixample Folder	CU1+D				Jurisdiction						
ave	Ctriks				Analysis Year			2021			
ave As	Ft2	0	11/30/	2021	Project Descrip	otion		1			
llose	Ctrl+W	-			Number of Yea	ars of Observed Cra	ashes	1			
Jnits		-			Facility Data						
rint rint Preview	Ctrl+P Ctrl+F2	Insert Sectio	n Nei	w Section Facility Type Rural Two-Lar	ne ··· New Section T	ype Segment ~		Delete Section			
New		N	ame	Model Type	AADT, veh/day	Length, mi	Details	N(spf)	N(predicted)		
new											
Report		ne	_	Two-Lane Undivided Segment (2U)	1000	1.000	Details	0.267	0.267		
		1		1	Parameters			0.267 dicted crashes is : 0.2		_	
Report Parameter Template	•	1		1	1					_	-
Report Parameter Template Export to CSV	Alt+F	1		1	1					_	
Report Parameter Template Export to CSV Default Settings	AR+F	ne		1	1					_	
Report Parameter Template Export to CSV Default Settings Help	Alt+F Alt+F4	ne neters.	158200	1	1					_	

- c. Using the keyboard shortcut "Ctrl+S" for Save
- d. Using the keyboard shortcut "F12" for Save As

e. Exiting the program or closing the file without saving changes beforehand; this will prompt you to save changes to the file before anything is closed



- i. Selecting "Yes" will save the file if it is an existing file. If the file has not been previously saved, the Save As dialog box will pop up allowing you to change the file name and save it.
- ii. Selecting "No" will exit the program or close the file without saving the file
- iii. Selecting "Cancel" will prevent the file from closing

Note: Using Save with an existing file will save a file without prompting you to specify a file name. Using Save with a new file will bring up the Save As dialog box for you to specify a file name for saving. Using Save As will always bring up the Save As dialog box for you to specify a file name for saving.

#### Close a File

- 1. There are three options for closing an open file:
  - a. Selecting *File > Close* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen and then selecting "Close"

START GENER	RAL DETAIL	REPOR	π							
New	Ctrl+N +			- 00-	and the second second					-
Open Example Folder	Ctri+O			a Maj	ect Properties Jurisdiction			1		
Save Save As	Ctrl+S F12		11/30/2	2021	Analysis Year Project Desc			2021		
Close	Ctrl+W				Number of Y	ears of Observed Cr	rashes	TT .		
Units					Facility Data					
Print Print Preview	Ctri+P Ctri+F2	nsert Secti	on Nev	w Section Facility Type Rural Two-La		Type Segment +	1	Delete Section		
View			Vame	Model Type	AADT. veh/day	Length: mi	Details	Nispfi	N(predicted)	
Report		ne		Two-Lane Undivided Segment (2U)	1000	1.000	Details	0.267	0.267	
Parameter Template Export to CSV	·	-			Parameters	The total nu	mber of pre	dicted crashes is : 0.3	267	
Default Settings	All+F									
Help		meters								
Exal	A0+154	n Severity								
			158200							
Fatal/Injury, \$										

- b. Using the keyboard shortcut "Ctrl+W"
- c. Exiting the program itself; please see How To: Exit the Program

#### **Exit the Program**

1. From the Start screen, there are three options for exiting the program:



Note: The program can be exited even if a file is still open; you do not need to start from the Start screen.

a. Selecting *File > Exit* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen and then selecting "Exit"



b. Using the keyboard shortcut "Alt+F4"

c. Selecting "X" in the top right-hand corner of the screen; this can be found below in the red box



### **Edit the Default Settings**

1. From the Start screen, there are two options for editing the Default Settings:

Highway Safety Software	1 5 ×	- 🗆 X
Start New File Open File Example Folder Recent	HSS	Help Topics HCS Updates HSS on the Web McTrans on the Web HSM/HSS Training E-mail McTrans About HCS
	HCS2022 UF Transportation Institute UNIVERSITY of FLORIDA	100
Copyright © 2021 University of Florida. All Rights Reserved.	abanaad ayon if an aviating file is alrea	HSS™ Version 2022

Note: The Default Settings can be changed even if an existing file is already open; you do not need to start from the Start screen.

a. Selecting *File > Default Settings* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen and then selecting "Default Settings"

hway Safety Software			- 0
lew	COTHN *		
open xample Folder	Ctri+Q		
ave ave As	Ctri+S F12		
lose	Cmi+W		Help
Inits			
rint rint Preview	Ctri+P Chil+F2	2	Topics HCS Updates
liew .		HSS	HSS on the Web
eport.		HSS	McTrans on the Web
arameter Template xport to CSV	e ·		HSM/HSS Training E-mail McTrans
efault Settings	Alt+F		About HCS
lelp			
xit	Alt+F4		
		MCS2022	
			1 1
		UF Transportation Institute McTrans	
nht @ 2021 Linkwrsib	y of Florida. All Rights Reserved.		HSS ** Versik

- b. Using the keyboard shortcut "Alt+F4"
- 2. Opening the Default Settings will cause a Default Settings window to pop up:

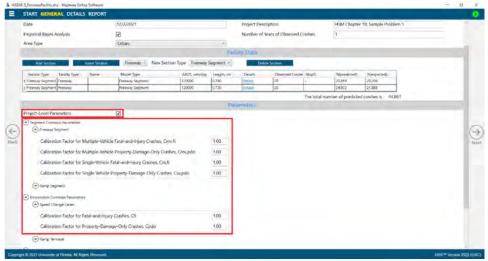
Lefault Settings	×
Analyst Agency Jurisdiction	
Default Template Units	
● USC ○ Metr	ric
ОК С	ancel

- 3. You can specify Analyst, Agency, and Jurisdiction by clicking in the corresponding text boxes and typing the desired text.
- 4. You are also given the option to specify a default parameters template. You can either click the 'Default Template' button which will allow you to browse through files in an Open dialog box and select an HSS Template File (\*.xhzt) or you can type out the path of the file in the provided text box. Selecting a file through the dialog box will automatically fill out the text box with the path of the file. For more information on the Default Template, please see *How To: Change Parameters*.
- 5. Under 'Units', you are given the option of running the analysis in either U.S. Customary (USC) or SI (Metric) units.
- 6. Clicking "OK" will save the changes made and close the Default Settings window; clicking "Cancel" will close the Default Settings window without saving any changes.
- 7. When a new file is created, the Analyst, Agency, and Jurisdiction fields will automatically be populated with the text specified in the Default Settings.

- 8. When a new file is created or an existing file is opened, the parameters from the default template selected will be applied to the analysis.
- 9. When starting a new file, the inputs and results will display according to the units specified in the Default Settings

#### **Change Parameters**

- 1. Parameters within HSS can be changed by editing individual fields or with the use of a Parameters Template.
- 2. Individual Fields
  - a. To edit individual fields, you can access parameters either on the General page with Project-Level Parameters or the Details page with Section-Level Parameters.
    - i. Project-Level Parameters
      - 1. On the General page, there is a 'Project-Level Parameters' checkbox. Checking this box will add the parameters to the General page where you can edit any of the enabled fields. *Note: Parameter fields are enabled/disabled depending on the analysis type.*



- 2. Corresponding parameters are applied to all the sections within the facility.
- 3. The Parameters section on the Details page is hidden when 'Project-Level Parameters' is checked.
- ii. Section-Level Parameters
  - 1. On the Details page, there is a Parameters section. This section is only available when 'Project-Level Parameters' on the General page is unchecked. If it is checked, then the Parameters section on the Details page will be hidden.

START GENERAL DETAILS REP	OKT				100		
		L Instant Imp	me .				
Analysi		64	i-Bilen				
Agency.		14	alysin Virar				
Date	12/2/2023		wint Description	HSM Charter 18: Sample Troblem 5			
Empirical Brens Analysis	Ø		inter of Wars of Observed Charlen	1			
Zena Type	Unberr						
		Facility E	letá				
Automat	Trepos	- New Section Type   Interney Segment -	Farmer Section				
Sector lipe Hallty /ge /Ren			alt Otherwell Leaster Mapri	Navelided Reported			
1 Heating Sourced Franking	woever/see			21227 22.23			
2 Anzhen Sogrant Freeze	Resource tog	nov USXE ano bo	20	74CR0 25.0/B			
1				ster of protocol confestion 44.081	(A)		
		/www.	67.				
Project Level Parameters (*) Itemper: Analysis Convice Taminotom	11 A 10	St.A formation theory - Highway Solving Solving Solving			1 Prints	-	
	-	START GENERAL DETAILS REPORT					
Secretal Clash Cress by Card Seve				Lane Champs Implit			1
Fid4/14/25	758200	Propertion of Length within a type & Weeking Section	(hvevbing 0000	Proportion of Length within a type & Weeking t	Section (hweld dec) U000		
Hoperty Damage Diris, S.	7400	Weaving Section Length (Levecine), m	0.100	Winning Section Langth (Lansider), mil	0.100		
THE BERTHERE		Distances from Sugment on Lowersan Perturner Rame C	Kurrel ett 0.500	Distance here Segnard in Upstrain Entered	Rene (Runer), mil 0,100		
		Distance from Segners to Contrage Feb once Kono D	New Deb	Distance from Segment to Lipstware withince I	Ramp Die erti m D. ND		
		AADI Volume of Estimate Ramp of Roard (AAD) band	1 million 8000	ANDI Volume of bill Kamp at Xizest SACilium	di vehitavi lisito		
		JADI Volume of Entrance Ramp at Xeeril (MDReeril)		AAD! Volume of Eals Ramp at Xoosi, (AADRoose			
		1		Page 10	a noticed and a second	-	
		8		and the second s			-
state & 2011 Industry of Paul Is All Dights Re-	and the second	Calification factor for Multiple White Hotal and Hy	wy Crafes. Lmc 5 tim				
	Œ	Californitor: Factor: Ion Multiple/Whicke Property-Da					11/
	- Co	Calification Factor for Single Vehicle Fatal and Inge	y Crastes: Cov/1 110				
		Lakinitor Nicht fo Single Vehicle Poperty Dani	ige Only Clashes Leviedo tilo				-11
				Observed Costine			-
		Atultizio Virtuzio facali triany		Multiple Which Property Damage Only	7		
		Single White Fabilitiery	1	Single Vehicle Property Develop Only	*		
				Ourpol.			-1
		NOPL IN D	1359	N SPT. mic publi	11/17		-
			2.117		5.115		
		N. (SPT; ac. 4)	1.154	N SPF, try pds) CMF Combined (mu ods)	1.20		
		CNF Combined (mc 5)					
		-CMP combined (av. 8)	0540	CMH Combined (sk, polo)	#27b		- 64
		Predicted Crafters (mir, 16)	4.612	Fredicial Coales (mc. pdu)	11.129		

2. The parameters available in the Parameters section is dependent on the Facility Type, Section Type, and Model Type of the current section displayed. *Note: You can switch between sections by selecting a different section using the Section drop down menu on the Details page.* 

#### 3. Parameters Template

- a. Default Template in Default Settings
  - i. To specify a default parameters template to use, a valid path must be provided in the Default Template textbox within the Default Settings. This can be done by either selecting the HSS Template File (\*.xhzt) or typing out the path of the file in the textbox.
    - 1. To select the template file, click the 'Default Template' button. An Open dialog box will pop up allowing you to browse through files and select a template. Once selected and opened, the Default Template textbox will automatically populate with the path of the selected file.

Analyst				
Agency				
Jurisdiction				
Default Template				
Units				
• US	C O	Metr	ic	

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Dropbox (Personal)	Template1.xhzt	12/3/2021 10:08 AM	XHZT File	
Dropbox (UFL)				
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This PC				
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	٢			
File nan	ne: Template1.xhzt	~ H	SS Template Files (	*.xhzt)
			Open	Cancel
Default Settings		×		
		×		
Analyst		×		
Analyst Agency		×		
Analyst Agency Jurisdiction	\HSS\Template1.xhzt	×		
Analyst Agency Jurisdiction Default Template	\HSS\Template1.xhzt	×		
Agency Jurisdiction Default Template Units		×		
Analyst Agency Jurisdiction Default Template Units	HSS\Template1.xhzt	×		

- 2. When typing out the path itself, the full path must be specified and it must be valid. An example of a parameters template file path would be *C:\Users\UserName\Desktop\FileName.xhzt*.
- ii. Once a default template file is specified in the Default Settings, the parameters within that template will apply to all new files or to any changes made in existing files (e.g., adding new sections).
- b. View/Edit Template
  - i. To view or edit the parameters template, select *File > Parameter Template > View/Edit Template* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen, hovering over "Parameter Template", and then selecting "View/Edit Template".

START GENE	RAL DETAILS	REPORT								
Vervy	OIHN .			Project P	roperties.					
Open Sample Folder	Onio				Jurisdiction					
Save	COME				Analysis Year		2021			
Save As.,	F#2	12/3/	1502		Project Description					
liesar	CultyW				Number of Years of	Observed Crashes	1			
Meta				Facili	ity Data					
Print Preview	CHIEF	esert Section No	ew Section Facility Type Rural Two-L	ane - New Section	Type Segment -	Delete Se	tion			
/ev			Model Type	AADT, veh/day	Length: mi		NGPO	N(predicted)		
Research		n#	Two-Lane Undivided Segment (20)	1000	1.000	A second s	0.267	0.267		
arameter Templat/	e •	View/Edit Temple				The tot	al number of	predicted crashes is :	0.267	-
oport to CSV		Export Template Import Template		Pare	meters.					-
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nega Set	All+F4									Nex
Det	101119	n Seventy								
Fatal/Injury.	\$	158200								
Property Da	mage Only, 5	7400								
	- We - We									

ii. When viewing or editing the parameters template, you are taken to the General page where all existing parameters for all facility types, model types, and section types become available to view and edit.

GENERAL DOTAL COMMENT			
-Level Parameters			
ment Common Rwameters ) Rural Two-Lane			
Calibration Factor, C			1.00
Proportion of Related Crashes, Pra			0.574
Proportion of Nighttime Crashes th	at Involve a Fat	ality or Injury	Pine 0.382
Proportion of Nighttime Crashes th	at Involve Prop	erty Damage	Ppre 0.618
Proportion of Crashes that Occur at	Night, Pnr		0.370
Proportion of Fatal			0.013
Proportion of Incapacitating Injury			0.054
Propertion of Nonincepacitating Ing			0.109
Proportion of Possible Injury			0,145
Collision Type	Total	Я	PDO
Single-Vehicle Crashes	14.794		
Collision with Animal	0,121	0.038	0.184
Collision with Bicycle	0.002	0,004	0.001
Collision with Pedestrian	0.003	0.007	0.001
Overturned	0.025	0.037	.0.015
Ran Off Road	0.521	0.545	0.505
Other Single-Vehicle Collision	0.021	0.007	0.029
Mathematical Additional Provider	_	_	_

- iii. Other pages become disabled and you can no longer navigate to other pages to make edits to inputs. Viewing or editing of the parameters template must be completed before editing other inputs.
- iv. To finish viewing or editing the parameters template, select *File > Parameter Template > To Normal Mode* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen, hovering over "Parameter Template", and then selectin "To Normal Mode". *Note: This option only becomes available when in the middle of viewing or editing the parameters template.*

	GENERAL													
New		CI/HN: +					Project Pr	opernes					_	
Open Example F		ono						Jurisdiction						
Sine		0145						Analysis Year		2021				
Save As.		F\$2	3	12/3/202	21			Project Descriptic	HT.					
Cleve		(Trile)W	1					Number of Years	of Observed Crashes	1				
Units							Facilit	Data						
Print Print Previ		ChikP	isert Section	New	Section Facility Type	Rural Two-La	ne - New Section	Type Segment	· Dete	te Section				-
View			Name		Model Type Two-Lane Undwided :	annen Oli	AADT, veh/day	Length; mi	Details	NGP0	N(predicted)	1		
Report					Internet Charge of	addision (cont	1000	1000	A STORE OF		edicted crashes is : 0	267		
Parameter Export to t			To Normal Export Terry				Paran	Notizes.	THE D	orea regimes of bu	eucleu classies is	207		
Delault Se		Alter	Import len				( and	inerero.						1
Help	and.													(
Eet		All+F4												1
	Calibration F	actor, C				1.00								
	Proportion o	Related C	ashes, Pra			0.574								
	Proportion o	f Nighttime	Crashes that In	volve à f	atality or Injury. Pinr	0.382								
	Proportion o	Nighttime	Crashes that in	volve Pri	operty Damage. Ppnr									
			at Occur at Nig			0.370								
	Proportion o	f Fatal				0.013								
	Proportion o	f Incapacita	ting Injury			0.054								
	Proportion o	f Nonincapa	acitating Injury			0.109								
	Proportion o	/ Possible In	jury			0.145								

- c. Export Template
  - i. Editing the parameters template is necessary before exporting if you want to export parameters other than the default HSM/HSS parameters.
  - ii. To export the parameters into a template, select *File > Parameter Template > Export Template* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen, hovering over "Parameter Template", and then selecting "Export Template".

AL DETAILS	REPORT									
			Project P	mperties.						
Dillo				Jurisdiction						
				Analysis Year		.2021				
	12/3/202	1		Project Description	00					
						-				
	U.				of Observed Crashes	1.				
			Facili	ty Data						
Coler2	cert Sertion New 5	Section Facility Type Rural Two-Lar	ne - New Section	Type Segment	Delete S	ection				
	Name	Model Type	AADT, vehilaki	Length, mi	Detans	Nispfi	Nipredicted)			
	•	Two-Lane Undivided Segment (20)	1000	1.000	Details	0.267	0.267	1		
		* spreach Stap (451)			Detainy	0.817	0.817	1		
		ne Unawded Segment (20)	1000	1.000	Details	0.267	0.267	1		
		oproach Signal (45G)	1		Details	1,456	1.486	]		-
Wite I	Import lemplate	ne Unpilsded Segment (2U)	1000	1.000	DATE:	0,267	0.257	1		e
	4	Three Approach Stop (3ST)	14		Detaily	0.361	0.367	1		
Alexand a	¢ 1 1	Two-Lane Undhilded Segment (2U)	1000	1.000	Details	0.267	0.257	1		the
	e	Roundaksiour (70)			Defails	0.848	0.848	]		
					The to	tal number of	predicted crashes is : 4	1.581		
			Pava	merers						
amelers										
rus Common Param	Adapts.									
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h Costs by Crash	Severity 158200									
	ColeN Prints	Col-N + Diffio Col-S F12 C	Clief V Clief V Clief V Clief V Clief V Clief V Clief V Clief V Clief V Clief V Vest Sector Facility Type (Rust Two-Lar Vest Sector Facility Type (Ru	Collection     C	Current     Progress Photperifies       Oni-5     Avriadiation       Current     Avriadiation       T2     Avriadiation       T2     Avriadiation       T2     Avriadiation       Current     New Section Facility Type       New Section Facility Type     Avriadiation       New Section Facility Type     New Section Facility Type       New Section Facility Type     Avriadiation       New Section Facility Type     New Section Facility Type       New Section Facility Type     New Section Facility Type       New Section Facility Type     New Section Facility Type       New Section Facili		Curlent     Progress Photoentices     Auridiction     Auridictind     Auridictind     Aur	Project Phyperties     Aridiction     Aridicti	Olifs       Project Symporties         Olifs       Autodiction         12/12/021       Project Sexploin         Number Olessploin       Number Olessploin         Numer Moot Nype       Number	Project P/Poporties     Aridiction     Aridiction     Aridy is Year     2021     Aridy is Year     2021     Project Description     Aridy is Year     2021     Project Description     Number of New Section Facility Type     Number of New Section Facility Type     New Sectin Fact Type     New Sectin Fa

iii. This will open a Save As dialog box allowing you to specify a name for saving the template file (\*.xhzt).

Save As								×
1	> This F	C > Desktop > HSS	v	U	P	Search HSS		
Organize • Nev	v folder						10 · (	2
<ul> <li>Quick access</li> <li>Dropbox (Perso</li> <li>Dropbox (UFL)</li> <li>OneDrive</li> <li>This PC</li> </ul>		Name	Date modi 12/3/2021		4	Type XHZT File	Size	-97
Network File name: Save as type:	HSS1.xh	zt plate Files (*.xhzt)						< <
<ul> <li>Hide Folders</li> </ul>						Save	Cancel	1

- iv. Once a file name is specified, click the Save button. *Note: The default template file name is the name of the HSS file with the template file extension (\*.xhzt) but can be overwritten.*
- v. The template file will be saved in the folder you specified when saving.

- ~ † <b>-</b> > Th	is PC > Desktop > HSS			~ O	_O Search HSS	
10.000	Name:	Date modified	Туре	Size		
A Quick access	HSS1.xhzt	12/3/2021 2:07 PM	XHZT File	97 KB		
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- d. Import Template
  - i. Importing a parameters template file requires access to an already saved template file (\*.xhzt).
  - ii. To import parameters from a template, select *File > Parameter Template > Import Template* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen, hovering over "Parameter Template", and then selecting "Import Template".

AL DETAILS	REPORT									
CM+N *	-		Province P	roperties						
CHIAD				Jurisdiction						
0.045						2021				
112	12/3/202	1		Project Description	on					
CMPW				Number of Wears	of Observed Crash	es. 1				
			Each	ty Date						
CM+P. CM+F2	art Section New 5	Section Facility Type Rural Two-La			- Del	ete Section				
	Name	Model Type	AADT, veh/day	Length mi	Ortalis	Nispô	N(predicted)			
	- 1	Two-Lane Undivided Segment (20)	1000	1.000	CHEARL	0.267	0.267			
	110 000 100	Ir * aproach Stop (4ST)		-	Details	0,817	0.817			
-			1000	1.000	Detailes		0.267			
			+		Octavia	1.455	1.486			1
All+F	Import Iomolate		1000	1,000	Details.	0.267	0.267			(-
10					Ortalite	0.361	0.361			2
Alting 2		Two-Lane Uncluded Segment (20)	1000	1.000	Details	0.267	0.267	-		74
	·	Roundabout (R)			Desirity	0.848	0.848			
					n n	ne total number of p	predicted crashes is :	4.581		
			Para	meters						
sis Common Param	enters.									
Costs by Crash	Severity									
	158200									
	Colletty Col	Context - Contex	Coli-Mi Coli-M	Clinite     Program       Program     Program	Control Programmer     Arredetion     Analysis liver     Ananalysis liver     Analysis liver     Analys	Control Programmer     Arrisdetion     Analysis War     Analysis War     Analysis War     Analysis War     Project Discription     Analysis War     Project Discription     Analysis War     Project Discription     New Section Facility Type     Warden of Wara of Discrete Count     New Section Facility Type     Warden of Wara of Discrete Count     New Section Facility Type     Warden of Wara of Discrete Count     New Section Facility Type     Warden of Wara of Discrete Count     New Section Facility Type     Warden of Wara of Discrete Count     New Section Facility Type     Warden of Wara of Discrete Count     New Section Facility Type     Warden of Wara of Discrete Count     New Section Type     Warden of Wara of Discrete Count     New Section Type     Warden of Wara of Discrete Count     New Section Type     Warden of Wara of Discrete Count     New Section Type     Warden of Wara of Discrete Count     Wara     Wara of	Collection     C	Project Properties     Avidence     Avi	Cliffer     Project Properties       Cliffer     Ansight War       Cliffer     Project Description       Very Cliffer     New Section Facility Type       Very Cliffer     Template       Project Description     New Section Facility Type       Very Cliffer     New Section Facility Type       Very Cliffer     Template       Project Description     New Section Facility Type       Very Cliffer     Template       Project Description     New Section Type       Particle     Project Description       Project Description     New Section Type       Particle     Project Description       Project Description     New Section Facility Type       Particle     Project Description       Project Description     New Section Facility Type       Project Description     New Section Type       Project Description     New Section Type       Project Description     New Section Type       Project Descriptio	Propriod? Proprietues  Ansight for  Ansight

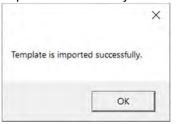
iii. This will open an Open dialog box allowing you to select a template file (\*.xhzt).

Name     Date modified     Type     Size       Unick access     HSS1.xhzt     12/3/2021 2:07 PM     XHZT File       Dropbox (Personal)     Template1.xhzt     12/3/2021 10:08 AM     XHZT File       Dropbox (UFL)       OneDrive       This PC       Network	Open				×
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the numer	Network		~   H	SS Template Files (* <i>x</i> hzt	) ~

iv. Once a file name is selected, click the Open button.

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File name:	Template1.xhzt	~) 	HSS Templa	te Files (*.xhzt	) ~
			Open	Ca	ncel

v. The template file will be imported and a message will pop up saying if the template was imported successfully.



vi. The 'Project-Level Parameters' checkbox on the General page should now be checked, if it was not already, and the parameters from the imported template file should be reflected in the project-level parameters.

# **Export to CSV**

1. To export data to a CSV file, select *File > Export to CSV* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen, and then selecting "Export to CSV".

Vew	Ctrl+N +			Projec	tt Properties						-
Open Example Folder	Ctrl+O	-			Jurisdiction					1	
lave	Ctrl+S				Analysis Year			2021			
ave As	F12		12/3/202	21	Project Descrip	tion				1	
Close	Ctrl+W				Number of Yea	rs of Observed Cra	shes	1			
Inits				F	cility Data						
Print Print Preview	Ctrl+P Ctrl+F2	Insert Secti	ion New	Section Facility Type Rural Multilane		ype Segment		Delete Section			
/iew		2	Name	Model Type	AADT, veh/day	Length, mi	Details	N(spf)	N(predicted)		
Report		ane		Two-Lane Undivided Segment (2U)	1000	1.000	Details	0.267	0.267	1.1	
		ane		Four Approach Stop (4ST)	<		Details	0.817	0.817	110	1
arameter Template		ane		Two-Lane Undivided Segment (2U)	1000	1.000	Details	0.267	0.267	1	( -
1		ane		Four Approach Signal (4SG)	5		Details	1.486	1.486		1
Default Settings	Alt+F	ane		Two-Lane Undivided Segment (2U)	1000	1.000	Details	0.267	0.267		
lelp		ane		Three Approach Stop (3ST)	-		Details	0.361	0.361		
xit	Alt+F4	ane		Two-Lane Undivided Segment (2U)	1000	1.000	Details	0.267	0.267	- 6	
8 mersection	Indian INO-	Lane		Roundabout (R)	1 5		Details	0.848	0.848	1	
9 Segment	Rural Mult	lane		Divided	1000	1.000	Details	0.169	0.169		
10 Intersection	Rural Mult	lane		Four Approach Stop (4ST)	-		Details	0.348	0.348		100
11 Segment	Rural Mult	lane		Divided	1000	1.000	Details	0.169	0.169		
12 Intersection	Rural Mult	0.3502		Four Approach Signal (4SG)			Details	1.143	1.143		
13 Segment	Rural Mult	lane		Undivided	1000	1.000	Details	0.217	0.217	- 1	
14 Intersection	Rural Mult			Three Approach Stop (3ST)	•		Details	0.076	0.076		
15 Segment	Rural Mult	Sardial .		Undivided	1000	1.000	Details	0.217	0.217		
16 Intersection	Rural Mult	lane		Roundabout (R)	-		Details	0.848	0.848		

2. When an analysis is exported to a CSV file, a Save As dialog box will pop up allowing you to specify a name for saving the HCS CSV file (\*.csv). Note: The default CSV file name is the name of the HSS file (\*.xhz) along with "-Results.csv" but can be overwritten.

A Save As						×
🗧 🐘 🛉 🔛 > This PC > Downloads > HSS			~ C	Search HSS		p
Organize - New folder						0
Name	Date modified	Туре	Size			
> 🐉 Dropbox (Personal)	No items r	match your search.				
> 👺 Dropbox (UFL)						
> 💼 OneDrive						
> 🛄 This PC						
> 📑 Network						
File name: RuralWithRbt-Results.csv						~
Save as type: HCS7 CSV file (*.csv)						Ý
				-	Cance	

3. Once a file name is specified, click the Save button.

🛱 Save As								×
← *↑	> This PC > Downlo	ads > HSS			~ O	Search HSS		p
Organize 👻 New	folder							0
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> 🐉 Dropbox (UFL) > 🌰 OneDrive								
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> 🍎 Network								
File name:	RuralWithRbt-Results.	csv						~
Save as type:	HCS7 CSV file (*.csv)							×
∧ Hide Folders						Save	Cance	s .

4. The CSV file of the analysis results will be saved in the folder you specified when saving.

🚽 👻 🛧 📃 > Thi	is PC > Downloads > HSS				v Ö	Search HSS	,o
🕈 Quick access	Name	Date modified	Туре	Size			
	RuralWithRbt-Results.csv	10/31/2019 10:05	Microsoft Excel C		2 KB		
Dropbox (Personal)							
Dropbox (UFL)							
OneDrive							
This PC	1						
Network							

5. If you open the exported CSV file, the default program for CSV files will open.

1	Con Copy Format	Fanter	Calbri B I U -			● 秒・ ■ Wrap Test   七七 ■ Merge & I		· Fr	Format as	Bad Deployotory	Good Imput	Newtrai	Calculation	•	inset Delet	· Kannes	∑ AutoSum	Sec. 20	East R.		
00	beard			Ford	a-	Alighment	G Number				9Ac				CEN			ithing			
	-		~ fe	(Providence)																	
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	-		¢	0		i	a	н		1	1.		L M	N	0	P	a	R.	- 61	Ť.	
ectie				IF Combined P		dicted Fatal Predicted (		redicted Nonincapaci													
	1	0.085		1	0.086	0.003	0.014		0.029	0.039	0.181	0.267									
	2	0.352	0.465	1	0.352	0.015	0.035		0.132	0.17	0.455	0.817									
		0.086	0.181	1	0.086	0.003	0.014		0.029	0.039	0.181	0.267									
	4	0.505	0.981	1	0.505	0.013	0.031		0.156	0.305	0.981	1.485									
	3	0.086	0.181	1	0.086	0.003	0.014		0.029	0.039	0.181	0.267									
	0	0.15	0.211	1	0.15				0.08		0.211										
	8	0.085	0.181	1	0.086	0.003	0.014		0.029	0.039	0.181	0.267									
	9	0.108	0.866 -		0.056 -						0.06	0.169									
	10	0.165		1	0.109 -	- 0			1		0.182	0.348									
	11	0.109		1	0.109 -						0.06	0.169									
	12	0.682	0.461		0.682 -		2				0.461	1.143									
	15	0.157	0.06		0.157 -	6					0.06	0.217									
	14	0.043	0.033	1	0.043 -	6					0.033	0.076									
	15	0.157	0.06	1	0.157 -						0.06	0.217									
		0.146			0.045 -						0.81	0.855									
	-																				

6. Results from the HSS file (\*.xhz) will be displayed in the CSV file. HSS currently only exports select outputs from each analysis type.

# **Run an Empirical Bayes Analysis**

- 1. Empirical Bayes Analysis, or EB Analysis, is a method used to combine observed crash frequency data for a given site with predicted crash frequency data from many similar sites to estimate its expected crash frequency.
- 2. To run an EB Analysis, the 'Empirical Bayes Analysis' checkbox on the General page must be checked.

				Project	Properties					
Analyst					Jurisdiction	1				
Agency					Analysis Ye	ar		2017		
Date			12/20/2017		Project Des	scription		HSM Ch	apter 12: Sample Pr	oblem 5
mpirical Bayes	Analysis				Number of	Years of Obse	rved Crashes	1		
				Fac	lity Data					
Add Sectio	n	Insert Section	New Section Type Segmen	t * 🚺	Delete Section					
Section Type	Facility Type	Name	Model Type	AADT, veh/day	Length, mi	Details	Observed Crashe	N(spf)	N(predicted)	N(expected)
Segment	Urban		Three-Lane Segment Including a cer	11000	1.500	Details	13	4.274	4.104	8.958
Segment	Urban	1	Four-Lane Divided Segment (4D)	23000	0.750	Details	0	3,509	3,430	1,161
Intersection	Urban		Three Approach Stop (3ST)	÷		Details	5	2.241	1.579	2.652
Intersection	Urban		Four Approach Signal (4SG)	2	2	Details	6	4.324	3.396	4.946
						The to	tal number of predict	ed crashes	is: 12.510	
				Par	ameters					
Project-Level Pa	rameters		V							
Segment Com	mon Parameters									
Intersection Co	ommon Parameter	s								
Economic Ana	lysis Common Para	ameters								
Societal Cra	sh Costs by Cras	sh Severity								
Fatal/Injury,		Ē	158200							

- 3. Running an EB analysis will enable new fields:
  - a. 'Observed Crashes' in the table on the General page for facility analyses; *Note: Depending on the analysis type of the dataset, these field may be readable only.*

START GEN	RAL DETAILS	REPORT									
				Project	Properties	2					×
Analyst					Jurisdiction	1. C					
Agency					Analysis Ye	ar		2017			
Date			12/20/2017		Project De	cription		HSM Cha	pter 12: Sample Pr	oblem 5	
Empirical Baye	Antherie		2			Years of Obser	and Cristing				
empincai baye	s Analysis		M	-		rears of Cabser	rved Chantes	10			
				Fad	ility Data						
Add Secti	on	Insert Section	New Section Type Segmen	u ~	Delete Section	h					
Section Type	Facility Type	Name	Model Type	AADT, veh/day	Length, mi	Details	Observed Crashe	N(spf)	N(predicted)	N(expected)	
1 Segment	Urban	1	Three-Lane Segment Including a cer	11000	1.500	Detais	13	274	4.104	8.958	
2 Segment	Urban	1	Four-Lane Divided Segment (4D)	23000	0.750	Details	0	509	3,430	1.161	
3 Intersection	Urban		Three Approach Stop (3ST)		1	Dietails	5	241	1.579	2.652	
4 Intersection	Urban	- C	Four Approach Signal (4SG)			Details	6	324	3.396	4.946	
						The tot	tal number of predict	ed crashes	is: 12.510	S	
				Har	émeters						
Project-Level P	arameters										
Segment Con	nmon Parameters										
	Common Parameter	5									
( Economic An	alysis Common Para	emeters									- 1
Societal Cra	ash Costs by Cras	h Severity									
			158200								

b. 'N(expected)' in the table on the General page for facility analyses; *Note: These fields are readable only.* 

START GEN	ERAL DETAILS	REPORT									
				Project	Properties						~
Analyst					Jurisdiction						
Agency					Analysis Yea	ar		2017			
Date			12/20/2017		Project Des			HSMCh	apter 12: Sample Pr	oblant 5	
			Laboration of the second secon						ipter te sample en	ubiciti 3	
Empirical Baye	s Analysis		2		Number of	Years of Obser	rved Crashes	1			
				Fad	ility Data						
Add Sect	on	Insert Section	New Section Type Segment	~	Delete Section						
Section Type	Facility Type	Name	Model Type	AADT, veh/day	Length, mi	Details	Observed Crashe	N(spf)	N(predicted)	N(expected)	
1 Segment	Urban	1	Three-Lane Segment Including a cen	11000	1.500	Details	13	4.274	4,104	8.958	
2 Segment	Urban		Four-Lane Divided Segment (4D)	23000	0.750	Details.	0	3.509	3.430	1.161	
3 Intersection	Urban		Three Approach Stop (8ST)		1	Details	5	2.241	1.579	2.652	
4 Intersection	Urban	-P	Four Approach Signal (4SG)	-		Details	6	4.324	3.396	4.946	
						The tot	tal number of predict	ed crashes	is: 12.510		
				Han	ameters						
Project-Level R	arameters										
Segment Co	mmon Parameters										
( Intersection Urban	Common Parameter	5									
	nalysis Common Para										
Societal Cr	rash Costs by Cras	sh Severity									

c. Observed Crashes on the Details page; *Note: Depending on the analysis type of the dataset, there may be an Observed Crashes section with multiple fields.* 

A HSSI	2-5_UrbanFacility.khg - Highway Safety Software				-	ø ×
=	START GENERAL DETAILS REPORT					- (j)
	Section Section Type	1> Segment	-	Section Data Facility Type Model Type	Urban Three-Lane Segment Including a center TWLTL (3T)	
				Input		
( Back	AADT, veh/day Number of Major Commercial Driveways Number of Major Industrial/Institutional Driveways Number of Major Residential Driveways Number of Other Driveways Curb Length of On-Street Parking for Both Sides of Road, mi Roadside Fixed Objects Fixed-Object Density, fored objects/mi	11000 0 2 2 0 200 2 10 200		Length, mi Number of Minor Commercial Driveways Number of Minor Industrial/Institutional Driveways Number of Minor Residential Driveways Parking Type Road Type Foad-Object Offset, ft Median Bartiers Median Width, ft	1.500 10. 3. 15. None Commercial or Industrial/Institutional 6. 21. 15.	() Not
	Automated Speed Enforcement			Posted Speed, mi/h	35	
			Ob	iserved Crashes		
	Multiple Vehicle Non Driveway Single Vehicle	7		Multiple Vehicle Driveway	2	
				Output		
	Safety Performance Function (SPF) CME1 (On-Street Parking) CME3 (Median Weith) CMES (Automated Speed Enforcement)	4.274 1.000 1.000 1.000		Predicted Crash Frequency (Npredicted) CMF2 (Roadside Fixed Objects) CMF4 (Lighting)	4,104 1,008 0,934	
Copyrig	pt © 2021 University of Florida. All Rights Reserved				HSS <sup>TM</sup> Verso	n 2022 (USC)

- 4. Running an EB analysis will add new sections and results to the reports:
  - a. 'Expected Roadway Section Crashes' in the formatted report

1	# Major Residential Driveways	2	# Minor Resid	dential Driveways	15	
	# Other Driveways	0	Calibration Fa		1.00	
	Crash Modification Fact	tors				
	On-Street Parking - CMF1	1.000	Lighting - CN	IF4	0.934	
	Roadside Fixed Objects - CMF2	1.008	Automated S	peed Enforcement - CMF5	1.000	
	Median Width - CMF3	1.000	Combined CM	ИF	0.942	
	Predicted Roadway Sec	tion Crashes				
	Crash Severity	Predicted Crash Free	quency	Crash Rate	(crashes/mi/year)	
	Fatal and Injury (FI)	1.080		0.720		
	Property Damage Only (PDO)	3.024		2.016		
	Total	4.104		2.736		
	Expected Roadway Sect	ion Crashes				
	Crash Severity	Expected Crash Free	quency	Expected Crash	Rate (crashes/mi/year)	
	Fatal and Injury (FI)	2.358		1.572		
	Property Damage Only (PDO)	6.600		4.400		
	Total	8.958		5.972		
	Economic Analysis (Exp	ected Crashes)				
	Crash Severity	Per Crash Societal Crash Cost	Expecte	ed Annual Crashes	Total Societal Crash Cost	
	Fatal and Injury (FI)	\$158,234.00	2.358	S	373,102.88	

b. 'Expected Crashes' in the text report

	START GENERAL DETAILS REPO	RT:							i
	Sideswipe, Same Direction Sideswipe, Opposite Direction Other Multiple-Vehicle Collision Total Multiple-Vehicle Crashes	0.001 0.017 0.034 1.000	0.001 0.012 0.024 0.698		0.078 0.020 0.020 1.000	0.172 0.044 0.044 2.206			
			Expecte	d Crashes -					
Dack	Total Observed Crashes Crashes(NV, N Total Observed Crashes Crashes(NV, N Total Observed Crashes Crashes(NV, Average Observed Crashes Crashes(NV, Average Observed Crashes Crashes(NV, Average Observed Crashes Crashes(NV, Overdispersion Parameter(NV, Non-Ori Overdispersion Parameter(NV, Non-Ori Veglispersion Parameter(NV, Non-Ori Veglispersion Parameter(NV, Non-Ori Veglispersion Parameter(SV), k Weighted Adjustment(NV, Driveway), w Weighted Adjustment(NV, Driveway) Expected Crashes(NV, Driveway) Expected Crashes(SV) Expected Crashes(FI) Expected Crashes (PDO) Total Expected Crashes	Driveway) , Non-Drive , Driveway) , Lveway), k Ay), k /), W	eway)	7 2 4 7.000 2.000 4.000 0.660 1.100 1.370 0.343 0.680 0.343 0.680 0.486 5.595 0.932 2.431 2.358 6.600 8.958			crashes crashes crashes/year crashes/year crashes/year crashes/year crashes/year crashes/year crashes/year crashes/year crashes/year		
		a a contra da contra							
	*Based on Expected Crash Frequency Annual Societal Crash Cost (FI) Annual Societal Crash Cost (FDO) Total Annual Societal Crash Cost		Economi	c Analysis \$373,102.8 \$49,210.21 \$422,313.0	18				
1	0			atted Report	Costi	on   1>	- *1	ſ	

5. Economic analysis will be based on Expected Crash Frequency instead of Predicted Crash Frequency when an EB analysis is run. Please see *How To: Run an Economic Analysis*.

# **Run an Economic Analysis**

- 1. The Federal Highway Administration (FHWA) has completed research that established a basis for quantifying, in monetary terms, the human capital crash costs to society of fatalities and injuries from highway crashes
- 2. State and local jurisdictions often have accepted societal crash costs by crash severity and collision type. When available, their locally-developed societal crash cost data are used with procedures in the HSM.
- 3. On the General page of an analysis, Economic Analysis Common Parameters are provided. This includes Societal Crash Costs by Crash Severity.

	AL DETAILS	REPORT										
			12/2/2021	1	Project Descr	iption		HSM Chapte	er 11: Sample Pr	oblem 4		126
cal Bayes A	nalysis				Number of Y	ears of Obser	ved Crashes	1				
				Faci	lity Data							
Add Section		nsert Section	New Section Facility Type	Rural Two-Lane	<ul> <li>New Section</li> </ul>	n Type Segr	ment 👻	Delete Section				
ion Type	Facility Type	Name	Model Type	AADT, veh/day	Length, mi	Details	Observed Crashe		N(predicted)	N(expected)	1	
		-			Autom	Details	4					
				8000	0.100		2		and the late of th	01999		
ection	Rural Multilane		Three Approach Stop (3ST)	-		Details	3	0.928	0.618	1.144	1	
						The tot	al number of predic	ted crashes is :	3.884			
ersection Com	nmon Parameters -Lane											
nomic Analys	sis Common Paran	meters										
cietal Crash	Costs by Crash	Severity										
tal/Injury, \$		1	58234									
-1.5.5	age Only, \$		58234 456									
t pi	on Type ent ent ection -Level Para ment Comm ) Rural Two- ) Rural Mult rsection Con ) Rural Two- ) Rural Mult rsection Con ) Rural Mult	on Type Facility Type ent Rural Multilane Rural Multilane Rural Multilane Rural Multilane -Level Parameters ment Common Parameters ) Rural Multilane section Common Parameters ) Rural Multilane ) Rural Multilane	on Type Facility Type Name ent Rural Multilane ent Rural Multilane extron Rural Multilane -Level Parameters Parameters Parameters Parametors Parameters Paral Multilane	on Type Facility Type Name Model Type ent Rural Multilane Divided ent Bural Multilane Undivided ctton Rural Multilane Three Approach Stop (3ST) -Level Parameters ment Common Parameters ) Rural Multilane srection Common Parameters ) Rural Multilane srection Common Parameters ) Rural Multilane somic Analysis Common Parameters.	Add Section         Insert Section         New Section Facility Type         Rural Two-Lane           on Type         Facility Type         Name         Model Type         AADT, veh/day           on Type         Rural Multilane         Undivided         8000         8000           ent         Rural Multilane         Undivided         8000         9           extent         Rural Multilane         Undivided         8000         9           extent         Rural Multilane         Three Approach Stop (35T)         -         -           -Level Parameters         Image: Section Common Parameters         Image: Section Common Parameters         Pare Section Common Parameters         Rural Multilane         Image: Section Common Parameters         Section Common Parameters<	on Type Facility Type Name Model Type AADT, veh/day Length, mi ant Rural Multilane Divided 10000 11500 ent Bural Multilane Undivided 8000 0.100 ection Rural Multilane Three Approach Stop (3ST) - Parameters -Level Parameters Para	Insert Section       New Section Facility Type       Rural Two-Lane       New Section Type       Seg         bin Type       Facility Type       Name       Model Type       AADT, veh/day       Length, mi       Details         bin Type       Facility Type       Name       Model Type       AADT, veh/day       Length, mi       Details         ent       Rural Multiane       Undivided       8000       0.100       Details         ent       Rural Multiane       Undivided       8000       0.100       Details         rection       Rural Multiane       Three Approach Stop (3ST)       -       Details       The tot         Parameters         -Level Parameters       Image: Section Common Parameters         Naral Multiliane       Section Common Parameters       Section Common Parameters	New Section     New Section Facility Type     Rural Two-Lane     New Section Type     Segment       an Type     Facility Type     Name     Model Type     AADT, veh/day     Length, mi     Details     4       an Type     Facility Type     Name     Model Type     AADT, veh/day     Length, mi     Details     4       ant     Rural Multiane     Undivided     8000     0.100     Details     2       ent     Rural Multiane     Undivided     8000     0.100     Details     3       ceton     Rural Multiane     Three Approach Stop (35T)     -     Details     3       The total number of predic	New Section     New Section Facility Type     Rural Two-Lane     New Section Type     Segment     Detete Section       on Type     Facility Type     Name     Model Type     AADT, veh/day     Length, mi     Details     4     2.835       ent     Rural Multilane     Undivided     8000     0.100     Details     2     0.250       extent     Rural Multilane     Undivided     8000     0.100     Details     3     0.928       Three Approach Stop (351)     -     Details     3     0.928   The total number of predicted crashes is :       Parameters   Aural Two-Lane       Naral Multilane     New Section Section     Section     Section     Section   Aural Two-Lane       Naral Multilane     New Section Parameters     Section Common Parameters     Section Common Parameters   Aural Multilane       New Section Parameters     Section Common Parameters     Section Common Parameters   Aural Multilane       New Section Parameters     Section Parameters	New Section     New Section Facility Type     Rural Two-Lane     New Section Type     Delete Section       on Type     Facility Type     Name     Model Type     AADT, veh/day     Length, mi     Details     4     2.83     3.008       on Type     Bural Multiane     Undivided     8000     0.100     Details     2     0.250     0.259       ent     Bural Multiane     Undivided     8000     0.100     Details     3     0.928     0.618       Three Approach Stop (351)     -     Details     3     0.928     0.618   The total number of predicted crashes is : 3.884 Parameters -Level Parameters Pa	New Section     New Section Facility Type     Rural Two-Lane     New Section Type     Segment     Delete Section       on Type     Facility Type     Name     Model Type     AADT, veh/day     Length, mi     Details     Observed Crashe     N(pr)     N(predicted)     N(expected)       on Type     Facility Type     Name     Model Type     AADT, veh/day     Length, mi     Details     4     2.835     3.008     3.304       ent     Rural Multiane     Undivided     8000     0.100     Details     2     0.250     0.259     0.826       extent     Mural Two-Lane     Three Approach Stop (3ST)     -     Details     3     0.928     0.618     1.144	New Section       New Section Facility Type       Rural Two-Lane       New Section Type       Dedete Section         on Type       Facility Type       Name       Model Type       AADT, veh/day       Length, mi       Details       Observed Grashe       Night       Night

- a. Default Values
  - i. Fatal/Injury: \$158,200
  - ii. Property Damage Only: \$7,400
- 4. An Economic Analysis in HSS is automatically run. However, you have the option of adjusting the cost of fatal and injury (FI) crashes and property damage only (PDO) crashes by editing the monetary value in the corresponding text boxes.
- 5. On both the formatted and text reports, an Economic Analysis section is provided.
  - a. Formatted Report

Shoulder Type/Width - Civir2	1.040	CMF	omated speed enforcement - 5	1.000	
Median Width - CMF3	1.020				
Combined CMF	1.061				
Predicted Roadway Se	ction Crashes				
Crash Severity	Overdispersion Parameter	Nspf.rs by Sever	rity Predicted Crash Frequency	Crash Rate (crashes/mi/year)	
Fatal and Injury (FI)	3	1.480	1.570	1.047	
Property Damage Only (PDO)	-	1.355	1.438	0.958	
Total	0.142 2.835		3.008	2.005	
Expected Roadway See	ction Crashes		1		
Crash Severity	Average Observed Crashes	Weight	Expected Crash Frequency	Crash Rate (crashes/mi/year)	
Fatal and Injury (FI)	-	-	1.725	1,150	
Property Damage Only (PDO)	-	+	1.579	1.053	
Total	4.000	0.701	3.304	2,203	A
Economic Analysis (Ex	pected Crashes)				
Crash Severity	Per Crash Societal C	rash Cost	Expected Annual Crashes	Total Societal Crash Cost	
Fatal and Injury (FI)	\$158,234.00	1.72	5	\$272,889.74	
Property Damage Only (PDO)	\$7,456.00	1.57	9	\$11,776.04	
Total	-	3.30	4	\$284.665.78	A

b. Text Report

	START GENERAL	DETAIL	STREPOI	10							10
	Predicted Crashes					1.570			crashes/year		
	Predicted Crashes					1.438			crashes/year		
	Total Predicted (	Crashes				3.008			crashes/year		
				Crashes by	Severity	Level and	Collision	Туре			
		Total C	rashes	Fatal-a	nd-Injury	FI (KAB)		Property	/-Damage-Only		
	Collision Type	Prop.	N	Prop.	N	Prop.	N	Prop.	N		
	Head-On	0.006	0.018	0.013	0.020	0.018	0.028	0.002	0.003		
	Sideswipe	0.043	0.129	0.027	0.042	0.022	0.035	0.053	0.076		
	Rear-End	0.116	0.349	0.163	0.256	0.114	0.179	0.088	0.127		
	Angle	0.043	0.129	0.048	0.075	0.045	0.071	0.041	0.059		
	Single	0.768	2.310	0.727	1.141	0.778	1,221	0.792	1.139		
	Other	0.024	0.072	0.022	0.035	0.023	0.036	0.024	0.035		
-) ck	Total Observed Cr Average Observed Overdispersion Pa Weighted Adjustme Expected Crashes Expected Crashes Total Expected Cr	rashes Crashes arameter, H ent, w (FI) (PDO)				4 4.000 0.142 0.701 1.725 1.579 3.304			crashes crashes/year crashes/year crashes/year crashes/year		
	*Based on Expecte	d Coach Ei			Econom	ic Analysi	s				
	Annual Societal ( Annual Societal ( Annual Societal ( Total Annual Soci	Crash Cost Crash Cost	(FI) (PDO)			\$272,889 \$11,776. \$284,665	04				
	Q					natted Repor	Soc	tion 1>	- 61	1	

- 6. The societal crash costs are based on either predicted crashes or expected crashes. This is dependent on whether an EB analysis is run.
  - a. If 'Empirical Bayes Analysis' is unchecked on the General page, then the societal crash costs are based on predicted crashes.

STAR	T GENERAL	DETAILS REPORT							1	
C.					P	roject Properties			01	
Analy	at .					Jurisdiction				
Agene	v					Analysis Year		2021		
Date			12/2/2021			Project Descr	intere	HSM C		
_		~						11.300 5		
Empir	ical Bayes Analy:	313				Number of Ye	ars of Observed Crashes	1		
4	H5511-4 RuralM	ultilaneFacility.xhz" - Higt	way Safety Software			P 100 (P)			-	
	START (	SENERAL DETAILS	REPORT							
N.F.F	- Share	SETTEMAL DETAILS				- 10				
2 18	Lane V	Width (ft)	12.0	_	Roadway	у Туре	Divided			
11 25		Shoulder Width (ft)	6		Median	Width (ft)	20			
31	Auto 5	Speed Enforcement	No	_	Calibrati	ion Factor	1.00			
	Cras									
100	Lane V	Width + CMF1	1.000		Lighting	- CMF4	1.000			
Pre	Shouk	der Type/Width - CMF2	1.040		Automat CMF5	ted Speed Enforcement	1.000			
0	Media	in Width CMF3	1.020							
	Comb	ined CMF	1.061							
6	Pred	licted Roadway Se	ction Crashes		-					
OC		Crash Seventy	Overdispersion Parameter	Nept to by	Seventy	Predicted Crash Frequency	Crash Rate (crashes/mi/year)			
wright C	Fatal a	ind Injury (FI)	+	1.480		1.570	1.047			
	Prope	rty Damage Only (PDO)	A	1.355		1.438	0.958			
	Total		0.142	2.835		3.008	2.005			
	Econ	nomic Analysis (Pr	edicted Crashes)							
		Crash Severity	Per Crash Societal	Crash Cost	Pn	edicted Annual Crashes	Total Societal Crash Cost			
	Fatal a	and linjury (FI)	\$158,234.00		1.570	Andrew A new relevant	\$248,407.23			
	Proper	rty Damage Only (PDO)	\$7,456.00		1.438		\$10,719.54			
	Total				3.008		\$259,126.77			

b. If 'Empirical Bayes Analysis' is checked on the General page, then the societal crash costs are based on expected crashes.

START 6	ENERAL DETAILS REPORT							1			
and the second				Project	Properties				1		
Analyst					Jurisdiction						
Agency					Analysis Year		2021				
Date		12/2/2021			Project Descr	intion	HSM Ch:				
	ayes Analysis	2				ars of Observed Crashes	1				
-				~	-		_				
A HSST	11-4_RuralMultilaneFacility.xhz* High	way Safety Software						-			
	START GENERAL DETAILS	REPORT									
	Shoulder Type/Widtk - CMF2	1.040		utomated Speer MF5	d Enforcement	1.000					
k 23	Median Width - CMF3	1.020	-				-				
3.	Combined CMF	1.061									
	Predicted Roadway Se	ction Crashes		_							
1.3	Crash Sevenity	Overdispersion Parameter	Napfina by Ser	verity Predicte	ed Crash Frequency	Crash Rate (crashes/mi/year)					
Pre	Fatal and Injury (FI)	1	1.480	1.570		1.047					
0	Property Damage Only (PDO)	•	1.355	1.438		0.958					
	Total	0.142	2.035	3.008		2.005					
0	Expected Roadway See	tion Crashes									
Back	Crash Severity	Average Observed Crashes	Weight	Expecte	d Crash Frequency	Crash Rate (crashes/mi/year)					
vrigtd @	Fatal and Injury (FI)	*	+	1.725		1.150					
	Property Damage Only (PDO)	÷	-	1.579	-	1.053					
	Total	4.000	0.701	3.304	-	2.203					
	Economic Analysis (Ex	pected Crashes)									
	Crash Severity	Per Crash Societal (	Crash Cost	Expected A	nnual Crashes	Total Socielal Crash Cost					
	Fatal and Injury (FI)	\$158,234.00	1.	725		\$272,889.74					
	Property Damage Only (PDO)	\$7,456.00	1,	579		\$11,776.04					
	Total		3.	304		\$284,665.78					
	D	A PORC FICE	itch to Text Rep	Sector Sector	ction 1>	N N	E E -	-			

# **View Results of the Analysis**

- 1. After editing all the necessary inputs, results of the analysis can be found in the form of pages and in the form of reports.
- 2. There are two options for pages: Details and Report
  - a. Although the Details page includes inputs, there is an Output section at the bottom of the page that includes a few results.

10-5_RuralTwoLaneFacility.xhz - Highway Safety START GENERAL ORTAILS REP	ORT				î
		Sec	ction Data	-	
Section	1>		Facility Type	Rural Two-Lane	
Section Type	Segment		Model Type	Two-Lane Undivided Segment (2U)	
			Input		
AADT, veh/day	10000		Length, mi	1.500	
Lane Width, ft	10.0		Shoulder Width, It	4	
Shoulder Type	Gravel	*	Horizontal Curve		
Horizontal Curve Length, ml	1,000		Horizontal Curve Radius, ft	100	
Spiral Transition	Present		Superelevation Variance, ft/ft	0,010	
Grade. %	2.0		Number of Driveways	9	
Centerline Rumble Strips			Passing Lanes	No Passing or Climbing Lanes	 -
Two-Way Left-Turn Laries			Roadside Hazard Rating	(4	(
Lighting			Automated Speed Enforcement		140
Observed Crashes	10				_
			Output		
Safety Performance Function (SPF)	4,008		Predicted Crash Frequency (Npredicted)	5.522	
CMF1 (Lane Width)	1.172		CMF2 (Shoulders)	1.087	
CMF3 (Horizontal Curves)	1.000		CMF4 (Horizontal Curves: Superelevation)	1,000	
CMF5 (Grades)	1,000		CMF6 (Driveway Density, CMF6=1 when <=5)	1,012	
CMF7 (Centerline Rumble Strips)	1.000		CMF8 (Passing Lanes)	1.000	
CMF9 (Two-Way Left-Turn Lanes)	1.000		CMF10 (Roadside Design)	1.069	
CMF11 (Lighting)	1.000		CMF12 (Automated Speed Enforcement)	1.000	

b. The Report page can display single section formatted reports and single section text reports.

High	way Safety Software R	lural Two Lane Segment Rep	port	
Project Information				
Analyst		Date	12/2/2021	
Jurisdiction		Analysis Year	2021	
Project Description	HSM Chapter 10: Sample Problem S	Section Number	1	
Input Data				
Length of Segment (mi)	1.500	AADT (veh/day)	10000	
Lane Width (ft)	10.0	Grade (%)	2.0	
Shoulder Type	Gravel	Shoulder Width (ft)	4	
Driveway Density (driveway/mi)	6	Roadside Hazard Rating	4	
Centerline Rumble Strips	No	Passing Lanes	No Passing or Climbing Lanes	
Two-Way Left Turn Lane	No	Segment Lighting	No	
Automated Speed Enforcement	No	Calibration Factor	1.00	
Crash Modification Facto	rs			
Lane Width - CMF1	1.172	Centerline Rumble Strips - CMF7	1.000	
Shoulder Type/Width - CMF2	1.067	Passing Lanes - CMF8	1.000	
Horizontal Curve - CMF3	1.000	Two-Way Left Turn Lane - CMF9	1.000	
Superelevation CMF4	1.000	Roadside Design - CMF10	1.069	
Grade - CMF5	1.000	Lighting - CMF11	1.000	
Driveway Density - CMF6	1.012	Auto Speed Enforcement - CMF12	1.000	
Combined CMF	1.378		10.00	

- 3. There are two options for reports: Formatted and Text
  - a. Formatted reports show the most important results in a presentable format

Project Information					
Analyst	1		Date		12/2/2021
Jurisdiction			Analyse	1 Ymar	2021
Project Description	HSM Chapter 10 Sa Piobleni S	mple	Section	Number	1
Input Data					
Length of Segment (mill	7.500		AADT IN	whideyi	10000
Lanc Width (ft)	10.0		Gante (	64	28
Shoulder Type	Gravel		Shoulde	er Wichth (ft)	4
Driveway Density (driveway/mil	6 .		Rouduld	e Hazard Rating	4
Centerline Rumble Strips	Ma	_	Paining	Lanes	No Passing or Elimbing Lone
Two-Way Laft Turn Lane	No		Segmer	n Lighting	No
Automated Speed Enforcement	t Na		Calibrat	ion Factor	1.00
Crash Modification Fa	ctors	-	-		
Lane Width - CMF1	1.172		Centuri	ne Rumble Strips - CMF7	1.000
Shoulder Type/Width - CMF2	3.087	-	Patning	Lanes - CMF8	1.000
Horizontal Curve-CMF3	1000		Two-We	y Left Turn Lans - CMER	3,000
Superelevation CMF4	1.000		Roadeid	e Design - CMF10	1.069
Grade - CMF5	1.000		Lightning	- CMF11	1.000
Driveway Density - CMF6	1.012	_	Auto Sa	end Enforcement - CME12	1.000
Combined CMF	3.378				
Predicted Roadway Se	ction Crashes		-		
Crash Seventy	Overfinpecsion Parameter	Nut a by	Silventy	Predicted Crash Frequency	Crash Rata Losses2migrae
Fatal and Injury (FI)	+	1286		1,272	1.181
Property Damage Drily (PDO)	A.,	2.721		1749	2.500
Total	0.157	4.008	-	5.92	8661
Expected Roadway Se	ction Crashes				
Cristin Seventy	Average Observed Crashes	We	(M	Expected Crash Frequency	Crash Rate (crashes/mi/year
Fatal and Injury (P)	+		-	2.439	1.676
Property Damage Divily (PDO)	1	h	-	\$.361	1441
Tatil	10.000	0.536		7 500	5.067
Economic Analysis (Ex	pected Crashes)				
Crash Severity	Per Crash Societal	Chash Cost	Đ	quested Annual Grathes	Total Societal Crash Cost
Firtal and Irgury (Fi)	\$158,200.00		2,439		\$145,639.86
Property Danuige Only (PDO)	\$7,400.00		5.161		\$38.191.87
Total	5		7.600		\$424.031 72

b. Text reports show a more detailed analysis in plain text

File Name:	ftware Text Report HSS10-5_RuralTwoLaneFacility	/.xhz	Predicted Crashes (Fatal) Predicted Crashes (Incapacitating In: Predicted Crashes (Nonincapacitating Predicted Crashes (Possible Injury) Predicted Crashes (PDO)			0.072 0.298 0.602 0.801 3.749			crashes/yw crashes/yw crashes/yw crashes/yw crashes/yw	tar tar	
Analyst: Agency:			Total Predicted Crashes			5.522			crashes/ye		
Jurisdiction:											
Date:	12/2/2021		(	Crashes	by Severity I	Level and C	ollision	Type			
Analysis Year: Project Description:	2021 HSM Chapter 10: Sample Prob)			Tetra 1	Crashes		Exercit rest	nd-Injury		Deserve	-Damage-Only
Units:	U.S. Customary	ien >	Collision Type	Prop.	N		Prop.	N N		Property Prop.	N N
on a con	0.5. (45(0)4.)		Single-Vehicle	riops			ri opi			ri up i	
			Collision with Animal	0.121	0.668		0.038	0.067		0.184	0.690
			Collision with Bicycle	0.002	0.011		0.004	0.007		0.001	0.004
Sau	tion 1:		Collision with Pedestrian Overturned	0.003	0.017		0.007 0.037	0.012 0.066		0.001	0.004
200			Ran Off Road	0.025			0.037	0.000		0.015	0.055
Facility Type	RunalTwoLane		Other Single-Vehicle Collision	0.021	0,116		0.007	0.012		0.029	0.109
Section Type	Segment		Total Single-Vehicle Crashes	0.693	3.827		0.638	1.131		0.735	2.756
Model Type	Two-Lane Undivided Segment (	(20)	Multiple-Vehicle								
Area Type	Runal		Angle Collision Head-On Collision	0.085	0.469		0.100	0.177 0.060		0.072	0.270
			Rear-End Collision	0.016	0.784		0.034	0.291		0.003	0.457
	Input		Sideswipe Collision	0.037	0.284		0.038	0.067		0.038	0.142
			Other Multiple-Vehicle Collision	0.027			0.026	0.046		0.030	0.112
AADT	10000	veh/day	Total Multiple-Vehicle Crashes	0.307	1,695		0.362	0.642		0.265	0.994
Length Lane Width	1.500	mi ft									
Shoulder Width	4	ft			····· Expecte	ed Crashes					
Shoulder Type	Gravel										
Horizontal Curve	No		Total Observed Crashes			18			crashes		
Grade	2.0	x	Average Observed Crashes			10.000			crashes/ye	tan	
Driveway Density	6	driveway/mi	Overdispersion Parameter, k Weighted Adjustment, w			0.157					
Centerline Rumble Strips Passing Lanes	No NoPassingLane		Expected Crashes (FI)			2.439			crashes/y	ar	
Two-Way Left-Turn Lanes	No		Expected Crashes (PDO)			5.161			crashes/ye		
Lighting	No		Total Expected Crashes			7.680			crashes/y		
Automated Speed Enforcement	No										
					Economi	ic Analysis					
Observ	red Crashes										
			*Based on Expected Crash Frequency								
Number of Observed Crashes	10		Annual Societal Crash Cost (FI) Annual Societal Crash Cost (FDO)			\$385,839.					
			Total Annual Societal Crash Cost			\$424,031.					
	Autput										
	SDE										
	347		This Highway Safety Software text rep	port was	created in H	HSS <sup>™</sup> Versio	in 2022 of	n 12/3/2021	1 09:31:36		
N(SPF, FI)	1.286										
N(SPF, PDO)	2.721										
	CMFs ·····										
CHF1 (Lane Width)	1.172										
CMF2 (Shoulders)	1.087										
OFF3 (Horizontal Curves) OFF4 (Horizontal Curves: Superelevation)	1.000										
OF5 (Grades)	1,000										
CMF6 (Driveway Density, CMF6=1 when <=5)	1.012										
CMF7 (Centerline Rumble Strips)	1.000										
CMF8 (Passing Lanes)	1.000										
OMF9 (Two-Way Left-Turn Lanes) OMF10 (Roadside Design)	1.000										
OFF11 (Lighting)	1.009										
OWF12 (Automated Speed Enforcement)	1.000										
CMF Combined	1.378										
Predic	ted Crashes										
Predicted Crashes (FI)	1.772	crashes/year									

4. The type of report displayed can be changed by using the main menu items, keyboard shortcuts, or toggle buttons found under the report

- a. Main Menu Items
  - i. To switch to the Formatted Report, select *File > Report > Formatted Report* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen, hovering over "Report", and then selecting "Formatted Report".

START GENERA	No. of Concession, Name					- 0
New	Chi+N +					
Open Example Folder	Ctri+O	nway Safety Software Ru	ral Two Lane Segment Rep	oort		
Save	Ctri+5					
Save As	F12		Date	12/2/2021		
Close	Ctri+W		Analysis Year	2021		
Units		HSM Chapter 10: Sample Problem 5	Section Number	1		
Print Print Preview	Ctri+P Ctri+F2			Yanna		
View		1.500	AADT (veh/day)	10000		
Report		Formatted Report 64	Frade (%)	2.0		
		Text Report 56	Shoulder Width (ft)	4		
Parameter Template Export to CSV	- 0	10	Roadside Hazard Rating	4		
		No	Passing Lanes	No Passing or Climbing Lanes		
Default Settings	Alt+F	No	Segment Lighting	No		
нер		No	Calibration Factor	1.00		
Exit	AJE+Fd	ors				
Lane Width - CM	151	1.172	Centerline Rumble Strips - CMF7	1.000		
Shoulder Type/W	Vidth - CMF2	1.087	Passing Lanes - CMF8	1.000		
Horizontal Curve	- CM/3	1.000	Two-Way Left Tum Lane - CMF9	1.000		
Superelevation -	CMF4	1.000	Roadside Design - CMF10	1.069		
Grade - CMF5		1,000	Lighting - CMF11	1.000	0	
Driveway Density	y - CMF6	1.012	Auto Speed Enforcement - CMF12	1.000		
Combined CMF		1.378				
P			Switch to Text Report	Section 1>		
right © 2021 University of	PROVIDENCE PROVIDE	- December 1		A los of the second		HSS <sup>TH</sup> Version 2022

ii. To switch to the Text Report, select *File > Report > Text Report* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen, hovering over "Report", and then selecting "Text Report".

START GENERA	an arrange	-						
Contraction and the second		Report	1.1					1.11
New	ChieN +							
Open	Ctri+O		ONFs					
Example Folder			1.1	72				
Save	Ctrie5		1.0	17				
Save As.	F12	relevation)	1.0	Nð.				
Close	CtrieW	1 when (=5)	1.0					
		(4)	1.0					
Units		3	1.0	93				
Print	Cm+P		1.0	19				
Print Preview	Chirfs	esent)	1.0	10				
View			1.3					
Report		Formatted R	eport F4	wshes			******	
Parameter Template		Text Report	16 7			hes/year		
Export to CSV		ting Injury)	0.0			hes/year hes/year		
Default Settings	Alt+F	itating Injury)	0.6 8.3	12	cras	nes/year		
Help	Contra La	njury)	3.7	19.	cres	hes/year hes/year		
			5.5	2	cras	nes/year		
Exit	Ale+F4	····· Crashes by	y Severity Level	and Collision	Type			
		Total d	Trashes	Fatal-	nd-Injury	Propert	Damage - Dally	
Collision Type Single-Vehicle		Prop.	N	Prop.	N	Prop.	N	
Collision with		0.121	9.668	0.038	0.067	0.184	0.690	
Collision with Collision with	Bicycle	0.002	0.011 0.017	0.004	0.007	0.001	0.004	
Overturned	Pedestrian	0.025	0.017	0,037	0.066	0.001	0.056	
Ran Off Road		0.521	2.877	0.545	0.966	0.505	1.893	
Other Single-Ve			0.116	8.997	0.012	0.029	0.109	
Total Single-Ve Multiple-Vehicl		0.693	3.827	0.638	1.131	0.735	2,756	
Angle Collision		0.005	9.469	0,100	9.177	0.072	9,270	
P					Formatted Report	Section 12		III
							_	

- b. Keyboard Shortcuts
  - i. Formatted Report: keyboard shortcut is "F4"
  - ii. Text Report: keyboard shortcut is "F6"
- c. Report Toggle Buttons

i. If the formatted report is currently being displayed, the toggle button will say "Switch to Text Report" which will allow you to display the text report if clicked.

HSS10-	5_RuralTwoLaneFacility.xhz - Highway	Safety Software			- 🗆 🗙
s	TART GENERAL DETAILS	EPORT			
	High	way Safety Software R	ural Two Lane Segment Re	eport	
	Project Information				
	Analyst		Date	12/2/2021	
	Jurisdiction		Analysis Year	2021	
	Project Description	HSM Chapter 10: Sample Problem 5	Section Number	1	
$\in$	Input Data				
	Length of Segment (mi)	1.500	AADT (veh/day)	10000	
	Lane Width (ft)	10.0	Grade (%)	2.0	
acic	Shoulder Type	Gravel	Shoulder Width (ft)	4	
	Driveway Density (driveway/mi)	6	Roadside Hazard Rating	4	
	Centerline Rumble Strips	No	Passing Lanes	No Passing or Climbing Lanes	
	Two-Way Left Turn Lane	No	Segment Lighting	No	
	Automated Speed Enforcement	No	Calibration Factor	1.00	
	Crash Modification Facto	rs			
	Lane Width - CMF1	1.172	Centerline Rumble Strips - CMF7	1.000	
	Shoulder Type/Width - CMF2	1.087	Passing Lanes - CMF8	1.000	
	Horizontal Curve - CMF3	1.000	Two-Way Left Turn Lane - CMF9	1.000	
1		Switch to Te	xt Report Section 1>		

ii. If the text report is currently being displayed, the toggle buttons will say "Switch to Formatted Report" which will allow you to display the formatted report if clicked.

🏄 HSS1	10-5_RuralTwoLaneFacility.xhz - Highway Safet	y Software			-		X
	START GENERAL DETAILS REPO	DRT					i
		Highway Safety Software Text Re	eport				- Î
	File Name: Analyst: Agency: Jurisdiction:		alTwoLaneFacility.xhz				
	Date: Analysis Year: Project Description: Units:	12/2/2021 2021 HSM Chapter U.S. Custom	10: Sample Problem 5 ary				1
$\bigcirc$		Section 1:					
Back	Facility Type Section Type Model Type Area Type	RuralTwoLan Segment Two-Lane Un Rural	e divided Segment (2U)				
		Input					
	AADT Length Lane Width Shoulder Width Shoulder Type Horizontal Curve	10000 1.500 10.0 4 Gravel No	veh/day mi ft ft				
	Grade Driveway Density Centerline Rumble Strips	2.0 6 No	% driveway/mi				~
	P	Switch to Formatted Report	Section   1>	\$			-*
Copyrig	ht © 2021 University of Florida. All Rights Res	erved.			HSS™ Versi	ion 2022	(USC)

5. For both formatted and text reports, a Section drop down menu is provided next to the toggle button. All reports are section specific reports. The drop down menu allows you to select which section to display on the Report page. There is also the option of showing all sections which will show each of the section reports one after the other.

_High	way Safety Software R	ural Two Lane Segment Rep	port		
Project Information					
Analyst	1	Date	12/2/2021		
Jurisdiction		Analysis Year	2021		
Project Description	HSM Chapter 10: Sample Problem 5	Section Number	1		
Input Data					
Length of Segment (mi)	1.500	AADT (veh/day)	10000		
Lane Width (ft)	10.0	Grade (%)	2.0		
Shoulder Type	Gravel	Shoulder Width (ft)	4		
Driveway Density (driveway/mi)	6	Roadside Hazard Rating	4		
Centerline Rumble Strips	No	Passing Lanes	No Passing	or Climbing Lanes	
Two-Way Left Turn Lane	No	Segment Lighting	No		
Automated Speed Enforcement	No	Calibration Factor	1.00		
Crash Modification Facto	ors				
Lane Width - CMF1	1.172	Centerline Rumble Strips - CMF7	1.000		
Shoulder Type/Width - CMF2	1.087	Passing Lanes - CMF8	1.000		
Horizontal Curve - CMF3	1.000	Two-Way Left Turn Lane - CMF9	1.000		
Superelevation - CMF4	1.000	Roadside Design - CMF10	1.069		
Grade - CMF5	1.000	Lighting - CMF11	1.000	1>	
Driveway Density - CMF6	1.012	Auto Speed Enforcement - CMF12	1.000	2>	
Combined CMF	1.378			3> All Sections	

6. The magnification of the report currently being displayed can be changed using the zoom slider found at the bottom right-hand corner of the screen.

High	way Safety Software R	ural Two Lane Segment Re	eport	
Project Information				
Analyst		Date	12/2/2021	
Jurisdiction		Analysis Year	2021	
Project Description	HSM Chapter 10: Sample Problem 5	Section Number	1	
Input Data	29. Z			
Length of Segment (mi)	1.500	AADT (veh/day)	10000	
Lane Width (ft)	10.0	Grade (%)	2.0	
Shoulder Type	Gravel	Shoulder Width (ft)	4	
Driveway Density (driveway/mi)	6	Roadside Hazard Rating	4	
Centerline Rumble Strips	No	Passing Lanes	No Passing or Climbing Lanes	
Two-Way Left Turn Lane	No	Segment Lighting	No	
Automated Speed Enforcement	No	Calibration Factor	1.00	
Crash Modification Facto	rs			
Lane Width - CMF1	1.172	Centerline Rumble Strips - CMF7	1.000	
Shoulder Type/Width - CMF2	1.087	Passing Lanes - CMF8	1.000	
Horizontal Curve - CMF3	1.000	Two-Way Left Turn Lane - CMF9	1.000	

- a. To zoom in, drag the slider to the right; to zoom out, drag the slider to the left
- b. Clicking the plus (+) button will zoom in; clicking the minus (-) button will zoom out

c. Holding down "ctrl" on the keyboard and scrolling up on the mouse wheel will zoom in; holding down "ctrl" on the keyboard and scrolling down on the mouse wheel will zoom out

## **Print a Report**

- 1. There are four options for printing a report:
  - a. Selecting *File > Print* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen and then selecting "Print"

S19-4_D4RampTerminalOnUrbanArterialW	ithSignalControLxhz - )	Highway Safety Softw	are			- 0
START GENERAL DETAILS	REPORT					
lew Ctrl+N .						
Open Clrl+D Example Folder	Highway Safe	ty Software Ra	imp Terminal Report			
Save Ctriks						
Save As F12	_	Date		12/2/2021		
Close Ctrl (W			vsis Year			
Units •	HSM Chapter 19	Sample Problem 4		_		
Print Ctrl+P						
Print Preview Ctrl+P2	ninal	Signal-Controlled				
View +		D3ex Prese	ence of Non-ramp Public Street Le	ig	No	
Report +	ntersection (mi)	1.000 Dista	nce to Adjacent Ramp Terminal (i	nij	0.100	
Parameter Template	.eg)	0 # Pub	blic Street Approaches (Outside C	rossroad Leg)	0	
Export to CSV		12 Exit R	Camp Skew Angle		0.0	
Default Settings Alt+F	1	Inside Approa	ch Outside Approach	Exit Ramp	Approach	
Help +		2	2	3		
Exit Alt+F4		No	No	No		
sent runn samerbay		Yes	No			
Right Turn Lane/Bay		No	No.			
AADT (veh/day)		28000	28000	7100		
AADT of Entrance Ramp Approac	h (veh/day)	6750				
Crash Modification Fac	tors					
	-	Combined CMF	G	libration Factor		
	Fatal and Inj		amage Only Fatal and Inju		Jamage Only	
Total	0.733	0.715	1.00	1.00		
P			Switch to Text Report	Section 1>		

b. Selecting *File > Print Preview* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen and then selecting "Print Preview"

START GENER	AL DETAIL	S RE	PORT							
Vew	Ctrl+N									
Open Example Folder	Ctri+O	H	ighway Safet	y Softwa	are Ramp Te	minal Report				
Save	CtrI+S									
Save As	F12	1			Date		12/2/2021	1		
Close	Cirl+W				Analysis Year					
Units			HSM Chapter 19:	Sample Pro	blem 4					
Print	Ctri+P									
Print Preview	CYG+F2	mina	1	Signal-Con	trolled			_		
View		-		D3ex	Presence of No	n-ramp Public Street Lee	1	No		
Report		nter	section (mi)	1.000	Distance to Ad	acent Ramp Terminal (m	n)	0.100		
Parameter Template		Legi		0	# Public Street	Approaches (Outside Cri	ossroad Leg)	0		
Export to CSV				12	Exit Ramp Ske	Angle		0.0		
Default Settings	Alt+F			Inside	Approach	Outside Approach	Exit Ram	p Approach		
Help				2			3			
Exil	All+F4			No		4o	No			
		1		Yes		No	1			
Right Turn Lar	201 - 20 - 20 - 20 - 20 - 20 - 20 - 20 -			No		No				
AADT (veh/da				28000		8000	7100			
AADT of Entra	nce Ramp Appri	sach (vi	eh/day)	6750			-			
Crash Mor	lification Fa	ctor	5							
				Combined C	MF	Cal	bration Factor			
			Fatal and Inju	ary Pro	operty Damage Or	ily Fatal and Injury	Property	Damage Only		
Total		-	0.733	0.7		1.00	1.00			
2					Sw	tch to Text Report	Section 1		~	

- c. Using the keyboard shortcut "Ctrl+P" for Print
- d. Using the keyboard shortcut "Ctrl+F2" for Print Preview

- 2. Print
  - a. Using Print will bring up a Print dialog box where you can select which printer to print to

eneral	
Select Printer	
Microsoft Print to PDF Microsoft XPS Document Writer OneNote for Windows 10	
۲	>
Status: Ready Location: Comment:	Preferences Find Printer
Page Range C All C Selection C Pages	Number of copies: 1 🕂
	Print Cancel Apply

#### 3. Print Preview

a. Using Print Preview will bring up a window where you can view how the report will look on paper before sending it to the printer

	Highway S	afety So	ftware Ramp	Term	inal Report		
Project Informat							_
Analyst			Date		1	12/2/2021	_
Jurisdiction			Analysis Ye	ar.		The section of	
Project Description	HSM Chapte	er 19: Sample		-			
Input Data							
Type of Control at Cross	sroad Terminal	Signal	-Controlled	_			
Ramp Terminal Configu	ration	D3ex		f Non-r	amp Public Street Les	2	No
Distance to Next Outsid	se Public Intersection (mi)	1.000	Distance to	o Adjace	ent Ramp Terminal (m	i)	0.100
= Driveways (Outside C	rossroad Leg)	0	# Public St	reet App	proaches (Outside Cr	ossroad Leg)	0
Crossroad Median Widt	th (ft)	12	Exit Ramp	Skew An	ngle		0.0
1		1	nside Approach		Outside Approach	Exit Ram	p Approach
Number of Lanes		2		2		3	
Right Turn Channelizati	on	No		No		No	
Left Turn Lane/Bay		Yes		No		·	
Right Turn Lane/Bay		No		No		+	
AADT (veh/day)		28000	2	2800	00	7100	
AADT of Entrance Ramp	p Approach (veh/day)	6750		1	_		
Crash Modificati	on Factors						
		Combi	ned CMF		Cal	ibration Factor	
	Fatal an	d Injury	Property Damag	e Only	Fatal and Injury	Property	Damage Only
Total	0.733		0.715	-	1.00	1.00	

b. The print icon in the toolbar found in the top left-hand corner can then be selected



c. A print dialog box will pop up where you can select which printer to print to

Print .	
General	
Select Printer	
Microsoft Print to PDF Microsoft XPS Document Writer OneNote for Windows 10	
¢	>
Status: Ready Location: Comment:	Preferences Find Printer
Page Range	
C Selection C Current Page	Number of copies: 1
C Pages:	
-	Print Cancel Apply

# **Glossary of Terms**

#### AADT

Annual average daily traffic; the counted (or estimated) total traffic volume in one year divided by 365 days/year.

# Rural Two-Lane, Two-Way Roads (Chapter 10); Rural Multilane Highways (Chapter 11); Urban and Suburban Arterials (Chapter 12)

For each roadway segment, the AADT is the average daily two-way, 24-hour traffic volume on that roadway segment in each year of the evaluation period.

For each intersection, two values are required in each predictive model. These are the AADT of the major street,  $AADT_{maj}$ , and the two-way AADT of the minor street,  $AADT_{min}$ .

In Chapter 10, AADT<sub>maj</sub> and AADT<sub>min</sub> are determined as follows: if the AADTs on the two major road legs of an intersection differ, the larger of the two AADT values is used for the intersection. For a three-leg intersection, the minor road AADT is the AADT of the single minor road leg. For a four-leg intersection, if the AADTs of the two minor road legs differ, the larger of the two AADT values is used for that intersection. If AADTs are available for every roadway segment along a facility, the major road AADTs for intersection legs can be determined without additional data.

In Chapter 11,  $AADT_{maj}$  and  $AADT_{min}$  are determined as follows: if the AADTs on the two major-road legs of an intersection differ, the larger of the two AADT values are used for  $AADT_{maj}$ . For a three-leg intersection, the AADT of the minor-road leg is used for  $AADT_{min}$ . For a four-leg intersection, the larger of the AADTs for the two minor-road legs should be used for  $AADT_{min}$ . If a highway agency lacks data on the entering traffic volumes, but has two-way AADT data for the major and minor-road legs of the intersection, these may be used as a substitute for the entering volume data. Where needed,  $AADT_{total}$  can be estimated as the sum of  $AADT_{maj}$  and  $AADT_{min}$ .

In Chapter 12, AADT<sub>maj</sub> and AADT<sub>min</sub> are determined as follows: if the AADTs on the two-major-road legs of a fourleg intersection differ, the larger of the AADTs for the two minor road legs is used. For a three-leg intersection, the AADT of the single minor road leg is used. If AADTs are available for every roadway segment along a facility, the major-road AADTs for intersection legs can be determined without additional data.

#### Freeways (Chapter 18)

For each freeway segment, the following five AADT values are required:

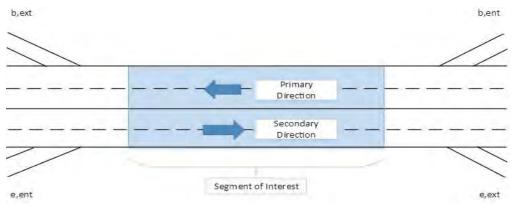
- (1) the AADT volume of the freeway segment (AADT<sub>fs</sub>),
- (2) the AADT volume of the nearest entrance ramp upstream of the segment for the increasing milepost travel direction (AADT<sub>b,ent</sub>),
- (3) the AADT volume of the nearest entrance ramp upstream of the segment for the decreasing milepost travel direction (AADT<sub>e,ent</sub>),
- (4) the AADT volume of the nearest exit ramp downstream of the segment for the increasing milepost travel direction (AADT<sub>b,ext</sub>), and

(5) the AADT volume of the nearest exit ramp downstream of the segment for the decreasing milepost travel direction (AADT<sub>b,ext</sub>).

For each ramp entrance speed-change lane, two values are required. They include the AADT volume of the freeway segment and the AADT volume of the ramp.

For each ramp exit speed-change lane, only the AADT volume of the freeway segment is required. The AADT volume of the ramp is not needed.

The AADT volumes are needed for each year of the evaluation period. The AADT volume for a given year represents an annual average daily 24-hour traffic volume. The freeway segment AADT volume is a two-way volume (i.e., the total of both travel directions). Each ramp AADT volume represents a one-way volume.



#### Ramps (Chapter 19)

The AADT volume of the ramp is needed for each ramp segment. The AADT volume of the C-D road is needed for the evaluation of each C-D road segment.

For each crossroad ramp terminal, one AADT value is needed for each intersection leg. Thus, for a four-leg ramp terminal, the following values are needed: AADT volume of the crossroad leg "inside" the interchange, AADT volume of the crossroad leg "outside" of the interchange, AADT volume of the exit ramp, and AADT volume of the entrance ramp. The inside crossroad leg is the leg that is on the side of the ramp terminal nearest to the freeway. The outside crossroad leg is on the other side of the ramp terminal. The AADT of the loop ramp at a terminal with either an A4 or B4 configuration is not needed (or used in the calculations.

The AADT volumes are needed for each year of the evaluation period. The AADT volume for a given year represents and annual average daily 24-hour traffic volume. The ramp and C-D road segment AADT volume is a one-way volume. The crossroad segment AADT volume is a two-way volume (i.e., total of both travel directions).

AADT<sub>r</sub> is the AADT volume of the ramp segment in veh/day. AADT<sub>c</sub> is the AADT volume of the C-D road segment in veh/day.

The AADT of the ramps are shown in the diagram below.

#### Add Horizontal Curve

For Freeway Segment, Ramp Segment, and Freeway Intersection analyses, a button for adding a horizontal curve is available when 'Include Horizontal Curves' is checked.

For Freeway Segment and Speed Change Lanes analyses, clicking on the button 'Add Horizontal Curve' will add a row of inputs which include the following: Primary Radius, Secondary Radius, and Length in Segment. For Ramp Segment and C-D Road Segment analyses, clicking on the button 'Add Horizontal Curve' will add a row of inputs which include the following: Radius of Curve, Average Entry Speed, and Length in Segment.

The user can add an unlimited number of horizontal curves.

#### Add Section

For facility analyses, a button for adding a section is available. Clicking on the button 'Add Section' will add a row of inputs which include the following: Section Type, Facility Type, Model Type, Details, N(spf), and N(predicted). Section Type can either be Segment or Intersection. Facility Type can either be Rural Two-Lane or Rural Multilane in a Rural Facility analysis. Facility Type can only be Urban in an Urban Facility analysis. Section Type and Facility Type cannot be changed within the rows. They must be specified before the new section is added. Model Type can be changed within the rows and the choices available are dependent on Section Type and Facility Type combinations. Clicking on Details within a row will bring the user to the Details page for that specific section. N(spf) specifies the predicted average crash frequency for base conditions for that individual section. N(predicted) specified on the Details page. The user can add an unlimited number of sections.

#### Agency

This field is provided to document the agency or company associated with this analysis or project.

## Analysis Type

This specifies the type of analysis to be done. Choices include: Segment, Intersection, Rural Facility, Urban Facility, Freeway Facility, and Ramp Facility.

#### Analysis Year

This field is provided to document the year for which the analysis is being performed.

#### Analyst

This field is provided to document the name of the analyst.

#### Angle

The angle to next leg is used to measure the relative intersection skew; it is measured in degrees. Angle is measured for each leg of the roundabout.

#### Any Ramps within 0.5 mi

A checkbox is provided to indicate if there are any ramps within 0.5 miles (or 0.8 kilometers in metric). If ramps are within 0.5 miles (or 0.8 kilometers in metric) of the end point of the segment, there is a potential for increased crashes due to lane changing.

## Approach

A lane or set of lanes at an intersection that accommodates all left-turn, through, and right-turn movements from a given direction.

#### Approaches for which Right-Turn-on-Red is Prohibited

This is the number of signalized intersection approaches for which right-turn-on-red is prohibited. This affects the CMF for right-turn-on-red operation ( $CMF_{4i}$ ).

#### **Approaches with Turn Lanes**

The number of approaches with left-turn lanes and the number of approaches with right-turn lanes are necessary for determining the effects of individual geometric design of intersections. Approaches include the major and minor road approaches. Turn lanes include exclusive left-turn lanes and exclusive right-turn lanes. Stop-controlled approaches are not considered in determining the number of approaches with right- or left-turn lanes.

#### Area Type

This specifies whether the area is rural or urban.

See also Rural Areas and Urban Environment.

#### **Automated Speed Enforcement**

Automated speed enforcement systems use video or photographic identification in conjunction with radar or lasers to detect speeding drivers. The systems automatically record vehicle registrations without needing police officers at the scene.

#### Average Entry Speed

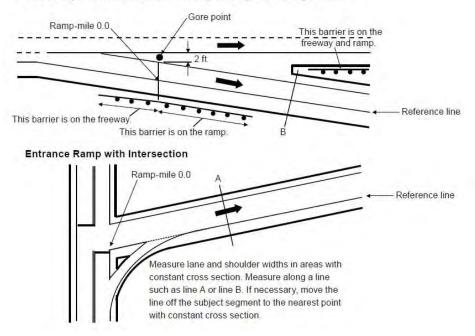
The estimated speed of vehicles upon entering the curve.

The procedure for predicting the average curve entry speed for each curve on a ramp or C-D road is developed for use with the horizontal curve CMF. It is not intended to be used with other applications, or to predict vehicle speed at other points along a ramp or C-D road.

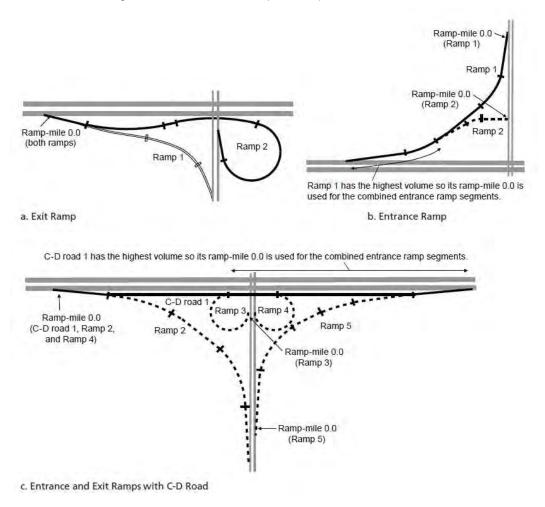
The speed prediction procedure consists of a sequence of steps that lead to a prediction of average entry speed for each horizontal curve on the subject ramp or C-D road. Each curve is addressed by the procedure in the same sequence as they are encountered when traveling along the ramp or C-D road. In this manner, the speed for all previous curves encountered must be calculated first, before the speed on the subject curve can be calculated. The steps used will vary depending on whether the segment is part of an entrance ramp, exit ramp, connector ramp, or C-D road.

The horizontal curves are located along the ramp or C-D road using a linear referencing system. For exit ramps, ramp-mile 0.0 (or ramp-kilometer 0.0 in metric) is located at the gore point. For entrance ramps that intersect the crossroad, ramp-mile 0.0 (or ramp-kilometer 0.0 in metric) is located at the point where the ramp reference line intersects with the near edge of traveled way of the crossroad. The location of ramp-mile 0.0 (or ramp-kilometer 0.0 in metric) is shown in the figure below for simple situations.

#### Exit Ramp, C-D Road, Entrance Ramp with Speed-Change Lane



It is shown in the figure below for more complex ramp and C-D road combinations.



When a specific entrance ramp or C-D road segment serves traffic from two or more sources combined, ramp-mile 0.0 (or ramp-kilometer 0.0 in metric) for this segment should be that of the one ramp that is the source of the highest daily traffic volume.

The input data needed for this procedure are identified in the table below. The first three variables listed represent required input data. Default values are provided for the remaining variables.

Variable	Description	Default Value	Applicable Site Type
X,	Ramp-mile of the point of change from tangent to curve (PC) for curve $i$ (mi) <sup>a</sup>	None	All
R <sub>i</sub>	Radius of curve $i$ (ft) <sup>b</sup>	None	All
L <sub>c.i</sub>	Length of horizontal curve i (mi)	None	All
$V_{frey}$	Average traffic speed on the freeway during off-peak periods of the typical day (mi/h)	Estimate as equal to the speed limit	All
$V_{xroad}$	Average speed at the point where the ramp connects to the crossroad (mi/h)	15 – ramps with stop-, yield-, or signal-controlled crossroad ramp terminals	Entrance ramp, exit ramp, connector ramp at service interchange
		30 – all other ramps at service interchanges	
$V_{cdroad}$	Average speed on C-D road or connector ramp (measured at the mid-point of the C-D road or ramp) (mi/h)	40	C-D road, connector ramp at system interchange

<sup>a</sup> If the curve is preceded by a spiral transition, then X<sub>i</sub> is computed as equal to the average of the TS and SC ramp-mile locations, where TS is the point of change from tangent to spiral and SC is the point of change from spiral to curve.

<sup>b</sup> If the curve has spiral transitions, then R<sub>i</sub> is equal to the radius of the central circular portion of the curve.

#### **Base Model**

A regression model for predicting the expected average crash frequency in each HSM prediction procedure given a set of site characteristics. The base model, like all regression models, predicts the value of a dependent variable as a function of a set of independent variables. The expected average crash frequency is adjusted for changes to set site characteristics with the use of a CMF.

#### **Bicycle Crash Adjustment Factor**

For roadway segments,  $f_{biker}$  is the bicycle crash adjustment factor. It is used in the determination of the number of vehicle-bicycle collisions per year for a roadway segment. The values of  $f_{biker}$  are likely to depend on the climate and the bicycling environment in particular states or communities. The following table shows the bicycle crash adjustment factors for roadway segments, but users are encouraged to replace the values in the table with suitable values for their own state or community through the calibration process.

	Bicycle Crash Adjustment Factor (f <sub>biker</sub> )							
Road type	Posted Speed 30 mph or Lower	Posted Speed Greater than 30 mph						
2U	0.018	0.004						
3T	0.027	0.007						
4U	0.011	0.002						
4D	0.013	0.005						
5T	0.050	0.012						

Note: These factors apply to the methodology for predicting total crashes (all severity levels combined).

All bicycle collisions resulting from this adjustment factor are treated as fatal-and-injury crashes and none as

property-damage-only crashes.

Source: HSIS data for Washington (2002-2006)

For intersections,  $f_{bikei}$  is the bicycle crash adjustment factor. It is used in the determination of the number of vehiclebicycle collisions per year for an intersection. The values of  $f_{bikei}$  are likely to depend on the climate and bicycling environment in particular states or communities. The following table shows the bicycle crash adjustment factors for intersections, but users are encourage to replace the values in the table with suitable values for their own state or community through the calibration process.

Intersection Type	Bicycle Crash Adjustment Factor (f <sub>bikel</sub> )
3ST	0.016
3SG	0.011
4ST	0.018
4SG	0.015

Note: These factors apply to the methodology for predicting total crashes (all severity levels combined). All bicycle collisions resulting from this adjustment factor are treated as fatal-and-injury crashes and none as property-damage-only crashes. Source: HSIS data for California (2002–2006)

#### **Calibration Factor**

A factor to adjust crash frequency estimates produced from a safety prediction procedure to approximate local conditions. The factor is computed by comparing existing crash data at the state, regional, or local level to estimates obtained from predictive models.

## **Circulating AADT**

Average annual daily traffic volume circulating the roundabout; measured in vehicles per day for each approach leg

## **Circulating Width**

Circulating width is the width of the circulatory roadway within the roundabout. It is measured in feet and recorded as the nearest integer foot (or nearest tenth of a meter in metric). Roundabouts in which the number of circulating lanes varies and/or roundabouts that are not circular (e.g., oblong shaped) may have circulating widths that vary. In these instances, the aligned dimension will need to be used to measure the circulating width in front of the splitter island on each leg.

#### Clear Zone

The total roadside border area, starting at the edge of the traveled way, available for use by errant vehicles.

#### **Clear Zone Width**

This width is measured from the edge of traveled way to typical limits of vertical obstruction (e.g., non-traversable slope, fence line, utility poles) along the roadway. The clear zone width includes the outside shoulder. It is measured for both travel directions. If this width varies along the segment, then use the estimated length-weighted average clear zone width (excluding the portion of the segment with barrier). Do not consider roadside barrier when determining the clear zone width for the predictive method. Barrier location and influence is addressed in other CMFs. If the segment has roadside barrier on both sides for its entire length, then the clear zone width will not influence the model prediction, and any value can be used as model input.

#### Crash

A set of events not under human control 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, a bicyclist, a pedestrian or an object.

#### **Crash Distribution**

Proportions to determine the distribution of crashes by collision type. Proportions can be edited, but defaults are based off of the following tables found in the Highway Safety Manual (HSM):

- **Table 10-4.** Default Distribution by Collision Type for Specific Crash Severity Levels on Rural Two-Lane, Two-Way Roadway Segments
- **Table 10-6.** Default Distribution for Collision Type and Manner of Collision at Rural Two-Way Intersections
- **Table 11-4.** Default Distribution of Crashes by Collision Type and Crash Severity Level for Undivided Roadway Segments
- **Table 11-6.** Default Distribution of Crashes by Collision Type and Crash Severity Level for Divided Roadway Segments
- Table 11-9. Default Distribution of Intersection Crashes by Collision Type and Crash Severity
- **Table 12.4.** Distribution of Multiple-Vehicle Nondriveway Collisions for Roadway Segments by Manner of Collision Type
- Table 12-6. Distribution of Single-Vehicle Crashes for Roadway Segments by Collision Type
- Table 12-11. Distribution of Multiple-Vehicle Collisions for Intersections by Collision Type
- Table 12-13. Distribution of Single-Vehicle Crashes for Intersection by Collision Type

#### **Crash Frequency**

Number of crashes occurring at a particular site, facility, or network in a one year period and is measured in number of crashes per year.

#### **Crash Modification Factor (CMF)**

An index of how much crash experience is expected to change following a modification in design or traffic control. CMF is the ratio between the number of crashes per unit of time expected after a modification or measure is implemented and the number of crashes per unit of time estimated if the change does not take place.

#### **Crash Prediction Algorithm**

Procedure used to predict average crash frequency, consisting of three elements. It has two analytical components: baseline models and crash modification factors, as well as a third component: crash histories.

## **Crash Rate**

The number of crashes per unit of exposure. For an intersection, this is typically the number of crashes divided by the total entering AADT; for road segments, this is typically the number of crashes per million vehicle-miles traveled on the segment.

#### **Crash Rate Method**

A method that normalizes the frequency of crashes against exposure (i.e., traffic volume for the study period for intersections, and traffic volume for the study period and segment length for roadway segments).

#### **Crash Reduction Factor (CRF)**

The percentage of crash reduction that might be expected after implementing a modification in design or traffic control. The CRF is equivalent to (1 - CMF).

#### **Crash Severity**

The level of injury or property damage due to a crash, commonly divided into categories based on the KABCO scale.

#### **Cross Section Lanes**

The total number of through lanes in the segment. Rural Ramp Segments are limited to one lane. Urban ramp segments are limited to two lanes. A segment with a lane-add or -drop taper is considered to have the same number of through lanes as the roadway just downstream of the taper. If the segment ends at a ramp terminal, then the number of through lanes is not based on the lane assignment, or lane markings, at the terminal.

#### **Crossroad Median Width**

This width is measured along a line perpendicular to the centerline of the crossroad in the vicinity of the intersection. If no median exists, then a width of 0.0 ft (or 0.0 m in metric) is used in the predictive model. If a raised curb is present, then the width is measured from face-of-curb to face-of-curb. If a raised curb is not present, then the width is measured from face-of-curb to face-of-curb. If a raised curb is not present, then the width is measured between the near edge of the traveled way for the two opposing travel directions. If a left turn bay is present, then the median width includes the width of the left turn bay. It is measured from the lane line delineating the bay to the face of curb adjacent to (or the near edge of the traveled way for) the opposing travel direction. If the median width is different on the two crossroad legs, then use an average of the two widths.

#### **Curb Length with On-Street Parking**

This is the sum of curb length, in miles (or kilometers in metric), with on-street parking for both side of the road combined. This can be determined from field measurements or video log review to verify parking regulations. Estimated can be made by deducting from twice the roadway segment length allowances for intersections widths, crosswalks, and driveway widths.

#### **Daily Pedestrian Volume**

This is the sum of daily pedestrian volumes, in pedestrians/day, crossing all intersection legs.

#### Date

This field is provided to document the date when the analysis is performed.

#### **Delete Horizontal Curve**

For Freeway Segment, Ramp Segment, and Freeway Intersection analyses, a button for deleting a horizontal curve is available when 'Include Horizontal Curves' is checked. Clicking on the button 'Delete Horizontal Curve' will delete the row of inputs corresponding to the currently selected horizontal curve(s).

#### **Delete Section**

For facility analyses, a button for deleting a section is available. Clicking on the button 'Delete Section' will delete the row of inputs corresponding to the currently selected section(s).

#### **Distance from Inside Shoulder to Barrier**

Measured from the nearest edge of traveled way to the barrier face. A barrier is associated with the freeway if the offset from the near edge of traveled way is 30 feet of less. Barrier adjacent to a ramp, but also within 30 feet of the freeway traveled way should also be associated with the freeway.

#### **Distance from Outside Shoulder to Barrier**

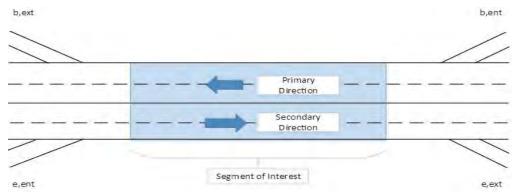
Measured from the nearest edge of traveled way to the barrier face. A barrier is associated with the freeway if the offset from the near edge of traveled way is 30 feet (or 9.1 meters in metric) or less. Barrier adjacent to a ramp, but also within 30 feet (or 9.1 meters in metric) of the freeway traveled way should also be associated with the freeway.

#### **Distance from Segment to Downstream Ramp**

This is the distance from the segment endpoint to the next downstream exit ramp. If there is an exit ramp within the segment, this value is equal to 0.

This value is computed separately for the increasing and decreasing milepost directions.

Downstream *entrance* ramps are not of direct interest, and data are not needed for them if they exist in the vicinity of the segment.

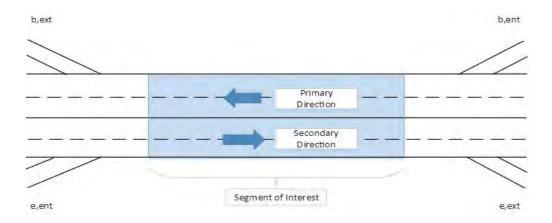


#### **Distance from Segment to Upstream Ramp**

This is the distance from the segment endpoint to the next upstream entrance ramp. If there is an entrance ramp within the segment, this value is equal to 0.

This value is computed separately for the increasing and decreasing milepost directions.

Upstream *exit* ramps are not of direct interest, and data are not needed for them if they exist in the vicinity of the segment.



#### **Distance to Adjacent Intersection**

Distance to the next public street intersection on the outside crossroad leg. This data element represents the distance between the subject ramp terminal and the nearest public street intersection located in a direction away from the freeway (measured along the crossroad from the subject terminal center to the intersection center).

#### **Distance to Adjacent Ramp**

This data element represents the distance between the subject ramp terminal and the adjacent ramp terminal (measured along the crossroad from terminal center to terminal center). If there is no adjacent ramp terminal, then use the distance to the next public street intersection (located in the direction opposite to the intersection described by the distance to adjacent intersection data field).

#### **Driveway Density**

The number of driveways per mile (or per kilometers in metric) on both sides of the roadway combined.

## Driveway Type

Seven specific driveway types have been considered in modeling. These are:

- Major commercial driveways
- Minor commercial driveways
- Major industrial/institutional driveways
- Minor industrial/institutional driveways
- Major residential driveways
- Minor residential driveways
- Other driveways

Major driveways are those that serve sites with 50 or more parking spaces. Minor driveways are those that serve sites with less than 50 parking spaces. It is not intended that an exact count of the number of parking spaces be made for each site. Driveways can be readily classified as major or minor from a quick review of aerial photographs that show parking areas or though user judgment based on the character of the establishment served by the driveway. Commercial driveways provide access to establishments that serve retail customers. Residential driveways serve single- and multiple-family dwellings. Industrial/institutional driveways serve factories, warehouses, schools, hospitals, churches, offices, public facilities, and other places of employment. Commercial sites with no restriction on access along an entire property frontage are generally counted as two driveways.

		Coefficient	s for Specific Roa	dway Types	
- Driveway Type (j)	2U	3T	4U	4D	5T
Number of Driveway-Related Collisions per Drivew	ay per Year (N <sub>j</sub> )				
Major commercial	0.158	0.102	0.182	0.033	0.165
Minor commercial	0.050	0.032	0.058	0.011	0.053
Major industrial/institutional	0.172	0.110	0.198	0.036	0.181
Minor industrial/institutional	0.023	0.015	0.026	0.005	0.024
Major residential	0.083	0.053	0.096	0.018	0.087
Minor residential	0.016	0.010	0.018	0.003	0.016
Other	0.025	0.016	0.029	0.005	0.027
Regression Coefficient for AADT (t)					
All driveways	1.000	1.000	1.172	1.106	1.172
Overdispersion Parameter (k)					
All driveways	0.81	1.10	0.81	1.39	0.10
Proportion of Fatal-and-Injury Crashes (f <sub>duy</sub> )					
All driveways	0.323	0.243	0.342	0.284	0.269
Proportion of Property-Damage-Only Crashes					
All driveways	0.677	0.757	0.658	0.716	0.731

Note: Includes only unsignalized driveways; signalized driveways are analyzed as signalized intersections. Major driveways serve 50 or more parking spaces; minor driveways serve less than 50 parking spaces.

#### **Economic Analysis**

#### Societal Crash Costs:

The Federal Highway Administration (FHWA) has completed research that establishes a basis for quantifying, in monetary terms, the human capital crash costs to society of fatalities and injuries from highway crashes. These estimates include monetary losses associated with medical care, emergency services, property damage, lost productivity, and the like, to society as a whole. They are not to be confused with damages that may be awarded to a particular plaintiff in a personal injury or wrongful death lawsuit. Tort liability damages are based only on the particularized loss to the individual plaintiff and are not allowed to include any societal costs of crashes, which can be used if desired.

State and local jurisdictions often have accepted societal crash costs by crash severity and collision type. When available, these locally-developed societal crash cost data are used with procedures in the HSM.

HSM Default Values:

- FI: \$158,200
- PDO: \$7,400

#### **Empirical Bayes Analysis**

Method used to combine observed crash frequency data for a given site with predicted crash frequency data from many similar sites to estimate its expected crash frequency.

#### **Entering AADT**

Average annual daily traffic volume entering the intersection; measured in vehicles per day for each approach leg

#### Entrance/Exit

Entrance ramps: Merge points

Exit ramps: Diverge points

## **Entry Width**

The entry width should be measured per leg for each roundabout site. The entry width is measured at the entrance line (i.e., the continuation of the inscribed circle diameter) and is the perpendicular width of the lane relative to a vehicle entering the circulatory roadway. The width is measured from the splitter island curb to the curb face at the outside edge of travel way. In the absence of a curb on the outside edge of travel way, the width is measured from the splitter island curb face to the paved edge of travel way. Measurements should be entered in feet and rounded to the nearest foot.

## **Exiting AADT**

Average annual daily traffic volume exiting the intersection; measured in vehicles per day for each approach leg

#### **Expected Average Crash Frequency**

The estimated of long-term expected average crash frequency of a site, facility, or network under a given set of geometric conditions and traffic volumes (AADT) in a given period of years. In the Empirical Bayes (EB) methodology, this frequency is calculated from observed crash frequency at the site and predicted crash frequency at the site based on crash frequency estimates at other similar sites.

#### Expected Average Crash Frequency, Change in

The difference between the expected average crash frequency in the absence of treatment and with treatment in place.

#### **Expected Crashes**

As estimated of long-range average number of crashes per year for a particular type of roadway or intersection.

## Facility

A length of highway that may consist of connected sections, segments, and intersections.

## Facility Type

The facility types and facility site types in the HSM Part C are defined below.

- Chapter 10–Rural Two-Lane, Two-Way Roads–includes all rural highways with two-lanes and two-way traffic operation. Chapter 10 also addresses two-lane two-way highways with center two-way left-turn lanes and two-lane highways with added passing or climbing lanes or with short segments of four-lane cross-sections (up to two miles in length) where the added lanes in each direction are provided specifically to enhance passing opportunities. Short lengths of highway with four-lane cross-sections essentially function as two-lane highways with side-by-side passing lanes, and therefore, are within the scope of the two-lane, two-way highway methodology. Rural highways with longer sections of four-lane cross-sections can be addressed with the rural multilane highway procedures in Chapter 11. Chapter 10 includes three- and four-leg intersection with minor-road stop control and four-leg signalized intersections on all the roadway cross-sections to which the chapter applies.
- *Chapter 11*–Rural Multilane Highways–includes rural multilane highways without full access control. This includes all rural nonfreeways with four through travel lanes, except for two-lane highways with side-by-

side passing lanes, as described above. Chapter 11 includes three- and four-leg intersections with minorroad stop control and four-leg signalized intersections on all the roadway cross-sections to which the chapter applies.

- Chapter 12–Urban and Suburban Arterial Highways–includes arterials without full access control, other than freeways, with two or four through lanes in urban and suburban areas. Chapter 12 includes three- and four-leg intersections with minor-road stop control or traffic signal control and roundabouts on all of the roadway cross-sections to which the chapter applies.
- Chapter 18–Freeways–have fully-restricted access control and grade separation with all intersecting roadways. Freeways are accessed only through grade-separated interchanges. Roads having at-grade access should be analyzed as rural highways or suburban arterials.
- *Chapter 19*–Ramp/Ramp Terminals–applies to the following site types: entrance ramp segment with one or two lanes, exit ramp segment with one or two lanes, C-D road segment with one or two lanes, and crossroad ramp terminal. Connector ramp segments are represented using one of these site types.

## **Fixed-Object Density**

In estimating the density of fixed objects, only point objects that are 4 inches (or 10.2 centimeters in metric) or more in diameter and do not have breakaway design are considered. Point objects that are within 70 ft (or 21.3 meters in metric) of one another longitudinally along the road are counted as a single object. Continuous objects that are not behind point objects are counted as one point object for each 70 ft (or 21.3 meters in metric) of length.

The Fixed-Object Density is measured in fixed objects per mile (or per kilometer in metric), for both sides of the road combined.

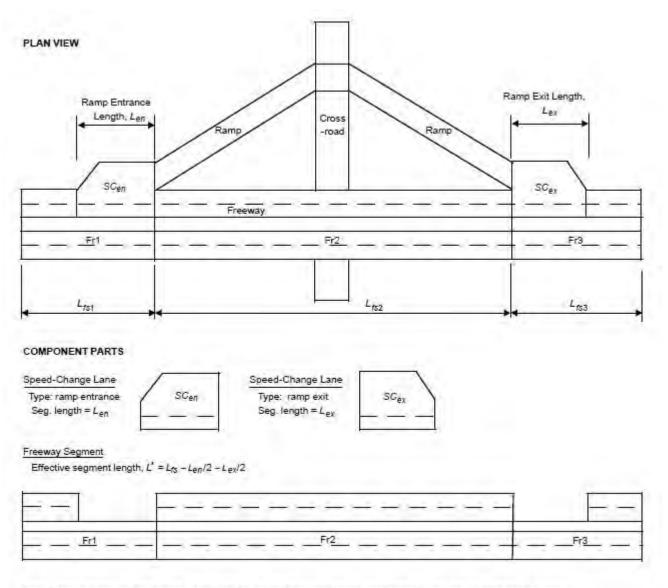
#### **Fixed-Object Offset**

The offset distance is an estimate of the average distance from the edge of the traveled way to roadside objects over an extended roadway segment. If the average offset to fixed objects exceeds 30 ft (or 9.1 meters in metric), use the value of offset for 30 ft (or 9.1 meters in metric). Only fixed objects on the roadside on the right of the roadway in each direction of travel are considered; fixed objects in the roadway median on divided arterials are not considered.

#### **Freeway Segment**

When using the predictive method, the freeway within the defined project limits is divided into individual sites. A site is either a homogenous freeway segment or a speed-change lane. A facility consists of a contiguous set of individual sites. A roadway network consists of a number of contiguous facilities.

Three freeway segments are shown schematically in the figure below. They are labeled  $F_r$  in the figure. The presence of a speed-change lane adjacent to a freeway segment requires a reduction in the effective length of the freeway segment. This reduction is used to account for the crashes assigned to the speed-change lanes. The equation for computing the "effective" segment length is shown in the bottom of the figure for a freeway segment with one ramp entrance and one ramp exit.



Note: Freeway segment length does not include the length of speed-change lanes if these lanes are adjacent to the segment.

# Grade

The base condition for grade is a generally level roadway. The CMFs in the table below are applied to each individual grade segment on the roadway being evaluated without respect to the sign of the grade. The sign of the grade is irrelevant because each grade on a rural two-lane, two-way highway is an upgrade for one direction of travel and a downgrade for the other. The grade factors are applied to the entire grade from one point of vertical intersection (PVI) to the next (i.e., there is no special account taken of vertical curves). The CMFs in the following table apply to total roadway segment crashes:

Approximate Grade (%)			
Level Grade (≤ 3%)	Moderate Terrain $(3\% < \text{grade} \le 6\%)$	Steep Terrain (> 6%)	
1.00	1.10	1.16	

# **Horizontal Curve**

The presence or absence of horizontal curve (curve/tangent) is necessary to select a SPF and to determine whether the site specific conditions vary from the base conditions and, therefore, whether a CMF is applicable. If the segment has one or more curve:

- Length of horizontal curve (miles, or kilometers in metric), (this represents the total length of the horizontal curve and includes spiral transition curves, even if the curve extends beyond the limits of the roadway segment being analyzed);
- Radius of horizontal curve (feet, or meters in metric);
- Presence or absence of spiral transition curve, even if the beginning and/or end of the horizontal curve are beyond the limits of the segment being analyzed); and
- Superelevation of horizontal curve and the maximum superelevation (e<sub>max</sub>) used according to policy for the jurisdiction, if available.

# Horizontal Curve Length

Curve length is measured along the reference line from the point where the tangent ends and the curve begins (i.e., the PC) to the point where the curve ends and the tangent begins (PT). If the curve PC and PT do not lie on the reference line, then they must be projected onto this line and the curve length measured between these projected points along the reference line.

If the curve has spiral transitions, then measure from the "effective" PC point to the "effective" PT point. The effective PC point is located midway between the TS and SC, where the TS is the point of change from tangent to spiral and the SC is the point of change from spiral to circular curve. The effective PT is located midway between the CS and ST, where CS is the point of change from circular curve to spiral and ST is the point of change from spiral to tangent.

The length of curve in segment is the length of the curve within the boundaries of the segment (or speed-change lane). This length cannot exceed the segment length or the curve length.

### **Horizontal Curve Radius**

Radius is measured separately for each roadbed curve. The line used to define curve radius is the inside edge of the traveled way. This line is established separately on each roadbed. If the curve has spiral transitions, then use the radius of the central circular portion of the curve.

### **Include Horizontal Curves**

If the segment includes 1 or more horizontal curves, select this box to input additional information about the curves.

For Rural Two-Lane Undivided Segments, segment endpoints should be located at the Point of Curvatures and the Point of Tangency of each curve, limiting each segment to either no curves, or the entire segment is a curve. To calculate values for multiple segments, use the Rural Facility Module.

# **Inscribed Circle Diameter**

The inscribed circle diameter (ICD) is the parameter used to discuss the general size of a roundabout. It is the diameter of the largest circle that can be inscribed within the outer edges of the circulatory roadway. The ICD serves as the width of the roundabout. The measurement is taken in feet and rounded to the nearest integer (or meters and rounded to the nearest tenth of a meter in metric).

### **Insert Horizontal Curve**

For Freeway Segment, Ramp Segment, and Freeway Intersection analyses, a button for inserting a horizontal curve is available when 'Include Horizontal Curves' is checked.

For Freeway Segment and Speed Change Lanes analyses, clicking on the button 'Insert Horizontal Curve' will add a row of inputs before the selected row. The added row includes the following inputs: Primary Radius, Secondary Radius, and Length in Segment. For Ramp Segment and C-D Road Segment analyses, clicking on the button 'Insert Horizontal Curve' will add a row of inputs before the selected row. The added row includes the following inputs: Radius of Curve, Average Entry Speed, and Length in Segment.

The user can insert an unlimited number of horizontal curves.

### **Insert Section**

For facility analyses, a button for inserting a section is available. A row of inputs must be selected before inserting a section. Clicking on the button 'Insert Section' will add a row of inputs before the selected row. The added row includes the following inputs: Section Type, Facility Type, Model Type, Details, N(spf), and N(predicted). Section Type can either be Segment or Intersection. Facility Type can either be Rural Two-Lane or Rural Multilane in a Rural Facility analysis. Facility Type can only be Urban in an Urban Facility analysis. Section Type and Facility Type cannot be changed within the rows. They must be specified before the new section is added. Model Type can be changed within the rows and the choices available are dependent on Section Type and Facility Type combinations. Clicking on Details within a row will bring the user to the Details page for that specific section. N(spf) specifies the predicted average crash frequency for base conditions for that individual section. N(predicted) specifies the Details page. The user can add an unlimited number of sections.

### Inside Shoulder Width

Represents only the paved width, and is an average for both roadbeds. Should be measured where the cross section is constant, and should not be measured where one or more edges are discontinuous or tapered. If a width varies along the segment or speed change lane (but not enough to justify beginning a new segment), then compute the length-weighted average widths. Rules for defining segment boundaries are provided in section 18.5.2.

### Interchange

Intersections that consist of structures that provide for the cross-flow of traffic at different levels without interruption, thus reducing delay, particularly when volumes are high.

### Interchange Ramp Terminal

A junction with a surface street to serve vehicles entering or exiting a freeway.

### Intersection

General area where two or more roadways or highways meet, including the roadway, and roadside facilities for pedestrian and bicycle movements within the area.

### Intersection Related Crash

A crash that occurs at the intersection itself or a crash that occurs on an intersection approach within 250 ft (or 76.2 meters in metric) of the intersection and is related to the presence of the intersection.

# Is Controlled Right Turn

This information is needed only for the exit ramp. It is focused on the right turn movement, which may have a different control type than the left-turn movement. Control types considered include: free flow, merge, yield, stop, and signal (where free-flow and merge operation are recognized to represent "no control").

# Is Left Side Ramp

Ramp Entrance or Exit on left side of the roadbed.

# Jurisdiction

This field is provided to document any jurisdiction convention or project related information.

# KABCO

An injury scale developed by the National Safety Council to measure the observed injury severity for any person involved as determined by law enforcement at the scene of the crash. The acronym is derived from (Fatal Injury (K), Incapacitating Injury (A), Non-Incapacitating Injury (B), Possible Injury (C), and No Injury (O).) The scale can also be applied to crashes, for example, a K crash would be a crash in which the most severe injury was a fatality, and so forth.

# Lane Width

The lateral distance, measured in feet (or meters in metric), between stripes for a given lane.

# Lanes Added

Lane added to the ramp segment or C-D road, not as a result of a second merging ramp. If a lane is added, then the length of the taper in the segment is needed.

# Lanes Dropped

Lane dropped from the ramp segment or C-D road, not as a result of a second diverging ramp. If a lane is dropped, then the length of the taper in the segment is needed.

### Lanes, Primary Direction

Number of through lanes in the increasing milepost direction. Rural Freeways are limited to eight lanes. Urban Freeways are limited to ten lanes. A segment with a lane add or drop taper is considered to have the same number of through lanes as the roadway just downstream of the taper.

### Lanes, Secondary Direction

Number of through lanes in the decreasing milepost direction. Rural Freeways are limited to eight lanes. Urban Freeways are limited to ten lanes. A segment with a lane add or drop taper is considered to have the same number of through lanes as the roadway just downstream of the taper.

### Left-Turn Lane Present on Crossroad Leg

The lane (or bay) can have one or two lanes. A lane (or bay) is considered to be present when it (a) is for the exclusive use of a turn movement, (b) extends 100 ft or more back from the stop line, and (c) ends at the intersection stop line.

### Left-Turn Lane Width

This variable represents the total width of all lanes that exclusively serve turning vehicles on the subject approach. It is measured from the near edge of the traveled way of the adjacent through lane to the near lane marking (or curb face) that delineates the median.

# Left-Turn Lanes

The lane (or bay) can have one or two lanes. A lane (or bay) is considered to be present when it (a) is for the exclusive use of a turn movement, (b) extends 100 ft or more back from the stop line, and (c) ends at the intersection stop line.

The base condition for intersection left-turn lanes is the absence of left-turn lanes on the intersection approaches. CMFs apply to installation of left-turn lanes on any approach to a signalized intersection but only on uncontrolled major-road approaches to stop-controlled intersections. The CMFs for installation of left-turn lanes on multiple approaches to an intersection are equal to the corresponding CMF for installation of a left-turn on one approach raised to a power equal to the number of approaches with left-turn lanes. There is no indication of any change in crash frequency for providing a left-turn lane on an approach controlled by a stop sign, so the presence of a left-turn lane on a stop-controlled approach is not considered in applying the table found below:

		Number of Approaches with Left-Turn Lanes <sup>a</sup>			
Intersection Type	Intersection Traffic Control	One Approach	Two Approaches	Three Approaches	Four Approaches
Three-leg intersection	Minor-road stop controlb	0.67	0.45	-	—
	Traffic signal	0.93	0.86	0.80	-
Four-leg intersection	Minor-road stop control <sup>b</sup>	0.73	0.53	-	-
	Traffic signal	0.90	0.81	0.73	0.66

<sup>a</sup> Stop-controlled approaches are not considered in determining the number of approaches with left-turn lanes.

<sup>b</sup> Stop signs present on minor-road approaches only.

The CMFs in the table apply to total intersection crashes (not including vehicle-pedestrian and vehicle-bicycle collisions). A CMF of 1.00 is always used when no left-turn lanes are present.

# Left-Turn Phasing

Types of left-turn signal phasing considered include permissive, protected, protected/permissive, and permissive/protected. Protected/permissive operation is also referred to as a leading left-turn signal phase; permissive/protected operation is also referred to as a lagging left-turn signal phase. The base condition for the Intersection Left-Turn Signal Phasing CMF is permissive left-turn signal phasing. This CMF applies to total intersection crashes (not including vehicle-pedestrian and vehicle-bicycle collisions) and is applicable only to signalized intersections. A CMF value of 1.00 is always used for unsignalized intersections.

If several approaches to a signalized intersection have left-turn phasing, the values of  $CMF_{2i}$  for each approach are multiplied together.

# Length

The distance, in miles (or kilometers in metric), from end to end of the segment.

# Lighting

Artificial lighting is often provided on roadway segments in urban and suburban areas. Lighting is also often provided at rural locations where road users may need to make a decision.

# Maximum Lanes Crossed by Pedestrian

The values of  $n_{lanesx}$  in Equation 12-29 represents the maximum number of traffic lanes that a pedestrian must cross in any crossing maneuver at the intersection. Both through and turning lanes that are crossed by a pedestrian along the crossing path are considered. If the crossing path is broken by an island that provides a suitable refuge for the pedestrian so that the crossing may be accomplished in two (or more) stages, then the number of lanes crossed in each stage is considered separately. To be considered as a suitable refuge, an island must be raised or depressed; a flush or painted island is not treated as a refuge for purposes of determining the values of  $n_{lanesx}$ .

# Median

The portion of a divided highway separating the traveled ways from traffic in opposite directions.

### **Median Barriers**

Median barriers are devices used to prevent a vehicle from striking a more severe obstacle or feature located in the median or to prevent crossover median crashes.

# **Median Width**

The width, in feet (or meters in metric), of the median, which is the portion of a divided highway separating the traveled ways from traffic in opposite directions.

### **Minor Street**

The lower volume street controlled by stop signs at a two-way or four-way stop-controlled intersection; also referred to as a *side street*. The lower volume street at a signalized intersection.

# Model Type

This specifies the Site Type for the combination of Facility Type and Section Type being analyzed.

See also Site Type.

### **Multilane Highway**

A highway with at least two lanes for the exclusive use of traffic in each direction, with no control, partial control, or full control of access, but that may have periodic interruptions to flow at signalized intersections.

# Non-Ramp Public Street Leg

This situation occurs occasionally. When it does, the public street leg is opposite from one ramp, and the other ramp either does not exist or is located at some distance from the subject ramp terminal such that it is not part of the terminal. This information is needed only for signalized terminals.

### **Number of Access Points**

An access point is a driveway (not a public roadway) located along one of the legs of the roundabout of interest. The count of access points on a leg represents the number of driveways or unsignalized access points on the leg (either side) within 250 feet (or 76.2 meters in metric) of the yield line.

### **Number of Alcohol Sales Establishments**

The number of alcohol sales establishments within 1,000 ft (or 304.8 meters in metric) of the center of an intersection. The base condition for alcohol sales establishments is the absence of alcohol sales establishments near the intersection. Any alcohol sales establishments wholly or partly within 1,000 ft (or 304.8 meters in metric) of the intersection may be counted.

The CMF for alcohol sales establishments indicates that an intersection with alcohol sales establishments nearby is likely to experience more vehicle-pedestrian collisions than an intersection without alcohol sales establishments even if the traffic and pedestrian volumes at the two intersections are identical. This indicates the likelihood of higher risk behavior on the part of either pedestrians or drivers near alcohol sales establishments. The CMF includes any alcohol sales establishment which may include liquor stores, bars, restaurants, convenience stores, or grocery

stores. Alcohol sales establishments are counted if they are on any intersection leg or even on another street, as long as they are within 1,000 ft (or 304.8 meters in metric) of the intersection being evaluated.

### **Number of Bus Stops**

The number of bus stops within 1,000 ft (or 304.8 meters in metric) of the center of the intersection. The base condition for bus stops is the absence of bus stops near the intersection.

Multiple bus stops at the same intersection (i.e., bus stops in different intersection quadrants or located some distance apart along the same intersection leg) are counted separately. Bus stops located at adjacent intersections would also be counted as long as any portion of the bus stop is located within 1,000 ft (or 304.8 meters in metric) of the intersection being evaluated.

### **Number of Circulating Lanes**

The number of circulating lanes represents the count of circulating lanes immediately downstream of the entry that forms the end of the segment under study.

### Number of Crossroad Lanes

Lanes on the cross road. This value only include lanes that continue through the intersection. Count the lanes along the crosswalk (or the logical location of the crosswalk if it is not marked).

### Number of Driveways

The number of driveways of a specific type,  $n_j$ , is the sum of the number of driveways of that type for both sides of the road combined. The number of driveways is determined separately for each side of the road and then added together.

See also Driveway Type.

### Number of Entering Lanes

The number of entering lanes represents the count of lanes entering the roundabout for each leg. The number of entering lanes per leg does not include right-turn bypass lanes on the leg.

### **Number of Exiting Lanes**

The number of exiting lanes represents the count of lanes exiting the roundabout for each leg. The number of exit lanes per leg does not include any lanes that may be formed from a bypass lane.

### Number of Lanes Serving the Exit Ramp

Lanes can serve any movement. If right turn channelization is provided, then count the lanes at the last point where all exiting movements are joined (i.e., count at the channelization gore point). All lanes counted must be fully developed for at least 100 ft before intersecting the crossroad. If a lane's development length is less than 100 ft, then it is not counted as a lane for this application. The lane (or lanes) associated with the loop exit ramp at a B4 terminal configuration are not included in this count.

### Number of Legs

A leg of a roundabout should be counted as such it is a public roadway (i.e., not a private driveway). A leg does not need to accommodate two-way traffic. A leg can, but does not need to, separate opposing traffic with a physical or painted splitter island. Options are provided for 4-leg and 3-leg roundabouts.

### Number of Luminaires

A luminaire is a light fixture that appears to have been designed to illuminate the roadway right-of-way along the legs of the roundabout and through a roundabout. Luminaires do not include adjacent lighting that is oriented to illuminate roadside buildings or features like billboards or other advertising signs. The number of luminaires represents the count of luminaires within 250 feet (or 76.2 meters in metric) of the roundabout entry point on each leg.

# Number of Traffic Lanes that Oppose Left Turn

Number of lanes on the crossroad that conflict with left turn movements

# Number of Unsignalized Driveways

This number represents the count of unsignalized driveways on the outside crossroad leg and within 250 feet (or 76.2 meters in metric) of the ramp terminal. The count is taken on both sides on the leg (two travel directions). The count should only include "active" driveways (i.e., those driveways with an average daily volume of 10 veh/day or more).

### Number of Unsignalized Public Street Approaches

This number represents the count of unsignalized public street approaches on the outside crossroad leg and within 250 feet (or 76.2 meters in metric) of the ramp terminal. The count is taken on both sides on the leg (two travel directions). If a public street is present at the terminal, then it is not counted for this entry.

See Non-Ramp Public Street Leg.

# Number of Years of Observed Crashes

The Empirical Bayes analysis uses prior years of observed crash history to estimate the expected crash frequency. This is the number of years of observed crashes used. The Highway Safety Manual recommends at least 2 years of observed crash history should be used. Each year of observed crash history used should have the same geometric conditions as reported on the details page.

# **Observed Crashes**

Observed crashes for this segment or intersection occurring during the years specified. Crashes should be assigned to the appropriate segment or intersection depending on the appropriate criteria:

- 1. All crashes occurring within the curb-line limits of the intersection are assigned to the intersection
- 2. Other crashes are assigned to the segment or the intersection depending on their characteristics. Crashes classified on the crash report as intersection-related or have characteristics consistent with an intersection related crash are assigned to the intersection to which they are related; such crashes would include rearend collisions related to queues on an intersection approach. Crashes that occur between intersections and are not related to an intersection, such as collisions related to turning maneuvers at driveways, are assigned to the roadway segment on which they occur.

# **Outbound Leg associated with a Ramp Terminal**

A roundabout is considered a ramp terminal intersection if one or more of the legs to the roundabout is a ramp leading from or to a controlled access facility, such as a freeway. Checkboxes are provided to indicate if the subject leg is an outbound leg associated with a ramp terminal.

# **Outside Shoulder Width**

Represents only the paved width, and is an average for both roadbeds. Should be measured where the cross section is constant, and should not be measured where one or more edges are discontinuous or tapered. If a width varies along the segment or speed change lane (but not enough to justify beginning a new segment), then compute the length-weighted average widths. Rules for defining segment boundaries are provided in section 18.5.2.

# Parking

There are two broad types of parking facilities: at the curb or on-street parking, and off-street parking in lots or parking structures. Parking safety is influenced by a complex set of driver and pedestrian attitudinal and behavioral patterns.

Certain kinds of crashes may be caused by curb or on-street parking operations, these include:

- Sideswipe and rear-end crashes resulting from lane changes due to the presence of a parking vehicle or contact with a parked car;
- Sideswipe and rear-end crashes resulting from vehicles stopping prior to entering the parking stall;
- Sideswipe and rear-end crashes resulting from vehicles exiting parking stalls and making lane changes; and
- Pedestrian crashes resulting from passengers alighting from the street-side doors of parked vehicles, or due to pedestrians obscured by parked vehicles.

# Parking Type

There are three types of on-street parking. These include: No Parking, Parallel Parking, and Angle Parking. No Parking is when parking is prohibited on the street. Parallel parking is when the vehicle parks aligned with the road. Angle parking is when the vehicle parks on a specified angle to the curb.

### **Passing Lane**

A lane added to improve passing opportunities in one or both directions of travel on a two-lane highway.

The base condition for passing lanes is the absence of a lane (i.e., the normal two-lane cross section). The CMF for a conventional passing or climbing lane added in one direction of travel on a rural two-lane, two-way highway is 0.75 for total crashed in both directions of travel over the length of the passing lane from the upstream end of the lane addition taper to the downstream end of the lane drop taper. This value assumes that the passing lane is operationally warranted and that the length of the passing lane is appropriate for the operational conditions on the roadway. There may also be some safety benefit on the roadway downstream of a passing lane, but this effect has not been quantified.

### Pedestrian

A person traveling on foot or in a wheelchair

### **Pedestrian Activity**

Pedestrian crossing volumes are categorized into general levels of Pedestrian Activity. There are five level of pedestrian activity. These include: *High, Medium-high, Medium, Medium-low,* and *Low.* The following table shows estimated of pedestrian crossing volumes based on general level of pedestrian activity.

	Estimate of PedVol (pedestrians/day) for Use in Equation 12-29		
General Level of Pedestrian Activity	<b>3SG Intersections</b>	4SG Intersections	
High	1,700	3,200	
Medium-high	750	1,500	
Medium	400	700	
Medium-low	120	240	
Low	20	50	

# Pedestrian Crash Adjustment Factor

For roadway segments,  $f_{pedr}$  is the pedestrian crash adjustment factor. It is used in the determination of the number of vehicle-pedestrian collisions per year for a roadway segment. The values of  $f_{pedr}$  are likely to depend on the climate and the walking environment in particular states or communities. The following table shows the pedestrian crash adjustment factors for roadway segments, but users are encouraged to replace the values in the table with suitable values for their own state or community through the calibration process.

	Pedestrian Crash Adjustment Factor (fpedr)			
Road Type	Posted Speed 30 mph or Lower	Posted Speed Greater than 30 mph		
2U	0.036	0.005		
3T	0.041	0.013		
4U	0.022	0.009		
4D	0.067	0.019		
5T	0.030	0.023		

Note: These factors apply to the methodology for predicting total crashes (all severity levels combined). All pedestrian collisions resulting from this adjustment factor are treated as fatal-and-injury crashes and none as property-damage-only crashes.

Source: HSIS data for Washington (2002–2006)

For intersections,  $f_{pedi}$  is the pedestrian crash adjustment factor. It is used in the determination of the number of vehicle-pedestrian collisions per year for a stop-controlled intersection. The values of  $f_{pedi}$  are likely to depend on the climate and walking environment in particular states or communities. The following table shows the pedestrian crash adjustment factors for stop-controlled intersections, but users are encouraged to replace the values in the table with suitable values for their own state or community through the calibration process.

Intersection Type	Pedestrian Crash Adjustment Factor (f <sub>pedi</sub> )	
3ST	0.021	
4ST	0.022	

Note: These factors apply to the methodology for predicting total crashes (all severity levels combined). All pedestrian collisions resulting from this adjustment factor are treated as fatal-and-injury crashes and none as property-damage-only crashes. Source: HSIS data for California (2002–2006)

### **Pedestrian Crosswalk**

Pedestrian roadway crossing facility that represents a legal crosswalk at a particular location.

### **Pedestrian Refuge**

An at-grade opening within a median island that allows pedestrians to wait for an acceptable gap in traffic.

# **Posted Speed**

This is the speed limit, in mi/h (or km/h in metric), that is posted for the roadway.

# **Predicted Average Crash Frequency**

The estimate of long-term average crash frequency which is forecast to occur at a site using a predictive model found in Part C of the HSM.

# **Predictive Method**

The methodology in Part C of the HSM used to estimate the 'expected average crash frequency' of a site, facility, or roadway under given geometric conditions, traffic volumes, and period of time.

# Presence of School

The base condition for schools is the absence of a school near the intersection. The CMF for schools within 1,000 ft (or 304.8 meters in metric) of the center of the intersection is presented in the following table:

Presence of Schools within 1,000 ft of the Intersection	CMF <sub>2p</sub>
No school present	1.00
School present	1.35

A school may be counted if any portion of the school grounds is within 1,000 ft (or 304.8 meters in metric) of the intersection. Where one or more schools are located near the intersection, the value of the CMF is independent of the number of schools present. This CMF applies to total vehicle-pedestrian collisions.

This CMF indicates that an intersection with a school nearby is likely to experience more vehicle-pedestrian collisions than an intersection without schools even if the traffic and pedestrian volumes at the two intersections are identical. Such increased crash frequencies indicate that school children are at higher risk than other pedestrians.

# **Project Description**

This field is provided for the user to document the analysis with any information for identification purposes.

# **Project-Level Parameters**

A checkbox is provided on the General page of a facility analysis for the user to indicate if parameters should be applied on a level that is project wide or if separate section-level parameters should be provided on the Details page of each section. Checking the box will indicate the project-level parameters will be applied to all the corresponding sections. Leaving the checkbox unchecked will indicate each section will apply its own parameters.

# **Proportion of AADT during High Volume Hours**

Proportion of freeway AADT volume that occurs during hours where the lane volume exceeds 1,000 vehicles per hour per lane. If local data is not available, a default value can be computed as  $1.0 - \exp(1.45 - 0.000124 \times AADT / n)$ , where n is the number of lanes in both directions, and AADT is total AADT for both directions.

# **Proportion of Barrier on Outside Shoulder**

Length of barrier present divided by length of segment

# **Proportion of Crashes that Occur at Night**

For segments, this is the proportion of total crashes for unlighted roadway segments that occur at night. It is denoted by  $p_{nr}$ . The tables below show the nighttime crash proportions for unlighted roadway segments based on roadway type.

#### Rural Two-Lane, Two-Way Roads (Chapter 10)

	Proportion of Total Nighttime Crashes by Severity Level		Proportion of Crashes that Occur at Night	
Roadway Type	Fatal and Injury <i>p<sub>inr</sub></i>	PDO <i>p</i> <sub>pnr</sub>	P <sub>nr</sub>	
2U	0.382	0.618	0.370	

Note: Based on HSIS data for Washington (2002–2006)

#### Rural Multilane Highways (Chapter 11)

Roadway Type	Proportion of Total Night-Time	Crashes by Severity Level	Proportion of Crashes that Occur at Night
	Fatal and Injury P <sub>inr</sub>	PDO P <sub>pnr</sub>	P <sub>nr</sub>
4U	0.361	0.639	0.255
7.2	Proportion of Total Nighttime	Crashes by Severity Level	Proportion of Crashes that Occur at Night
Roadway Type	Fatality and Injury pin	PDO P <sub>pnr</sub>	P <sub>nr</sub>
4D	0.323	0.677	0.426

#### Urban and Suburban Arterials (Chapter 12)

	Proportion of Total Nighttime Crashes by Severity Level		Proportion of Crashes that Occur at Nigh	
Roadway Segment Type	Fatal and Injury p <sub>inr</sub>	PDO p <sub>pnr</sub>	P <sub>nr</sub>	
2U	0.424	0.576	0.316	
3T	0.429	0.571	0.304	
4U	0.517	0.483	0.365	
4D	0.364	0.636	0.410	
5T	0.432	0.568	0.274	

For intersections, this is the proportion of total crashes for unlighted intersections that occur at night. It is denoted by  $p_{ni}$ . The tables below show the nighttime crash proportions for unlighted intersections.

#### Rural Two-Lane, Two-Way Roads (Chapter 10)

	Proportion of Crashes that Occur at Night $p_{ni}$	
Intersection Type		
3ST	0,260	
4ST	0.244	
4SG	0.286	

Note: Based on HSIS data for California (2002-2006)

#### Rural Multilane Highways (Chapter 11)

Intersection Type	Proportion of Crashes that Occur at Night, $p_{_{\!\!M\!I}}$
3ST	0.276
4ST	0,273

#### Urban and Suburban Arterials (Chapter 12)

	Proportion of Crashes that Occur at Night P <sub>ni</sub>	
Intersection Type		
3ST	0.238	
4ST	0.229	
3SG and 4SG	0.235	

### **Proportion of Fatal-and-Injury Crashes for Combined Sites**

Since there are no models for fatal-and-injury crashes at three- and four-leg stop-controlled urban intersections (3ST and 4ST) in HSM Table 12-12, HSM Equation 12-25 is replaced with the following equation in these cases:

 $N_{bisv(Fl)} = N_{bisv(total)} \times f_{bisv}$ 

where:

 $f_{bisv}$  = proportion of fatal-and-injury crashes for combined sites.

The default value of  $f_{bisv}$  is 0.31 for 3ST and 0.28 for 4ST intersections. It is recommended that these default values be updated based on locally available data.

### Proportion of Length Adjacent to Speed Change Lane

If there is a speed change area due to a second merging or diverging ramp, this is the length of that speed change area divided by the length of the segment.

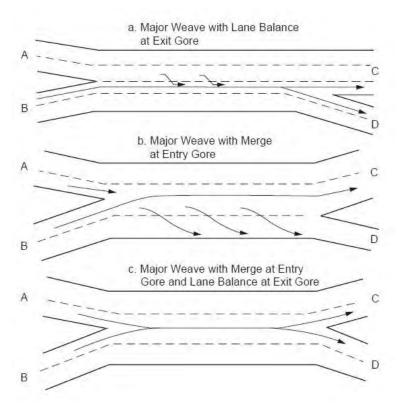
### Proportion of Length Adjacent to Taper

This is the length of the taper within the segment divided by the segment length.

### Proportion of Length within a Type B Weaving Section

This weaving section has the following characteristics: (a) one of the two weaving movements can be made without making any lane changes, (b) the other weaving movement requires at most one lane change, and (c) the ramp entrance and ramp exit associated with the weaving section are located on the right side of the freeway.

Typical Type B weaving sections are shown in the figure below.



Other weaving section types are addressed directly by the predictive method.

The proportion is the length of the weaving section located in the segment divided by the length of the segment. This value is computed separately for the increasing and decreasing milepost directions.

# Proportion of Length within a Weaving Segment

Computed as the ratio of the length of the weaving section in the segment to the length of the segment. If the segment is wholly located in the weaving section, then this variable is equal to 1.0.

# **Proportion of Median Barrier Length**

Length of barrier present divided by the length of segment. A barrier is associated with the freeway if the offset from the near edge of traveled way is 30 feet (or 9.1 meters in metric) or less. Barrier adjacent to a ramp, but also within 30 feet (or 9.1 meters in metric) of the freeway traveled way should also be associated with the freeway.

# Proportion of Multiple-Vehicle Crashes Represented by Rear-End Collisions

This is the proportion of crashes that are multiple-vehicle, rear-end collisions and it is denoted by  $p_{re}$ . The proportion of multiple-vehicle fatal-and-injury crashes represented by rear-end collisions is denoted by  $p_{remv(FI)}$ . The proportion of multiple-vehicle property-damage-only crashes represented by rear-end collisions is denoted by  $p_{remv(PDO)}$ .

# Proportion of Multiple-Vehicle Crashes Represented by Right-Angle Collisions

This is the proportion of crashes that are multiple-vehicle, right-angle collisions and it is denoted by  $p_{ra}$ . The proportion of multiple-vehicle fatal-and-injury crashes represented by right-angle collisions is denoted by  $p_{ramv(FI)}$ . The proportion of multiple-vehicle property-damage-only crashes represented by right-angle collisions is denoted by  $p_{ramv(FI)}$ .

# **Proportion of Nighttime Crashes that Involve a Fatality**

This is the proportion of total nighttime crashes for unlighted roadway segments that involve a fatality or injury. It is denoted by  $p_{inr}$ . The tables below show the nighttime crash proportions for unlighted roadway segments based on roadway type.

Roadway Type	Proportion of Total Nighttime Cras	Proportion of Crashes that Occur at Night	
	Fatal and Injury <i>p<sub>inr</sub></i>	PDO $p_{pnr}$	P <sub>nr</sub>
2U	0.382	0.618	0.370

#### Rural Two-Lane, Two-Way Roads (Chapter 10)

Note: Based on HSIS data for Washington (2002-2006)

#### Rural Multilane Highways (Chapter 11)

Roadway Type	Proportion of Total Night-Time	Crashes by Severity Level	Proportion of Crashes that Occur at Night
	Fatal and Injury P <sub>inr</sub>	PDO p <sub>pnr</sub>	P <sub>nr</sub>
4U	0.361	0.639	0.255
	Proportion of Total Nighttime (	Crashes by Severity Level	Proportion of Crashes that Occur at Night
Roadway Type	Fatality and Injury pin	PDO Ppnr	P <sub>nr</sub>
	19.28.0	0.677	0.426

#### Urban and Suburban Arterials (Chapter 12)

	Proportion of Total Nighttime C	Proportion of Crashes that Occur at Nigh		
Roadway Segment Type	Fatal and Injury p <sub>inr</sub>	PDO p <sub>pnr</sub>	Pnr	
2U	0.424	0.576	0.316	
3T	0.429	0.571	0.304	
4U	0.517	0.483	0.365	
4D	0.364	0.636	0.410	
5T	0.432	0.568	0.274	

### **Proportion of Nighttime Crashes that Involve Property Damage**

This is the proportion of total nighttime crashes for unlighted roadway segments that involve property damage only. It is denoted by  $p_{pnr}$ . The tables below show the nighttime crash proportions for unlighted roadway segments based on roadway type.

#### Rural Two-Lane, Two-Way Roads (Chapter 10)

	Proportion of Total Nighttime Cras	Proportion of Crashes that Occur at Night	
Roadway Type	Fatal and Injury <i>p<sub>inr</sub></i>	PDO <i>p</i> <sub>pnr</sub>	$P_{\mu r}$
2U	0.382	0.618	0.370

Note: Based on HSIS data for Washington (2002-2006)

Roadway Type	Proportion of Total Night-Time	Crashes by Severity Level	Proportion of Crashes that Occur at Night
	Fatal and Injury P <sub>inr</sub>	PDO P <sub>pnr</sub>	P <sub>nr</sub>
4U	0.361	0.639	0.255
	Proportion of Total Nighttime	Crashes by Severity Level	Proportion of Crashes that Occur at Night
Roadway Type	Fatality and Injury p <sub>int</sub>	PDO p <sub>pnr</sub>	P <sub>nr</sub>
4D	0.323	0.677	0.426

#### Rural Multilane Highways (Chapter 11)

#### Urban and Suburban Arterials (Chapter 12)

	Proportion of Total Nighttime C	Proportion of Crashes that Occur at Nig		
Roadway Segment Type	Fatal and Injury p <sub>int</sub>	PDO p <sub>pnr</sub>	P <sub>nr</sub>	
2U	0.424	0.576	0.316	
3T	0.429	0.571	0.304	
4U	0.517	0.483	0.365	
4D	0.364	0.636	0.410	
5T	0.432	0.568	0.274	

### **Proportion of Related Crashes**

This is the proportion of total crashes constituted by related crashes. It is denoted by  $p_{ra}$ .

### **Proportion of Rumble Strips on Inside Shoulders**

Length of rumble strips divided by the length of the roadway. Rumble strips are devices designed to give strong auditory and tactile feedback to errant vehicles leaving the travel way.

### **Proportion of Rumble Strips on Outside Shoulders**

Length of rumble strips divided by the length of the roadway. Rumble strips are devices designed to give strong auditory and tactile feedback to errant vehicles leaving the travel way.

### **Protected Left-Turn**

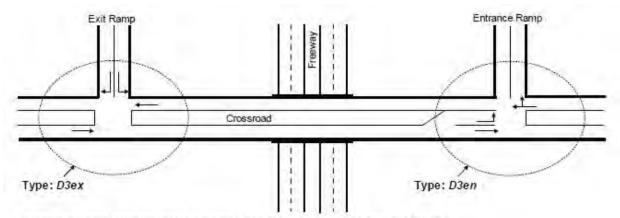
This information is needed for each crossroad left-turn movement that exists at the terminal. An affirmative response is indicated if the left-turn operates as protected only. If it operates as permissive or protected-permissive, then the response is negative.

# Ramp Length

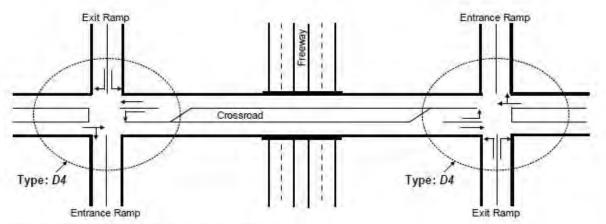
Length of entrance or exit ramp. Measured from the gore point to the taper point.

# **Ramp Terminal Type**

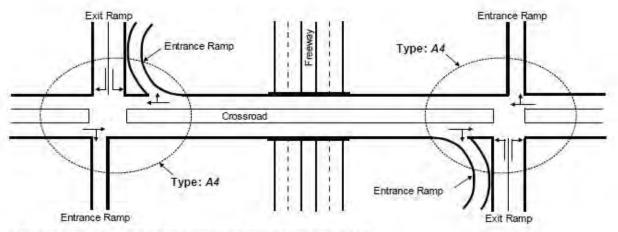
There are many different configurations of crossroad ramp terminal used at interchanges. The more common configurations include D3ex, D3en, D4, A4, B4, and B2. They are identified below:



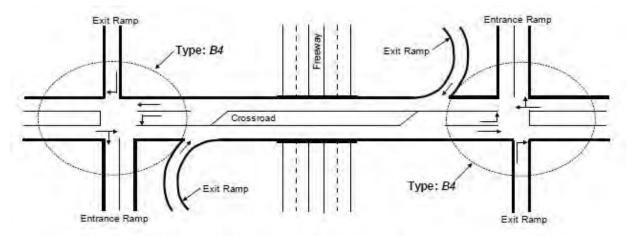
a. Three-Leg Ramp Terminal with Diagonal Exit or Entrance Ramp (D3ex and D3en)



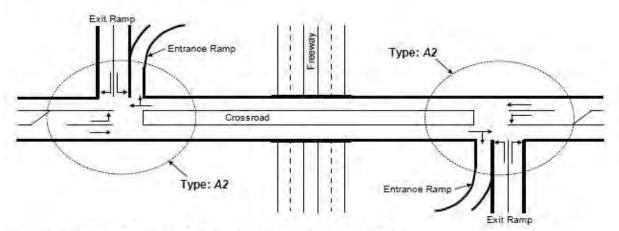
b. Four-Leg Ramp Terminal with Diagonal Ramps (D4)



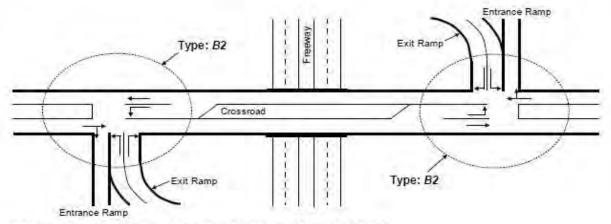
c. Four-Leg Ramp Terminal at Four-Quadrant Partial Cloverleaf A (A4)



d. Four-Leg Ramp Terminal at Four-Quadrant Partial Cloverleaf B (B4)



e. Three-Leg Ramp Terminal at Two-Quadrant Partial Cloverleaf A (A2)



f. Three-Leg Ramp Terminal at Two-Quadrant Partial Cloverleaf B (B2)

Differences among the terminals shown above reflect the number of ramp legs, number of left-turn movements, and location of crossroad left-turn storage (i.e., inside or outside of the interchange). Although not shown, control type (i.e., signalized or stop controlled) is also an important factor in characterizing a crossroad ramp terminal).

# Ramp Type

There are two types of ramps: entrance ramp and exit ramp. An entrance ramp is a ramp from a cross road to a freeway. An exit ramp is a ramp from a freeway to a cross road.

# **Red Light Cameras**

These are cameras installed for enforcement of red signal violations at a signalized intersection.

The base condition for red light cameras is their absence. A study indicates a CMF for red light camera installation of 0.74 for right-angle conditions and a CMF of 1.18 for rear-end collisions. In other words, red light cameras would typically be expected to reduce right-angle collisions and increase rear-end collisions. There is no evidence that red light camera installation affects other collision types.

# **Right-Turn Bypass Lane**

A right-turn bypass lane is a lane, typically for right turns but sometimes for through movements at T-intersections, that is separated from the adjacent entry lane either by a channelized island or pavement markings used to create physical, horizontal separation between the bypass lane and the adjacent roundabout entry lanes. Right-turn bypass lanes should not be included in the count of number of entering lanes on a leg.

# **Right-Turn Channelization**

This channelization creates a turning roadway that serves right-turn vehicles. It is separated from the intersection by a triangular channelizing island (delineated by markings or raised curb). The gore point at the upstream end of the island must be within 200 ft (or 61.0 meters in metric) of the downstream stop line for the right turn channelization to be considered "present". If this distance exceeds 200 ft (or 61.0 meters in metric), then the right-turn movement can be free-flow, stop, or yield controlled.

# **Right-Turn Lane Present on Crossroad Leg**

The lane (or bay) can have one or two lanes. A lane (or bay is considered to be present when it (a) is for the exclusive use of a turn movement, (b) extends 100 ft (or 30.5 meters in metric) or more back from the stop line, and (c) satisfies one of the following rules:

- If the bay or turn lane does not have island channelization at the intersection, then it must end at the intersection stop line.
- If the bay or turn lane has island channelization at the intersection, then the bay or turn lane must have (a) stop, yield, or signal control at its downstream end, and (b) an exit gore point that is within 200 ft (or 61.0 meters in metric) of the intersection.

# **Right-Turn Lanes**

The lane (or bay) can have one or two lanes. A lane (or bay is considered to be present when it (a) is for the exclusive use of a turn movement, (b) extends 100 ft (or 30.5 meters in metric) or more back from the stop line, and (c) satisfies one of the following rules:

- If the bay or turn lane does not have island channelization at the intersection, then it must end at the intersection stop line.
- If the bay or turn lane has island channelization at the intersection, then the bay or turn lane must have (a) stop, yield, or signal control at its downstream end, and (b) an exit gore point that is within 200 ft (or 61.0 meters in metric) of the intersection.

The base condition for intersection right-turn lanes is the absence of right-turn lanes on the intersection approaches. CMFs apply to installation of right-turn lanes on any approach to a signalized intersection, but only on uncontrolled major road approaches to stop-controlled intersections. The CMFs for installation of right-turn lanes on multiple

approaches to an intersection are equal to the corresponding CMF for installation of a right-turn lane on one approach raised to a power equal to the number of approaches with right-turn lanes. There is no indication of any safety effect for providing a right-turn lane on an approach controlled by a stop sign, so the presence of a right-turn lane on a stop-controlled approach is not considered in applying the table found below:

		Number of Approaches with Right-Turn Lanes <sup>a</sup>				
Intersection Type	Intersection Traffic Control	One Approach	Two Approaches	Three Approaches	Four Approaches	
Three-Leg Intersection	Minor road stop control <sup>b</sup>	0.86	0.74		-	
Four-Leg Intersection	Minor road stop control <sup>b</sup>	0.86	0.74	—		
	Traffic signal	0.96	0.92	0.88	0.85	

<sup>a</sup> Stop-controlled approaches are not considered in determining the number of approaches with right-turn lanes.

<sup>b</sup> Stop signs present on minor road approaches only.

The CMFs in the table apply to total intersection crashes. A CMF values of 1.00 is always used when no right-turn lanes are present. This CMF applies only to right-turn lanes that are identified by marking or signing. The CMF is not applicable to long tapers, flares, or paved shoulders that may be used informally by right-turn traffic.

# Road Type

Road Type refers to the land use. There are two categories of Road Type. These include: *Residential/Other* and *Commercial or Industrial/Institutional*.

# Roadside

The area between the outside shoulder edge and the right-of-way limits. The area between roadways of a divided highway may also be considered roadside.

Roadside geometry refers to the physical layout of the roadside, such as curbs, foreslopes, backslopes, and transverse slopes.

Designing a roadside environment to be clear of fixed objects with stable flattened slopes is intended to increase the opportunity for errant vehicles to regain the roadway safely or to come to a stop on the roadside. This type of roadside environment, called a "forgiving roadside," is also designed to reduce the chance of serious consequences if a vehicle leaves the roadway.

Roadside features include signs, signals, luminaire supports, utility poles, trees, driver-aid call boxes, railroad crossing warning devices, fire hydrants, mailboxes, bus shelters, and other similar roadside features.

### **Roadside Barrier**

A longitudinal device used to shield drivers from natural or man-made objects located along either side of a traveled way. It may also be used to protect bystanders, pedestrians, and cyclists from vehicular traffic under special conditions.

### **Roadside Fixed Objects**

These are objects fixed on the side of the roadway.

The base condition is the absence of roadside fixed objects on a roadway segment.

### **Roadside Hazard Rating**

Considers the clear zone in conjunction with the roadside slope, roadside surface roughness, recoverability of the roadside, and other elements beyond the clear zone such as barriers or trees. As the RHR increases from 1 to 7, the crash risk for frequency and/or severity increases.

# Roadway

The portion of a highway, including shoulders, for vehicular use.

# **Roadway Segment**

A portion of a road that has a consistent roadway cross-section and is defined by two endpoints.

# **Rumble Strips**

Devices designed to give strong auditory and tactile feedback to errant vehicles leaving the travel way.

Centerline rumble strips are installed on undivided highways along the centerline of the roadway which divides opposing directions of traffic flow. Centerline rumble strips are incorporated in the roadway surface to alert drivers who unintentionally cross, or begin to cross, the roadway centerline. The base condition for centerline rumble strips is the absence of rumble strips.

# **Rural Areas**

Places outside the boundaries of urban growth boundary where the population is less than 5,000 inhabitants.

# Safety

The number of crashes, by severity, expected to occur on the entity per unit of time. An entity may be a signalized intersection, a road segment, a driver, a fleet of trucks, etc.

# Safety Performance Function (SPF)

An equation used to estimated or predict the expected average crash frequency per year at a location as a function of traffic volume and in some cases roadway or intersection characteristics (e.g., number of lanes, traffic control, or type of median).

# **Section Name**

This field is provided for each section to identify the section or specify the start point and end point of the section under analysis.

# **Section Type**

This specifies whether the section being analyzed is a Segment or an Intersection.

# Segment

A portion of a facility on which a crash analysis is performed. A segment is defined by two endpoints.

See also Roadway Segment.

### Shoulder

A portion of the roadway contiguous with the traveled way for accommodation of pedestrians, bicycles, stopped vehicles, emergency use, as well as lateral support of the subbase, base, and surface courses.

# Shoulder Type

There exists four shoulder types: paved, gravel, composite, and turf.

# **Shoulder Width**

The width of the shoulder, in feet (or meters in metric).

### Sideslope

A sideslope is a roadway cross-section element. It is the slope of the cut or fill expressed as a ratio of vertical distance to horizontal distance. The CMF for the sideslope for undivided roadway segments of rural multilane highways is presented in the following table:

1:2 or Steeper	1:3	1:4	1:5	1:6	1:7 or Flatter
1.18	1.15	1.12	1.09	1.05	1.00

The base conditions are for a sideslope of 1:7 or flatter.

### Site

Project location consisting of, but not limited to, intersections, ramps, interchanges, at-grade rail crossings, roadway segments, etc.

# Site Type

The following table identifies the site types on rural two-lane, two-way roads for which SPFs have been developed from predicting average crash frequency, severity, and collision type.

Site Type	Site Types with SPFs in Chapter 10	
Roadway Segments	Undivided rural two-lane, two-way roadway segments (2U)	
	Unsignalized three-leg (stop control on minor-road approaches) (3ST)	
Intersections	Unsignalized four-leg (stop control on minor-road approaches) (4ST)	
	Signalized four-leg (4SG)	

These specific site types are defined as follows:

- Undivided roadway segment (2U)-a roadway consisting of two lanes with a continuous cross-section
  providing two directions of travel in which the lanes are not physically separated by either distance or a
  barriers. In addition, the definition includes a section with three lanes where the center lane is a two-way
  left-turn lane (TWLTL) or a section with added lanes in one or both directions of travel to provide increased
  passing opportunities (e.g., passing lanes, climbing lanes, and short four-lane sections).
- *Three-leg intersection with stop control (3ST)*—an intersection of a rural two-lane, two-way road and a minor road. A stop sign is provided on the minor road approach to the intersection only.
- *Four-leg intersection with stop control (4ST)*—an intersection of a rural two-lane, two-way road and two minor roads. A stop sign is provided on both minor road approaches to the intersection.
- *Four-leg signalized intersection (4SG)*—an intersection of a rural two-lane, two-way road and two other rural two-lane, two-way roads. Signalized control is provided at the intersection by traffic lights.

The following table identifies the site types on rural multilane highways for which predictive models have been developed for estimating expected average crash frequency, severity, and collision type. The four-leg signalized intersection models do not have base conditions and, therefore, can be used only for generalized predictions of crash frequencies.

Site Type	Site Types with SPFs in Chapter 11	
Roadway Segments	Rural four-lane undivided segments (4U)	
	Rural four-lane divided segments (4D)	
Intersections	Unsignalized three-leg (Stop control on minor-road approaches) (3ST	
	Unsignalized four-leg (Stop control on minor-road approaches) (4ST)	
	Signalized four-leg (4SG) <sup>a</sup>	

These specific site types are defined as follows:

- Undivided four-lane roadway segment (4U)-a roadway consisting of four lanes with a continuous crosssection which provides two directions of travel in which the lanes are not physically separated by either distance or a barrier. When multilane roadways whose opposing lanes are separated by a flush median (i.e., a painted median) are considered undivided facilities, not divided facilities, the predictive models in Chapter 11 do not address rural multilane highways with flush separators.
- *Divided four-lane roadway segment (4D)*—Divided highways are non-freeway facilities (i.e., facilities without full control of access) that have the lanes in the two directions of travel separated by a raised, depressed, or flush median which is not designed to be traversed by a vehicle; this may include raised or depressed medians with or without a physical median barrier, or flush medians with physical median barriers.
- Three-leg intersection with stop control (3ST)-an intersection of a rural multilane highway (i.e., four lane divided or undivided roadway) and a minor road. A stop sign is provided on the minor-road approach to the intersection only.
- Four-leg intersection with stop control (4ST)-an intersection of a rural multilane highway (i.e., four lane divided or undivided roadway) and two minor roads. A stop sign is provided on both minor-road approaches to the intersection.
- *Four-leg signalized intersection (4SG)*—an intersection of a rural multilane highway (i.e., four lane divided or undivided roadway) and two other rural roads which may be two lane or four land rural highways. Signalized control is provided at the intersection by traffic lights.

The following table identifies the specific site types on urban and suburban arterial highways that have predictive models. Separate SPFs are used for each individual site to predict multiple-vehicle nondriveway collisions, single-vehicle collisions, driveway-related collisions, vehicle-pedestrian collisions, and vehicle-bicycle collisions for both roadway segments and intersections. These are combined to predict the total average crash frequency at an individual site.

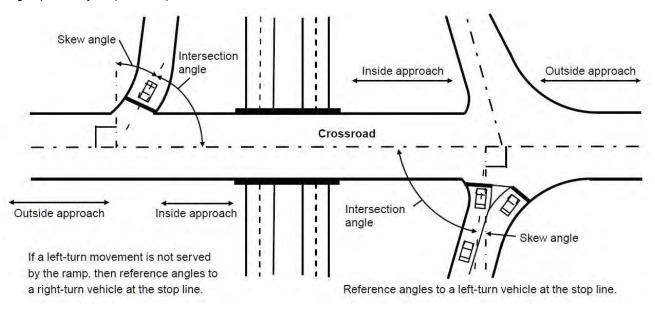
Site Type	Site Types with SPFs in Chapter 12	
Roadway Segments	Two-lane undivided arterials (2U)	
	Three-lane arterials including a center two-way left-turn lane (TWLTL) (3T)	
	Four-lane undivided arterials (4U)	
	Four-lane divided arterials (i.e., including a raised or depressed median) (4D)	
	Five-lane arterials including a center TWLTL (5T)	
Intersections	Unsignalized three-leg intersection (stop control on minor-road approaches) (3ST)	
	Signalized three-leg intersections (3SG)	
	Unsignalized four-leg intersection (stop control on minor-road approaches) (4ST)	
	Signalized four-leg intersection (4SG)	

These specific site types are defined as follows:

- *Two-lane undivided arterial (2U)*—a roadway consisting of two lanes with a continuous cross-section providing two directions of travel in which the lanes are not physically separated by either distance or barrier.
- *Three-lane arterials (3T)*—a roadway consisting of three lanes with a continuous cross-section providing two directions of travel in which center lane is a two-way left-turn lane (TWLTL).
- Four-lane undivided arterials (4U)-a roadway consisting of four lanes with a continuous cross-section providing two directions of travel in which the lanes are not physically separated by either distance or a barrier.
- Four-lane divided arterials (i.e., including a raised or depressed median) (4D)-a roadway consisting of two lanes with a continuous cross-section providing two directions of travel in which the lanes are physically separated by either distance or a barriers
- *Five-lane arterials including a center TWLTL (5T)*—a roadway consisting of five lanes with a continuous cross-section providing two directions of travel in which the center lane is a two-way left-turn lane (TWLTL).
- *Three-leg intersection with stop control (3ST)*—an intersection of an urban or suburban arterial and a minor road. A stop sign is provided on the minor road approach to the intersection only.
- *Three-leg signalized intersection (3SG)*—an intersection of an urban or suburban arterial and one minor road. Signalized control is provided at the intersection by traffic lights.
- *Four-leg intersection with stop control (4ST)*—an intersection of an urban or suburban arterial and two minor roads. A stop sign is provided on both the minor road approaches to the intersection.
- *Four-leg signalized intersection (4SG)*—an intersection of an urban or suburban arterial and two minor roads. Signalized control is provided at the intersection by traffic lights.

### Skew Angle, Exit Ramp

Skew angle equals 90 minus the intersection angle, in degrees. The intersection angle is the acute angle between the crossroad centerline and a line along the center of an imaginary vehicle stopped at the end of the ramp (i.e., where it joins the crossroad). The vehicle is centered in the traveled way and behind the stop line. If vehicles can exit the ramp as left- or right-turn movements, then use a left-turning vehicle as the vehicle of reference. This information is needed only for terminals with one-way stop control. At a B4 terminal configuration, the skew angle represents that for the diagonal exit ramp (not the loop exit ramp). The following figure shows the exit ramp skew angle (one-way stop control):



# **Skew Angle, Intersection**

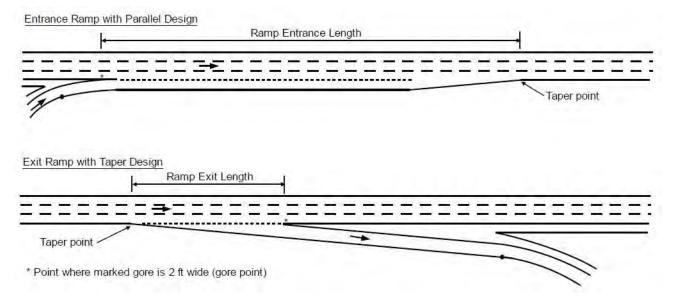
The skew angle for an intersection is defined as the absolute value of the deviation from an intersection angle of 90 degrees. The absolute value is used in the definition of skew angle because positive and negative skew angles are considered to have similar detrimental effect. The base condition of intersection skew angle is zero degrees of skew (i.e., an intersection angle of 90 degrees).

If the skew angle differs for the two minor road legs at a four-leg stop-controlled intersection, values of  $CMF_{1i}$  is computed separately for each minor road leg and then averaged.

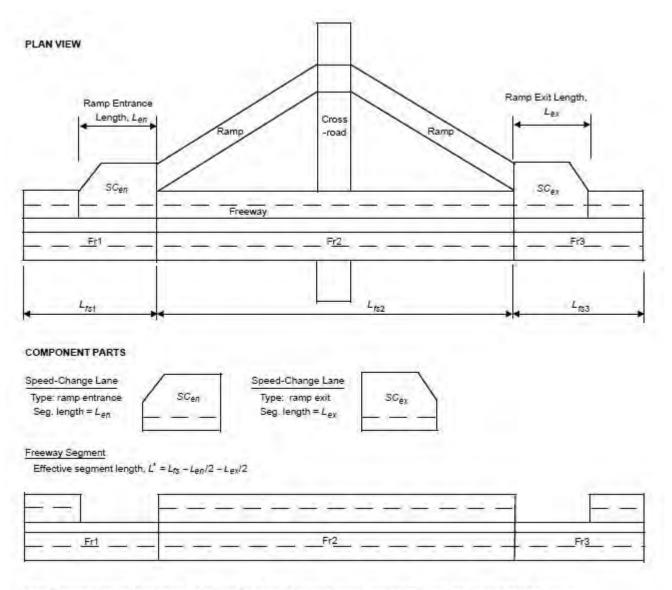
# Speed-Change Lane

When using the predictive method, the freeway within the defined project limits is divided into individual sites. A site is either a homogenous freeway segment or a speed-change lane. A facility consists of a contiguous set of individual sites. A roadway network consists of a number of contiguous facilities.

A speed-change land site is defines as the section of the roadway area located (a) between the marked gore and taper points of a ramp merge or diverge area, and (b) on the same side of the freeway as the merge or diverge area. The location of the gore and taper points is defined in the figure below.



Two speed-change lanes are shown schematically in the figure below. The speed-change lane associated with an entrance ramp is labeled  $SC_{en}$  and that associated with an exit ramp is labeled  $SC_{ex}$ .



Note: Freeway segment length does not include the length of speed-change lanes if these lanes are adjacent to the segment.

# **Spiral Transition**

A spiral transition provides a gradual transition from moving in a straight line to moving in a curve around a point, and vice versa. Spiral transitions are considered part of the horizontal curve they adjoin.

When a horizontal curve is present, it is necessary to specify the presence or absence of a spiral transition curve at the beginning and end of the horizontal curve, even if the beginning and/or end of the horizontal curve are beyond the limits of the segment being analyzed.

### Superelevation

The banking of a roadway in a curve to counteract lateral acceleration.

# **Superelevation Variance**

This represents the superelevation rate contained in the AASHTO Green Book minus the actual superelevation of the curve. This is denoted by *SV* and is measured in ft/ft (or m/m in metric).

# **Taper Area**

An area characterized by a reduction or increase in pavement width, typically located between mainline and ramp or areas with lane reductions.

# **Traffic Barrier**

A device used to prevent a vehicle from striking a more severe obstacle or feature located on the roadside or in the median or to prevent crossover median crashes. There are four classes of traffic barriers, namely, roadside barriers, median barriers, bridge railings, and crash cushions.

# **Traveled Way**

Lanes, excluding the shoulders.

# Turn Bay

The lane (or bay) can have one or two lanes. A lane (or bay) is considered to be present when it (a) is for the exclusive use of a turn movement, (b) extends 100 ft (or 30.5 m in metric) or more back from the stop line, and (c) ends at the intersection stop line.

# **Two-Way Left-Turn Lanes**

The installation of a center two-way left-turn lane (TWLTL) on a rural two-lane, two-way highway to create a threelane cross-section can reduce crashes related to turning maneuvers at driveways. The base condition for two-way left-turn lanes is the absence of a TWLTL.

The CMF for TWLTL installation is not applied unless the driveway density is greater than or equal to five driveways per mile. If the driveway density is less than five driveways per mile, the CMF for TWLTL installation is 1.00

### **Urban Environment**

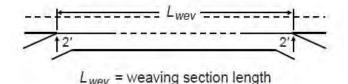
An area typified by high densities of development or concentrations of population, drawing people from several areas within a region.

# Volume

The number of persons or vehicles passing a point on a lane, roadway, or other traffic-way during some time interval, often one hour, expressed in vehicles, bicycles, or persons per hour.

# Weaving Section Length

This is the total length of the Type B weaving section length. This length is measured along the edge of the freeway traveled way from the gore point of the ramp entrance to the gore point of the next ramp exit, as shown in the figure below.



The gore point is located where the pair of solid white pavement edge markings that separate the ramp from the freeway main lanes are 2.0 ft (or 0.61 m in metric) apart. If the markings do not extend to a point where they are

2.0 ft (or 0.61 m in metric) apart, then the gore point is found by extrapolating both markings until the extrapolated portion is 2.0 ft (or 0.61 m in metric) apart. If the measured gore-to-gore distance exceeds 0.85 miles, or 1.368 kilometers in metric (4,500 ft, or 1371.6 m in metric), then a weaving section is not considered to exist. Rather, the entrance ramp is a "lane add" and the exit ramp is a "lane drop".

This value is computed separately for the increasing and decreasing milepost directions.

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