Illinois Department of Transportation

JANUARY 2013

VERSION 2.0

ENHANCED NCHRP 17-38 SPREADSHEET TOOL

USERS MANUAL

Prepared for
Highway Safety Improvement Program

Driving Zero Fatalities to a Reality
Partnering for Illinois

Highway Safety Improvement Program

Enhanced NCHRP 17-38 Spreadsheet Tool Version 2.0 Users Manual

Illinois Department of Transportation

January 2013

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1. Introduction

1.1. Overview

The National Cooperative Highway Research Program (NCHRP) 17-38 project deliverables included the development of briefing materials and a training course to assist highway agencies to understand the Highway Safety Manual (HSM). As part of the project, three Microsoft Excel spreadsheets were developed to help analysts understand how to apply the crash predictive methods for different facility types included in Part C of the HSM. Predictive models for rural two-lane, two-way roads, rural multilane highways, and urban and suburban arterials are provided in HSM Chapters 10, 11, and 12.

The Illinois Enhanced 17-38 Spreadsheet Tool (IEST) has been built using the NCHRP 17-38 spreadsheets as starting point, and provides a more robust and user-friendly interface for applying the three HSM Part C predictive methods.

This second version of the tool provides improved capabilities for analyzing roadway facilities. For example, users can now decide between entering Average Annual Daily Traffic (AADT) information for each year or applying a growth factor.

This manual provides step-by-step instructions for using the IEST tool developed by Illinois Department of Transportation (IDOT). It also provides several example scenarios to assist the analyst in understanding use of the tool in project development.

The manual is organized into four chapters and the appendix. Chapter 1 contains the introduction and new features of the tool. Chapter 2 provides examples of the tool new features. Chapter 3 provides examples of the application of each of the HSM predictive methods using the tool. Chapter 4 describes the utilities included in all modules. Appendix A contains the tab naming definition for all modules. And Appendix B contains the troubleshooting section for Microsoft Office 2003.

1.2. New Version Changes

The new version of the IEST tool includes several new features that are listed below:

- Improved user interface
- Ability to perform corridor analyses for up to 50 segment/intersection locations
- Ability to analyze up to 5 years of data
- Ability to apply a growth factor
- Improved summary sheets
- Additional data entry option using tabular format

2. Tool New Features Examples

2.1. New Data Entry Overview

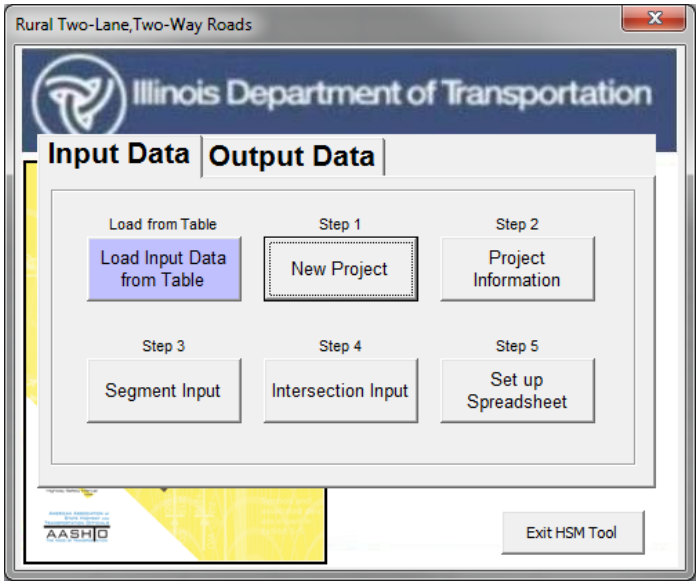
One of the major changes in this new version is the additional data entry option. This option allows users to enter data for all segments and intersections in a table format to facilitate the data entry process.

Introduction

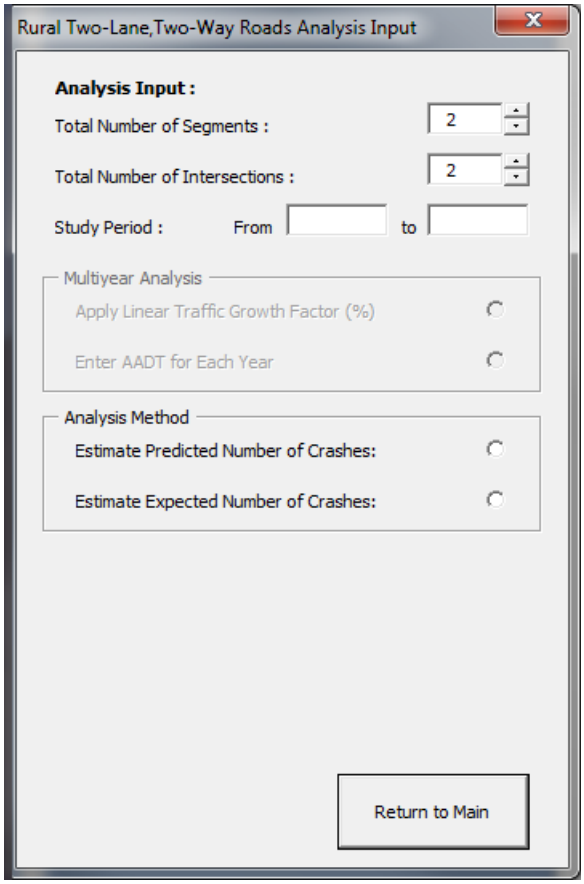
The following example intends to demonstrate what steps are required to run an analysis using the new data entry option. This method is similar for all three modules (rural two-lane, rural multilane, and urban and suburban arterials).

STEP 1: Select a predictive method for analysis. The rural two-lane roads module is used in this example. The main menu user form will open.

The main interface still maintains the original multiple-step process to run the analysis. A new purple button has been added and is labeled as **Load Input Data from Table**.



STEP 2: Select the **Load Input Data from Table** button to display the input data user form.



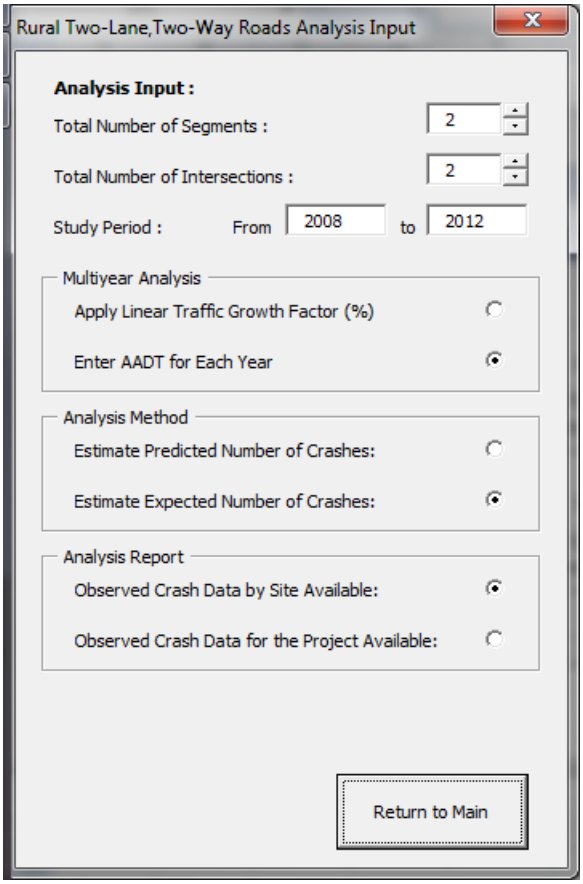
STEP 3: Input the information requested in the fields. Fields may vary with regards to the analysis type chosen. More details regarding each of the analysis types are provided in the examples included in Section 3.

The **Total Number of Segments** and the **Total Number of Intersections** should be a number between 0 and 50. For **Study Period**, enter the period for which crash data is available (for example, 2008 to 2012). The tool has been designed to handle a maximum of 5 years.

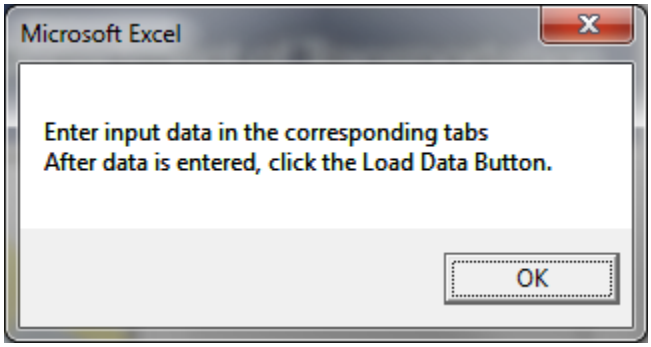
Multiyear analyses can now be conducted using either a growth factor or entering AADT for each analysis year. Multiyear analysis options will be enabled only when the difference between study period years is greater than 1. If **Apply Linear Traffic Growth Factor (**%**)** is selected, make sure to enter the respective value in percentage. If AADT for each analysis year is available, select **Enter AADT for Each Year** by clicking on the circle next to the text.

For this example, the study period is from 2008 to 2012. The analysis method selected is Estimate Expected Number of Crashes with Empirical Bayes (EB) adjustment using Observed Crash Data by Site Available. Details about the difference between the EB methods can be found in the Highway Safety Manual, Appendix A, Section A.2.1 (pages A-19 and A-20).

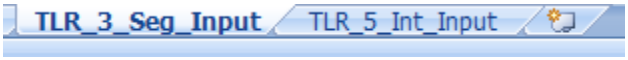
Once the user form is filled in, click Return to Main.



STEP 4: A warning message appears providing instructions on next steps as shown below. Click OK to continue.



STEP 5: The main interface closes, and two new tabs appear. Segment and intersection data are entered in these two tabs. The naming convention varies between different modules. TLR is for the two-lane rural roads, MLR is for multilane rural roads, and UrbArt is for Urban and Suburban Arterials. In this example, the TLR_3_Seg_Input and TLR_5_Int_Input tabs are used for data entry. The tabs are sequentially numbered, and are displayed based on the type of analysis selected.

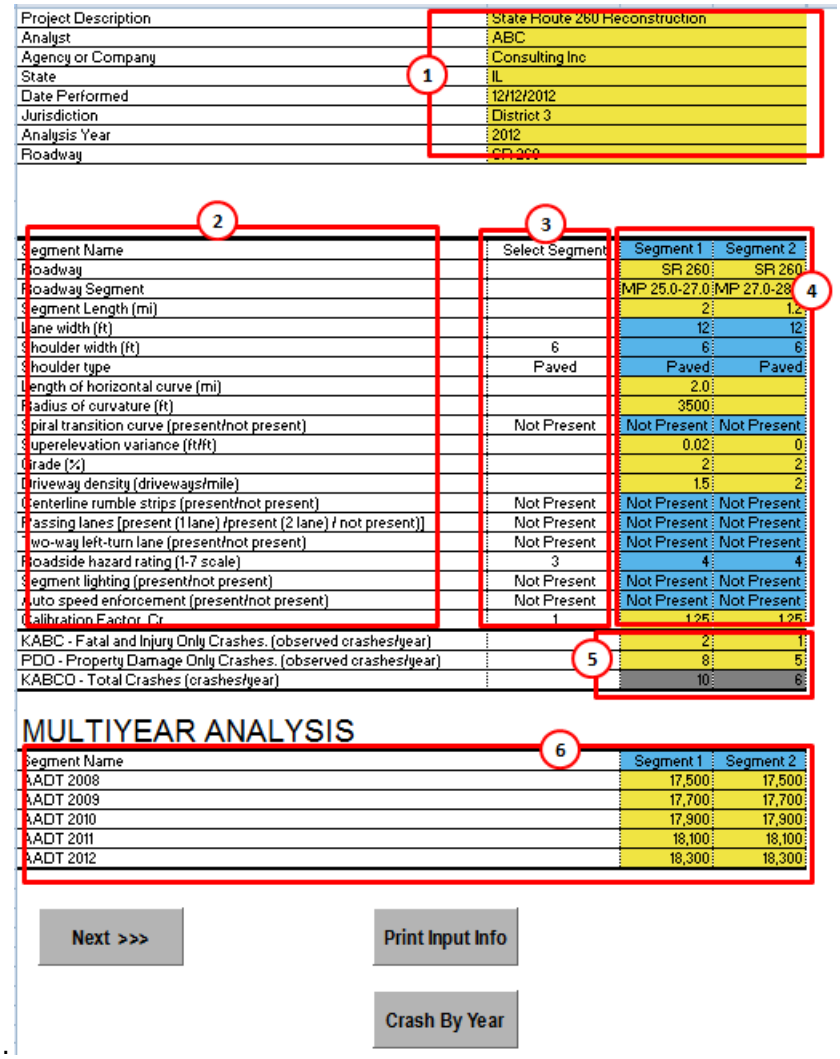


Data must be input only in color-coded cells. Cells highlighted in yellow are hardcoded values. Cells highlighted in blue are dropdown menus with pre-set options. If particular data values are the same among all facilities, users can copy and paste, or drag values

among the different facility types. In the segment tab (TLR_3_Seg_Input), the top portion (1) is where the project information is entered. This information is copied to the calculation and summary sheets. Block 2 includes the list of all the variables required to apply the predictive method. Block 3 contains the facility Base Conditions (see HSM Chapter 10 for details). Each column represents one facility (4). In this case, there are two columns for the two segments. The tool is designed to analyze up to 50 segments.

Block 5 is for the observed crash data. These rows are visible because the Estimate Expected Number of Crashes analysis method was selected.

Block 6 is for the AADT data required to conduct a multiyear analysis. This is visible because the Enter AADT for Each Year option was selected as part of the Multiyear Analysis method (see Step 3).

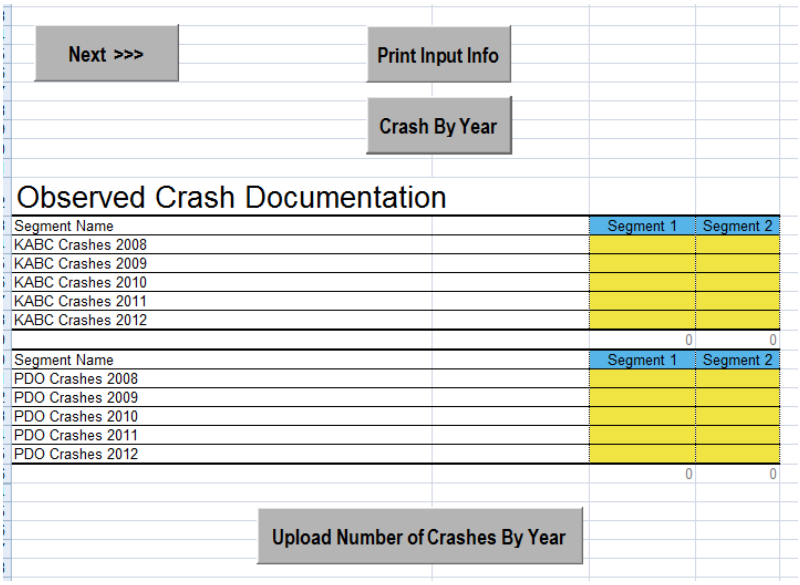


There are three buttons at the bottom of the page.

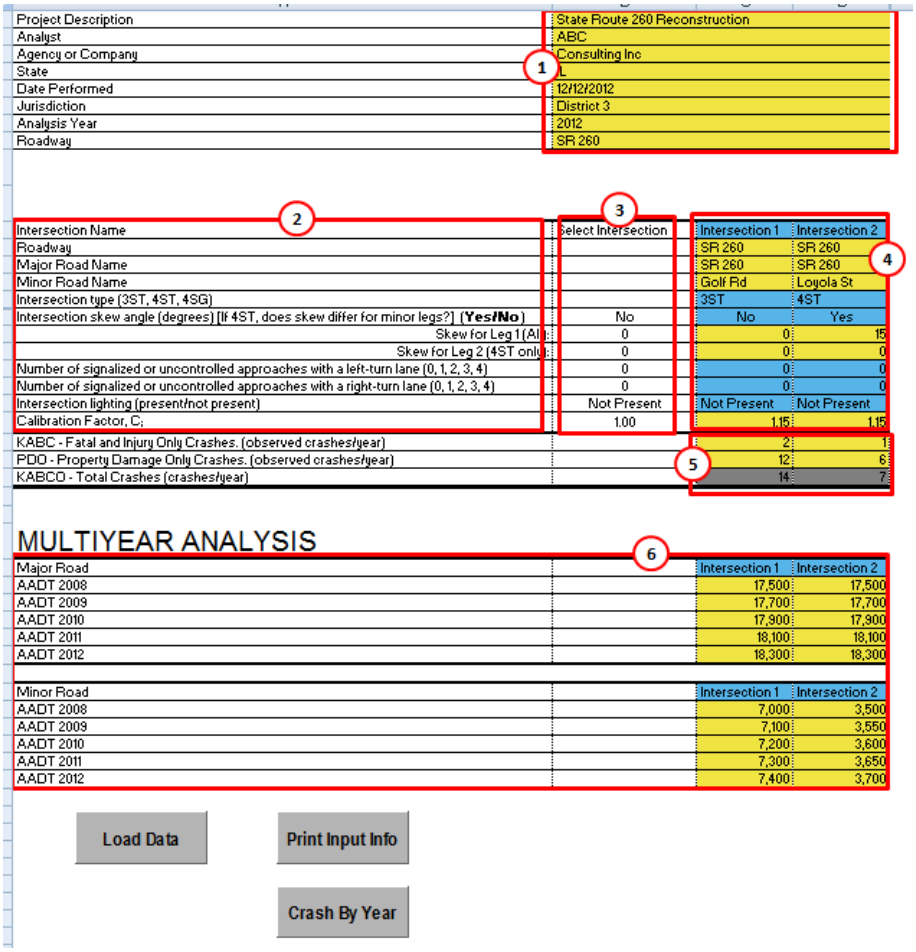
Next is used to go to the next tab.

Print Input Info is used to set the segment data input tab for printing using the Page Break View.

Crash by Year is an optional button only used for the Estimate Expected Number of Crashes using Observed Crash Data by Site Available analysis method. This utility is used only if the user wants to document the crashes by year by segment in the spreadsheet. By clicking the button Crash by Year, additional rows at the bottom of the page will be unhidden and crash data for each segment included in the analysis, by severity levels for each study period year, can be entered. In addition, a new button appears (Upload Number of Crashes by Year), which is used to populate the crash data input in the main input table.



STEP 6: Click “Next” to go to the intersections tab (TLR_5_Int_Input). Similar to the segment tab, Block 1is for the project information and Block 2 lists the variables required to apply the predictive method. Block 3 lists the predictive method Base Conditions. Block 4 is the data required for each intersection. Each column represents one facility. Block 5 is for the observed crash data broken down by severity type. Block 6 is for the AADT required to conduct a multiyear analysis. This option is visible only when the Enter AADT for Each Year option is selected.



Project Description	State Route 260 Reconstruction
Analyst	ABC
Agency or Company	Consulting Inc
State	IL
Date Performed	12/12/2012
Jurisdiction	District 3
Analysis Year	2012
Roadway	SR 260

Intersection Name	Select Intersection	Intersection 1	Intersection 2
Roadway		SR 260	SR 260
Major Road Name		SR 260	SR 260
Minor Road Name		Golf Rd	Loyola St
Intersection type (3ST, 4ST, 4SG)		3ST	4ST
Intersection skew angle (degrees) [If 4ST, does skew differ for minor legs?] (Yes/No)	No	No	Yes
Skew for Leg 1 (All)	0	0	15
Skew for Leg 2 (4ST only)	0	0	0
Number of signalized or uncontrolled approaches with a left-turn lane (0, 1, 2, 3, 4)	0	0	0
Number of signalized or uncontrolled approaches with a right-turn lane (0, 1, 2, 3, 4)	0	0	0
Intersection lighting (present/not present)	Not Present	Not Present	Not Present
Calibration Factor, C;	1.00	1.15	1.15
KABC - Fatal and Injury Only Crashes. (observed crashes/year)		2	1
PDO - Property Damage Only Crashes. (observed crashes/year)		12	6
KABCO - Total Crashes (crashes/year)		14	7

MULTIYEAR ANALYSIS

Major Road		Intersection 1	Intersection 2
AADT 2008		17,500	17,500
AADT 2009		17,700	17,700
AADT 2010		17,900	17,900
AADT 2011		18,100	18,100
AADT 2012		18,300	18,300

Minor Road		Intersection 1	Intersection 2
AADT 2008		7,000	3,500
AADT 2009		7,100	3,550
AADT 2010		7,200	3,600
AADT 2011		7,300	3,650
AADT 2012		7,400	3,700

Load Data Print Input Info Crash By Year

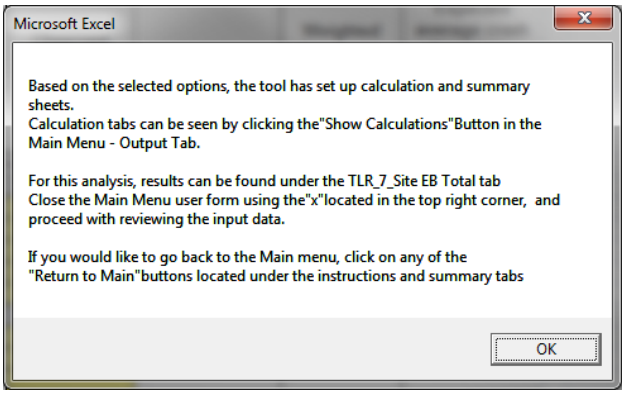
STEP 7: Once all the data have been input and reviewed, the next step is to set up the spreadsheets. Click on the **LOAD DATA** button to run the set-up procedure.

NOTE: There are two additional buttons at the bottom of the page.

Print Input Info is used to set the segment data input tab for printing using the Page Break View.

Crash by Year is an optional button. This utility is used only if the user wants to document the crashes by year and by segment in the spreadsheet. By clicking the button Crash by Year, additional rows at the bottom of the page will be unhidden and crash data for each segment included in the analysis, by severity levels for each study period year, can be entered. In addition, a new button appears (Upload Number of Crashes by Year) and is used to populate the crash data input in the main input table.

STEP 8: After the process is done running, a new window appears providing instructions about next steps. It indicates what tab contains the summary sheet, and how to move forward with the analysis. From this point forward, the steps are the same either using the original five-step process, or using the new Load Data option. Details about the five-step process are provided in Chapter 3.



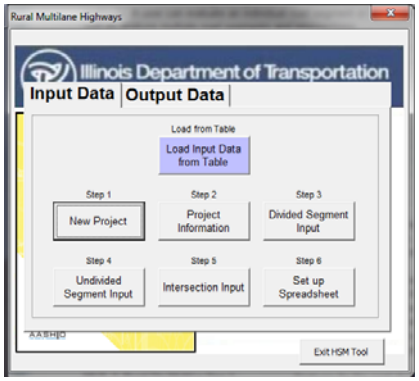
2.2. Multiyear Analysis Applying Growth Factor

Another major change in the new version of the tool is the incorporation of a new method for conducting the multiyear analysis by applying a traffic growth factor. Originally, if the user wanted to conduct a multiyear analysis, AADT by year was a required data input. Annual AADT data are not always available; therefore, application of a growth factor will only require entering data for one year, and the tool will extrapolate the results of the predictive method by applying the growth factor.

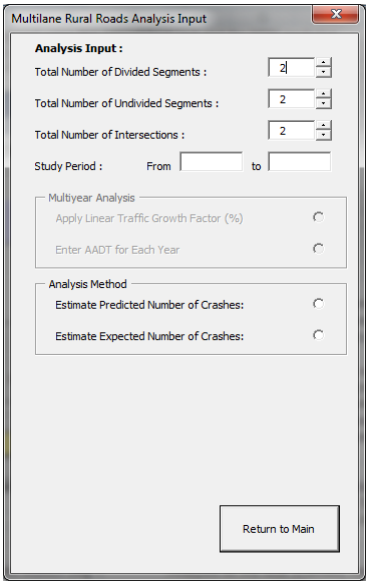
Introduction

The following example demonstrates the steps required to run a multiyear analysis by applying a traffic growth factor. This method is similar for all three modules (rural two-lane, rural multilane, and urban and suburban arterials). The multilane rural roads predictive method is used in this example.

STEP 1: Once the user selects the predictive method for the analysis, the main menu user form will open up as seen below.

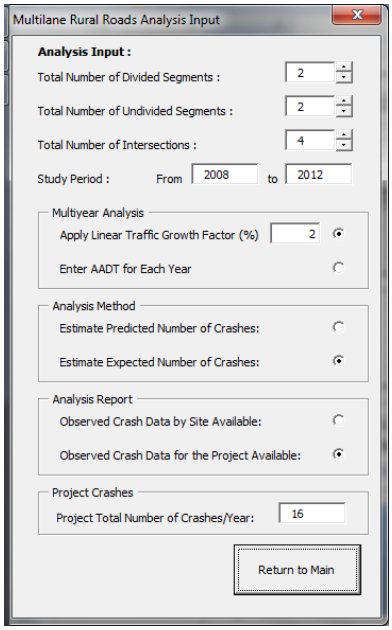


STEP 2: Select the New Project button. The Multilane Rural Roads Analysis Input user form will appear.

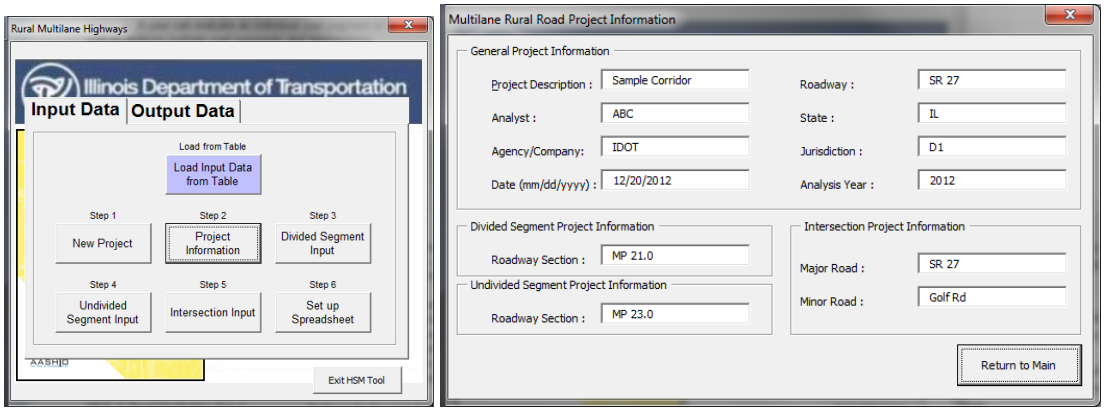


STEP 3: Enter the required data. For this example, two divided segments, two undivided segments, and four intersections will be included in the analysis. The study period is from 2008 to 2012. For the multiyear analysis, Apply Linear Traffic Growth Factor (%) is

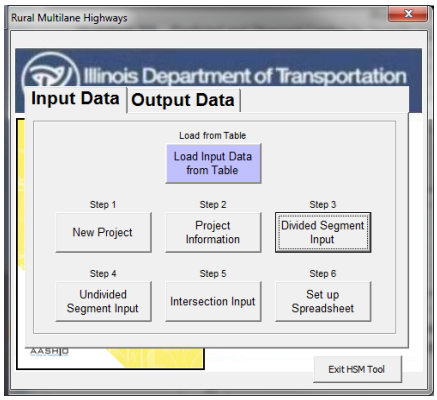
selected, and a value of 2 is used. The analysis method for this example is the Expected Number of Crashes using observed crash data at the project level. The total number of crashes for the project per year is 16. Once all the data are entered, click on Return to Main.

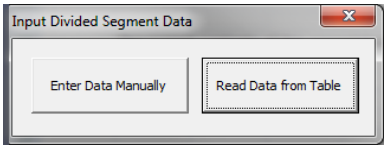


STEP 4: Press the Project Information button, and enter details about the project. Once the form is filled up, press Return to Main to go back to the main menu.

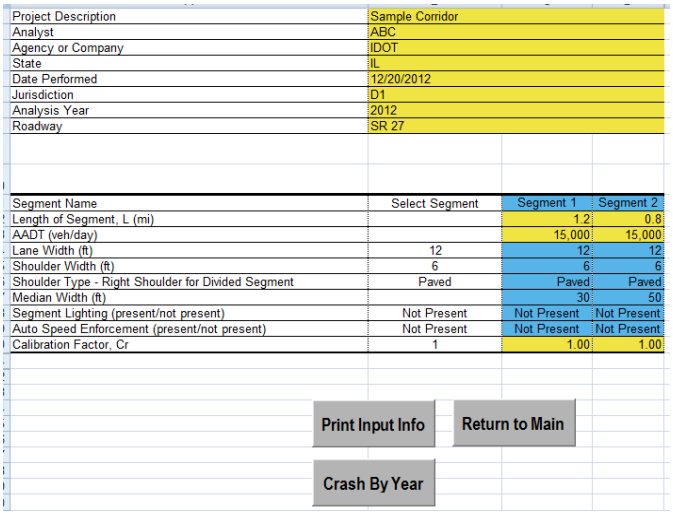


STEP 5: Depending on the Analysis Input, proceed to enter the data. Yellow cells are hard coded values. Blue cells are dropdown menus with pre-set options. In this example, all facility types are included (divided and undivided segments, and intersections); to continue, click on the Divided Segment Input button. A new user form appears asking the user to choose the data input method. Data can be input either using user forms or in a table format. For this example, the Read Data from Table option is selected.



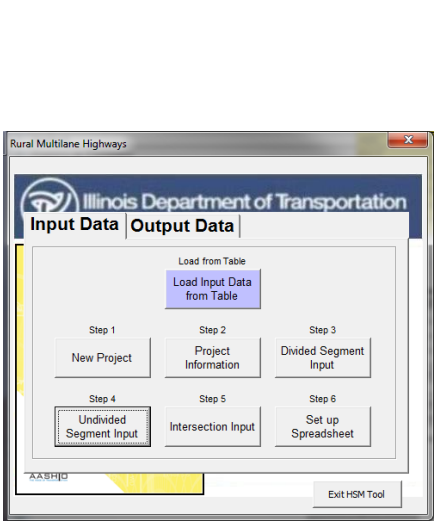


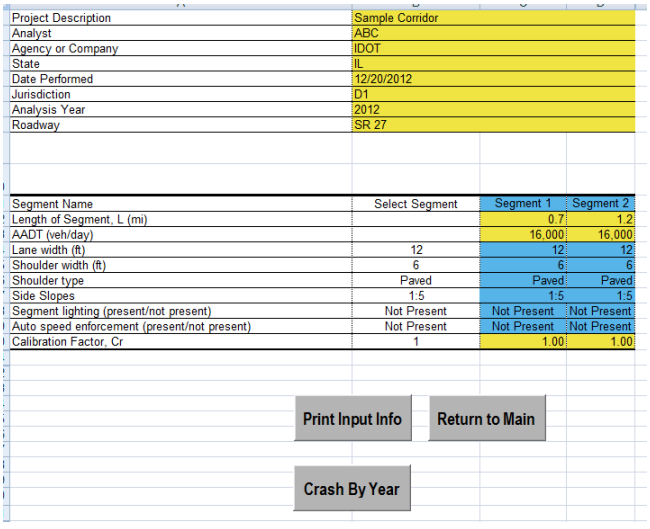
Once data entry is completed, press Return to Main.



Project Description	Sample Corridor		
Analyst	ABC		
Agency or Company	IDOT		
State	IL		
Date Performed	12/20/2012		
Jurisdiction	D1		
Analysis Year	2012		
Roadway	SR 27		
Segment Name	Select Segment	Segment 1	Segment 2
Length of Segment, L (mi)		1.2	0.8
AADT (veh/day)		15,000	15,000
Lane Width (ft)	12	12	12
Shoulder Width (ft)	6	6	6
Shoulder Type - Right Shoulder for Divided Segment	Paved	Paved	Paved
Median Width (ft)		30	50
Segment Lighting (present/not present)	Not Present	Not Present	Not Present
Auto Speed Enforcement (present/not present)	Not Present	Not Present	Not Present
Calibration Factor, Cr	1	1.00	1.00

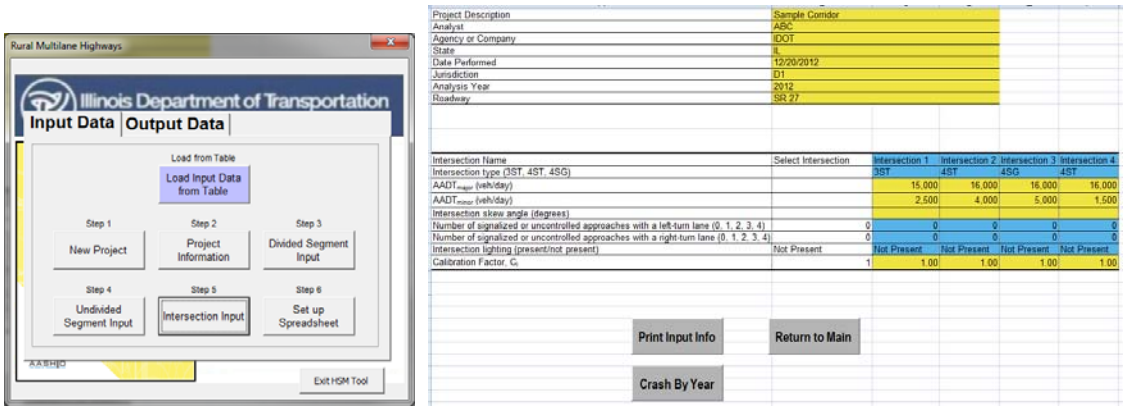
STEP 6: Repeat the same process for undivided segments (if applicable). Press the button Undivided Segment Input, and complete the data entry. Click Return to Main to go back to the main interface



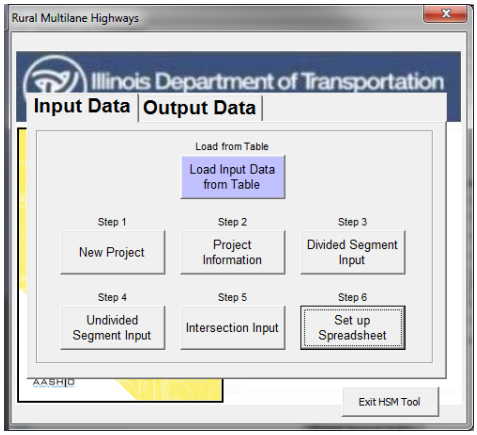


Project Description	Sample Corridor		
Analyst	ABC		
Agency or Company	IDOT		
State	IL		
Date Performed	12/20/2012		
Jurisdiction	D1		
Analysis Year	2012		
Roadway	SR 27		
Segment Name	Select Segment	Segment 1	Segment 2
Length of Segment, L (mi)		0.7	1.2
AADT (veh/day)		16,000	16,000
Lane width (ft)	12	12	12
Shoulder width (ft)	6	6	6
Shoulder type	Paved	Paved	Paved
Side Slopes	1:5	1:5	1:5
Segment lighting (present/not present)	Not Present	Not Present	Not Present
Auto speed enforcement (present/not present)	Not Present	Not Present	Not Present
Calibration Factor, Cr	1	1.00	1.00

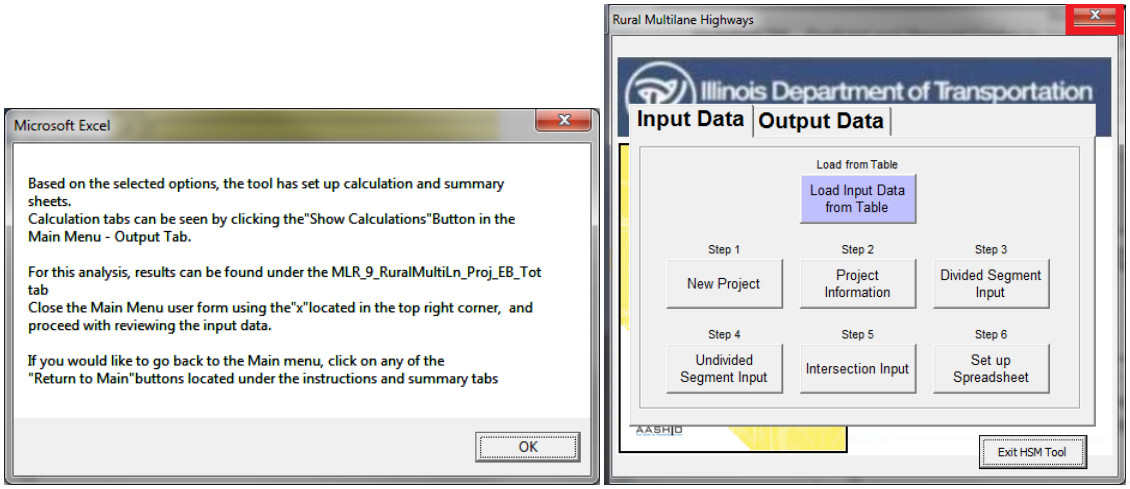
STEP 7: Press the button Intersection Input, and complete the data entry. Click Return to Main to go back to the main interface



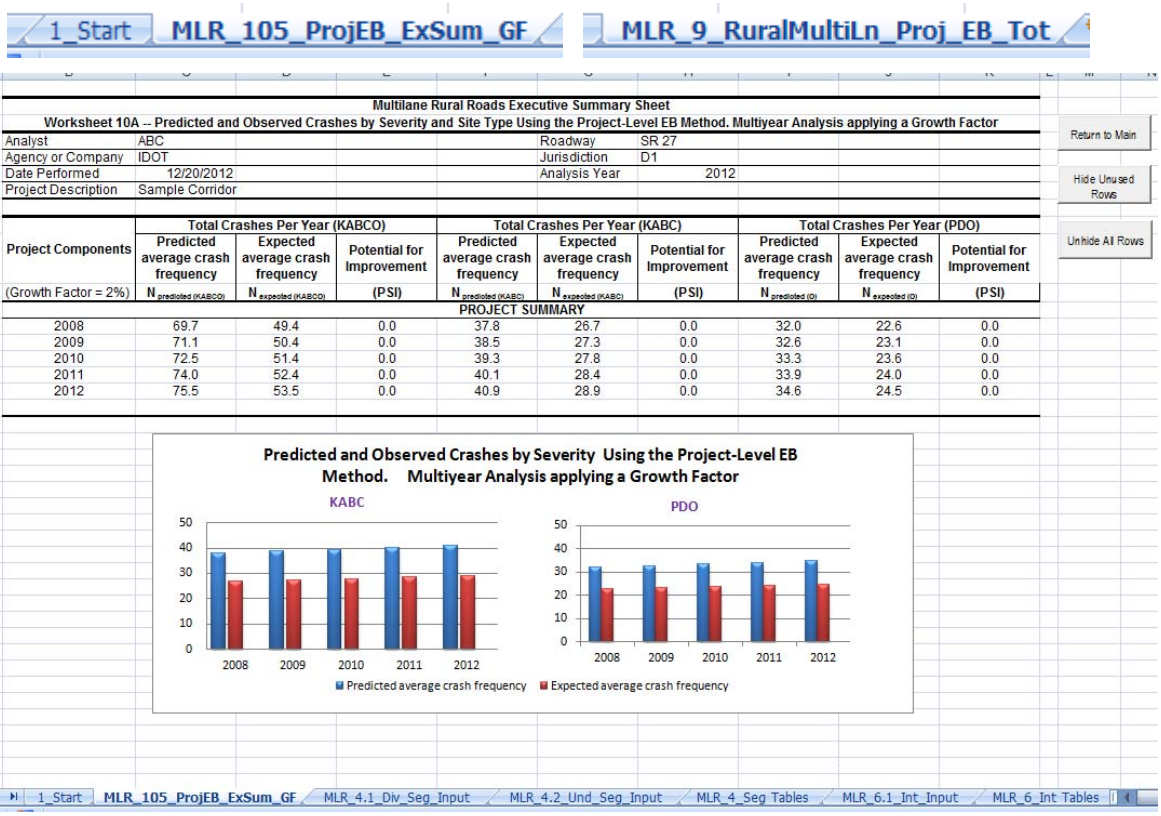
STEP 8: Once all the data entry is completed, press the **Set up Spreadsheet button**. This button will run the entire set-up process for the application of the predictive method.

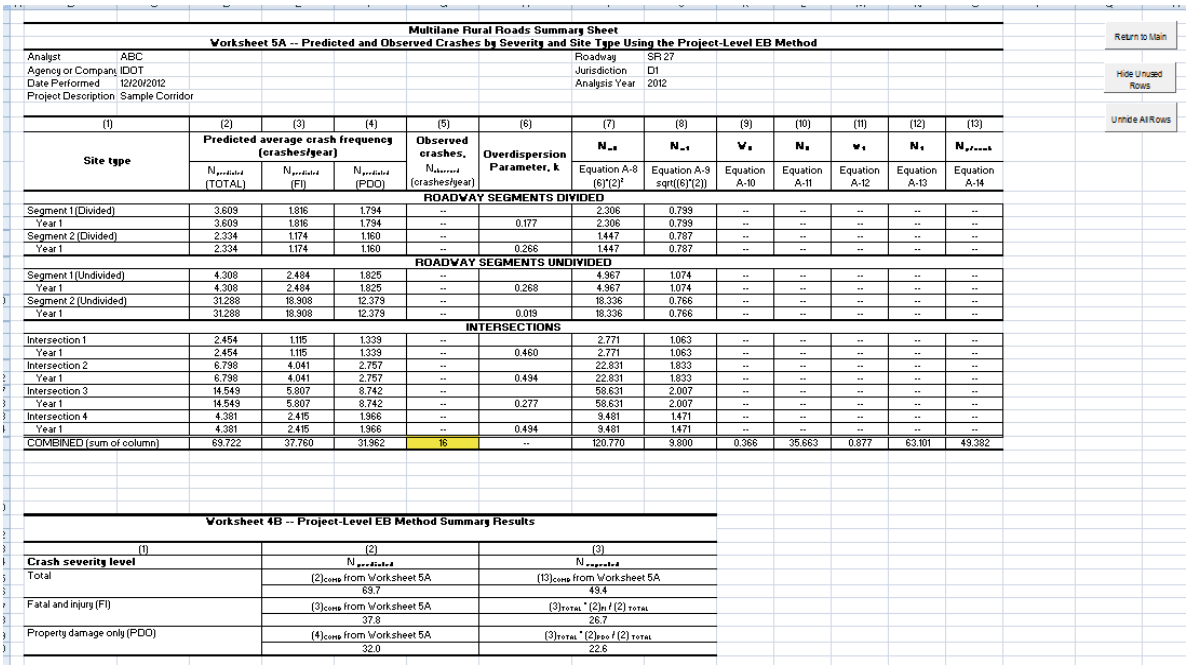


STEP 9: Once the process is finished running, a pop-up window will appear, providing users with instructions on the next steps, and where to find results of the analysis. Click OK to continue, and close the main menu interface to go to the summary sheet.

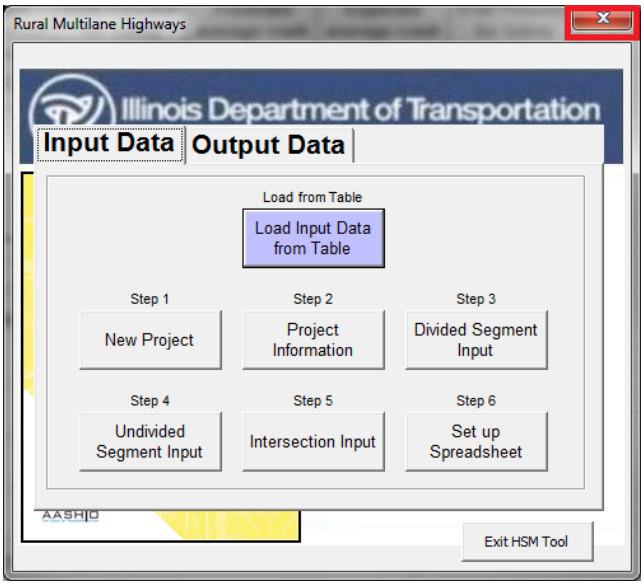


STEP 10: Results can be found in Tabs MLR_9_RuralMultiLn_Proj_EB_Tot and MLR_105_ProjEB_EXSum_GF.

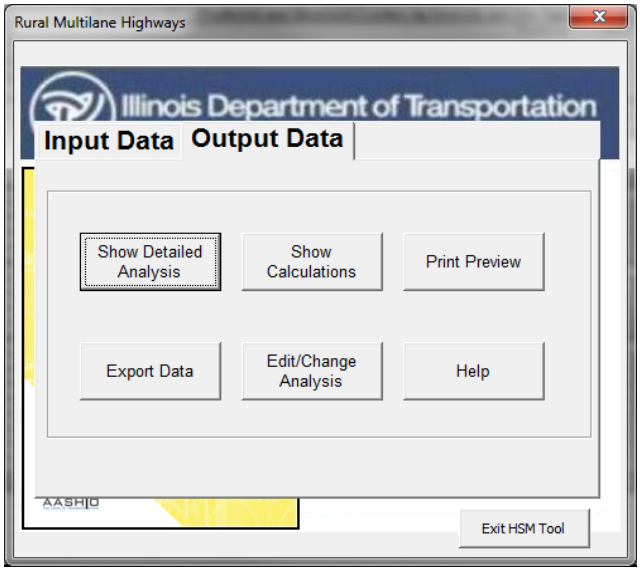




STEP 11: To print, export, make changes, or view the detailed calculations, return to the summary sheet tabs, and use the Return to Main button located in the top right corner.



Once in the main menu, go to the Output Data tab to access the different utilities included in the tool.



More details about the different utilities included in the Output Data tab will be provided in section 4.

3. Tool Application of the Predictive Methods

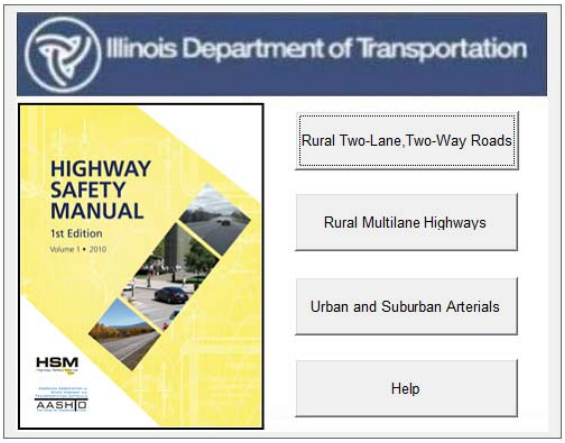
3.1. Rural Two-Lane, Two-Way Roads

Introduction

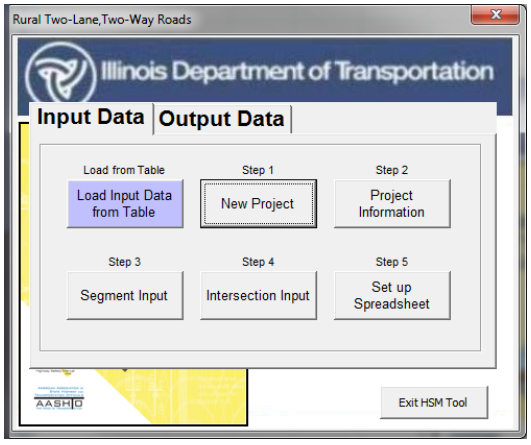
The Highway Safety Manual (Chapter 10) provides a methodology for estimating the predicted average crash frequency, crash severity, and collision types for rural two-lane, two-way facilities. This chapter is applicable to facilities with two-lane and two-way traffic operations that do not have access control or are outside of cities with a population less than 5,000 people. More details about the applicability of this module can be found in the HSM Section 10.3.

This example illustrates how to apply the Rural Two-Lane, Two-Way Roads predictive method using the IEST tool.

STEP 1: The screen capture below shows the opening page of the IEST tool. Press the Rural Two-Lane, Two-Way Roads button to begin with the analysis.



STEP 2: A new window opens and shows the main menu interface. The main menu is comprised of two main tabs: Input Data and Output Data. The Input Data tab opens by default when starting the tool. The output tab contains a series of utilities including print preview, export, among others. More details about the output tab utilities are provided in section 4.

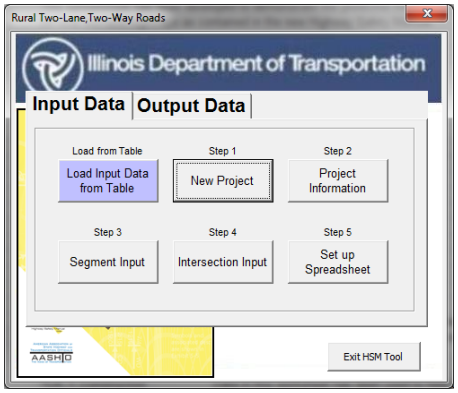


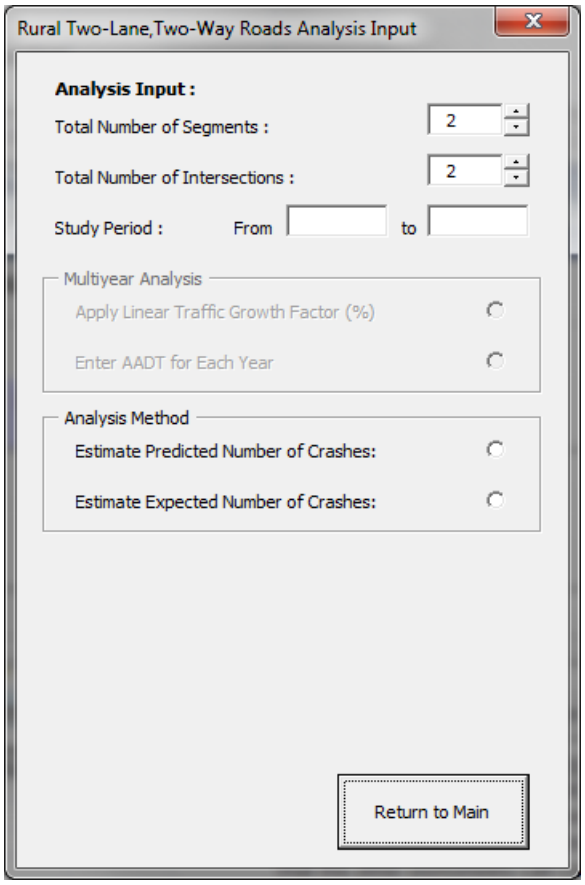
There are a total of six buttons on the Input Data tab.

Users now have the ability to run the analysis using two methods. The first one is using the button **Load Input Data from Table** (described in Section 2.1), and the second one is following steps 1 through 5 (Five Step Process). Both methods produce the same results, but the first one is an abbreviation of the second method. Section 2.1 includes an example using the Load Data from Table process.

For illustrative purposes, this example will be conducted using the Tool's Five Step Process.

STEP 3: Select the button labeled New Project**.** The Analysis Input user form will appear.





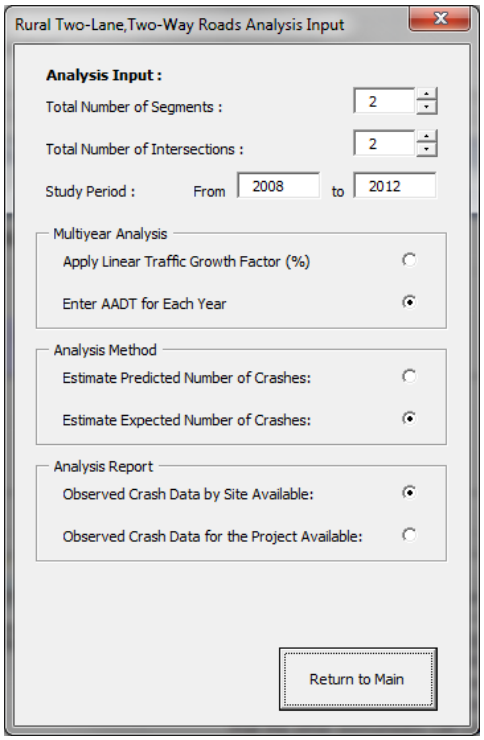
STEP 4: Input the information requested in the fields. The **Total Number of Segments** and the **Total Number of Intersections** should be a number between 0 and 50. For **Study Period**, enter the period for which crash data is available (for example, 2008 to 2012). The tool has been designed to handle a maximum of 5 years.

Multiyear analyses can now be conducted using either a growth factor or entering AADT for each analysis year. An example with the application of growth factor is provided in Section 2.2. Multiyear analysis options will be enabled only when the difference between study period years is greater than 1. If **Apply Linear Traffic Growth Factor (%)** is selected, make sure to enter the respective value in percentage. If AADT for each analysis year is available, select **Enter AADT for Each Year** by clicking on the circle next to the text.

Analysis Method: If observed crash data is not available, select **Estimate Predicted Number of Crashes** by clicking on the circle next to the text. If observed crash data is available, select **Estimate Expected Number of Crashes** by clicking on the circle next to the text.

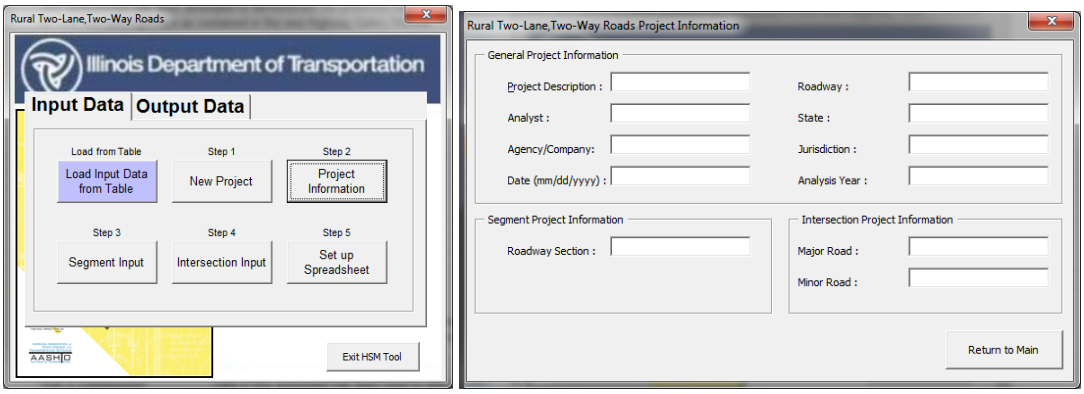
The expected crash frequency is obtained by applying the Empirical Bayes Method. This method combines the predicted average crash frequency with the observed crash data to provide a more reliable estimate. Selecting the **Estimate Expected Number of Crashes** option will enable the Analysis Report frame. There are two methods to apply the Empirical Bayes adjustment using observed crash data. The **Observed Crash Data by Site Available** option is used when available crash data is disaggregated by site (segments and/or intersections), and the **Observed Crash Data for the Project Available** option is used when observed crash data is only available at aggregated/project level across the all the sites. Refer to HSM Section A.2.4 and A.2.5 (Pages A-19 and A-20) for additional details on the different EB methods.

This analysis includes 2 segments and 2 intersections. The study period is from 2008 to 2012. The multiyear analysis will be conducted using AADT for each year. Estimate Expected Number of Crashes using Observed Crash Data by Site is the selected analysis method.

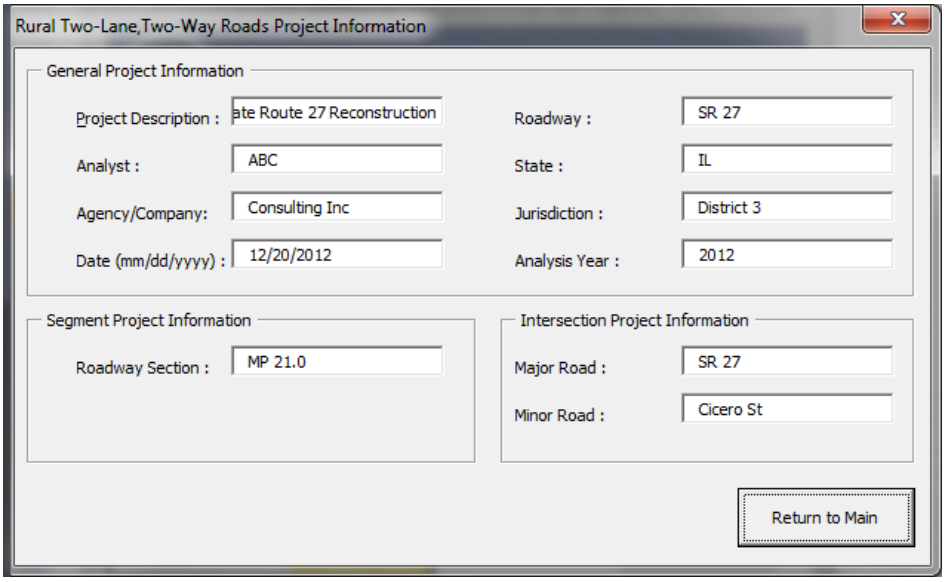


When complete click on the **Return to Main** button to return to the main input window.

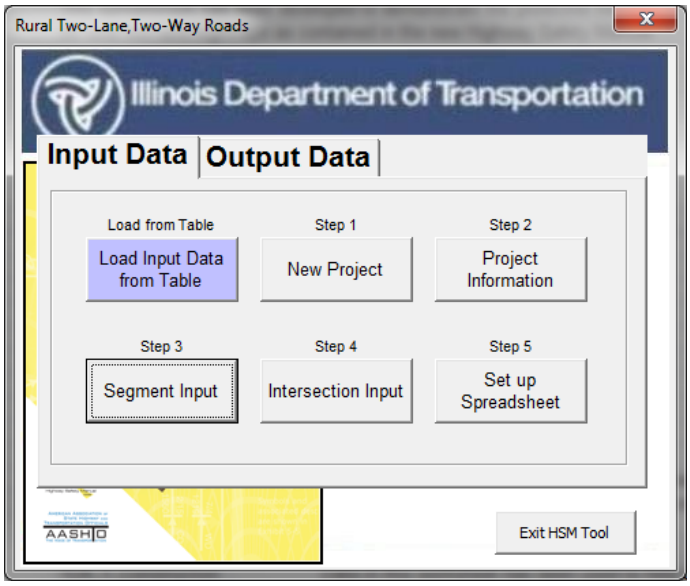
STEP 5: On the main menu, select the button labeled **Project Information**.



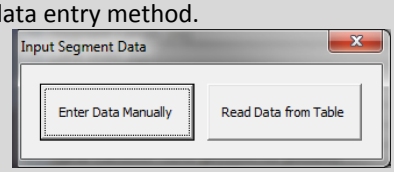
STEP 6: Complete the information requested in the General Project Information input window. For Segments Project Information field, enter either a reference milepost or Key Route or Marked Route, or the reference milepost. Key Route refers to the Illinois Roadway Information System (IRIS) terminology and it is a universal identifier for any segment. Marked Route refers to the Division of Traffic Safety route inventory. The key route information is not necessary for intersections, but all information provided will assist in tracking projects. For Intersection Project Information, enter a description for **Major Road** and **Minor Road** (for example, SR 27 and Cicero St, respectively). When all fields have been completed, click on **Return to Main**.



STEP 7: Select the button labeled **Segment Input**.

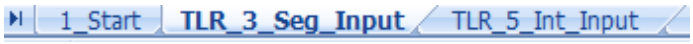


NOTE: Depending on the analysis input data entered, there are instances when an additional user form appears asking about the data entry method.



Enter Data Manually: Data entry is performed one facility at a time using a user form.
Read Data from Table: Data entry is performed for all facilities using a table (worksheet)

The main interface closes, and two new tabs appear. Segment and intersection data are entered in these two tabs. The naming convention varies between different modules. TLR is for two-lane rural roads, MLR is for multilane rural roads, and **UrbArt** is for Urban and Suburban Arterials. For this example the TLR_3_Seg_Input and TLR_5_Int_Input tabs are used for data entry. The tabs are sequentially numbered, and are displayed based on the type of analysis selected.

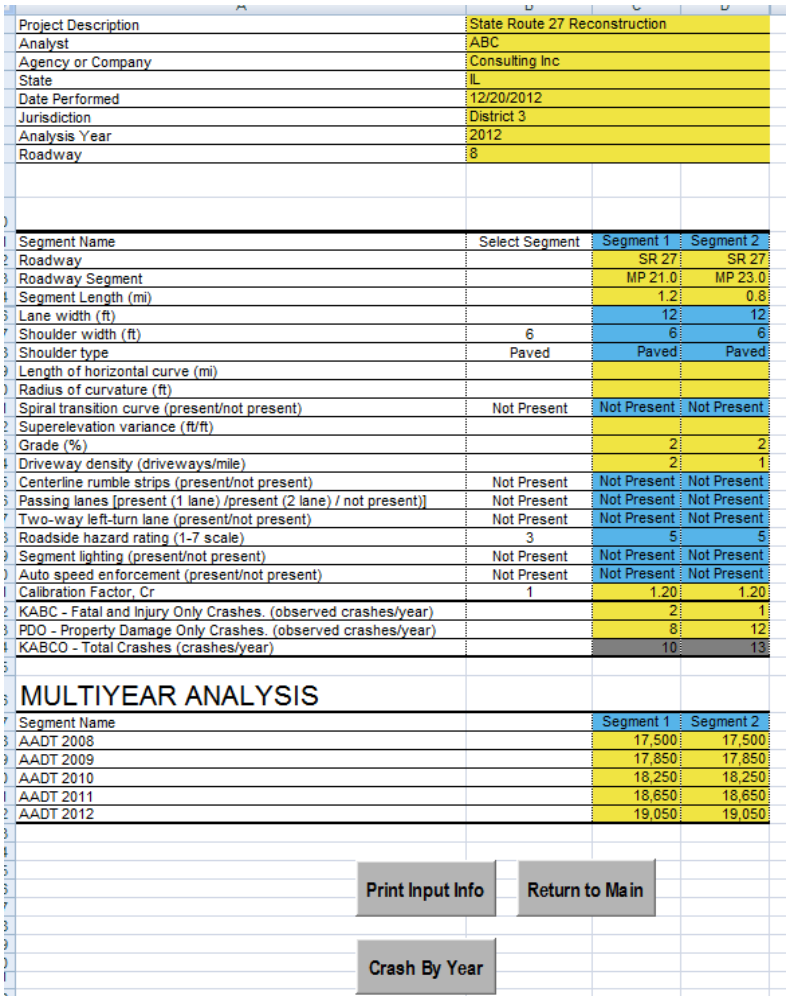


STEP 8: Enter data in the color-coded cells. Cells highlighted in yellow are hardcoded values. Cells highlighted in blue are dropdown menus with pre-set options. If particular data values are the same among all facilities, users can copy and paste, or drag values among the different facility types. Table 1 provides details of the different variables needed to run the predictive method for segments.

Table 1
Rural Two Lane Segment Data Needs

Variable Name	Data Description
Segment name	Name of the roadway segment. Up to 50 segments
Length of Segment	Miles
AADT	AADT for roadway segment

Variable Name	Data Description
Lane width	Feet
Shoulder width	Feet
Shoulder type	Paved, gravel, composite or turf
Length of horizontal curve	Miles
Radius of curvature	Feet
Spiral transition curve	Present or not present
Superelevation variance	Feet/feet
Grade	Percent
Driveway density	Driveways/mile
Centerline rumble strips	Present or not present
Passing lanes	Present (1 lane), present (2 lane) or not present
Two-Way Left-Turn lane	Present or not present
Roadside hazard rating	1-7 scale with 1 the safest and 7 the most dangerous
Segment lighting	Present or not present
Auto speed enforcement	Present or not present
Calibration factor	Derived from calibration process



Project Description	State Route 27 Reconstruction		
Analyst	ABC		
Agency or Company	Consulting Inc		
State	IL		
Date Performed	12/20/2012		
Jurisdiction	District 3		
Analysis Year	2012		
Roadway	8		

Segment Name	Select Segment	Segment 1	Segment 2
Roadway		SR 27	SR 27
Roadway Segment		MP 21.0	MP 23.0
Segment Length (mi)		1.2	0.8
Lane width (ft)		12	12
Shoulder width (ft)	6	6	6
Shoulder type	Paved	Paved	Paved
Length of horizontal curve (mi)			
Radius of curvature (ft)			
Spiral transition curve (present/not present)	Not Present	Not Present	Not Present
Superelevation variance (ft/ft)			
Grade (%)		2	2
Driveway density (driveways/mile)		2	1
Centerline rumble strips (present/not present)	Not Present	Not Present	Not Present
Passing lanes [present (1 lane) /present (2 lane) / not present)]	Not Present	Not Present	Not Present
Two-way left-turn lane (present/not present)	Not Present	Not Present	Not Present
Roadside hazard rating (1-7 scale)	3	5	5
Segment lighting (present/not present)	Not Present	Not Present	Not Present
Auto speed enforcement (present/not present)	Not Present	Not Present	Not Present
Calibration Factor, Cr	1	1.20	1.20
KABC - Fatal and Injury Only Crashes. (observed crashes/year)		2	1
PDO - Property Damage Only Crashes. (observed crashes/year)		8	12
KABCO - Total Crashes (crashes/year)		10	13

MULTIYEAR ANALYSIS

Segment Name		Segment 1	Segment 2
AADT 2008		17,500	17,500
AADT 2009		17,850	17,850
AADT 2010		18,250	18,250
AADT 2011		18,650	18,650
AADT 2012		19,050	19,050

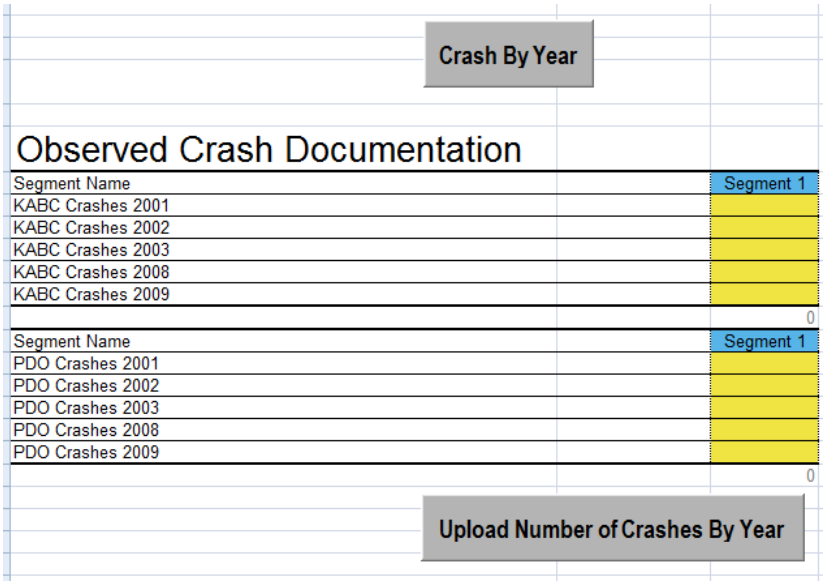
Print Input Info Return to Main

Crash By Year

There are three buttons at the bottom of the page.
Return to Main is used to go to the Main Menu.

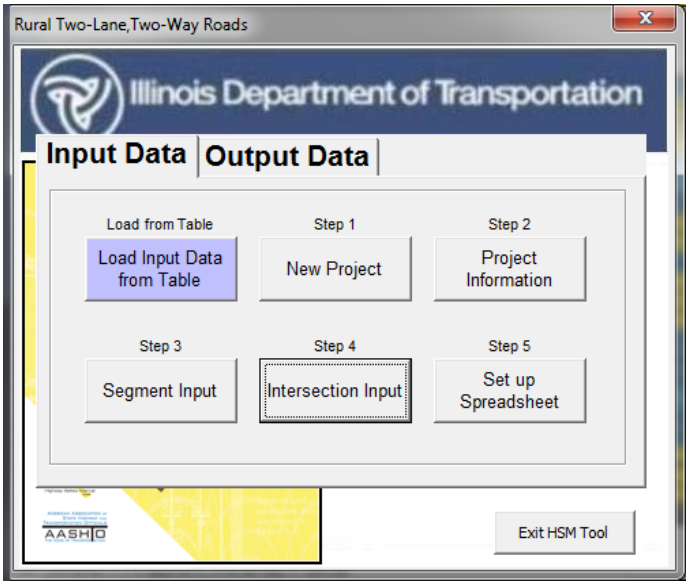
Print Input Info is used to set the segment data input tab for printing using the Page Break View.

Crash by Year is an optional button only used for the Estimate Expected Number of Crashes using Observed Crash Data by Site Available analysis method. This utility is used only if the user wants to document the crashes by year by segment in the spreadsheet. By clicking the button Crash by Year, additional rows at the bottom of the page will be unhidden and crash data for each segment included in the analysis, by severity levels for each study period year, can be entered. In addition, a new button appears (Upload Number of Crashes by Year), which is used to populate the crash data input in the main input table.



After entering the data in the worksheet for both segments, click Return to Main.

STEP 9: Select the button labeled **Intersection Input**.



STEP 10: Enter data in the color-coded cells. Cells highlighted in yellow are hardcoded values. Cells highlighted in blue are dropdown menus with pre-set options. If particular data values are the same among all facilities, users can copy and paste, or drag values among the different facility types. Table 2 provides details of the different variables needed to run the predictive method for intersections.

Table 2
Rural Two Lane Intersections Data Needs

Variable Name	Data Description
Intersection name	Intersection Name. Up to 50 intersections
Intersection type	3ST, 4ST, 4SG
AADT major	AADT for major roadway segment
AADT minor	AADT for minor roadway segment
Intersection skew angle	Degrees
If 4ST, does skew differ from minor legs?	Yes or No
Skew angle for leg 1	Degrees
Skew angle for leg 2 (4ST Only)	Degrees
Signalized/Uncontrolled approaches with left turn lane	Between 0 to 4
Signalized/Uncontrolled approaches with right turn lane	Between 0 to 4
Intersection lighting	Present or not present
Calibration factor	Derived from calibration process

Project Description	State Route 27 Reconstruction		
Analyst	ABC		
Agency or Company	Consulting Inc		
State	IL		
Date Performed	12/20/2012		
Jurisdiction	District 3		
Analysis Year	2012		
Roadway	8		

Intersection Name	Select Intersection	Intersection 1	Intersection 2
Roadway		SR 27	SR 27
Major Road Name		SR 27	SR 27
Minor Road Name		Cicero St	Golf Rd
Intersection type (3ST, 4ST, 4SG)		4ST	3ST
Intersection skew angle (degrees) [If 4ST, does skew differ for minor legs?] (**Yes/No**)	No	No	No
Skew for Leg 1 (All):	0	0	0
Skew for Leg 2 (4ST only):	0	0	0
Number of signalized or uncontrolled approaches with a left-turn lane (0, 1, 2, 3, 4)	0	0	0
Number of signalized or uncontrolled approaches with a right-turn lane (0, 1, 2, 3, 4)	0	0	0
Intersection lighting (present/not present)	Not Present	Not Present	Not Present
Calibration Factor, C_i	1.00	1.15	1.15
KABC - Fatal and Injury Only Crashes. (observed crashes/year)		1	0
PDO - Property Damage Only Crashes. (observed crashes/year)		5	7
KABCO - Total Crashes (crashes/year)		6	7

MULTIYEAR ANALYSIS

Major Road		Intersection 1	Intersection 2
AADT 2008		17,500	17,500
AADT 2009		17,850	17,850
AADT 2010		18,250	18,250
AADT 2011		18,650	18,650
AADT 2012		19,050	19,050

Minor Road		Intersection 1	Intersection 2
AADT 2008		3,500	1,800
AADT 2009		3,600	1,850
AADT 2010		3,700	1,900
AADT 2011		3,800	1,950
AADT 2012		3,900	2,000

Print Input Info Return to Main

Crash By Year

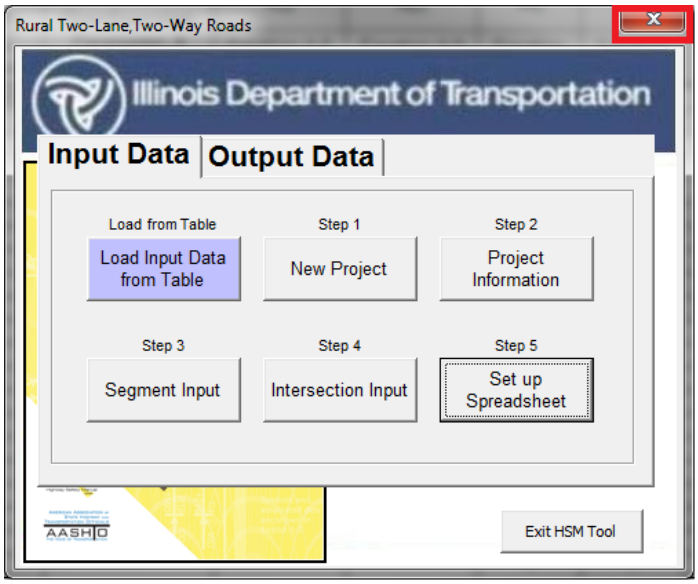
There are three buttons at the bottom of the page.

Return to Main is used to go to the Main Menu.

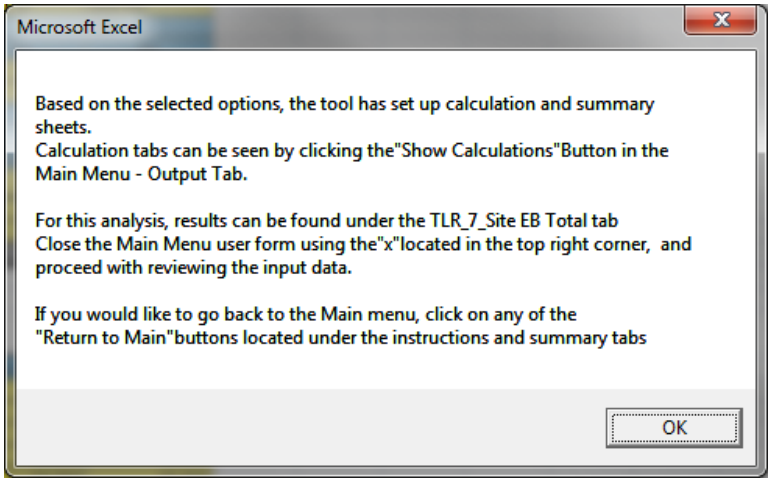
Print Input Info is used to set the segment data input tab for printing using the Page Break View.

Crash by Year is an optional button only used for the Estimate Expected Number of Crashes using Observed Crash Data by Site Available analysis method. This utility is used only if the user wants to document the crashes by year by segment in the spreadsheet.

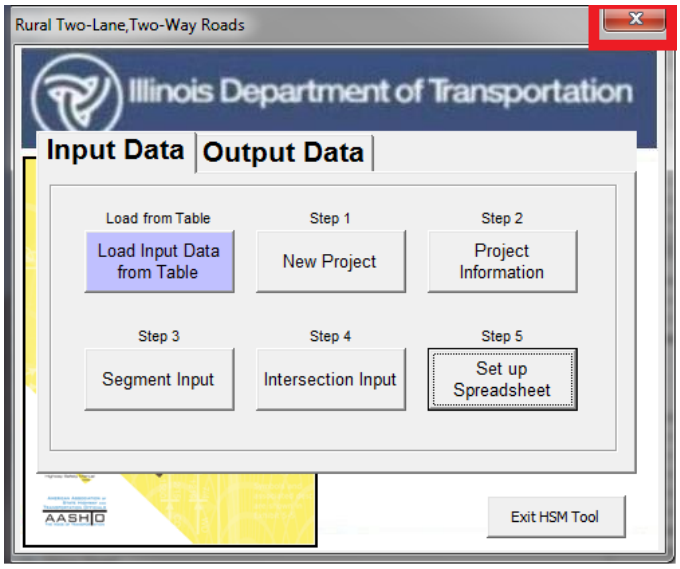
After entering the data in the worksheet for both intersections, click Return to Main.



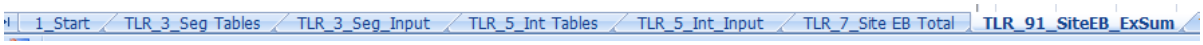
STEP 11: The last step in the process is to run the **Set up Spreadsheet** procedure. After the process is done running, a new window appears providing instructions about next steps. It indicates what tab contains the summary sheet, and how to move forward with the analysis. Click OK, and the main menu interface appears.



Close the Rural Two-Lane, Two-Way Roads main menu by clicking on the “X” located in the top right corner of the user form.



STEP 12: After closing the main menu, the predictive method summary is available, along with other tabs containing back up calculations.



For this example, the summary sheet is located in tab TLR_91_SiteEB_ExSum.

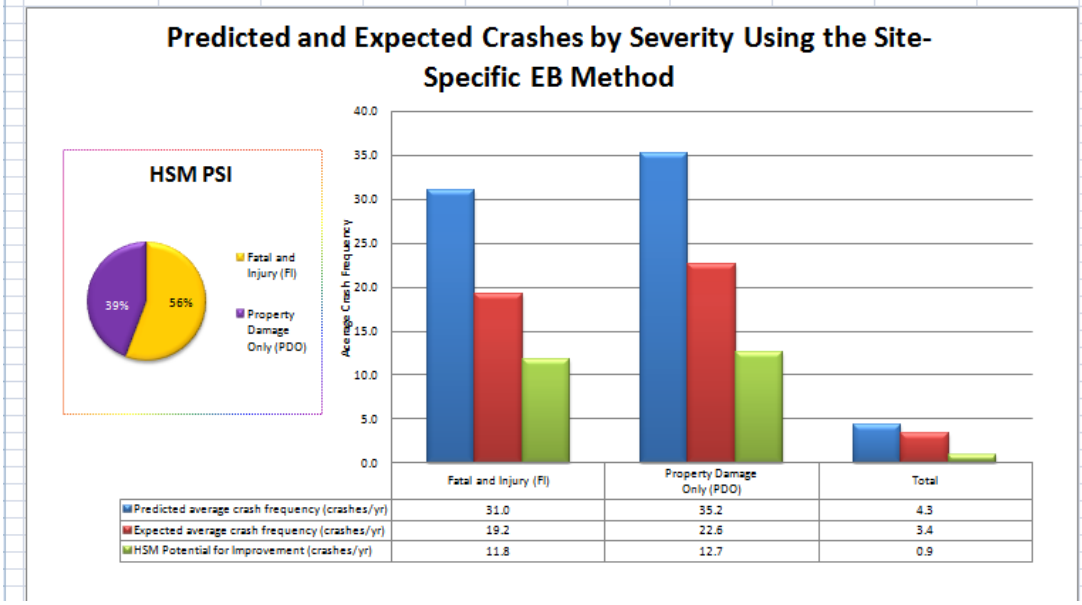
Two Lane Rural Roads Executive Summary Sheet

Worksheet 6A -- Predicted and Expected Crashes by Severity and Site Type Using the Site-Specific EB Method

Analyst	ABC	Roadway	SR 27
Agency or Company	Consulting Inc	Jurisdiction	District 3
Date Performed	12/20/2012	Analysis Year	2012
Project Description	State Route 27 Reconstruction		

Project Components	Total Crashes Per Year			Fatal and Injury Crashes Per Year (FI)			Property Damage Only Crashes Per Year (PDO)		
	Predicted average crash $N_{predicted\ [total]}$	Expected average crash $N_{expected\ [total]}$	HSM Potential for Improvement (HSM PSI)	Predicted average crash $N_{predicted\ [FI]}$	Expected average crash $N_{expected\ [FI]}$	HSM Potential for Improvement (HSM PSI)	Predicted average crash $N_{predicted\ [PDO]}$	Expected average crash $N_{expected\ [PDO]}$	HSM Potential for Improvement (HSM PSI)
SEGMENTS									
Segment 1	8.0	9.8	1.7	2.6	3.1	0.6	5.5	6.6	1.2
Segment 2	5.4	12.1	6.8	1.7	3.9	2.2	3.6	8.2	4.6
INTERSECTIONS									
Intersection 1	11.9	6.4	0.0	5.1	2.8	0.0	6.8	3.6	0.0
Intersection 2	5.6	6.9	1.3	2.3	2.9	0.5	3.3	4.0	0.7
COMBINED (sum of column)	31.0	35.2	4.3	11.8	12.7	0.9	19.2	22.6	3.4

Crash Severity Level	$N_{predicted}$ Predicted average crash frequency (crashes/yr)	$N_{expected}$ Expected average crash frequency (crashes/yr)	HSM PSI HSM Potential for Improvement (crashes/yr)
Fatal and Injury (FI)	31.0	35.2	4.3
Property Damage Only (PDO)	19.2	22.6	3.4
Total	11.8	12.7	0.9



The user can navigate through the other tabs to make changes if needed. The predictive method calculations for each facility type are available and can be displayed using the utilities in the Output Tab in the main menu. Section 4 of this guide provides additional information regarding the different utilities available for all three modules.

Tab TLR_7_SiteEB_Total, contains the predicted, expected, and observed crashes for all facilities included in the analysis.

Two Lane Rural Roads Summary Sheet

Worksheet 4A -- Predicted and Observed Crashes by Severity and Site Type Using the Site-Specific EB Method

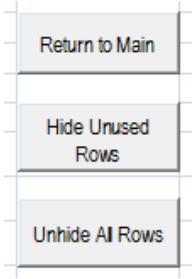
Analyst	ABC	Roadway	SR 27
Agency or Company	Consulting Inc	Jurisdiction	District 3
Date Performed	12/20/2012	Analysis Year	2012
Project Description	State Route 27 Reconstruction		

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Site type	**Predicted average crash frequency (crashes/year)**			**Observed crashes, $N_{observed}$** (crashes/year)	**Overdispersion Parameter, k**	**Weighted adjustment, w** Equation A-5 from Part C Appendix	**Expected average crash frequency,** Equation A-4 from Part C Appendix
	$N_{predicted}$ (TOTAL)	$N_{predicted}$ (FI)	$N_{predicted}$ (PDO)				
ROADWAY SEGMENTS							
Segment 1	8.029	2.577	5.452	10	0.197	0.112	9.8
Year 1	7.695	2.470	5.225	10	0.197		
Year 2	7.849	2.520	5.329	10	0.197		
Year 3	8.025	2.576	5.449	10	0.197		
Year 4	8.201	2.632	5.568	10	0.197		
Year 5	8.377	2.689	5.688	10	0.197		
Segment 2	5.353	1.718	3.635	13	0.295	0.112	12.1
Year 1	5.130	1.647	3.483	13	0.295		
Year 2	5.233	1.680	3.553	13	0.295		
Year 3	5.350	1.717	3.633	13	0.295		
Year 4	5.467	1.755	3.712	13	0.295		
Year 5	5.584	1.793	3.792	13	0.295		
INTERSECTIONS							
Intersection 1	11.932	5.143	6.789	6	0.240	0.065	6.4
Year 1	11.242	4.845	6.397	6	0.240		
Year 2	11.573	4.988	6.585	6	0.240		
Year 3	11.926	5.140	6.786	6	0.240		
Year 4	12.280	5.293	6.988	6	0.240		
Year 5	12.636	5.446	7.190	6	0.240		
Intersection 2	5.647	2.343	3.303	7	0.540	0.062	6.9
Year 1	5.317	2.206	3.110	7	0.540		
Year 2	5.473	2.271	3.202	7	0.540		
Year 3	5.643	2.342	3.301	7	0.540		
Year 4	5.814	2.413	3.401	7	0.540		
Year 5	5.987	2.484	3.502	7	0.540		
COMBINED (sum of column)	30.961	11.782	19.179	36	--	--	35.223

Worksheet 4B -- Site-Specific EB Method Summary Results

(1)	(2)	(3)
Crash severity level	$N_{predicted}$	$N_{expected}$
Total	(2)COMB from Worksheet 4A	(8)COMB from Worksheet 4A
	30.961	35.2
Fatal and Injury (FI)	(3)COMB from Worksheet 4A	$(3)_{TOTAL} * (2)_{FI} / (2)_{TOTAL}$
	11.782	13.4
Property Damage Only (PDO)	(4)COMB from Worksheet 4A	$(3)_{TOTAL} * (2)_{PDO} / (2)_{TOTAL}$
	19.179	21.8

There are three buttons on the top right side of the summaries that can be used to return to the main menu, and to hide and unhide unused rows.



Worksheets (tabs) TLR_3_Seg_Input and TLR_5_Int_Input contain the input data used in this analysis.

Note: Worksheets TLR_3_Seg_Tables and TLR_5_Int_Input contain the HSM predictive method supporting tables. IDOT has developed state-specific values for all these different distributions. So there is no need to use the HSM default values.

However, the IEST tool is flexible enough to allow modifications to such tables. Input data required from the user but restricted to **Yes** and **No** options are provided in the pull-down boxes (Blue cells). Orange cells contain the locally-derived data as shown in the figure below.

Tables Affiliated with Crash Statistics:

Table 10-3: Distribution for Crash Severity Level on Rural Two-Lane Two-Way Roadway Segments plus Locally-Derived Values

Crash severity level	Percentage of total roadway segment crashes	
Locally-Derived Values? No	HSM-Provided Values	Locally-Derived Values
Fatal	1.3	
Incapacitating Injury	5.4	
Nonincapacitating Injury	10.9	
Possible Injury	14.5	
Total Fatal Plus Injury	32.1	0.0
Property Damage Only	67.9	100.0
TOTAL	100.0	100.0

Note: HSM-provided crash severity data based on HSIS data for Washington (2002-2006)

Table 10-4: Default Distribution by Collision Type for Specific Crash Severity Levels on Rural Two-Lane Two-Way Roadway Segments plus Locally-Derived Values

Collision type	Percentage of total roadway segment crashes by crash severity level					
	HSM-Provided Values			Locally-Derived Values		
Locally-Derived Values? No	Total fatal and injury	Property damage only	TOTAL (all severity levels combined)	Total fatal and injury	Property damage only	TOTAL (all severity levels combined)
SINGLE-VEHICLE CRASHES						
Collision with animal	3.8	18.4	12.1	4.0	17.0	
Collision with bicycle	0.4	0.1	0.2			
Collision with pedestrian	0.7	0.1	0.3			
Overturned	3.7	1.5	2.5			
Ran off road	54.5	50.5	52.1			70.0
Other single-vehicle crash	0.7	2.9	2.1			
Total single-vehicle crashes	63.8	73.5	69.3	4.0	17.0	70.0
MULTIPLE-VEHICLE CRASHES						
Angle collision	10.0	7.2	8.5			
Head-on collision	3.4	0.3	1.6			2.0
Rear-end collision	16.4	12.2	14.2			
Sideswipe collision	3.8	3.8	3.7			6.0
Other multiple-vehicle collision	2.6	3.0	2.7			
Total multiple-vehicle crashes	36.2	26.5	30.7	0.0	0.0	8.0
TOTAL CRASHES	100.0	100.0	100.0	4.0	17.0	100.0

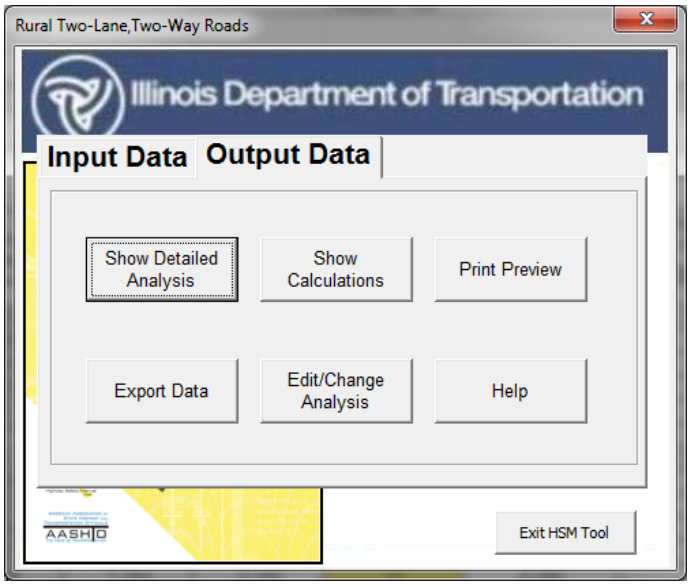
Note: HSM-provided values based on crash data for Washington (2002-2006); includes approximately 70 percent opposite-direction sideswipe and 30 percent same-direction sideswipe collisions.

Table 10-12: Nighttime Crash Proportions for Unlighted Roadway Segments plus Locally-Derived Values

Roadway Type	HSM Default Values			Locally Derived Values		
Locally-Derived Values?	No					
	Proportion of total nighttime crashes by severity level		Proportion of crashes that occur at night	Proportion of total nighttime crashes by severity level		Proportion of crashes that occur at night
	Fatal and Injury p_{inr}	PDO p_{pnr}	p_{nr}	Fatal and Injury p_{inr}	PDO p_{pnr}	p_{nr}
2U	0.382	0.618	0.370			

Note: HSM-provided values based on HSIS data for Washington (2002-2006)

STEP 13: To print the summary, export data, or make changes, click on the Return to Main button on the top right side of the summary tabs. This will prompt the main menu. Click on the Output Data tab.



Show Detailed Analysis: Displays the background summary calculations

Show Calculations: Displays the predictive method calculations (tabs) for each facility included in the analysis.

Print Preview: Prepares the summary sheet for printing.

Export Data: Creates a copy of the spreadsheet.

Edit/Change Analysis: Allows users to make changes, including adding facilities, changing values, and re-running the set-up process.

Help: Provides a hyperlink to the IEST Tool User's Manual posted on IDOT website.

More details about these utilities are provided in section 4.

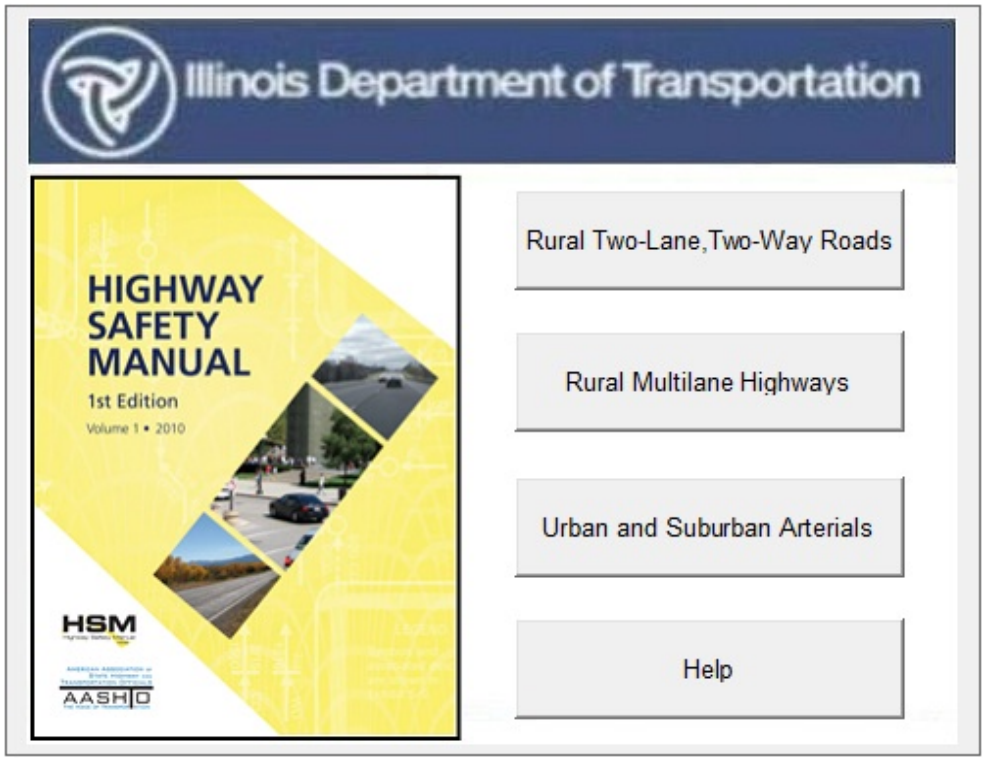
3.2. Rural Multilane Highways

Introduction

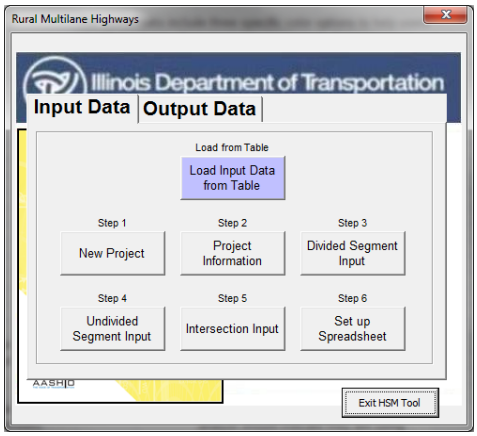
The Highway Safety Manual (Chapter 11) provides a methodology for estimating the predicted average crash frequency, crash severity, and collision types for rural multilane highways. This chapter is applicable to all multilane highways without full access control that are outside urban areas with a population less than 5,000 people. More details about the applicability of this module can be found in the HSM Section 11.3.

This example illustrates how to apply the Rural Multilane Highways predictive method using the IEST tool.

STEP 1: The screen capture below shows the opening page of the IEST tool. Press the Rural Multilane Highways button to begin with the analysis.



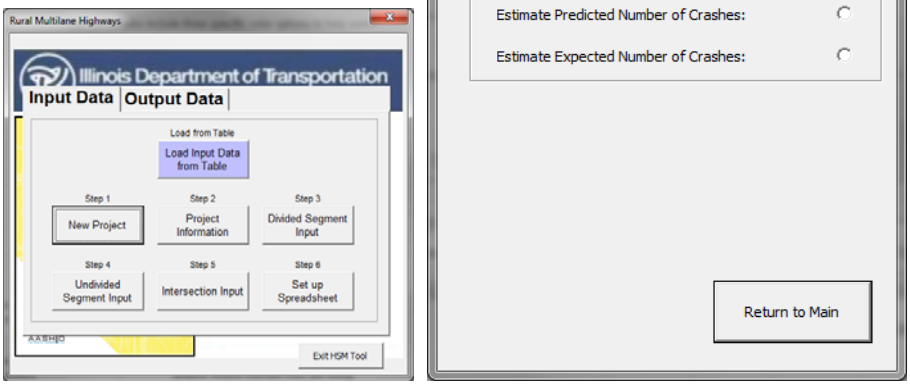
STEP 2: A new window opens and shows the main menu interface. The main menu is comprised of two main tabs: Input Data and Output Data. The Input Data tab opens by default when starting the tool. The output tab contains a series of utilities including print preview, export, among others. More details about the output tab utilities are provided in section 4.



In the Input Data tab, there are a total of seven buttons, which are used to run the analyses.

This new version of the tool includes two methods to run the analysis. The first one is using the button **Load Input Data from Table**, and the second one is following steps 1 through 6. This example will be conducted using the six steps.

STEP 3: Start by pressing the **New Project** button to display the Analysis Input form.



The Analysis Input window will appear.

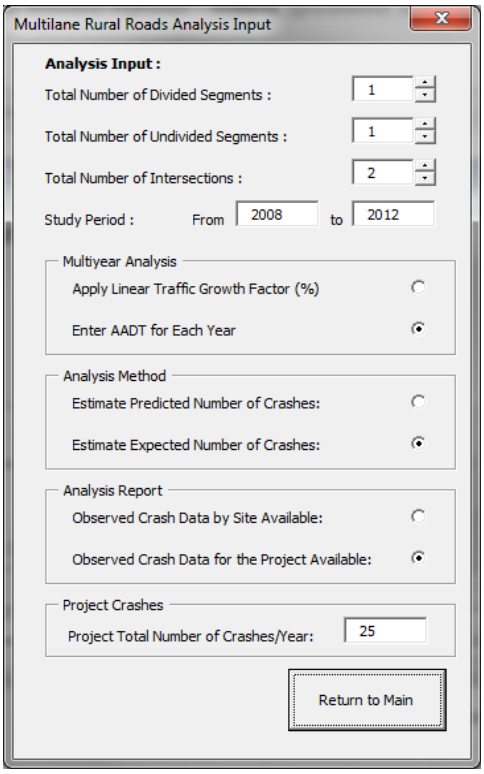
STEP 4: Input the information requested in the fields. The **Total Number of Divided Segments,** the **Total Number of Undivided Segments,** and the **Total Number of Intersections** should be a number between 0 and 50. For **Study Period**, enter the period for which crash data is available (for example, 2008 to 2012). The maximum study period length is 5 years

Multiyear analyses can now be conducted using either a growth factor or entering AADT for each analysis year. Multiyear analysis options will be enabled only when the difference between study period years is greater than 1. If **Apply Linear Traffic Growth Factor (%)** is selected, make sure to enter the respective value in percentage. If AADT for each analysis year is available, select **Enter AADT for Each Year** by clicking on the circle next to the text.

Analysis Method: If observed crash data is not available, select **Estimate Predicted Number of Crashes** by clicking on the circle next to the text. If observed crash data is available, select **Estimate Expected Number of Crashes** by clicking on the circle next to the text.

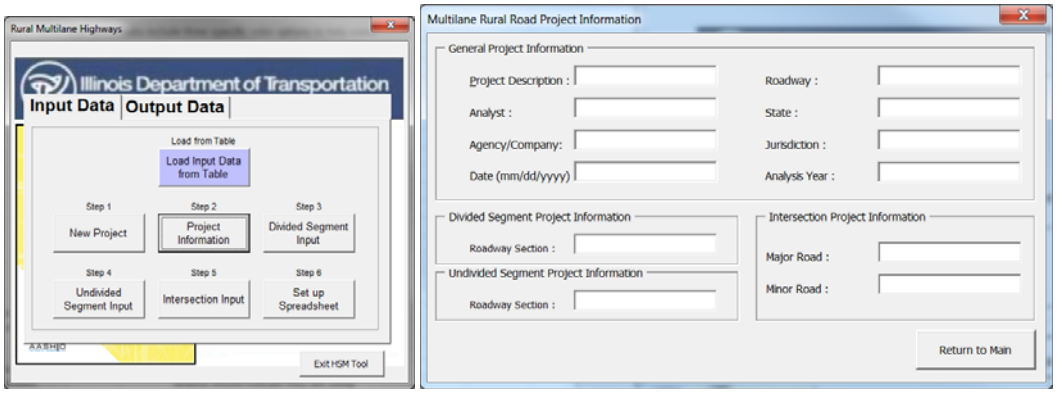
The expected crash frequency is obtained by applying the Empirical Bayes Method. This method combines the predicted average crash frequency with the observed crash data to provide a more reliable estimate. Selecting the **Estimate Expected Number of Crashes** will enable the Analysis Report frame. There are two methods to apply the Empirical Bayes adjustment using observed crash data. The **Observed Crash Data by Site Available** is used when available crash data is disaggregated by site (segments and/or intersections), and the **Observed Crash Data for the Project Available** is used when observed crash data is only available at aggregated/project level across the all the sites. Refer to the HSM Section A.2.4 and A.2.5 (Pages A-19 and A-20) for additional details on the different EB methods.

This analysis includes one divided segment, one undivided segment, and two intersections. The study period is from 2008 to 2012. The Multiyear Analysis will be conducted using AADT for each year. The Estimate Expected Number of Crashes Using Observed Crash Data for the Project Available is the selected analysis method.

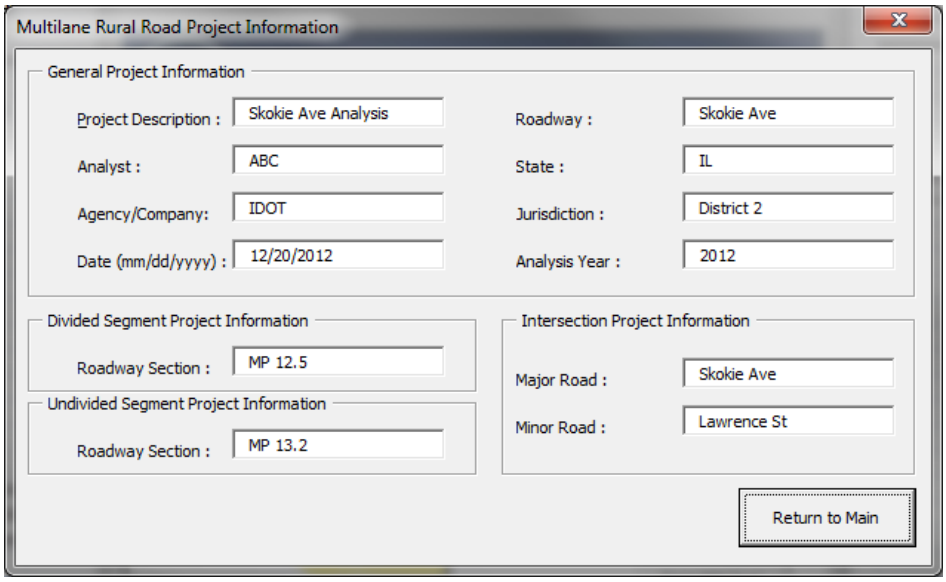


When complete click on the **Return to Main** button to return to the main input window.

STEP 5: On the main menu, select the button labeled **Project Information**.

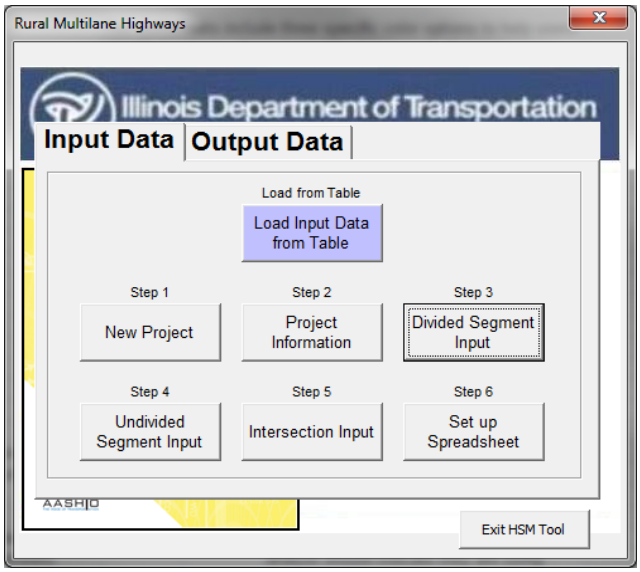


STEP 6: Complete the information requested in the General Project Information. For Divided and Undivided segment project information – Roadway Section, enter either a reference milepost or Key Route or Marked Route. Key Route refers to the Illinois Roadway Information System (IRIS) terminology and is a universal identifier for any segment. Marked Route refers to the Division of Traffic Safety route inventory. The key route information is not necessary for intersections, but all information provided will assist in tracking projects. For Intersection Project Information, enter a description for **Major Road** and **Minor Road** (for example, Golf Road/Milwaukee Ave., respectively). When all fields have been completed, click on **Return to Main**.

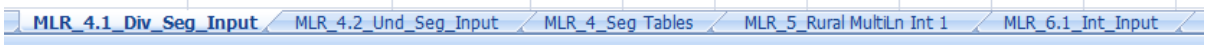


The main menu will re-open.

STEP 7: Select the button labeled **Divided Segment Input**.



The main interface closes, and two new tabs appear. Segment and intersection data are entered in these two tabs. The naming convention varies between different modules. MLR is for multilane rural roads, TLR is for the two-lane rural roads, and **UrbArt** is for Urban and Suburban Arterials. For this example the MLR_4.1_Div_Seg_Input, MLR_4.2_Und_Seg_Input and MLR_6.1_Int_Input tabs are used for data entry. The tabs are sequentially numbered, and are displayed based on the type of analysis selected.



STEP 8: Enter data in the color-coded cells. Cells highlighted in yellow are hardcoded values. Cells highlighted in blue are dropdown menus with pre-set options. If particular data values are the same among all facilities, users can copy and paste, or drag values

among the different facility types. Table 3 provides details of the different variables needed to run the predictive method for segments.

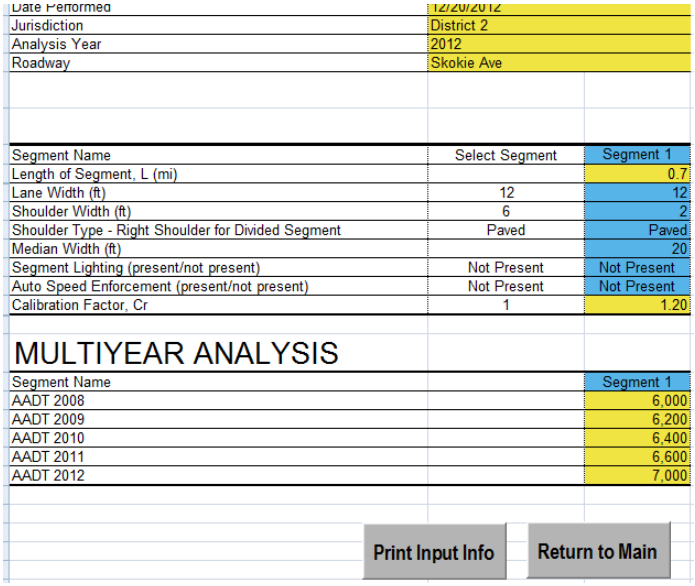
Table 3
Rural Multilane Highways – Divided Segments Data Input

Variable Name	Data Description/Units
Segment name	Name of the roadway segment. Up to 50 segments
Length of Segment	Miles
AADT	AADT for roadway segment
Lane width	Feet
Shoulder width	Feet
Shoulder Type–Right Shoulder for divided	Paved, gravel, composite or turf
Median Width	Feet
Segment lighting	Present or not present
Auto speed enforcement	Present or not present
Calibration factor	Derived from calibration process
KABC	Fatal and injury crashes recorded for the segment; this value is only applicable for Observed Crash Data by Site Available analysis method
PDO	Property damage only crashes recorded for the segment; this value is only applicable for Observed Crash Data by Site Available analysis method

There are two buttons at the bottom of the page.

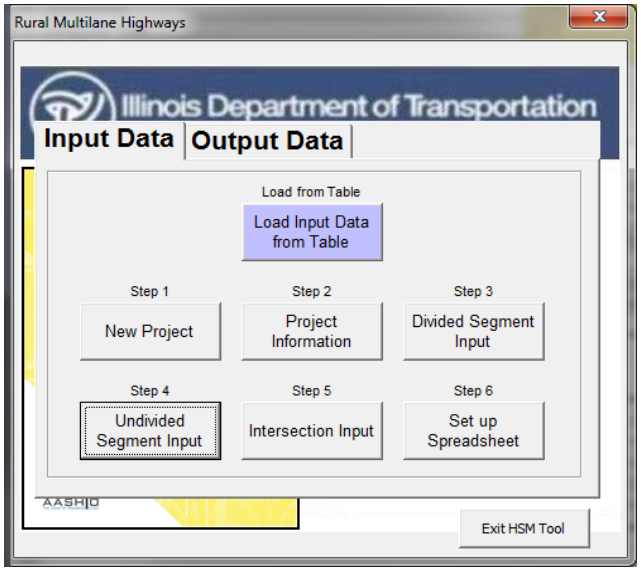
Return to Main is used to go to the main menu.

Print Input Info is used to set the segment data input tab for printing using the Page Break View.



When all fields have been completed, click on **Return to Main**.

STEP 9: Select the button labeled **Undivided Segment Input**.



STEP 10: Enter data in the color-coded cells. Cells highlighted in yellow are hardcoded values. Cells highlighted in blue are dropdown menus with pre-set options. If particular data values are the same among all facilities, users can copy and paste, or drag values among the different facility types. Table 4 provides details of the different variables needed to run the predictive method for intersections.

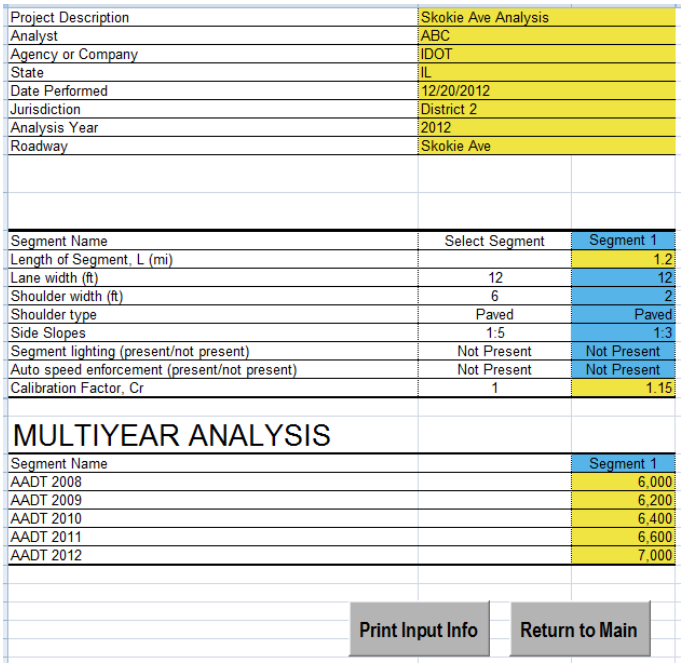
Table 4
Rural Multilane Highways – Undivided Segments Data Input

Variable Name	Data Description
Segment name	Name of the roadway segment. Up to 50 segments
Length of Segment	Miles
AADT	AADT for roadway segment
Lane width	Feet
Shoulder width	Feet
Shoulder Type–Right Shoulder for divided	Paved, gravel, composite or turf
Side Slopes	1:2 or Steeper to 1:7 or Flatter
Segment lighting	Present or not present
Auto speed enforcement	Present or not present
Calibration factor	Derived from calibration process
KABC	Fatal and injury crashes recorded for the segment; this value is only applicable for Observed Crash Data by Site Available analysis method
PDO	Property damage only crashes recorded for the segment; this value is only applicable for Observed Crash Data by Site Available analysis method

There are two buttons at the bottom of the page.

Return to Main is used to go to the Main Menu.

Print Input Info is used to set the segment data input tab for printing using the Page Break View.



Project Description		Skokie Ave Analysis
Analyst		ABC
Agency or Company		IDOT
State		IL
Date Performed		12/20/2012
Jurisdiction		District 2
Analysis Year		2012
Roadway		Skokie Ave
Segment Name	Select Segment	Segment 1
Length of Segment, L (mi)		1.2
Lane width (ft)	12	12
Shoulder width (ft)	6	2
Shoulder type	Paved	Paved
Side Slopes	1:5	1:3
Segment lighting (present/not present)	Not Present	Not Present
Auto speed enforcement (present/not present)	Not Present	Not Present
Calibration Factor, Cr	1	1.15

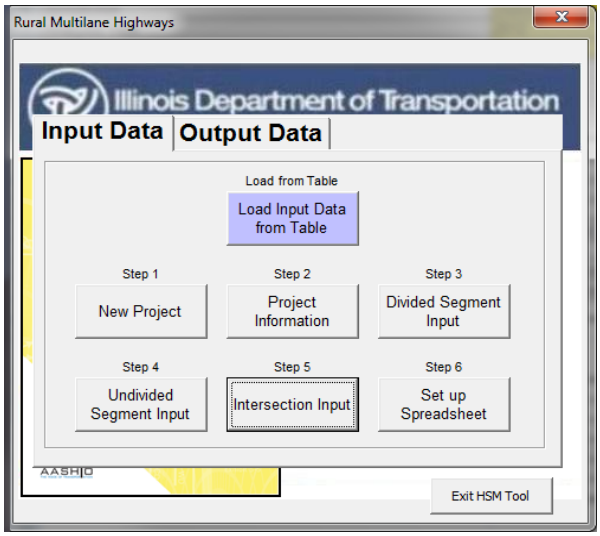
MULTIYEAR ANALYSIS

Segment Name	Segment 1
AADT 2008	6,000
AADT 2009	6,200
AADT 2010	6,400
AADT 2011	6,600
AADT 2012	7,000

Print Input Info Return to Main

When all fields have been completed, click on **Return to Main**.

STEP 11: Select the button labeled **Intersection Input**.



STEP 12: Enter the information requested in the fields of the **Rural Multilane Intersection Input** window for each intersection included in the analysis. Cells highlighted in yellow are hardcoded values. Cells highlighted in blue are dropdown menus with pre-set options. If particular data values are the same among all facilities, users can copy and paste, or drag values among the different facility types. Table 5 provides details of the different variables needed to run the predictive method for intersections.

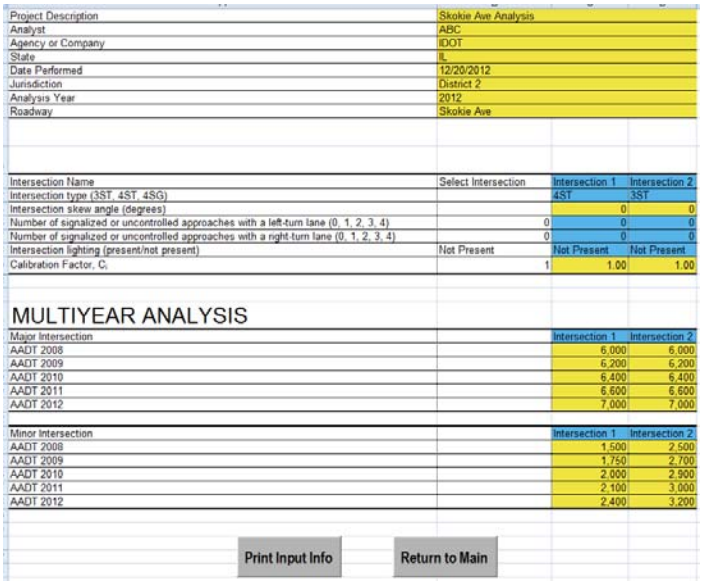
Table 5
Rural Multilane Highways – Intersections Data Input

Variable Name	Data Description
Intersection name	Name of the intersection. Up to 50 intersections
Intersection type	Three-leg stop control (3ST), four-leg stop control (4ST), four-leg signalized intersection (4SG).
AADT major	AADT for major roadway segment
AADT minor	AADT for minor roadway segment
Intersection skew angle	Degrees
Number of non-STOP-Controlled approaches with LT lane	0, 1, or 2
Number of non-STOP-Controlled approaches with RT lane	0, 1, 2, 3 or 4
Intersection lighting	Present or not present
Calibration Factor, Cr	Derived from calibration process
KABC	Fatal and injury crashes recorded for the segment; this value is only applicable for Observed Crash Data by Site Available analysis method
PDO	Property damage only crashes recorded for the segment; this value is only applicable for Observed Crash Data by Site Available Analysis method

There are two buttons at the bottom of the page.

Return to Main is used to go to the Main Menu.

Print Input Info is used to set the segment data input tab for printing using the Page Break View.



Project Description		Skokie Ave Analysis	
Analyst		ABC	
Agency or Company		IDOT	
State		IL	
Date Performed		12/20/2012	
Jurisdiction		District 2	
Analysis Year		2012	
Roadway		Skokie Ave	
Intersection Name	Select Intersection	Intersection 1	Intersection 2
Intersection type (3ST, 4ST, 4SG)		4ST	3ST
Intersection skew angle (degrees)		0	0
Number of signalized or uncontrolled approaches with a left-turn lane (0, 1, 2, 3, 4)	0	0	0
Number of signalized or uncontrolled approaches with a right-turn lane (0, 1, 2, 3, 4)	0	0	0
Intersection lighting (present/not present)	Not Present	Not Present	Not Present
Calibration Factor, C_i	1	1.00	1.00

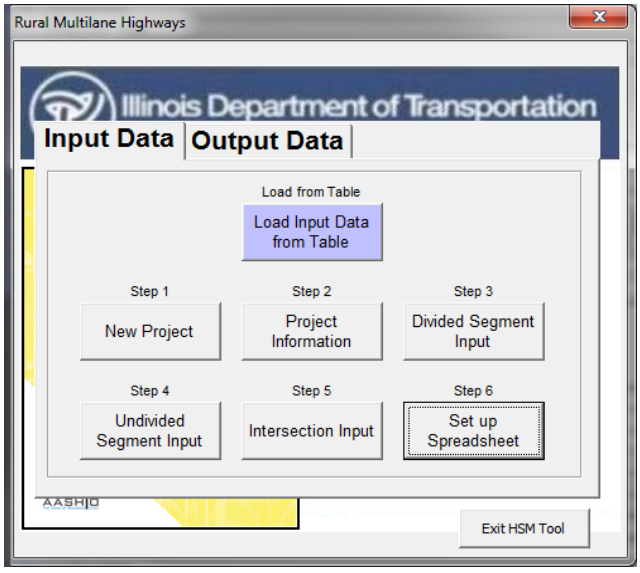
MULTIYEAR ANALYSIS

Major Intersection		Intersection 1	Intersection 2
AADT 2008		6,000	6,000
AADT 2009		6,200	6,200
AADT 2010		6,400	6,400
AADT 2011		6,600	6,600
AADT 2012		7,000	7,000
Minor Intersection		Intersection 1	Intersection 2
AADT 2008		1,500	2,500
AADT 2009		1,750	2,700
AADT 2010		2,000	2,900
AADT 2011		2,100	3,000
AADT 2012		2,400	3,200

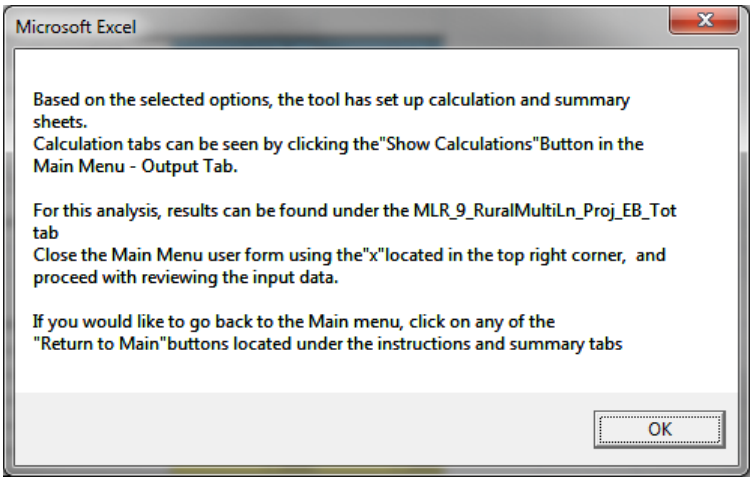
Print Input Info Return to Main

When all fields have been completed, click on **Return to Main**.

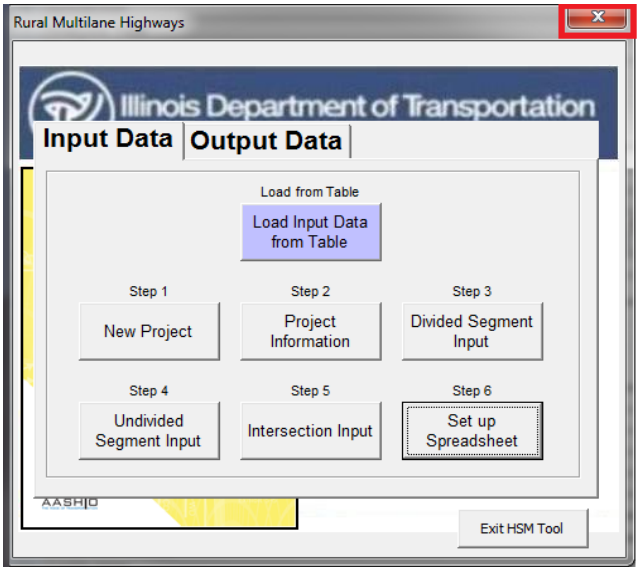
STEP 13: Select the button labeled **Set up Spreadsheet**.



Based on the selected options when creating a new project the user will get a message similar to the image shown below with next step instructions.

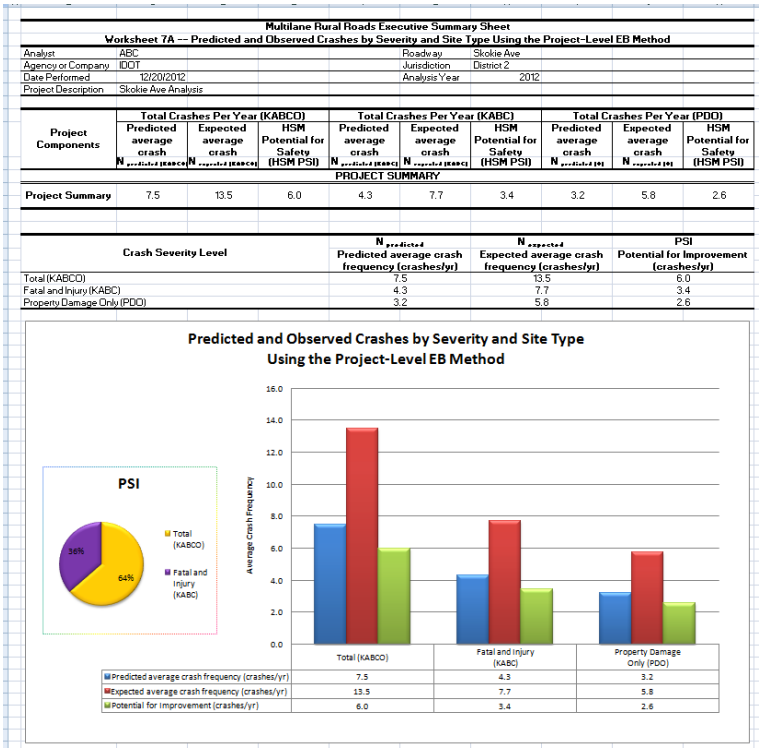


Click **OK**, and then close the Rural Multilane Highways main menu user form by clicking on the "X" button on the top right of the box..



The IEST tool can be used for analyzing single facilities, as well as for corridors with multiple segments and intersections and multi-year crash data. The **Set up Spreadsheet** procedure will create a customized summary sheet depending on the number of facilities, study period, and analysis method selected.

STEP 14: For this example the final results will be shown in tab MLR_102_ProjEB_ExSum. The executive summary contains predicted and expected average crash frequency for Total, Fatal and Injury (KABC), and Property Damage Only (PDO) crashes. In addition, the HSM Potential for Safety Improvement is included. The executive summary is shown below:



Multilane Rural Roads Executive Summary Sheet
Worksheet 7A -- Predicted and Observed Crashes by Severity and Site Type Using the Project-Level EB Method

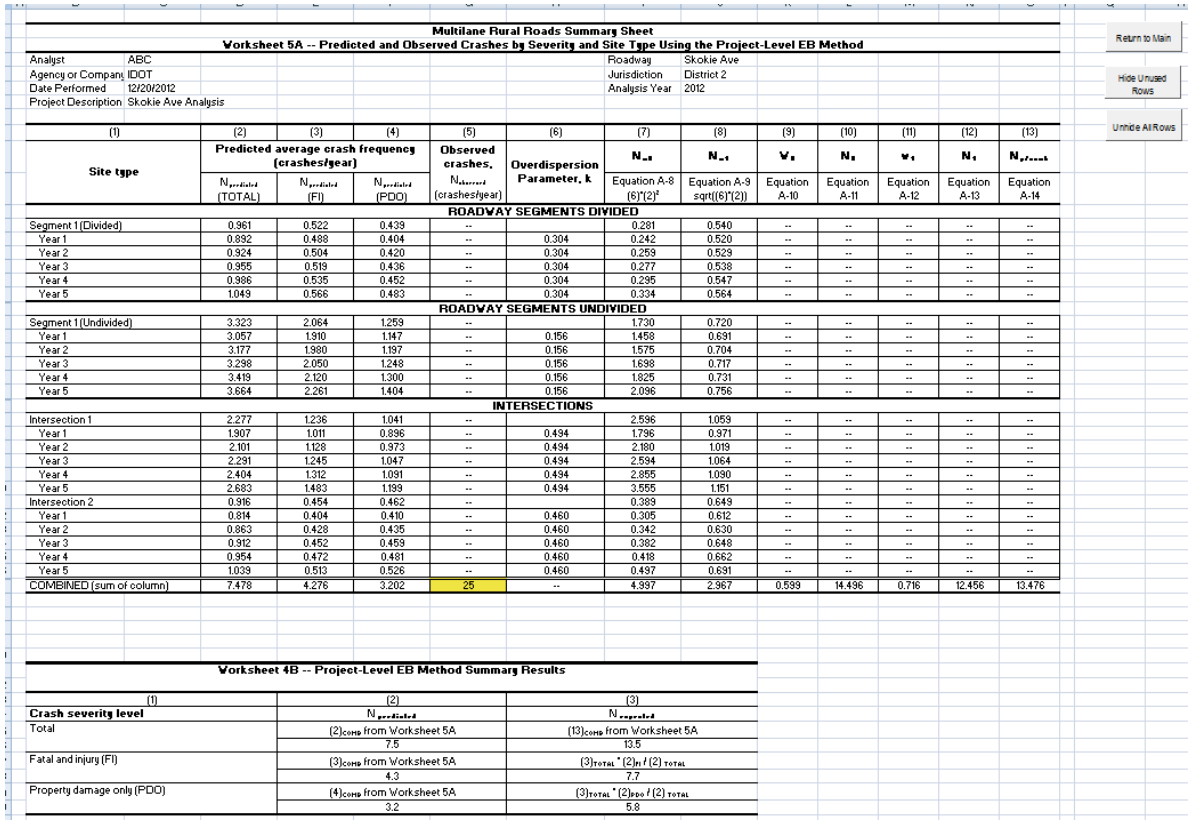
Analyst	ABC	Roadway	Skokie Ave
Agency or Company	IDOT	Jurisdiction	District 2
Date Performed	12/20/2012	Analysis Year	2012
Project Description	Skokie Ave Analysis		

Project Components	Total Crashes Per Year (KABCO)			Total Crashes Per Year (KABC)			Total Crashes Per Year (PDO)		
	Predicted average crash $N_{predicted\ [KABCO]}$	Expected average crash $N_{expected\ [KABCO]}$	HSM Potential for Safety (HSM PSI)	Predicted average crash $N_{predicted\ [KABC]}$	Expected average crash $N_{expected\ [KABC]}$	HSM Potential for Safety (HSM PSI)	Predicted average crash $N_{predicted\ [PDO]}$	Expected average crash $N_{expected\ [PDO]}$	HSM Potential for Safety (HSM PSI)
PROJECT SUMMARY									
Project Summary	7.5	13.5	6.0	4.3	7.7	3.4	3.2	5.8	2.6

Crash Severity Level	$N_{predicted}$ Predicted average crash frequency (crashes/yr)	$N_{expected}$ Expected average crash frequency (crashes/yr)	PSI Potential for Improvement (crashes/yr)
Total (KABCO)	7.5	13.5	6.0
Fatal and Injury (KABC)	4.3	7.7	3.4
Property Damage Only (PDO)	3.2	5.8	2.6

The user can navigate through the other tabs to make changes if needed. The predictive method calculations for each facility type are available and can be displayed using the utilities in the Output Tab in the main menu. Section 4 of this guide provides additional information regarding the different utilities available for all three modules.

Tab MLR_9_RuralMultiLn_Proj_EB_Tot, contains the predicted, expected, and observed crashes for all the facilities included in the analysis.



Multilane Rural Roads Summary Sheet
Worksheet 5A -- Predicted and Observed Crashes by Severity and Site Type Using the Project-Level EB Method

Return to Main | Hide Unused Rows | Unhide All Rows

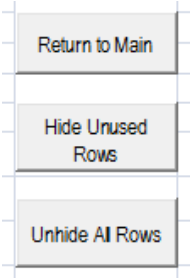
Analyst	ABC			Roadway	Skokie Ave
Agency or Company	IDOT			Jurisdiction	District 2
Date Performed	12/20/2012			Analysis Year	2012
Project Description	Skokie Ave Analysis				

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Site type	Predicted average crash frequency (crashes/year)			Observed crashes, $N_{observed}$ (crashes/year)	Overdispersion Parameter, k	N_{sa}	N_{sa-1}	V_a	N_a	w_1	N_1	$N_{expected}$
	$N_{predicted}$ (TOTAL)	$N_{predicted}$ (FI)	$N_{predicted}$ (PDO)			Equation A-8 (6)*(2)^2	Equation A-9 sqrt((6)*(2))	Equation A-10	Equation A-11	Equation A-12	Equation A-13	Equation A-14
ROADWAY SEGMENTS DIVIDED												
Segment 1 (Divided)	0.961	0.522	0.439	--		0.281	0.540	--	--	--	--	--
Year 1	0.892	0.488	0.404	--	0.304	0.242	0.520	--	--	--	--	--
Year 2	0.924	0.504	0.420	--	0.304	0.259	0.529	--	--	--	--	--
Year 3	0.955	0.519	0.436	--	0.304	0.277	0.538	--	--	--	--	--
Year 4	0.986	0.535	0.452	--	0.304	0.295	0.547	--	--	--	--	--
Year 5	1.049	0.566	0.483	--	0.304	0.334	0.564	--	--	--	--	--
ROADWAY SEGMENTS UNDIVIDED												
Segment 1 (Undivided)	3.323	2.064	1.259	--		1.730	0.720	--	--	--	--	--
Year 1	3.057	1.910	1.147	--	0.156	1.458	0.691	--	--	--	--	--
Year 2	3.177	1.980	1.197	--	0.156	1.575	0.704	--	--	--	--	--
Year 3	3.298	2.050	1.248	--	0.156	1.698	0.717	--	--	--	--	--
Year 4	3.419	2.120	1.300	--	0.156	1.825	0.731	--	--	--	--	--
Year 5	3.664	2.261	1.404	--	0.156	2.096	0.756	--	--	--	--	--
INTERSECTIONS												
Intersection 1	2.277	1.236	1.041	--		2.596	1.059	--	--	--	--	--
Year 1	1.907	1.011	0.896	--	0.494	1.796	0.971	--	--	--	--	--
Year 2	2.101	1.128	0.973	--	0.494	2.180	1.019	--	--	--	--	--
Year 3	2.291	1.245	1.047	--	0.494	2.594	1.064	--	--	--	--	--
Year 4	2.404	1.312	1.091	--	0.494	2.855	1.090	--	--	--	--	--
Year 5	2.683	1.483	1.199	--	0.494	3.555	1.151	--	--	--	--	--
Intersection 2	0.916	0.454	0.462	--		0.389	0.649	--	--	--	--	--
Year 1	0.814	0.404	0.410	--	0.460	0.305	0.612	--	--	--	--	--
Year 2	0.863	0.428	0.435	--	0.460	0.342	0.630	--	--	--	--	--
Year 3	0.912	0.452	0.459	--	0.460	0.382	0.648	--	--	--	--	--
Year 4	0.954	0.472	0.481	--	0.460	0.418	0.662	--	--	--	--	--
Year 5	1.039	0.513	0.526	--	0.460	0.497	0.691	--	--	--	--	--
COMBINED (sum of column)	7.478	4.276	3.202	25	--	4.997	2.967	0.599	14.496	0.716	12.456	13.476

Worksheet 4B -- Project-Level EB Method Summary Results

(1)	(2)	(3)
Crash severity level	$N_{predicted}$	$N_{expected}$
Total	$(2)_{COMB}$ from Worksheet 5A	$(13)_{COMB}$ from Worksheet 5A
	7.5	13.5
Fatal and injury (FI)	$(3)_{COMB}$ from Worksheet 5A	$(3)_{TOTAL} * (2)_{FI} / (2)_{TOTAL}$
	4.3	7.7
Property damage only (PDO)	$(4)_{COMB}$ from Worksheet 5A	$(3)_{TOTAL} * (2)_{PDO} / (2)_{TOTAL}$
	3.2	5.8

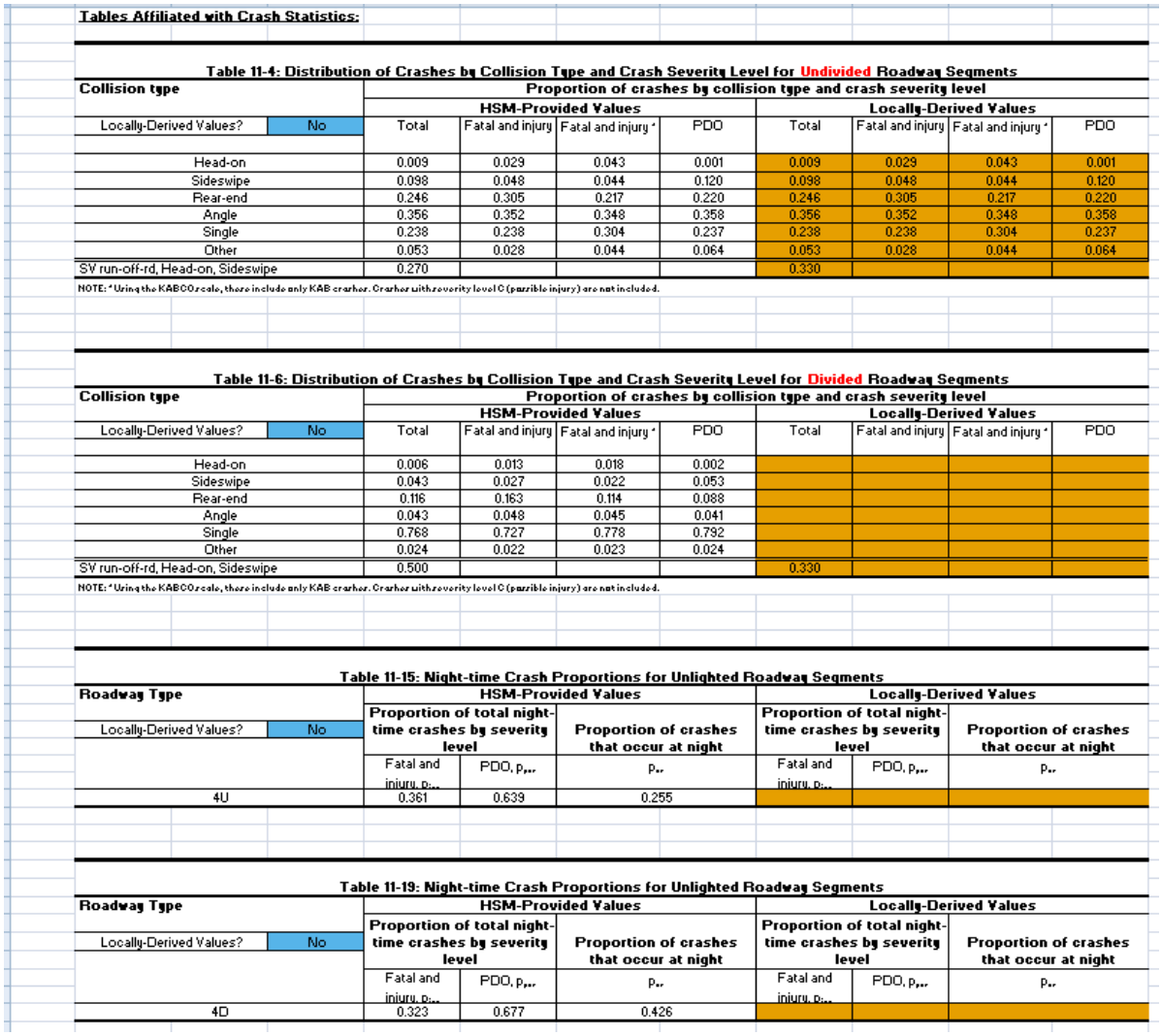
There are three buttons on the top right side of the summaries that can be used to return to the main menu, hide and unhide unused rows.



Tabs MLR_4.1_Div_Seg_Input, MLR_4.2_Und_Seg_Input, and MLR_6.1_Int_Input contain the input data used in this analysis.

Note: Worksheets MLR_4_Seg Tables and MLR_6_Int Tables contain the HSM predictive method supporting tables. IDOT has developed state-specific values for all these different distributions. So there is no need to use the HSM default values.

However, the IEST tool is flexible enough to allow modifications to such tables. Input data required from the user but restricted to **Yes** and **No** options are provided in the pull-down boxes (Blue cells). Orange cells contain the locally-derived data as shown in the figure below.



Tables Affiliated with Crash Statistics:

Table 11-4: Distribution of Crashes by Collision Type and Crash Severity Level for Undivided Roadway Segments

Collision type	Proportion of crashes by collision type and crash severity level							
	HSM-Provided Values				Locally-Derived Values			
Locally-Derived Values? No	Total	Fatal and injury	Fatal and injury *	PDO	Total	Fatal and injury	Fatal and injury *	PDO
Head-on	0.009	0.029	0.043	0.001	0.009	0.029	0.043	0.001
Sideswipe	0.098	0.048	0.044	0.120	0.098	0.048	0.044	0.120
Rear-end	0.246	0.305	0.217	0.220	0.246	0.305	0.217	0.220
Angle	0.356	0.352	0.348	0.358	0.356	0.352	0.348	0.358
Single	0.238	0.238	0.304	0.237	0.238	0.238	0.304	0.237
Other	0.053	0.028	0.044	0.064	0.053	0.028	0.044	0.064
SV run-off-rd, Head-on, Sideswipe	0.270				0.330			

NOTE: * Using the KABCO scale, there include only KAB crashes. Crashes with severity level C (possible injury) are not included.

Table 11-6: Distribution of Crashes by Collision Type and Crash Severity Level for Divided Roadway Segments

Collision type	Proportion of crashes by collision type and crash severity level							
	HSM-Provided Values				Locally-Derived Values			
Locally-Derived Values? No	Total	Fatal and injury	Fatal and injury *	PDO	Total	Fatal and injury	Fatal and injury *	PDO
Head-on	0.006	0.013	0.018	0.002				
Sideswipe	0.043	0.027	0.022	0.053				
Rear-end	0.116	0.163	0.114	0.088				
Angle	0.043	0.048	0.045	0.041				
Single	0.768	0.727	0.778	0.792				
Other	0.024	0.022	0.023	0.024				
SV run-off-rd, Head-on, Sideswipe	0.500				0.330			

NOTE: * Using the KABCO scale, there include only KAB crashes. Crashes with severity level C (possible injury) are not included.

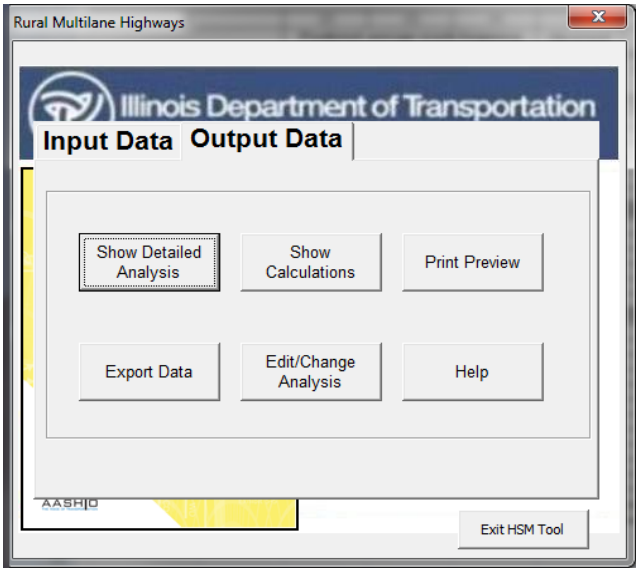
Table 11-15: Night-time Crash Proportions for Unlighted Roadway Segments

Roadway Type	HSM-Provided Values			Locally-Derived Values		
	Proportion of total night-time crashes by severity level		Proportion of crashes that occur at night	Proportion of total night-time crashes by severity level		Proportion of crashes that occur at night
Locally-Derived Values? No	Fatal and injury, $p_{i,ni}$	PDO, $p_{pdo,ni}$	p_{ni}	Fatal and injury, $p_{i,ni}$	PDO, $p_{pdo,ni}$	p_{ni}
4U	0.361	0.639	0.255			

Table 11-19: Night-time Crash Proportions for Unlighted Roadway Segments

Roadway Type	HSM-Provided Values			Locally-Derived Values		
	Proportion of total night-time crashes by severity level		Proportion of crashes that occur at night	Proportion of total night-time crashes by severity level		Proportion of crashes that occur at night
Locally-Derived Values? No	Fatal and injury, $p_{i,ni}$	PDO, $p_{pdo,ni}$	p_{ni}	Fatal and injury, $p_{i,ni}$	PDO, $p_{pdo,ni}$	p_{ni}
4D	0.323	0.677	0.426			

STEP 15: To print the summary, export data, or make changes, click on the Return to Main button on the top right side of the summary tabs. This will prompt the main menu. Click on the Output Data tab.



Show Detailed Analysis: Displays the background summary calculations

Show Calculations: Displays the predictive method calculations (tabs) for each facility included in the analysis.

Print Preview: Prepares the summary sheet for printing.

Export Data: Creates a copy of the spreadsheet.

Edit/Change Analysis: Allows users to make changes, including adding facilities, changing values, and re-running the set-up process.

Help: Provides a hyperlink to the IEST tool user's manual posted on IDOT website.

More details about these utilities are provided in section 4.

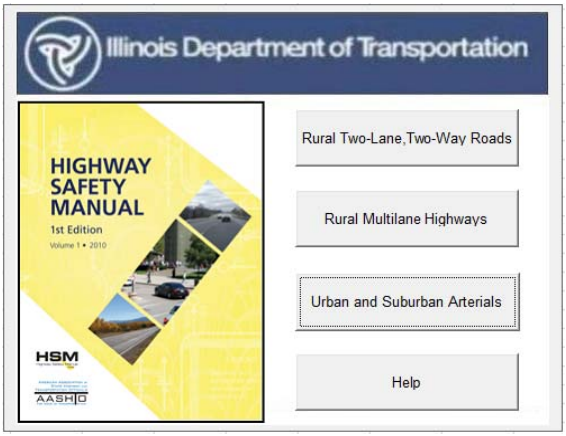
3.3. Urban and Suburban Arterials

Introduction

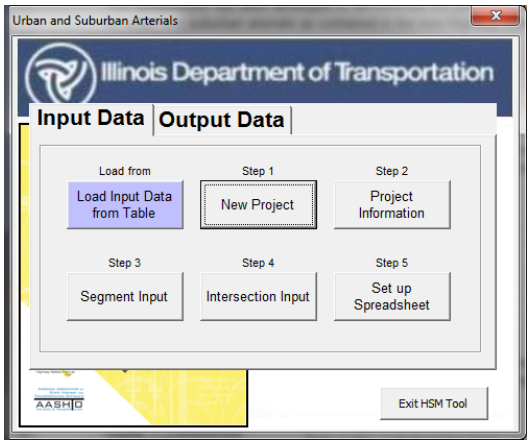
The Highway Safety Manual (Chapter 12) provides a methodology for estimating the predicted average crash frequency, crash severity, and collision types for urban and suburban facilities. This chapter is applicable to arterials without full access control (other than freeway), with two- or four-lane undivided facilities, four-lane divided and three- and five-lane roads with center two-way left-turn lanes in urban and suburban areas. More details about the applicability of this module can be found in the HSM Section 12.3.

This example illustrates how to apply the Urban and Suburban Arterials predictive method using the IEST tool.

STEP 1: The screen capture below shows the opening page of the IEST tool. Press the Urban and Suburban Arterials button to begin with the analysis.

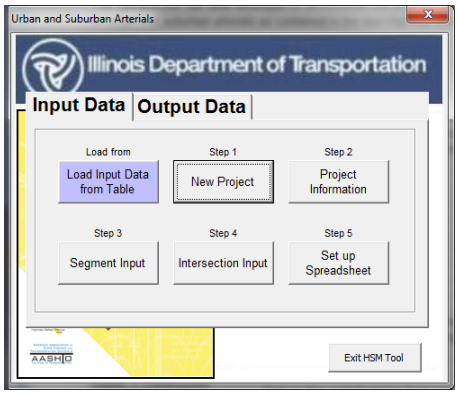


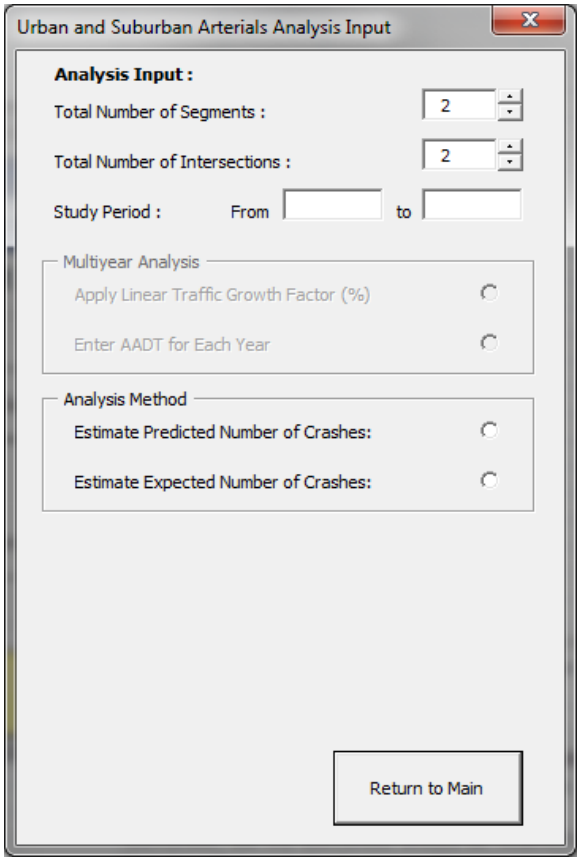
STEP 2: A new window opens and shows the main menu interface. The main menu is comprised of two main tabs: Input Data and Output Data. The Input Data tab opens by default when starting the tool. The output tab contains a series of utilities including print preview, export, among others. More details about the output tab utilities are provided in section 4.



This new version of the tool includes two methods to run the analysis. The first one is using the button **Load Input Data from Table**, and the second one is following steps 1 through 5. This example will be conducted using the five steps.

STEP 3: Select the button labeled **New Project.** The Analysis Input user form will appear.





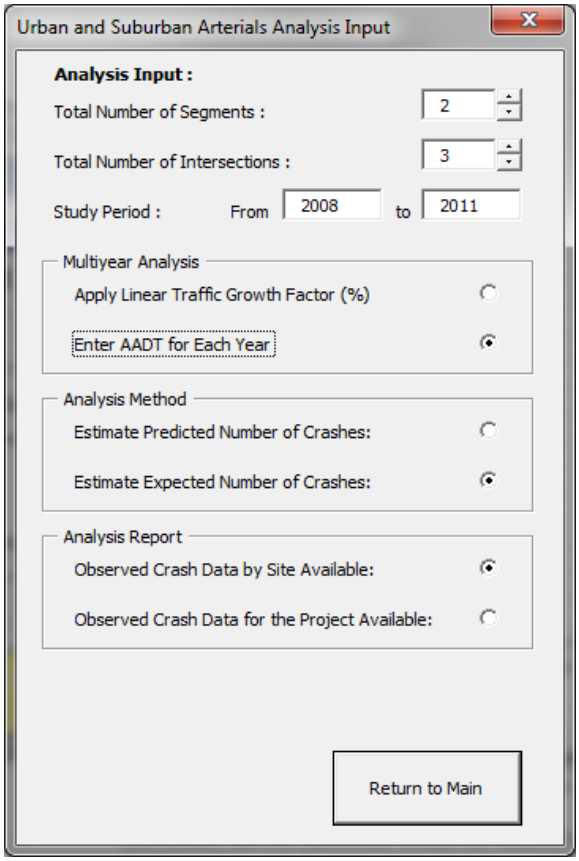
STEP 4: Input the information requested in the fields. The **Total Number of Segments** and the **Total Number of Intersections** should be a number between 0 and 50. For **Study Period**, enter the period for which crash data is available (for example, 2008 to 2011).

Multiyear analyses can now be conducted using either a growth factor or entering AADT for each analysis year. Multiyear analysis options will be enabled only when the difference between study period years is greater than 1. If **Apply Linear Traffic Growth Factor (%)** is selected, make sure to enter the respective value in percentage. If AADT for each analysis year is available, select **Enter AADT for Each Year** by clicking on the circle next to the text. Details on how to apply the Linear Traffic Growth Factor can be found in Section 2.2.

Analysis Method: If observed crash data is not available, select **Estimate Predicted Number of Crashes** by clicking on the circle next to the text. If observed crash data is available, select **Estimate Expected Number of Crashes** by clicking on the circle next to the text.

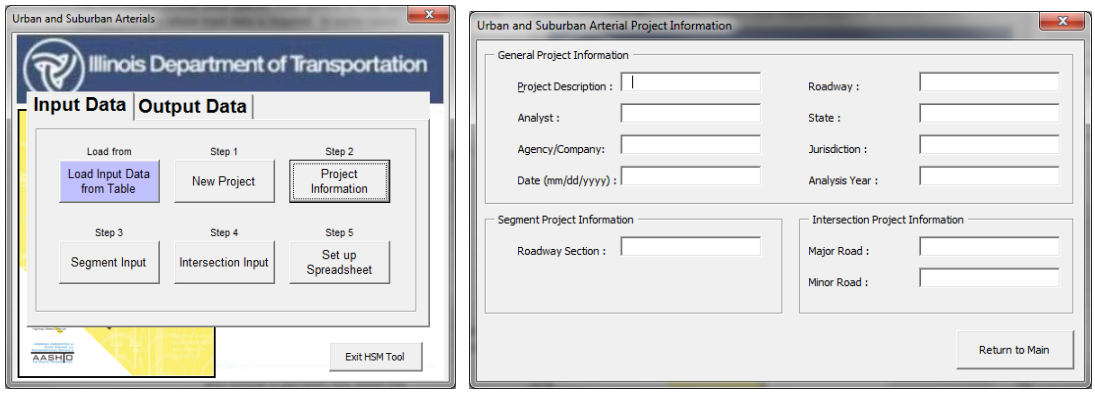
The expected crash frequency is obtained by applying the Empirical Bayes Method. This method combines the predicted average crash frequency with the observed crash data to provide a more reliable estimate. Selecting the **Estimate Expected Number of Crashes** will enable the Analysis Report frame. There are two methods to apply the Empirical Bayes adjustment using observed crash data. The **Observed Crash Data by Site Available** is used when available crash data is disaggregated by site (segments and/or intersections), and the **Observed Crash Data for the Project Available** is used when observed crash data is only available at aggregated/project level across the all the sites. Refer to the HSM Section A.2.4 and A.2.5 (Pages A-19 and A-20) for additional details on the different EB methods.

This analysis includes 2 segments and 3 intersections. The study period is from 2008 to 2011. The multiyear analysis will be conducted using AADT for each year. Estimate Expected Number of Crashes using Observed Crash Data by Site is the selected analysis method.

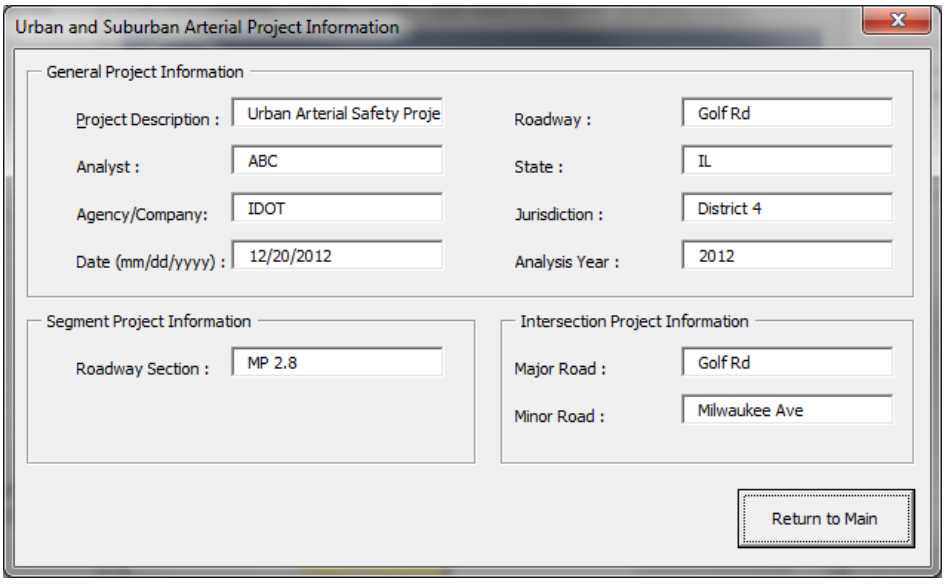


When complete click on the **Return to Main** button to return to the main input window.

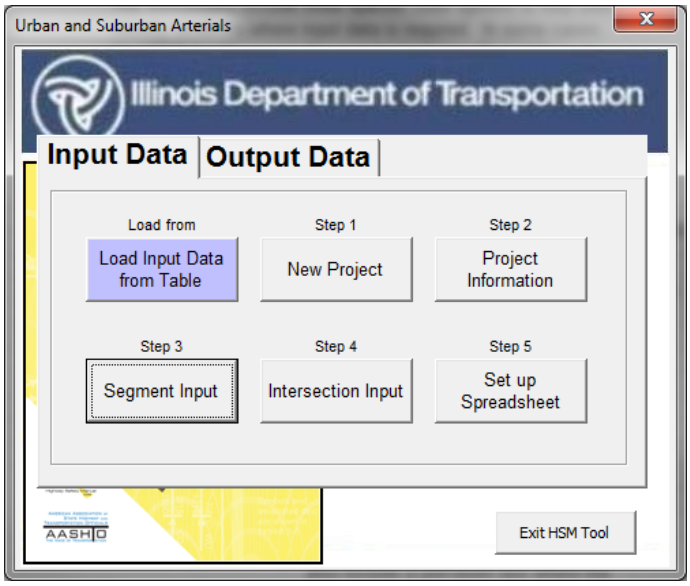
STEP 5: On the main menu, select the button labeled **Project Information**.



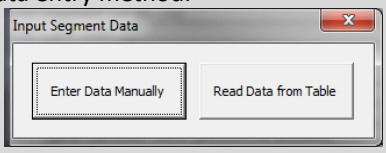
STEP 6 Complete the information requested in the General Project Information input window. For Segments Project Information, enter either a reference milepost or Key Route or Marked Route. Key Route refers to the Illinois Roadway Information System (IRIS) terminology and it is a universal identifier for any segment. Marked Route refers to the Division of Traffic Safety route inventory. The key route information is not necessary for intersections, but all information provided will assist in tracking projects. For Intersection Project Information, enter a description for **Major Road** and **Minor Road** (for example, Golf Road / Milwaukee Ave., respectively). When all fields have been completed, click on **Return to Main**.



STEP 7: Select the button labeled **Segment Input**.



NOTE: Depending on the analysis input data entered, there are instances when an additional user form appears asking about the data entry method.



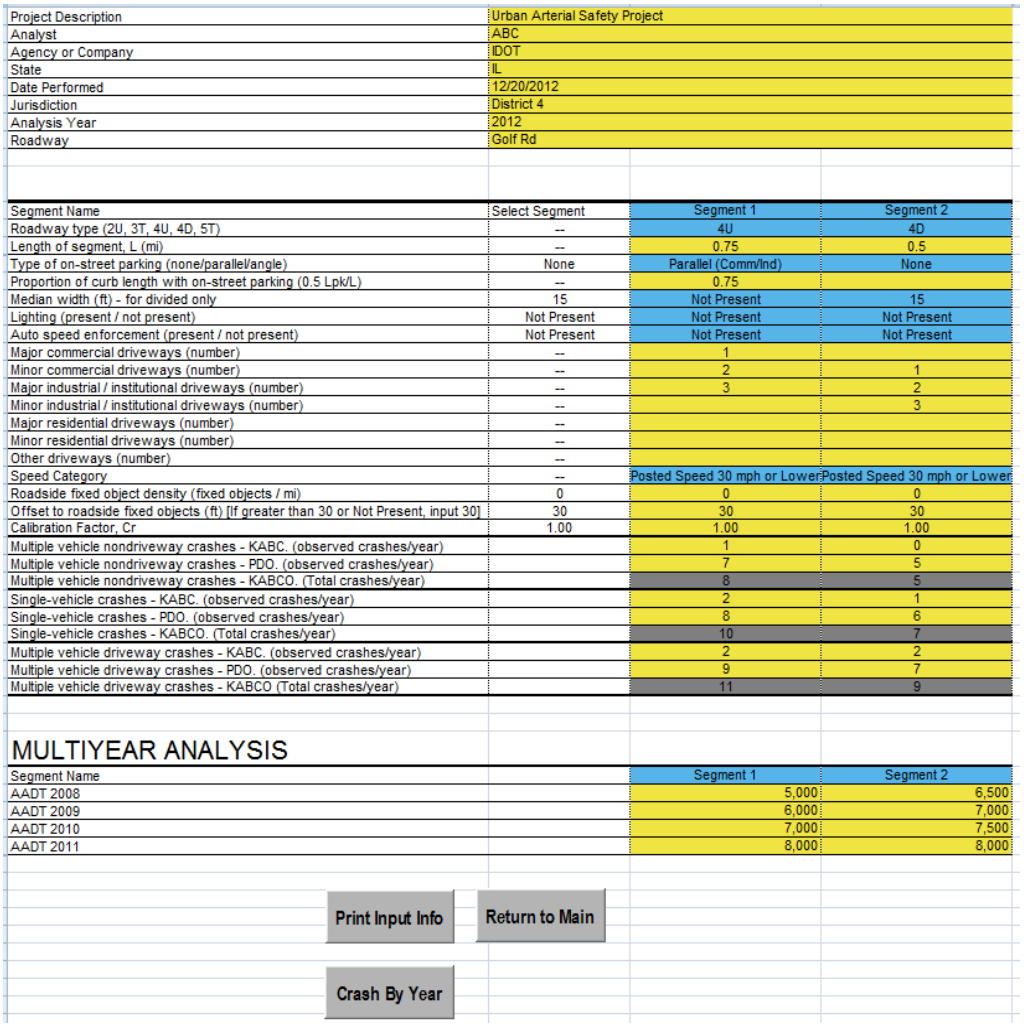
Enter Data Manually: Data entry is performed one facility at a time using a user form.
Read Data from Table: Data entry is performed for all facilities using a table (worksheet)

The main interface closes, and two new tabs appear. Segment and intersection data are entered in these two tabs. The naming convention varies between different modules. **TLR** is for the Two-Lane Rural roads, **MLR** is for Multilane Rural roads, and **UrbArt** abbreviation is for Urban and Suburban Arterials. For this example the UrbArt_3_Seg_Input and UrbArt_5_Int_Input tabs are used for data entry. The tabs are sequentially numbered, and are displayed based on the type of analysis selected.

STEP 8: Enter data in the color-coded cells. Cells highlighted in yellow are hardcoded values. Cells highlighted in blue are dropdown menus with pre-set options. If particular data values are the same among all facilities, users can copy and paste, or drag values among the different facility types. Table 6 provides details of the different variables needed to run the predictive method for segments.

Table 6
Urban and Suburban Arterials - Segment Data Needs

Variable Name	Data Description
Segment name	Name of the roadway segment. Up to 50 segments
Roadway type	2U, 3T, 4U, 5T
Length of Segment	Miles
AADT	AADT for roadway segment
Type of on-street parking	None, parallel, or angle
Proportion of curb length with on-street parking	Percent of on-street parking available. Includes both sides of the road (percent)
Median width-for divided only	Not present, or select from scale 10 Feet to 100 Feet
Lighting	Present or not present
Auto speed enforcement	Present or not present
Major commercial driveways	Number in segment
Minor commercial driveways	Number in segment
Major industrial/institutional driveways	Number in segment
Minor industrial/institutional driveways	Number in segment
Major residential driveways	Number in segment
Minor residential driveways	Number in segment
Other driveways	Number of other driveways in segment
Speed Category	30mph or lower, or greater than 30mph
Roadside fixed object density	Fixed objects/miles
Offset to roadside fixed objects	Feet
Calibration factor	Derived from calibration process
Multiple Vehicle Driveway Crashes	KABC and PDO crashes recorded for the segment; this value is only available for Observed Crash Data by Site Available
Multiple Vehicle Non-driveway Crashes	KABC and PDO crashes recorded for the segment; this value is only available for Observed Crash Data by Site Available
Single Vehicle Crashes	KABC and PDO crashes recorded for the segment; this value is only available for Observed Crash Data by Site Available



Project Description	Urban Arterial Safety Project
Analyst	ABC
Agency or Company	IDOT
State	IL
Date Performed	12/20/2012
Jurisdiction	District 4
Analysis Year	2012
Roadway	Golf Rd

Segment Name	Select Segment	Segment 1	Segment 2
Roadway type (2U, 3T, 4U, 4D, 5T)	--	4U	4D
Length of segment, L (mi)	--	0.75	0.5
Type of on-street parking (none/parallel/angle)	None	Parallel (Comm/Ind)	None
Proportion of curb length with on-street parking (0.5 Lpk/L)	--	0.75	
Median width (ft) - for divided only	15	Not Present	15
Lighting (present / not present)	Not Present	Not Present	Not Present
Auto speed enforcement (present / not present)	Not Present	Not Present	Not Present
Major commercial driveways (number)	--	1	
Minor commercial driveways (number)	--	2	1
Major industrial / institutional driveways (number)	--	3	2
Minor industrial / institutional driveways (number)	--		3
Major residential driveways (number)	--		
Minor residential driveways (number)	--		
Other driveways (number)	--		
Speed Category	--	Posted Speed 30 mph or Lower	Posted Speed 30 mph or Lower
Roadside fixed object density (fixed objects / mi)	0	0	0
Offset to roadside fixed objects (ft) [If greater than 30 or Not Present, input 30]	30	30	30
Calibration Factor, Cr	1.00	1.00	1.00
Multiple vehicle nondriveway crashes - KABC. (observed crashes/year)		1	0
Multiple vehicle nondriveway crashes - PDO. (observed crashes/year)		7	5
Multiple vehicle nondriveway crashes - KABCO. (Total crashes/year)		8	5
Single-vehicle crashes - KABC. (observed crashes/year)		2	1
Single-vehicle crashes - PDO. (observed crashes/year)		8	6
Single-vehicle crashes - KABCO. (Total crashes/year)		10	7
Multiple vehicle driveway crashes - KABC. (observed crashes/year)		2	2
Multiple vehicle driveway crashes - PDO. (observed crashes/year)		9	7
Multiple vehicle driveway crashes - KABCO (Total crashes/year)		11	9

MULTIYEAR ANALYSIS

Segment Name		Segment 1	Segment 2
AADT 2008		5,000	6,500
AADT 2009		6,000	7,000
AADT 2010		7,000	7,500
AADT 2011		8,000	8,000

Print Input Info Return to Main

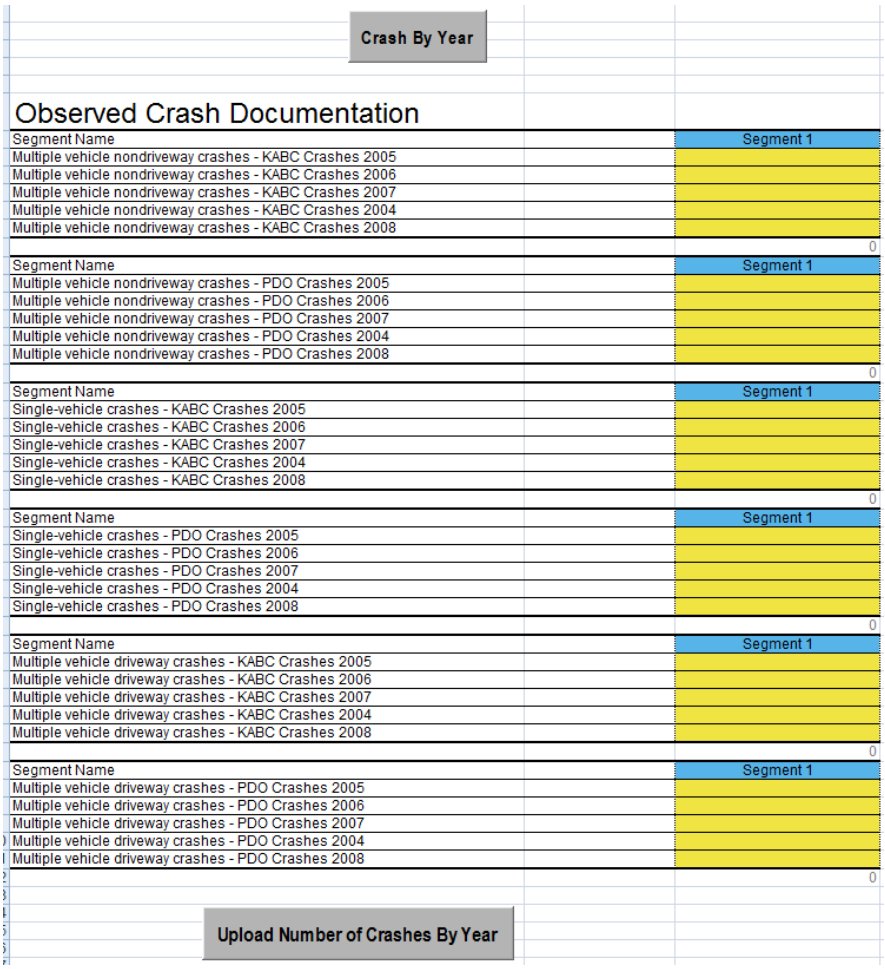
Crash By Year

There are three buttons at the bottom of the page.

Return to Main is used to go to the Main Menu.

Print Input Info is used to set the segment data input tab for printing using the Page Break View.

Crash by Year is an optional button only used for the Estimate Expected Number of Crashes using Observed Crash Data by Site Available analysis method. This utility is used only if the user wants to document the crashes by year by segment in the spreadsheet. By clicking the button Crash by Year, additional rows at the bottom of the page will be unhidden and crash data for each segment included in the analysis, by severity levels for each study period year, can be entered. In addition, a new button appears (Upload Number of Crashes by Year), which is used to populate the crash data input in the main input table.



Crash By Year

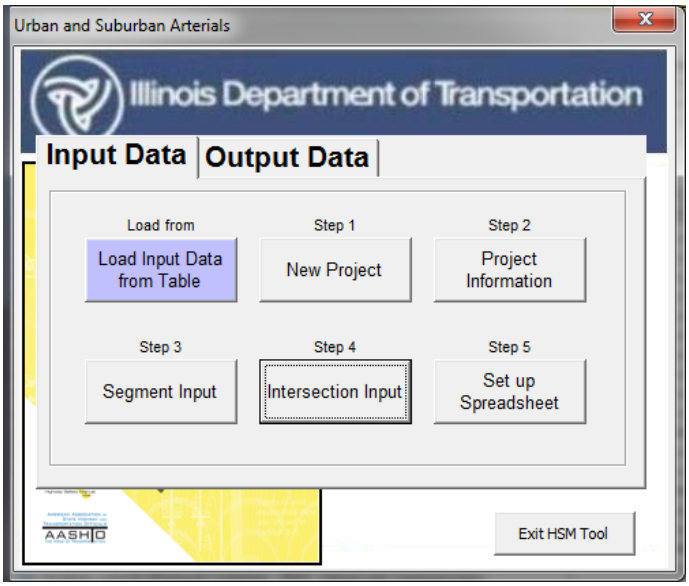
Observed Crash Documentation

Segment Name	Segment 1
Multiple vehicle nondriveway crashes - KABC Crashes 2005	
Multiple vehicle nondriveway crashes - KABC Crashes 2006	
Multiple vehicle nondriveway crashes - KABC Crashes 2007	
Multiple vehicle nondriveway crashes - KABC Crashes 2004	
Multiple vehicle nondriveway crashes - KABC Crashes 2008	
	0
Segment Name	Segment 1
Multiple vehicle nondriveway crashes - PDO Crashes 2005	
Multiple vehicle nondriveway crashes - PDO Crashes 2006	
Multiple vehicle nondriveway crashes - PDO Crashes 2007	
Multiple vehicle nondriveway crashes - PDO Crashes 2004	
Multiple vehicle nondriveway crashes - PDO Crashes 2008	
	0
Segment Name	Segment 1
Single-vehicle crashes - KABC Crashes 2005	
Single-vehicle crashes - KABC Crashes 2006	
Single-vehicle crashes - KABC Crashes 2007	
Single-vehicle crashes - KABC Crashes 2004	
Single-vehicle crashes - KABC Crashes 2008	
	0
Segment Name	Segment 1
Single-vehicle crashes - PDO Crashes 2005	
Single-vehicle crashes - PDO Crashes 2006	
Single-vehicle crashes - PDO Crashes 2007	
Single-vehicle crashes - PDO Crashes 2004	
Single-vehicle crashes - PDO Crashes 2008	
	0
Segment Name	Segment 1
Multiple vehicle driveway crashes - KABC Crashes 2005	
Multiple vehicle driveway crashes - KABC Crashes 2006	
Multiple vehicle driveway crashes - KABC Crashes 2007	
Multiple vehicle driveway crashes - KABC Crashes 2004	
Multiple vehicle driveway crashes - KABC Crashes 2008	
	0
Segment Name	Segment 1
Multiple vehicle driveway crashes - PDO Crashes 2005	
Multiple vehicle driveway crashes - PDO Crashes 2006	
Multiple vehicle driveway crashes - PDO Crashes 2007	
Multiple vehicle driveway crashes - PDO Crashes 2004	
Multiple vehicle driveway crashes - PDO Crashes 2008	
	0

Upload Number of Crashes By Year

When all fields have been completed, click on **Return to Main**.

STEP 9: Select the button labeled **Intersection Input**.



STEP 10: Enter data in the color-coded cells. Cells highlighted in yellow are hardcoded values. Cells highlighted in blue are dropdown menus with pre-set options. If particular data values are the same among all facilities, users can copy and paste, or drag values among the different facility types. Table 7 provides details of the different variables needed to run the predictive method for intersections.

Table 7
Urban and Suburban Arterial - Intersection Data Needs

Variable Name	Data Description
Intersection name	Name of the roadway segment. Up to 20 segments
Intersection type	3ST, 4ST, 4SG
AADT major	AADT for major roadway segment
AADT minor	AADT for major roadway segment
Intersection lighting	Present or not present
Calibration factor	Derived from calibration process
Data for unsignalized intersections only	
Number of major-road approaches with left-turn lanes	0,1, or 2
Number of major-road approaches with right-turn lanes	0,1, or 2
Data for signalized intersections only	
Number of approaches with left-turn lanes	0,1,2,3 or 4
Number of approaches with right-turn lanes	0,1,2,3 or 4
Number of approaches with left-turn signal passing	0,1,2,3 or 4
Type of left-turn signal phasing for Leg #1	Not applicable, permissive, protected, protected/permissive, or permissive/protected
Type of left-turn signal phasing for Leg #2	Not applicable, permissive, protected, protected/permissive, or permissive/protected
Type of left-turn signal phasing for Leg #3	Not applicable, permissive, protected, protected/permissive, or permissive/protected
Type of left-turn signal phasing for Leg #4	Not applicable, permissive, protected, protected/permissive, or permissive/protected
Number of approaches with right-turn-on-red prohibited	0,1,2,3, or 4
Intersection red light cameras	Present or not present
Sum of all pedestrian crossing volumes-only signalized intx	Sum of pedestrian volume
Maximum number of lanes crossed by a pedestrian	Number of lanes
Number of bus stops within 300 m (1,000 ft) of intersection	Number
Schools within 300 m (1,000 ft) of intersection	Number
Number of alcohol sales establishments	Number

Variable Name	Data Description
within 300 m (1,000 ft)	
Multiple Vehicle Crashes	KABC and PDO crashes recorded for the intersection; this value is only available for Observed Crash Data by Site Available
Single Vehicle Crashes	KABC and PDO crashes recorded for the intersection; this value is only available for Observed Crash Data by Site Available

There are three buttons at the bottom of the page.

Return to Main is used to go to the Main Menu.

Print Input Info is used to set the segment data input tab for printing using the Page Break View.

Crash by Year is an optional button only used for the Expected crash frequency using observed crash data by site. This utility is used only if the user wants to document the crashes by year by segment in the spreadsheet.

Project Description	Urban Arterial Safety Project
Analyst	ABC
Agency or Company	IDOT
State	IL
Date Performed	12/20/2012
Jurisdiction	District 4
Analysis Year	2012
Roadway	Golf Rd

Intersection Name	Select Intersection	Intersection 1	Intersection 2	Intersection 3
Intersection type (3ST, 3SG, 4ST, 4SG)	--	4ST	4SG	3ST
Intersection lighting (present/not present)	Not Present	Present	Present	Not Present
Calibration Factor, Cr	1.00	1.00	1.00	1.00
Data for unsignalized intersections only:	--	--	--	--
Number of major-road approaches with left-turn lanes (0,1,2)	0	0		0
Number of major-road approaches with right-turn lanes (0,1,2)	0	0		0
Data for signalized intersections only:	--	--	--	--
Number of approaches with left-turn lanes (0,1,2,3,4) [for 3SG, use maximum value of 3]	0		0	
Number of approaches with right-turn lanes (0,1,2,3,4) [for 3SG, use maximum value of 3]	0		0	
Number of approaches with left-turn signal phasing [for 3SG, use maximum value of 3]	--		0	
Type of left-turn signal phasing for Leg #1	--			
Type of left-turn signal phasing for Leg #2	--			
Type of left-turn signal phasing for Leg #3	--			
Type of left-turn signal phasing for Leg #4 (if applicable)	--			
Number of approaches with right-turn-on-red prohibited [for 3SG, use maximum value of 3]	0		0	
Intersection red light cameras (present/not present)	Not Present		Not Present	
Sum of all pedestrian crossing volumes (PedVol) -- Signalized intersections only			200	
Maximum number of lanes crossed by a pedestrian (nlanesx)			4	
Number of bus stops within 300 m (1,000 ft) of the intersection	0		0	
Schools within 300 m (1,000 ft) of the intersection (present/not present)	Not Present		Not Present	
Number of alcohol sales establishments within 300 m (1,000 ft) of intersection			1	
Multiple vehicle crashes - KABC. (observed crashes/year)		1	0	1
Multiple vehicle crashes - PDO. (observed crashes/year)		16	8	6
Multiple vehicle crashes - KABCO (Total crashes/year)		17	8	7
Single-vehicle crashes - KABC. (observed crashes/year)		0	0	1
Single-vehicle crashes - PDO. (observed crashes/year)		3	5	6
Single-vehicle crashes - KABCO. (Total crashes/year)		3	5	7

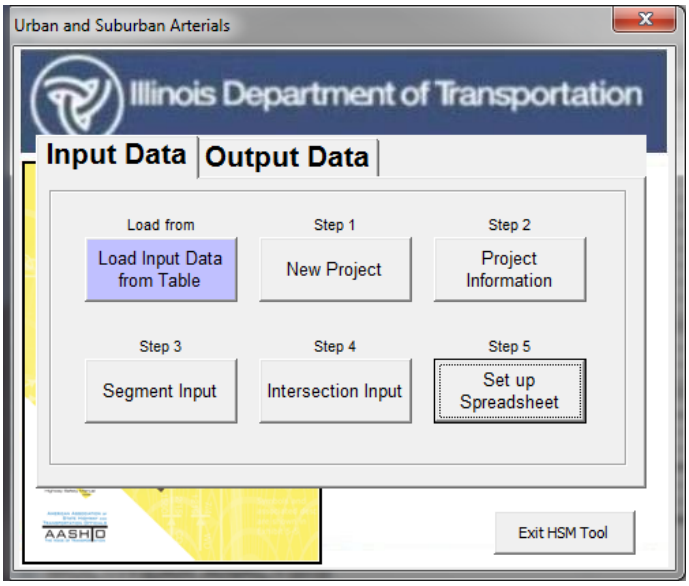
MULTIYEAR ANALYSIS

Major Intersection		Intersection 1	Intersection 2	Intersection 3
AADT 2008		5,000	6,500	6,200
AADT 2009		6,000	7,000	7,200
AADT 2010		7,000	7,500	7,650
AADT 2011		8,000	8,000	8,000

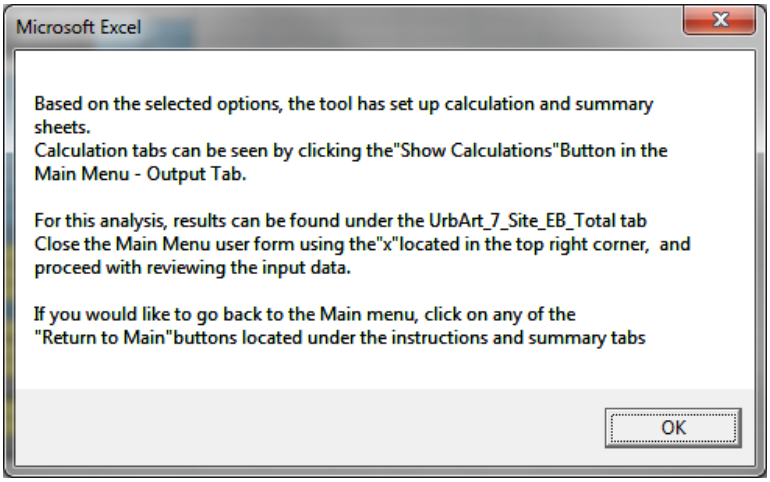
Minor Intersection		Intersection 1	Intersection 2	Intersection 3
AADT 2008		1,200	2,000	1,800
AADT 2009		1,350	2,100	1,900
AADT 2010		1,500	2,200	2,000
AADT 2011		1,600	2,400	2,100

Print Input Info Return to Main Crash By Year

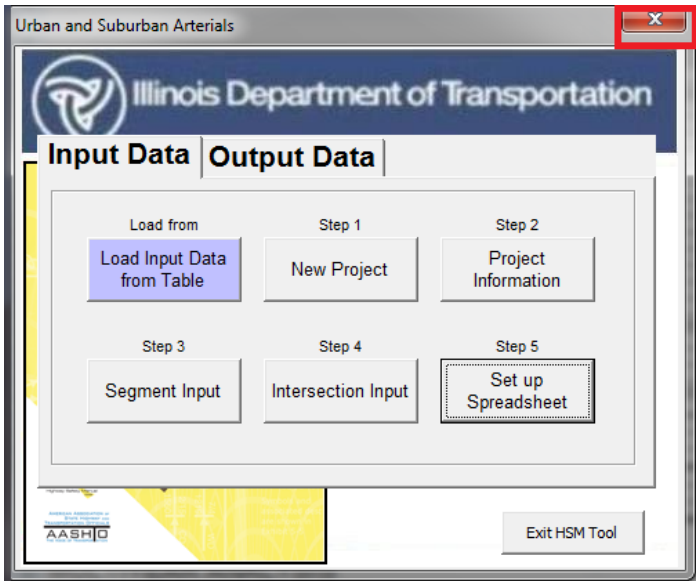
After entering the data in the worksheet for both intersections, click **Return to Main**.



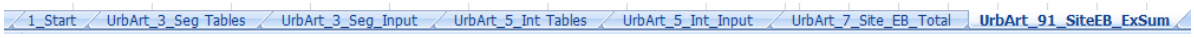
STEP 11: The last step in the process is to run the **Set up Spreadsheet** procedure. After the process is done running, a new window appears providing instructions about next steps. It indicates what tab contains the summary sheet, and how to move forward with the analysis. Click OK, and the main menu interface appears.



Close the Urban and Suburban Arterials main menu by clicking on the “X” located in the top right corner of the user form.



STEP 12: After closing the main menu, the predictive method summary is available, along with other tabs containing back up calculations (see figure below).



For this example, the summary sheet is located in tab UrbArt_91_SiteEB_ExSum.

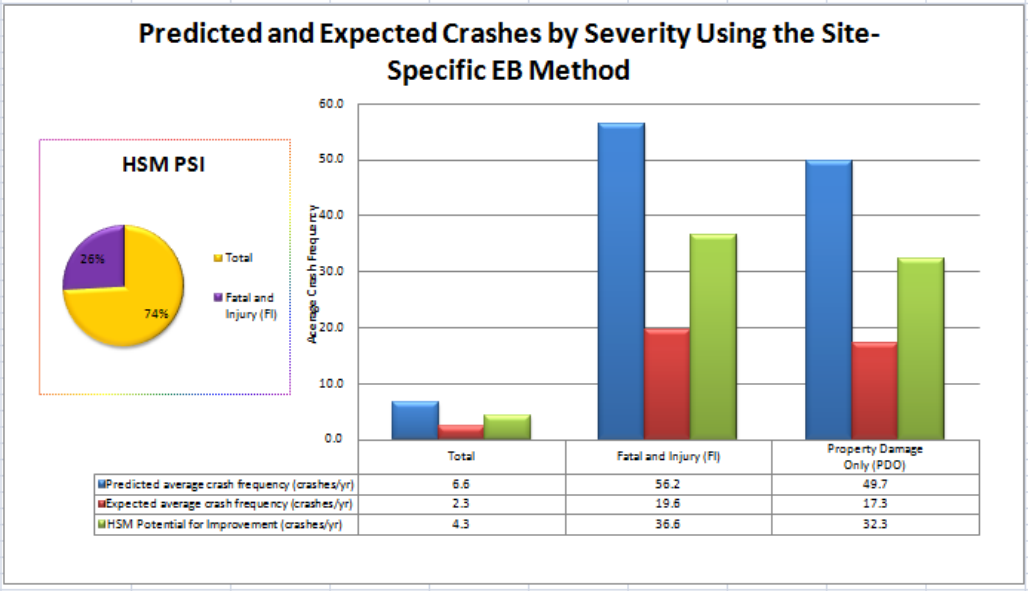
Urban and Suburban Arterials Summary Sheet

Worksheet 6A -- Predicted and Expected Crashes by Severity and Site Type Using the Site-Specific EB Method

Analyst	ABC	Roadway	Golf Rd
Agency or Company	IDOT	Jurisdiction	District 4
Date Performed	12/20/2012	Analysis Year	2012
Project Description	Urban Arterial Safety Project		

Project Components	Total Crashes Per Year			Fatal and Injury Crashes Per Year (FI)			Property Damage Only Crashes Per Year (P		
	Predicted average crash $N_{predicted\ [TOTAL]}$	Expected average crash $N_{expected\ [TOTAL]}$	HSM Potential for Safety (HSM PSI)	Predicted average crash $N_{predicted\ [FI]}$	Expected average crash $N_{expected\ [FI]}$	HSM Potential for Safety (HSM PSI)	Predicted average crash $N_{predicted\ [PDO]}$	Expected average crash $N_{expected\ [PDO]}$	HSM Potential for Safety (HSM PSI)
SEGMENTS									
Segment 1	2.3	20.5	18.2	0.8	7.1	6.3	1.5	13.4	11.9
Segment 2	0.7	8.4	7.7	0.2	2.6	2.3	0.5	5.8	5.4
INTERSECTIONS									
Intersection 1	1.3	12.2	10.9	0.5	4.6	4.1	0.8	7.6	6.8
Intersection 2	1.4	6.5	5.1	0.4	2.1	1.7	0.9	4.4	3.4
Intersection 3	0.9	8.6	7.7	0.3	3.2	2.9	0.6	5.4	4.8
COMBINED (sum of column)	6.6	56.2	49.7	2.3	19.6	17.3	4.3	36.6	32.3

Crash Severity Level	$N_{predicted}$ Predicted average crash frequency (crashes/yr)	$N_{expected}$ Expected average crash frequency (crashes/yr)	HSM PSI HSM Potential for Improvement
Total	6.6	56.2	49.7
Fatal and Injury (FI)	2.3	19.6	17.3
Property Damage Only (PDO)	4.3	36.6	32.3



The user can navigate through the other tabs to make changes if needed. The predictive method calculations for each facility type are available and can be displayed using the utilities in the Output Tab in the main menu. Section 4 of this guide provides additional information regarding the different utilities available for all three modules.

Tab UrbArt_7_Site_EB_Total contains the predicted, expected, and observed crashes for all facilities included in the analysis.

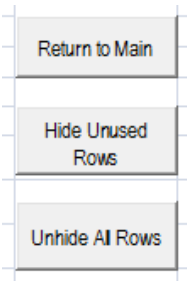
Urban and Suburban Arterials Summary Sheet

Worksheet 4A -- Predicted Crashes by Severity and Site Type and Observed Crashes Using the Site-Specific EB Method

Analyst	ABC	Roadway	Golf Rd
Agency or Company	IDOT	Jurisdiction	District 4
Date Performed	12/20/2012	Analysis Year	2012
Project Description	Urban Arterial Safety Project		

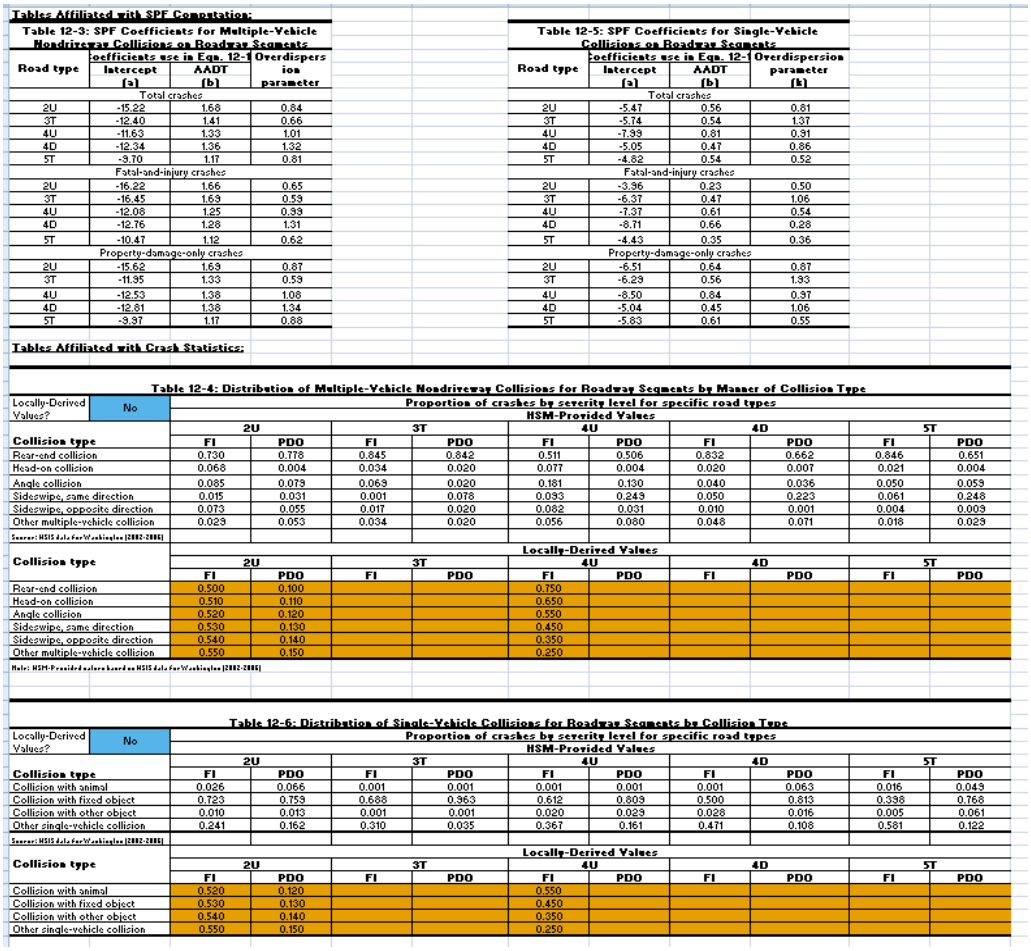
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Collision type / Site type	**Predicted average crash frequency (crashes/year)**			**Observed crashes,** $N_{observed}$ (crashes/year)	**Overdispersion Parameter, k**	**Weighted adjustment, w**	**Expected average crash frequency,** $N_{expected}$
	$N_{predicted}$ (TOTAL)	$N_{predicted}$ (FI)	$N_{predicted}$ (PDO)			Equation A-5 from Part C Appendix	Equation A-4 from Part C Appendix
ROADWAY SEGMENTS							
Multiple-vehicle nondriveway							
Segment 1	1.212	0.404	0.808	8	1.010	0.170	6.849
Year 1	0.849	0.290	0.559	8	1.010		
Year 2	1.082	0.364	0.719	8	1.010		
Year 3	1.329	0.441	0.888	8	1.010		
Year 4	1.587	0.520	1.067	8	1.010		
Segment 2	0.389	0.117	0.272	5	1.320	0.327	3.492
Year 1	0.335	0.102	0.233	5	1.320		
Year 2	0.371	0.112	0.259	5	1.320		
Year 3	0.407	0.123	0.285	5	1.320		
Year 4	0.445	0.133	0.311	5	1.320		
Single-Vehicle							
Segment 1	0.476	0.138	0.338	10	0.910	0.366	6.515
Year 1	0.386	0.117	0.269	10	0.910		
Year 2	0.447	0.132	0.315	10	0.910		
Year 3	0.507	0.146	0.361	10	0.910		
Year 4	0.565	0.159	0.406	10	0.910		
Segment 2	0.209	0.030	0.179	7	0.860	0.582	3.048
Year 1	0.199	0.028	0.171	7	0.860		
Year 2	0.206	0.029	0.177	7	0.860		
Year 3	0.212	0.030	0.182	7	0.860		
Year 4	0.219	0.032	0.187	7	0.860		
Multiple-vehicle Driveway-Related							
Segment 1	0.514	0.176	0.338	11	0.810	0.375	7.067
Year 1	0.377	0.129	0.248	11	0.810		
Year 2	0.467	0.160	0.307	11	0.810		
Year 3	0.559	0.191	0.368	11	0.810		
Year 4	0.654	0.224	0.430	11	0.810		
Segment 2	0.044	0.012	0.031	9	1.390	0.804	1.800
Year 1	0.039	0.011	0.028	9	1.390		
Year 2	0.042	0.012	0.030	9	1.390		
Year 3	0.046	0.013	0.033	9	1.390		
Year 4	0.049	0.014	0.035	9	1.390		
INTERSECTIONS							
Multiple-vehicle							
Intersection 1	1.022	0.358	0.665	17	0.400	0.379	10.938
Year 1	0.791	0.267	0.524	17	0.400		
Year 2	0.946	0.327	0.619	17	0.400		
Year 3	1.102	0.389	0.714	17	0.400		
Year 4	1.250	0.448	0.802	17	0.400		
Intersection 2	1.204	0.360	0.844	8	0.390	0.347	5.639
Year 1	1.050	0.311	0.739	8	0.390		
Year 2	1.149	0.343	0.807	8	0.390		
Year 3	1.251	0.376	0.875	8	0.390		
Year 4	1.367	0.413	0.954	8	0.390		
Intersection 3	0.682	0.245	0.437	7	0.800	0.314	5.014
Year 1	0.552	0.202	0.351	7	0.800		
Year 2	0.666	0.241	0.426	7	0.800		
Year 3	0.728	0.261	0.467	7	0.800		

There are three buttons on the top right side of the summaries that can be used to return to the main menu, and to hide and unhide unused rows.



Note: Worksheets UrbArt_3_Seg Tables and UrbArt_5_Int Tables contain the HSM predictive method supporting tables. IDOT has developed state-specific values for all these different distributions. So there is no need to use the HSM default values.

However, the IEST tool is flexible enough to allow modifications to such tables. Input data required from the user but restricted to **Yes** and **No** options are provided in the pull-down boxes (Blue cells). Orange cells contain the locally-derived data as shown in the figure below.



Tables Affiliated with SPF Computation:

Table 12-3: SPF Coefficients for Multiple-Vehicle Nondriveway Collisions on Roadway Segments

Road type	Coefficients use in Eqn. 12-1 Intercept (a)	AADT (b)	Overdispersion parameter
Total crashes			
2U	-15.22	1.68	0.84
3T	-12.40	1.41	0.66
4U	-11.63	1.33	1.01
4D	-12.34	1.36	1.32
5T	-9.70	1.17	0.81
Fatal-and-injury crashes			
2U	-16.22	1.66	0.65
3T	-16.45	1.69	0.59
4U	-12.08	1.25	0.39
4D	-12.76	1.28	1.31
5T	-10.47	1.12	0.62
Property-damage-only crashes			
2U	-15.62	1.69	0.87
3T	-11.95	1.33	0.59
4U	-12.53	1.38	1.08
4D	-12.81	1.38	1.34
5T	-9.37	1.17	0.88

Table 12-5: SPF Coefficients for Single-Vehicle Collisions on Roadway Segments

Road type	Coefficients use in Eqn. 12-1 Intercept (a)	AADT (b)	Overdispersion parameter (k)
Total crashes			
2U	-5.47	0.56	0.81
3T	-5.74	0.54	1.37
4U	-7.39	0.81	0.31
4D	-5.05	0.47	0.86
5T	-4.82	0.54	0.52
Fatal-and-injury crashes			
2U	-3.96	0.23	0.50
3T	-6.37	0.47	1.06
4U	-7.37	0.61	0.54
4D	-8.71	0.66	0.28
5T	-4.43	0.35	0.36
Property-damage-only crashes			
2U	-6.51	0.64	0.87
3T	-6.29	0.56	1.93
4U	-8.50	0.84	0.37
4D	-5.04	0.45	1.06
5T	-5.83	0.61	0.55

Tables Affiliated with Crash Statistics:

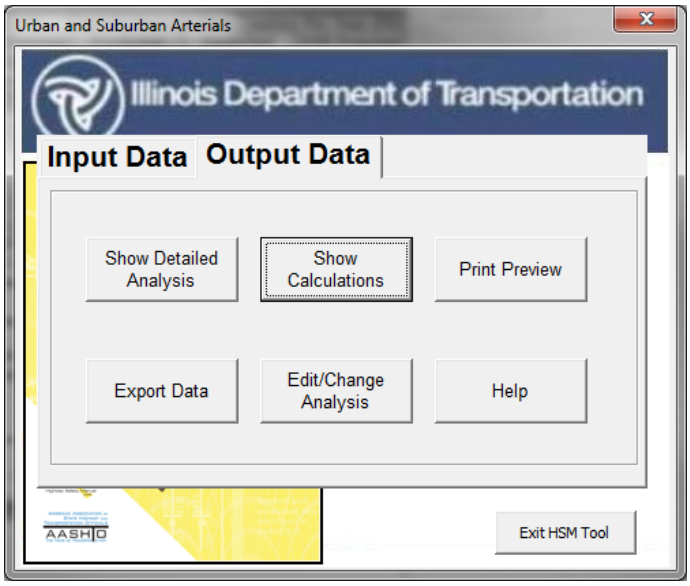
Table 12-4: Distribution of Multiple-Vehicle Nondriveway Collisions for Roadway Segments by Manner of Collision Type

Locally-Derived Values?	No									
	Proportion of crashes by severity level for specific road types									
	HSM-Provided Values									
	2U		3T		4U		4D		5T	
Collision type	FI	PDO	FI	PDO	FI	PDO	FI	PDO	FI	PDO
Rear-end collision	0.730	0.778	0.845	0.842	0.511	0.506	0.832	0.662	0.846	0.651
Head-on collision	0.068	0.004	0.034	0.020	0.077	0.004	0.020	0.007	0.021	0.004
Angle collision	0.085	0.073	0.063	0.020	0.181	0.130	0.040	0.036	0.050	0.053
Sideswipe, same direction	0.015	0.031	0.001	0.078	0.093	0.243	0.050	0.223	0.061	0.248
Sideswipe, opposite direction	0.073	0.055	0.017	0.020	0.082	0.031	0.010	0.001	0.004	0.003
Other multiple-vehicle collision	0.029	0.053	0.034	0.020	0.056	0.080	0.048	0.071	0.018	0.029
Source: HSIS data for Washington (2002-2006)										
	Locally-Derived Values									
Collision type	2U		3T		4U		4D		5T	
	FI	PDO	FI	PDO	FI	PDO	FI	PDO	FI	PDO
Rear-end collision	0.500	0.100			0.750					
Head-on collision	0.510	0.110			0.650					
Angle collision	0.520	0.120			0.550					
Sideswipe, same direction	0.530	0.130			0.450					
Sideswipe, opposite direction	0.540	0.140			0.350					
Other multiple-vehicle collision	0.550	0.150			0.250					
Note: HSM-Provided values based on HSIS data for Washington (2002-2006)										

Table 12-6: Distribution of Single-Vehicle Collisions for Roadway Segments by Collision Type

Locally-Derived Values?	No									
	Proportion of crashes by severity level for specific road types									
	HSM-Provided Values									
	2U		3T		4U		4D		5T	
Collision type	FI	PDO	FI	PDO	FI	PDO	FI	PDO	FI	PDO
Collision with animal	0.026	0.066	0.001	0.001	0.001	0.001	0.001	0.063	0.016	0.043
Collision with fixed object	0.723	0.753	0.688	0.363	0.612	0.803	0.500	0.813	0.338	0.768
Collision with other object	0.010	0.013	0.001	0.001	0.020	0.029	0.028	0.016	0.005	0.061
Other single-vehicle collision	0.241	0.162	0.310	0.035	0.367	0.161	0.471	0.108	0.581	0.122
Source: HSIS data for Washington (2002-2006)										
	Locally-Derived Values									
Collision type	2U		3T		4U		4D		5T	
	FI	PDO	FI	PDO	FI	PDO	FI	PDO	FI	PDO
Collision with animal	0.520	0.120			0.550					
Collision with fixed object	0.530	0.130			0.450					
Collision with other object	0.540	0.140			0.350					
Other single-vehicle collision	0.550	0.150			0.250					

STEP 13: To print the summary, export data, or make changes, click on the Return to Main button on the top right side of the summary tabs. This will prompt the main menu. Click on the Output Data tab.



Show Detailed Analysis: Displays the background summary calculations

Show Calculations: Displays the predictive method calculations (tabs) for each facility included in the analysis.

Print Preview: Prepares the summary sheet for printing.

Export Data: Creates a copy of the spreadsheet.

Edit/Change Analysis: Allows users to make changes, including adding facilities, changing values, and re-running the set-up process.

Help: Provides a hyperlink to the IEST Tool User's Manual posted on IDOT website.

More details about these utilities are provided in section 4.

4. Utilities

Another major change in this new version is the utility functions. The Output Data utilities functions have been expanded and now include Show Detailed Analysis, Show Calculations, Print Preview, Export Data, Edit/Change Analysis, and Help Menu options.

The following examples demonstrate what steps are required to apply the utility functions. This method is similar for all three modules (rural two-lane, rural multilane, and urban and suburban arterials).

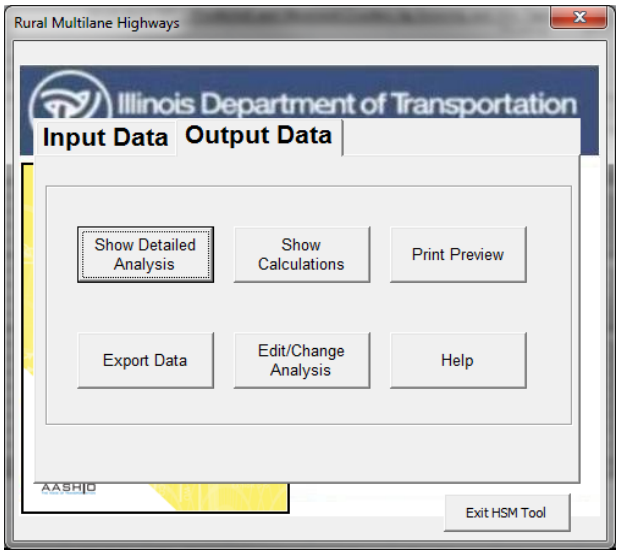
4.1. Show Detailed Analysis

The Show Detailed Analysis option allows users to enter data for all segments and intersections in a table format facilitating the data entry process.

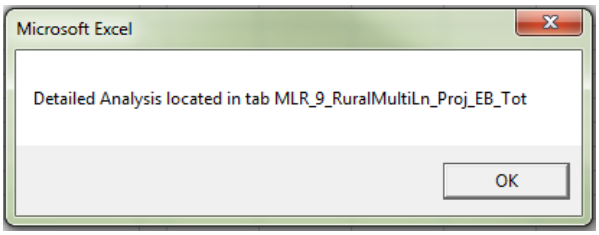
This example is a continuation of the Chapter 3.2 Rural Multilane Highways.

Once the Set up Spreadsheet procedure has been run, and the analysis is completed, the user has the option to unhide the summary containing the calculations.

Go back to any summary sheet, and click Return to Main. In the main menu, go to the Output Data tab.



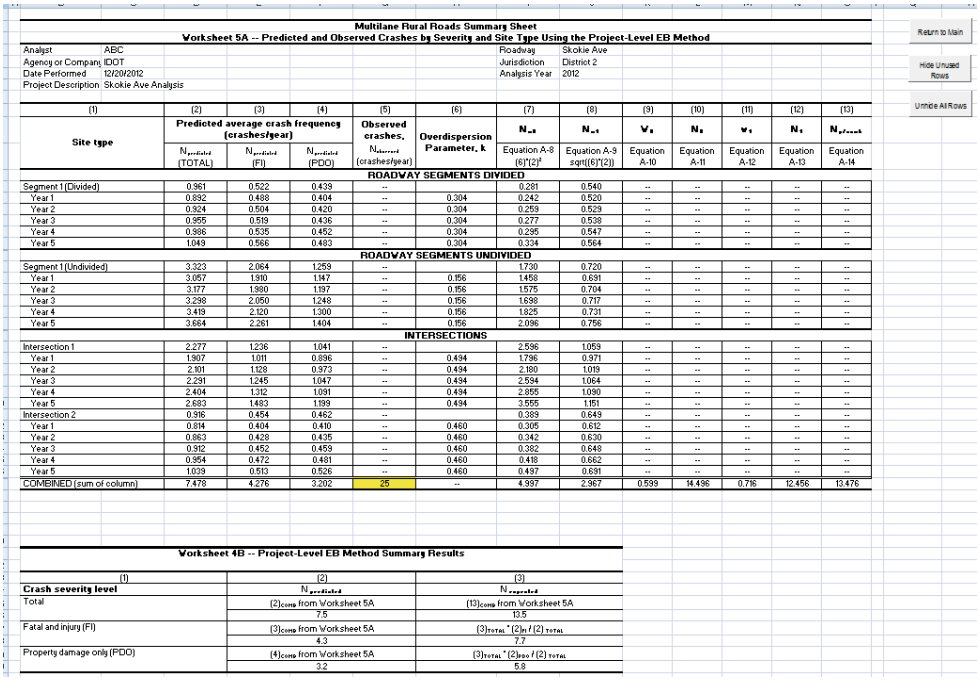
Click on the “Show Detailed Analysis” button, to unhide the summary worksheet. A user form will pop up providing details about the tab containing the desired summary sheet.



After clicking “OK”, the user form will close down, taking users back to the main menu.

Close the main menu by clicking on the “X” located in the top right corner of the user form to access the summary sheet.

Tab MLR_9_RuralMultiLn_Proj_EB_Tot, contains the predicted, expected, and observed crashes for all the facilities included in the analysis.



Multilane Rural Roads Summary Sheet
Worksheet 5A -- Predicted and Observed Crashes by Severity and Site Type Using the Project-Level EB Method

Analyst	ABC	Roadway	Skokie Ave
Agency or Company	IDOT	Jurisdiction	District 2
Date Performed	12/20/2012	Analysis Year	2012
Project Description	Skokie Ave Analysis		

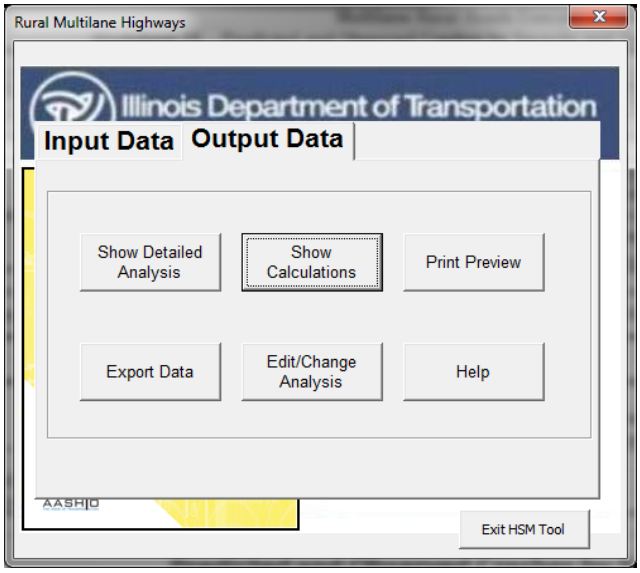
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Site type	Predicted average crash frequency (crashes/year)			Observed crashes, $N_{observed}$ (crashes/year)	Overdispersion Parameter, k	N_{ea}	N_{ec}	w_a	N_a	w_c	N_c	$N_{p,total}$
	$N_{predicted}$ (TOTAL)	$N_{predicted}$ (FI)	$N_{predicted}$ (PDO)			Equation A-8 (6)*(2)^2	Equation A-9 sqrt((6)*(2))	Equation A-10	Equation A-11	Equation A-12	Equation A-13	Equation A-14
ROADWAY SEGMENTS DIVIDED												
Segment 1 (Divided)	0.961	0.522	0.439	--		0.281	0.540	--	--	--	--	--
Year 1	0.892	0.488	0.404	--	0.304	0.242	0.520	--	--	--	--	--
Year 2	0.924	0.504	0.420	--	0.304	0.259	0.529	--	--	--	--	--
Year 3	0.955	0.519	0.436	--	0.304	0.277	0.538	--	--	--	--	--
Year 4	0.986	0.535	0.452	--	0.304	0.295	0.547	--	--	--	--	--
Year 5	1.049	0.566	0.483	--	0.304	0.334	0.564	--	--	--	--	--
ROADWAY SEGMENTS UNDIVIDED												
Segment 1 (Undivided)	3.323	2.064	1.259	--		1.730	0.720	--	--	--	--	--
Year 1	3.057	1.910	1.147	--	0.156	1.458	0.691	--	--	--	--	--
Year 2	3.177	1.980	1.197	--	0.156	1.575	0.704	--	--	--	--	--
Year 3	3.298	2.050	1.248	--	0.156	1.698	0.717	--	--	--	--	--
Year 4	3.419	2.120	1.300	--	0.156	1.825	0.731	--	--	--	--	--
Year 5	3.664	2.261	1.404	--	0.156	2.096	0.756	--	--	--	--	--
INTERSECTIONS												
Intersection 1	2.277	1.236	1.041	--		2.596	1.059	--	--	--	--	--
Year 1	1.907	1.011	0.896	--	0.494	1.796	0.971	--	--	--	--	--
Year 2	2.101	1.128	0.973	--	0.494	2.180	1.019	--	--	--	--	--
Year 3	2.291	1.245	1.047	--	0.494	2.594	1.064	--	--	--	--	--
Year 4	2.404	1.312	1.091	--	0.494	2.855	1.090	--	--	--	--	--
Year 5	2.683	1.483	1.199	--	0.494	3.555	1.151	--	--	--	--	--
Intersection 2	0.916	0.454	0.462	--		0.389	0.649	--	--	--	--	--
Year 1	0.814	0.404	0.410	--	0.460	0.305	0.612	--	--	--	--	--
Year 2	0.863	0.428	0.435	--	0.460	0.342	0.630	--	--	--	--	--
Year 3	0.912	0.452	0.459	--	0.460	0.382	0.648	--	--	--	--	--
Year 4	0.954	0.472	0.481	--	0.460	0.418	0.662	--	--	--	--	--
Year 5	1.039	0.513	0.526	--	0.460	0.497	0.691	--	--	--	--	--
COMBINED (sum of column)	7.478	4.276	3.202	25	--	4.997	2.967	0.599	14.496	0.716	12.456	13.478

Worksheet 4B -- Project-Level EB Method Summary Results

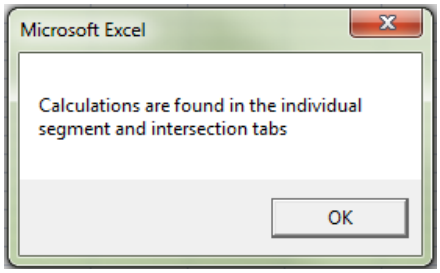
(1)	(2)	(3)
Crash severity level	$N_{predicted}$	$N_{expected}$
Total	$(2)_{comp}$ from Worksheet 5A	$(13)_{comp}$ from Worksheet 5A
	7.5	13.5
Fatal and injury (FI)	$(3)_{comp}$ from Worksheet 5A	$(3)_{TOTAL} * (2)_{FI} / (2)_{TOTAL}$
	4.3	7.7
Property damage only (PDO)	$(4)_{comp}$ from Worksheet 5A	$(3)_{TOTAL} * (2)_{PDO} / (2)_{TOTAL}$
	3.2	5.8

4.2. Show Calculations

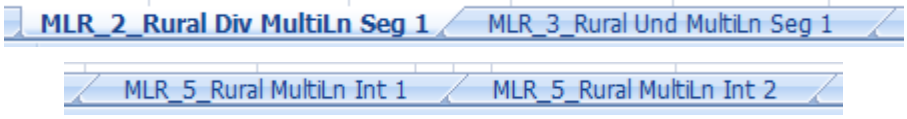
The Show Calculations button is used to access the detailed calculations of each segment and intersection. The screen captures below are the continuation of the rural multilane highways example from Section 3.2 of the manual. By clicking the Show Calculations button, the users will unhide the templates containing the HSM predictive method calculations used for the analysis.



After clicking on the button, the following message box pops up, indicating that the process is completed. Click “OK” to continue.



After this user form and the main menu are closed, the individual segment and intersection tabs can be accessed.



Worksheet 1A -- General Information and Input Data for Rural Multilane Roadway Segments

General Information		Location Information	
Project Description	1	Roadway	5
Analyst	2	Roadway Section	
Agency or Company	3	Jurisdiction	7
State	6	Analysis Year	8
Date Performed	01/04/00		

Input Data	Base Conditions	Site Conditions
Segment Name	--	Segment 1
Roadway type (divided / undivided)	Divided	
Length of segment, L (mi)	--	1
AADT (veh/day)	--	6,000
Lane width (ft)	12	12
Shoulder width (ft) - right shoulder width for divided [if differ for directions of travel, use averag	8	6
Shoulder type - right shoulder type for divided	Paved	Paved
Median width (ft) - for divided only	30	10
Side Slopes - for undivided only	1:7 or flatter	
Lighting (present/not present)	Not Present	Not Present
Auto speed enforcement (present/not present)	Not Present	Not Present
Calibration Factor, Cr	1.00	1.00

Worksheet 1B (a) -- Crash Modification Factors for Rural Multilane Divided Roadway Segments

(1)	(2)	(3)	(4)	(5)	(6)
CMF for Lane Width	CMF for Right Shoulder Width	CMF for Median Width	CMF for Lighting	CMF for Automated Speed Enforcement	Combined CMF
CMF 1rd	*CMF 2rd*	*CMF 3rd*	*CMF 4rd*	*CMF 5rd*	*CMF comb*
from Equation 11-16	from Table 11-17	from Table 11-18	from Equation 11-17	from Section 11.7.2	(1)*(2)*(3)*(4)*(5)
1.00	1.04	1.04	1.00	1.00	1.08

Worksheet 1C (a) -- Roadway Segment Crashes for Rural Multilane Divided Roadway Segments

(1)	(2)			(3)	(4)	(5)	(6)	(7)
Crash Severity Level	**SPF Coefficients** from Table 11-5			**N spf rd**	**Overdispersion Parameter, k**	**Combined CMFs** (6) from Worksheet 1B (a)	**Calibration Factor,**	**Predicted average crash frequency, N**
	a	b	c	from Equation 11-9	from Equation 11-10			(3)*(5)*(6)
Total	-9.025	1.049	1.549	1.106	0.212	1.08	1.00	1.196
Fatal and Injury (FI)	-8.837	0.958	1.687	0.605	0.185	1.08	1.00	0.654
Fatal and Injury* (FI*)	-8.505	0.874	1.740	0.406	0.176	1.08	1.00	0.439
Property Damage Only (PDO)	--	--	--	--	--	--	--	(7)TOTAL - (7)FI 0.542

NOTE: * Using the KABCO scale, these include only KAB crashes. Crashes with severity level C (possible injury) are not included.

Worksheet 1D (a) -- Crashes by Severity Level and Collision Type for Rural Multilane Divided Roadway Segments

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Collision Type	**Proportion of Collision**	**N predicted rs(d) (TOTAL) (crashes/year)**	**Proportion of Collision**	**N predicted rs(d) (FI; (crashes/year)**	**Proportion of Collisio**	**N *predicted rs* (FI*) (crashes/year)**	**Proportion of Collision**	**N *predicted rs* [PDO] (crashes/year)**
	from Table 11-6	(7)TOTAL from Worksheet 1C (a)	from Table 11-6	(7)FI from Worksheet 1C (a)	from Table 11-6	(7) FI* from Worksheet 1C (a)	from Table 11-6	(7)PDO from Worksheet 1C (a)
Total	1.000	1.196	1.000	0.654	1.000	0.439	1.000	0.542
		(2)*(3)TOTAL		(4)x(5)FI		(6)*(7)FI *		(8)*(3) PDO
Head-on collision	0.006	0.007	0.013	0.009	0.018	0.008	0.002	0.001
Sideswipe collision	0.043	0.051	0.027	0.018	0.022	0.010	0.053	0.029
Rear-end collision	0.116	0.139	0.163	0.107	0.114	0.050	0.088	0.048
Angle collision	0.043	0.051	0.048	0.031	0.045	0.020	0.041	0.022
Single-vehicle collision	0.768	0.919	0.727	0.476	0.778	0.342	0.792	0.429
Other collision	0.024	0.029	0.022	0.014	0.023	0.010	0.024	0.013

NOTE: * Using the KABCO scale, these include only KAB crashes. Crashes with severity level C (possible injury) are not included.

Worksheet 1E -- Summary Results for Rural Multilane Roadway Segments

(1)	(2)	(3)	(4)
Crash severity level	**Predicted average crash frequency (crashes/year)** (7) from Worksheet 1C (a) or (b)	**Roadway segment length (mi**	**Crash rate (crashes/mi/year)** (2)/(3)
Total	1.2	1.0	1.2
Fatal and Injury (FI)	0.7	1.0	0.7
Fatal and Injury* (FI*)	0.4	1.0	0.4
Property Damage Only (PDO)	0.5	1.0	0.5

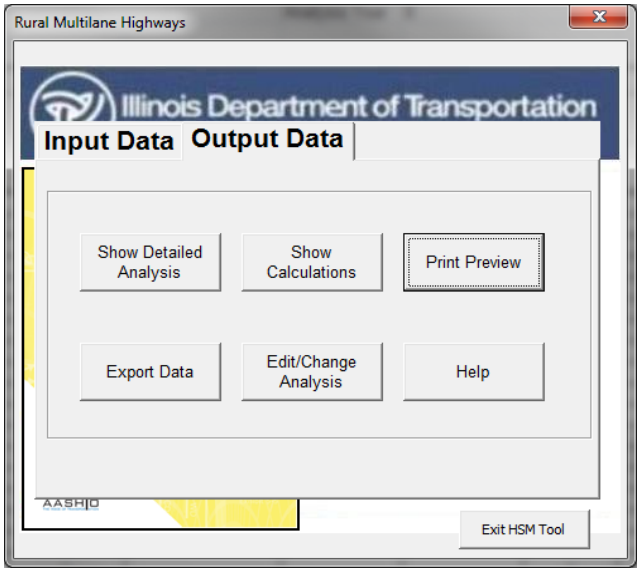
NOTE: * Using the KABCO scale, these include only KAB crashes. Crashes with severity level C (possible injury) are not included.

These tabs contain the input data for all the facilities included in the analysis.

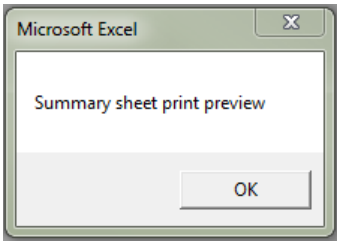
4.3. Print Preview

The print preview button is used to set up the summary sheet for printing. After running this utility, the summary will be displayed in Page Break View format.

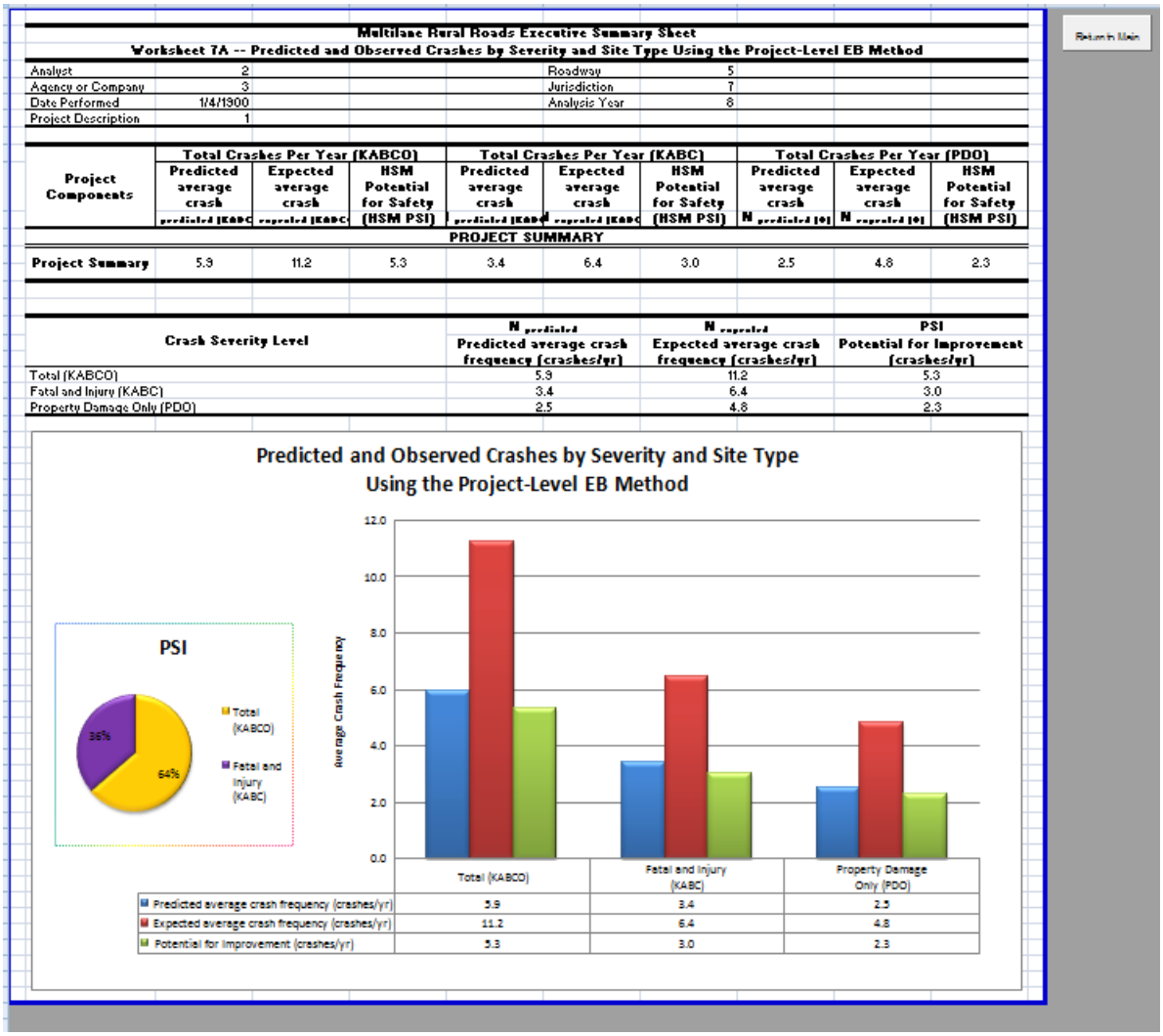
Go back to any summary sheet, and click Return to Main. In the main menu, go to the Output Data tab. Click the Print Preview button to run this utility.



After the process is done running, a message box will pop up indicating the Summary sheet print preview is ready.



Users can make changes as needed before sending the print preview page to the printer.



Multilane Rural Roads Executive Summary Sheet

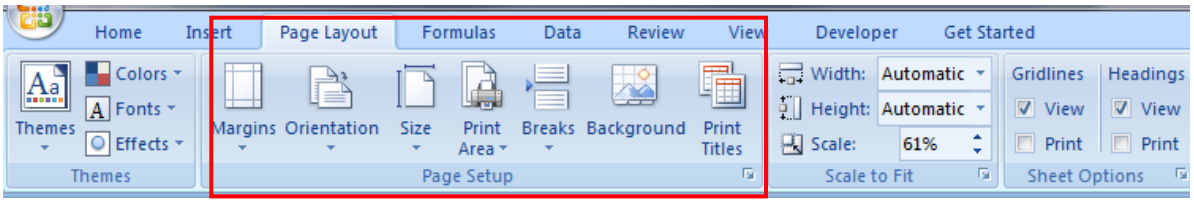
Worksheet 7A -- Predicted and Observed Crashes by Severity and Site Type Using the Project-Level EB Method

Analyst	2	Roadway	5
Agency or Company	3	Jurisdiction	7
Date Performed	1/4/1900	Analysis Year	8
Project Description	1		

Project Components	Total Crashes Per Year (KABCO)			Total Crashes Per Year (KABC)			Total Crashes Per Year (PDO)		
	Predicted average crash	Expected average crash	HSM Potential for Safety (HSM PSI)	Predicted average crash	Expected average crash	HSM Potential for Safety (HSM PSI)	Predicted average crash	Expected average crash	HSM Potential for Safety (HSM PSI)
				PROJECT SUMMARY					
Project Summary	5.9	11.2	5.3	3.4	6.4	3.0	2.5	4.8	2.3

Crash Severity Level	Predicted average crash frequency (crashes/yr)	Expected average crash frequency (crashes/yr)	Potential for Improvement (crashes/yr)
Total (KABCO)	5.9	11.2	5.3
Fatal and Injury (KABC)	3.4	6.4	3.0
Property Damage Only (PDO)	2.5	4.8	2.3

This page is set to fit into one page letter size paper. Users can use Excel's Page Layout functions to modify the page setup.

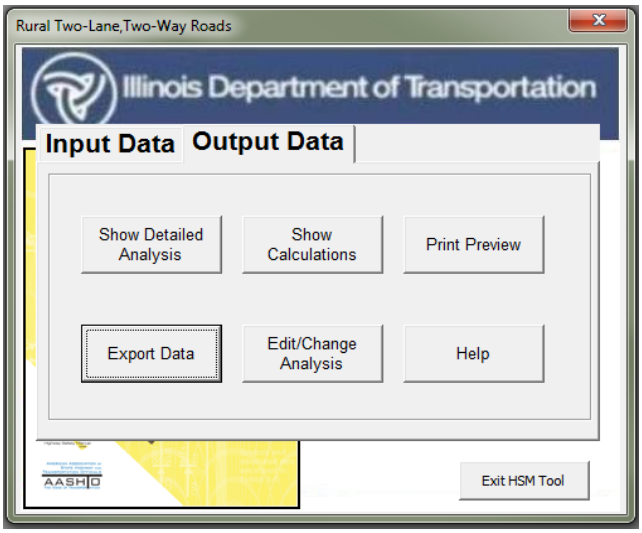


To modify the print area, go to Page Layout, and choose Print Area in Page Setup as shown above.

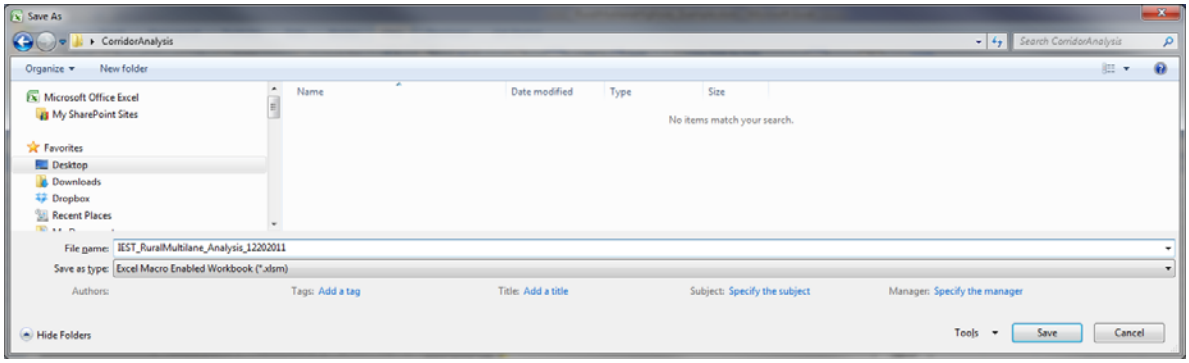
The users could also go back to the main menu to perform other actions by clicking the Return to Main button.

4.4. Export Data

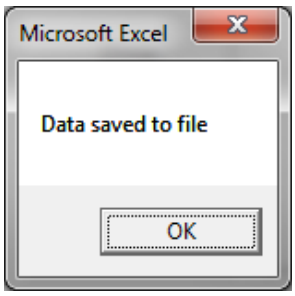
This function can be used anytime during the analysis. Following the Chapter 3.2 example, the main menu Output Data tab includes the Export Data option, which allows the users to export the data and save/create a copy of the analysis.

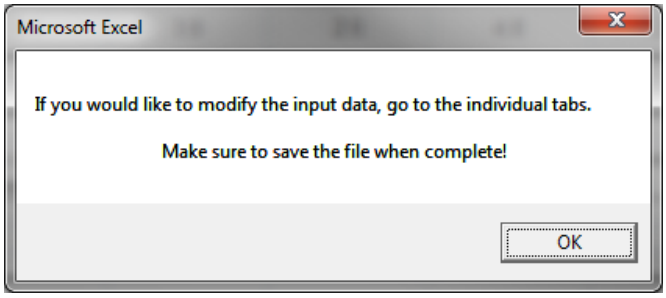


When the Export Data button is clicked, users will be directed to the following screen to save a copy of the analysis. Select a preferred file name and location.



After pressing the “Save” button, a copy of the spreadsheet containing the analysis is created in the specified location. Once the process is complete, two message boxes open up indicating the file has been saved, and providing instructions on how to proceed.





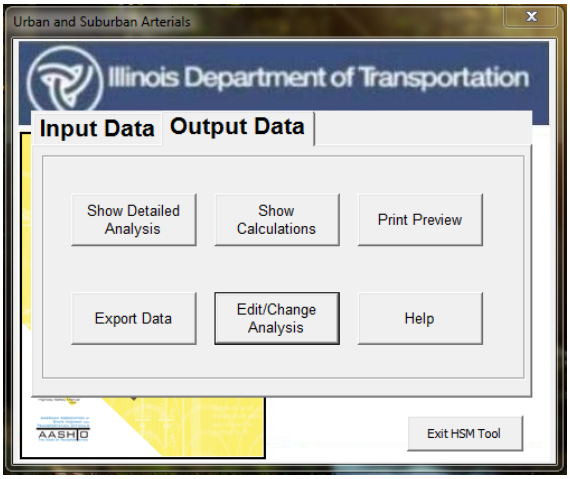
4.5. Edit/Change Analysis

The **Edit/Change Analysis** button is a new function that allows users to modify an existing analysis. Once the user has run the Set up Spreadsheet in the user form approach, or has run the process using the Load Data button, the analysis has been completed. With the Edit/Change utility, users can make changes such as adding or deleting facilities from the analysis, including additional crash data to run the EB

adjustments methods, or applying a growth factor instead of entering AADT for each year, among many other opt**ions.**

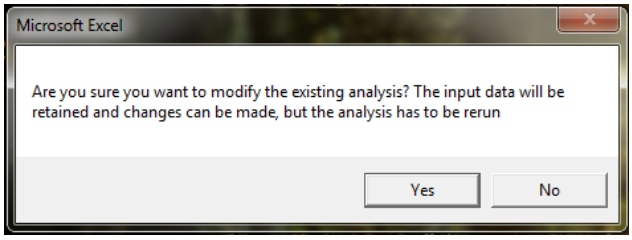
Without running this utility, users can make very minor changes to the template worksheets containing the HSM predictive method calculations. Any other major change can only be completed/run using the Edit/Change Utility.

STEP 1: Press **Return to Main** button located in any summary page to go back to the main menu.



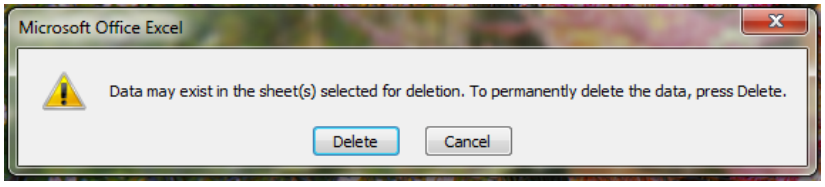
STEP 2: Users are given the option to confirm whether they want to move forward with making changes to the analysis. Note that once the process is started, the tool will be reset, and the analysis will be deleted. However, the data entered for the original analysis will be maintained.

After pressing the **Edit/Change Analysis** button, a message box appears asking whether users are sure they want to proceed with modifying the existing analysis.

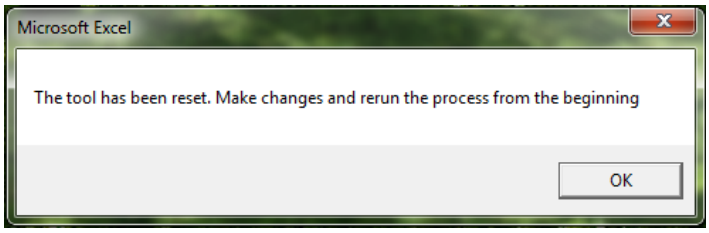


Press “No” to cancel modifying the analysis.

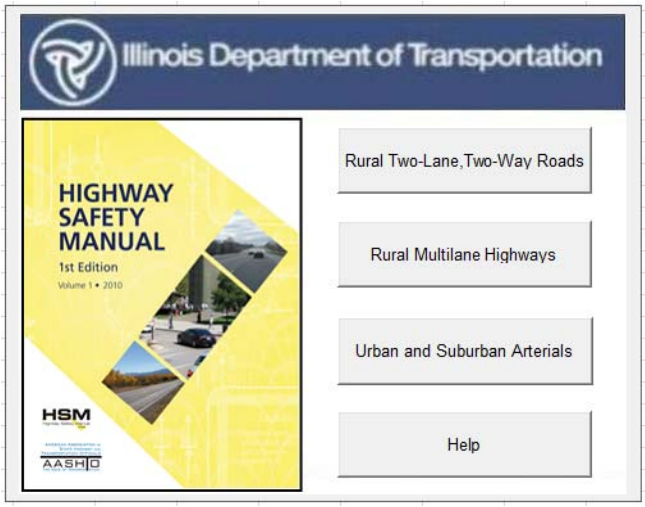
Press “Yes” to continue with the changes. The analysis will be reset, but the input data will be retained. If the analysis included multiple facilities (more than 1 segment /intersection) the following message box will appear asking permission to delete the tabs that were created during the set-up process. The tool only needs 1 template tab for each facility to run. Click delete as many times as needed to complete the process.



STEP 3: After all the unnecessary tabs are deleted, another message box indicating that reset process is now completed will appear.



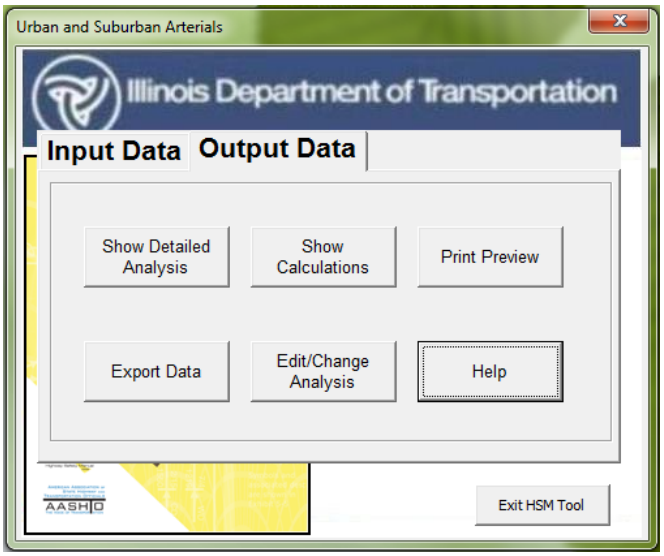
STEP 4: Press “OK” and then close the main menu. This will take the users back to the opening page of the IEST tool. Now the tool has been reset and is ready for editing and updating, while the segment and intersection original data the users have entered previously is still saved in the tool.



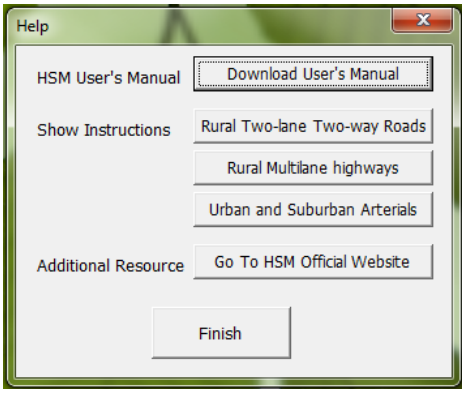
The tool is now ready to be modified. Repeat the steps used in the original analysis and make necessary changes as needed.

4.6. Help Menu

The Help Menu provides various resources for the users when they have questions and problems using the tool. The Help Menu can be accessed through the Output Tab in the main menu.



By pressing the Help button users can download the IEST Users Manual, access the different predictive methods instructions worksheets, and connect via hyperlink to the official HSM website. A screen capture of the help menu is shown below.



The instruction tabs provide information about tab naming conventions, facility types AADT thresholds, and provide a legend explaining the different color coded cells.

Tabs naming convention:

Worksheet Name	Contents
UrbArt_0_Instructions	Current worksheet displaying overview, summary of spreadsheet worksheets, and description of color coding included in the worksheets.
UrbArt_1_Construction	Data in this worksheet has been used to help define the pull-down options in the analysis worksheets. There is no need for a user to work within this worksheet, but the worksheet should be retained so that the other worksheets can continue to use the options included in this sheet.
UrbArt_2_Seg 1	Analysis for the urban and suburban arterial segment analysis. The associated HSM worksheets are Worksheets 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, and 1L.

Facilities AADT thresholds:

Urban and Suburban Arterials

Segment Type	AADT
2U	0 - 32,600
3T	0 - 32,900
4U	0 - 40,100
4D	0 - 66,000
5T	0 - 53,800

Intersection type	AADT major	AADT minor
3ST	0 - 45,700	0 - 9,300
4ST	0 - 46,800	0 - 5,900
3SG	0 - 58,100	0 - 16,400
4SG	0 - 67,700	0 - 33,400

Color coding scheme details in the worksheets:

Color Used	Type of Information Required from User
	Required input information as identified in the HSM.
	Input data required from the user but restricted to options provided in pull-down boxes.
	Optional input information that can be used to supplement the analysis if this information is available. This optional input information is reserved for locally-derived crash information. If the analyst elects to use this option so as to improve analysis for local crash distribution trends, each of the Tables with the locally- derived input also include a pull-down box where the analyst should indicate he or she is using locally derive crash information. The worksheets will then use the local values instead of the HSM default values.

Press “Finish” to close the Help Menu.

Appendix

Appendix A: Tab Naming Definition – All Modules

A-1 Rural Two-Lane, Two-Way Roads

Worksheet Name	Contents
TLR_0_Instructions	Current worksheet displaying overview, summary of spreadsheet worksheets, predictive method AADT thresholds, and description of color coding included in the worksheets.
TLR_1_Construction	Data in this worksheet has been used to help define the pull-down options in the analysis worksheets. There is no need for a user to work within this worksheet, but the worksheet should be retained so that the other worksheets can continue to use the options included in this sheet.
TLR_2_Seg 1	Analysis for the rural 2-lane segments that uses lookup tables from exhibits included in the worksheet "Segment Tables." The associated HSM worksheets are 1A, 1B, 1C, 1D, and 1E.
TLR_3_Seg Tables	Includes segment tables used for analysis of HSM-provided crash trends as well as locally-derived crash information. These are HSM Tables 10-3, 10-4, and 10-12. This worksheet also includes tables used for CMF calculations, and HSM Tables 10-8, 10-9, and 10-10.
TLR_4_Int 1	Analysis for the rural 2-lane intersections that uses lookup tables from exhibits included in the worksheet "Intersection Tables." The associated HSM worksheets are 2A, 2B, 2C, 2D, and 2E.
TLR_5_Int Tables	Includes intersection tables used for analysis of HSM- provided crash trends as well as locally-derived crash information. These are HSM Tables 10-5, 10-6, and 10-15. This worksheet also includes tables used for CMF calculations. These tables include Tables 10-13 and 10-14.
TLR_6_Predicted Total	Predicted number of crashes summary sheet using results from the 2-lane segments as well as 2-lane intersections worksheets. This analysis can be performed if no historic crash data is available within the study limits. The associated HSM worksheets are 3A and 3B.

Worksheet Name	Contents
TLR_7_Site EB Total	Analysis for site-specific EB analysis using results from the rural 2-lane segment as well as rural 2-lane intersection worksheets. This analysis can be performed if the analyst knows the exact location of historic crashes within the study limits. The associated HSM worksheets are 4A and 4B.
TLR_8_Project EB Total	Analysis for project-specific EB analysis using results from the rural 2-lane segment as well as rural 2-lane intersection worksheets. This analysis can be performed if the analyst has historic crash data, but does not know the exact location within the project limits at which the crashes occurred. The associated HSM worksheets are Worksheets 5A and 5B.
TLR_91_SiteEB_ExSum	Executive summary report for site-specific EB analysis. This report uses results from tab TLR_7_Site EB Total. This report is available when users perform a site-specific EB multiyear analysis entering AADT for each year.
TLR_92_ProjEB_ExSum	Executive summary report for project-specific EB analysis. This report uses results from tab TLR_8_Project EB Total. This report is available when users perform a project-specific EB multiyear analysis entering AADT for each year.
TLR_93_EB_ExSum_GF	Executive summary report for site-specific EB analysis. This report uses results from tab TLR_7_Site EB Total. This report is available when users perform a site-specific EB multiyear analysis and apply a linear traffic growth factor.
TLR_94_Pred_ExSum_GF	Executive summary report for the predicted number of crashes method. This report uses results from tab TLR_6_Predicted Total. This report is available when users perform a predicted crash multiyear analysis and apply linear traffic growth factor.
TLR_95_ProjEB_ExSum_GF	Executive summary report for project-specific EB analysis. This report uses results from tab TLR_8_Project EB Total. This report is available when users perform a project-specific EB multiyear analysis and apply linear traffic growth factor.

A-2 Rural Multilane Highways

Worksheet Name	Contents
MLR_0_Instructions	Current worksheet displaying overview, summary of spreadsheet worksheets, and description of color coding included in the worksheets.
MLR_1_Construction	Data in this worksheet has been used to help define the pull-down options in the analysis worksheets. There is no need for a user to work within this worksheet, but the worksheet should be retained so that the other worksheets can continue to use the options included in this sheet.
MLR_2_Rural Div MultiLn Seg 1	Analysis for the rural divided multilane segment analysis includes AADT specific Table 11-16. The associated HSM worksheets are Worksheets 1A, 1B(a), 1C(a), 1D(a), and 1E.
MLR_3_Rural Und MultiLn Seg 1	Analysis for the rural undivided multilane segment analysis includes AADT specific Tables 11-11 and 11-12. The associated HSM worksheets are Worksheets 1A, 1B(b), 1C(b), 1D(b), and 1E.
MLR_4_Seg Tables	Worksheet shows exhibits for use by the segment worksheets. These exhibits are independent and do not depend on input values. This worksheet includes exhibits that summarize crash information and can be modified for locally-derived conditions. These are Tables 11-4, 11-6, 11-15, and 11-19. Tables specific to CMFs are also included. The CMF tables in this worksheet are 11-13, 11-14, 11-17, and 11-18.
MLR_5_Rural MultiLn Int 1	Analysis for the rural multilane intersection analysis includesTables 11-9 and 11-24. The associated HSM worksheets are Worksheets 2A, 2B, 2C, 2D, and 2E.
MLR_6_Int Tables	Tables 11-9 and 11-24 are intersection exhibits for estimating crash distributions and can be modified for locally-derived conditions if this information is available.
MLR_7_Rural MultiLn Pred Total	Predicted number of crashes summary sheet using results from the rural divided and undivided segments as well as rural intersection multilane worksheets. This analysis can be performed if no historic crash data is available within the study limits. The associated HSM worksheets are 3A and 3B.

Worksheet Name	Contents
MLR_8_RuralMulti_Ln_Site_EB_Tot	Analysis for site-specific EB analysis using results from the rural divided and undivided segment as well as rural intersection multilane worksheets.This analysis can be performed if the analyst knows the exact location of historic crashes within the study limits. The associated HSM worksheets are Worksheets 3A and 3B.
MLR_9_RuralMultiLn_Proj_EB_Tot	Analysis for project-specific EB analysis using results from the rural divided and undivided segment as well as rural intersection multilane worksheets. This analysis can be performed if the analyst has historic crash data, but does not know the exact location within the project limits at which the crashes occurred. The associated HSM worksheets are Worksheets 4A and 4B.
MLR_101_SiteEB_ExSum	Executive summary report for site-specific EB analysis. This report uses results from tab MLR_8_RuralMulti_Ln_Site_EB_Tot. This report is available when users perform a site-specific EB multiyear analysis entering AADT for each year.
MLR_102_ProjEB_ExSum	Executive summary report for project-specific EB analysis. This report uses results from tab MLR_9_RuralMultiLn_Proj_EB_Tot. This report is available when users perform a project-specific EB multiyear analysis entering AADT for each year
MLR_103_Pred_ExSum_GF	Executive summary report for the predicted number of crashes method. This report uses results from tab MLR_7_Rural MultiLn Pred Total. This report is available when users perform predicted crash multiyear analysis and apply linear traffic growth factor.
MLR_104_SiteEB_ExSum_GF	Executive summary report for site-specific EB analysis. This report uses results from tab MLR_8_RuralMulti_Ln_Site_EB_Tot. This report is available when users perform a site-specific EB multiyear analysis and apply a linear traffic growth factor.
MLR_105_ProjEB_ExSum_GF	Executive summary report for project-specific EB analysis. This report uses results from tab MLR_9_RuralMultiLn_Proj_EB_Tot. This report is available when users perform a project-specific EB multiyear analysis and apply linear traffic growth factor.

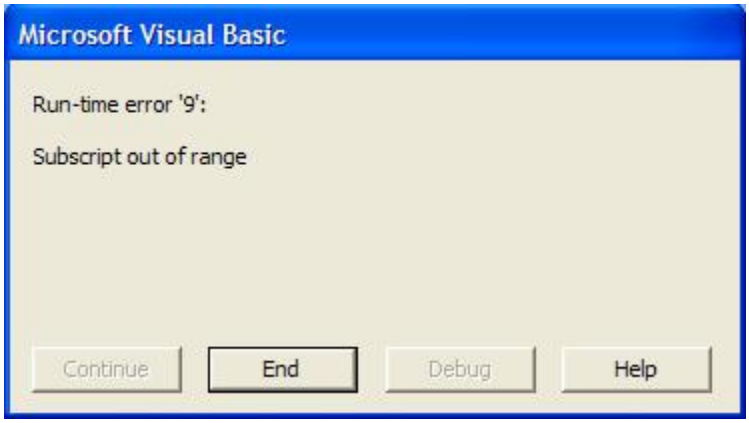
A-3 Urban and Suburban Arterials

Worksheet Name	Contents
UrbArt_0_Instructions	Current worksheet displaying overview, summary of spreadsheet worksheets, and description of color coding included in the worksheets.
UrbArt_1_Construction	Data in this worksheet has been used to help define the pull-down options in the analysis worksheets. There is no need for a user to work within this worksheet, but the worksheet should be retained so that the other worksheets can continue to use the options included in this sheet.
UrbArt_2_Seg 1	Analysis for the urban and suburban arterial segment analysis. The associated HSM worksheets are Worksheets 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K, and 1L.
UrbArt_3_Seg Tables	Tables used for the segment analysis. Includes Tables 12-3, 12-4, 12-5, 12-6, 12-7, 12-8, 12-9, 12-19, 12-20, 12-21, and 12-23.
UrbArt_4_Int 1	Analysis for the urban and suburban arterial intersection analysis. The associated worksheets are Worksheets 2A, 2B, 2C, 2D, 2E, 2F, 2G, 2H, 2I, 2J, 2K, and 2L. Worksheets specific to STOP control or traffic signals may be blank if they do not apply to the specific intersection type selected for analysis.
UrbArt_5_Int Tables	Tables used for the intersection analysis. Includes Tables 12-10, 12-11, 12-12, 12-13, 12-14, 12-24, 12-26, and 12-27.
UrbArt_6_Predicted Total	Predicted number of crashes summary sheet using results from the urban segments as well as urban intersections worksheets. This analysis can be performed if no historic crash data is available within the study limits. The associated HSM worksheets are 3A and 3B.
UrbArt_7_Site_EB_Total	Analysis for site-specific EB analysis using results from the urban segment and intersection worksheets. This analysis can be performed if the analyst knows the exact location of historic crashes within the study limits. The associated HSM worksheets are Worksheets 4A, 4B, and 4C.

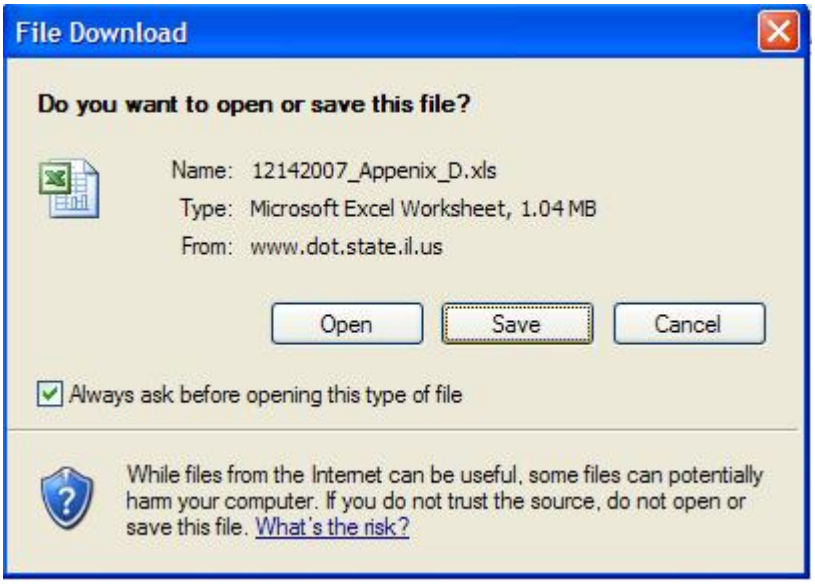
Worksheet Name	Contents
UrbArt_8_Proj_EB_Tot	Analysis for project-specific EB analysis using results from the rural divided and undivided segment as well as rural intersection multilane worksheets. This analysis can be performed if the analyst has historic crash data, but does not know the exact location within the project limits at which the crashes occurred. The associated HSM worksheets are Worksheets 4A and 4B.
UrbArt_91_SiteEB_ExSum	Executive summary report for site-specific EB analysis. This report uses results from tab UrbArt_7_Site_EB_Total. This report is available when users perform a site-specific EB multiyear analysis entering AADT for each year.
UrbArt_92_ProjEB_ExSum	Executive summary report for project-specific EB analysis. This report uses results from tab UrbArt_8_Proj_EB_Tot. This report is available when users perform a project-specific EB multiyear analysis entering AADT for each year
UrbArt_93_Pred_ExSum_GF	Executive summary report for the predicted number of crashes method. This report uses results from tab UrbArt_6_Predicted Total. This report is available when users perform predicted crash multiyear analysis and apply linear traffic growth factor.
UrbArt_94_SiteEB_ExSum_GF	Executive summary report for site-specific EB analysis. This report uses results from tab UrbArt_7_Site_EB_Total. This report is available when users perform a site-specific EB multiyear analysis and apply a linear traffic growth factor.
UrbArt_95_ProjEB_ExSum_GF	Executive summary report for project-specific EB analysis. This report uses results from tab UrbArt_8_Proj_EB_Tot. This report is available when users perform a project-specific EB multiyear analysis and apply linear traffic growth factor.

Appendix B: Troubleshooting Office 2003

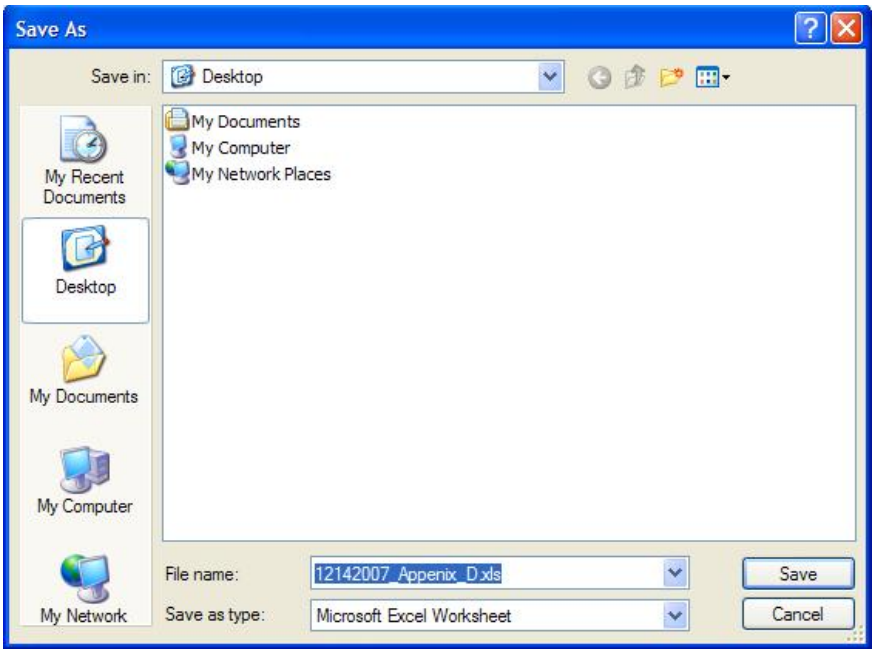
I opened the file from the IDOT website, and tried to run the tool, but I am getting the error shown below. How can I fix it?



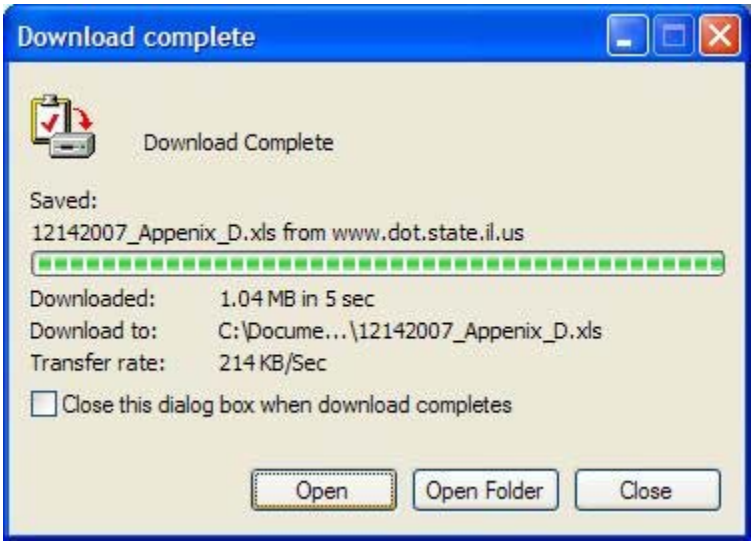
You must download the tool and save it to your computer prior to use. Download the tool and click the Save button.



Choose where you would like to save the tool. Name it appropriately.



After the download is completed, click Open, and the tool is ready to use.



When I opened the tool I clicked on Disable Macros, and the tool doesn't work.

Close the tool without saving changes and reopen it. Make sure to enable macros.

I accidentally saved the tool with the input data for my project inside. Is there a way to obtain the original tool without all the changes I made?

Yes. Go back to IDOT website (http://www.dot.state.il.us/illinoisCHSP/hsip.html) and download and save the tool again on your computer. If you want to save the information you input for a specific project, try using the Export Data option included in the tool under Output data.

Illinois Department of Transportation

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