Interactive Highway Safety Design Model (IHSDM) Technical Guide

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Prepared For:

Federal Lands Highway

Commitment to Excellence

By:

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This manual is intended to supplement the technical support information available at:

http://www.tfhrc.gov/safety/ihsdm/ihsdm.htm

Refer to the above website for the IHSDM software and further information on safety and roadway design.

The software products referred to in this publication are furnished by the Federal Highway Administration (FHWA) as a supplementary tool to augment the design process and are subject to the Notice in the IHSDM user manuals.

The information in this publication is subject to change without notice.

Trademarks

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Software Versions

IHSDM 2003 release.

MicroStation J version 07.01.04.10

GEOPAK 2001 MR, Build 29

CHAPTER 14 ANALYSIS AND DECISION MAKING

TO BE DEVELOPED AT A LATER DATE

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Chapter 1 Introduction

About IHSDM

The **Interactive Highway Safety Design Model (IHSDM)** is a suite of software analysis tools for evaluating safety and operational effects of geometric design decisions on two-lane rural highways.

IHSDM is a decision-support tool. It checks existing or proposed two-lane rural highway designs against relevant design policy values and provides estimates of a design's expected safety and operational performance. IHSDM results support decision making in the highway design process. Intended users include highway project managers, designers, and traffic and safety reviewers in State and local highway agencies and engineering consulting firms.

Purpose

This document is intended to outline uses for the Interactive Highway Safety Design Model (IHSDM). IHSDM consists of 6 modules:

1. Design Consistency Module.
2. Policy Review Module.
3. Crash Prediction Module.
4. Traffic Analysis Module.
5. Intersection Review Module
6. Driver/Vehicle Module (Not available in 2003 release. Will be added when available).

Workflows using best practices have been developed in a user-friendly and readily understandable format for each of these modules. Each workflow will use the same project so the workflows will contain only the information needed to complete each task.

This Technical Guide is to be used during the design process by both CFLHD internal designers and the A/E firms doing business with CFLHD.

The proper use of IHSDM can produce many desirable results, including:

- Ensuring Design Standards are met
- Expected crashes fro highway segments and intersections, allowing the user to identify design elements expected to have higher than average (or higher that a given threshold) crash experiences
- Design Consistency will be evaluated
- Highway Design Policies are met
- Evaluation of intersection designs
- Re-usability of data
- Increased ability to share resources

Data Needs

Each module uses specific data, some data are required; other data are optional. Refer to the Module Engineer's Manuals for details. Below is a table that can be used, as a quick reference to ensure all the needed data is available prior to the use of IHSDM:

Data Needed	Module				
	Policy Review (PRM)	Crash Prediction (CPM)	Design Consistency (DCM)	Traffic Analysis (TAM)	Intersection Review (IRM)
Terrain	X				
Functional Classification	X				
Design Speed	X	X	X		X
85th Percentile Speed					X
AADTV	X	X			X
Design Hourly Volume	X			X	
Peak Hourly Volume				X	X
Horizontal Alignment	X	X	X	X	X
Vertical Alignment	X	X	X	X	X
Cross Slope (Superelevation)	X	X		X	X
Pavement Type	X				X
Surface Type	X				
Normal Shoulder Slope	X				
Shoulder Slope (Varies)	X				
Shoulder Width	X	X			
Shoulder Material	X	X			
Shoulder Category	X				
Through Lane	X	X			X
Passing Lane	X	X		X	X
Turn Lane	X	X			X
Two Way Left Turn Lane	X	X			X
Climbing Lane	X	X		X	X
Lane Offset Width	X				X
Curve Widening	X				
Foreslope	X				
Backslope	X				
Ditch Type and Width	X				
Obstruction Offset	X			X	X
Bike Lanes	X				
Driveway Density		X			
Hazard Rating		X			
Accident History		X			X
Bridge Locations	X				
Decision Sight Distance	X				

Outline of Manual

The Technical Guide is broken into two sections. The first section will describe how to get the project started and how to input the design information. It contains the following chapters:

- Getting Started
- General Information Input
- Cross Section Information Input
- Lane Information Input
- Roadside Information Input
- Other Information Input
- Cross Street Information Input

The second section will describe which reports to use for each design phase. The chapters are broken out by type of project. It contains the following chapters:

- Analysis
- 3R Projects
- 4R & Minor Reconstruction Projects
- Major Reconstruction and New Construction Projects

Conventions

The Technical Guide contains special features designed to help the users find information quickly and easily. Below is a description of the conventions used throughout this manual.

Use of Bold and (>) Greater-Than Symbol

Bold letters are used to identify program commands, menus, and file names. The greater-than symbol **(>)** is used to divide a series of commands.

For example:

Open the existing project file using the **File>Project>Open Project** command. If it is not in the expected folder, click the **Cancel** button.

Caution is to be shown when the reader should take particular note of the information being discussed.

Information is used to provide helpful information about a particular item when it is being discussed, or to provide general information about the standards as needed.

Hyperlinking

Throughout the manual there will be references to information found on the CFLHD website, along with the accompanying web link to this information. Links will be in blue, as shown below:

http://www.cflhd.gov/

Terms and Abbreviations

Abbreviation	Description
IHSDM	Interactive Highway Safety Design Model
FLH	Federal Lands Highways
PRM	Policy Review Module
DCM	Design Consistency Module
CPM	Crash Prediction Module
TAM	Traffic Analysis Module
IRM	Intersection Review Module
D/VM	Driver/Vehicle Module (Not in 2003)
AADTV	Average Annual Daily Traffic Volume
CD	Conceptual Design
PD	Preliminary Design
FD	Final Design

Standard File Extensions

Extension	Description
.GPK	GEOPAK coordinate geometry database.
.DGN	MicroStation Drawing
.TXT	ASCII text file
.XLS	Excel Spreadsheet

Support

Support help using this manual, comments, and suggestions for improvements of this Technical Guide should be addressed to:

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Chapter 2 Getting Started

Installation of IHSDM

Before using this program, it needs to be installed locally on the designer's machine. The following workflow will describe the installation process:

Workflow 1: Installing IHSDM

FLH users should have ITS install the IHSDM software rather than attempting it themselves.

1. *Go to* **http://www.ihsdm.org/ihsdm_public/index.2.html#registration** *to register and download the files required to install the full distribution release of IHSDM.*
2. *Follow the directions on the webpage. IHSDM will allow the user to dictate where the program is to be loaded.*

The location where the program is installed on the user's computer does not matter. It is recommended that the program is located in the same directory as other programs.

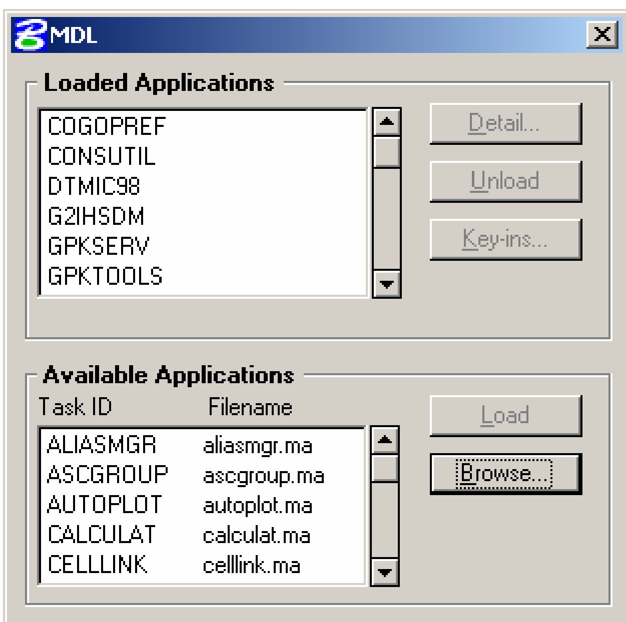
Creating an Alignment File

There are two methods for putting the horizontal and vertical elements of an alignment into IHSDM. The user can either use IHSDM commands or import a GEOPAK alignment. Since FLH uses GEOPAK for design purposes, this manual will only discuss the method for creating a GEOPAK output file in a format that IHSDM will import. The following workflow will describe the process for creating this file.

Workflow 2: Creating an Alignment Input File from GEOPAK Data

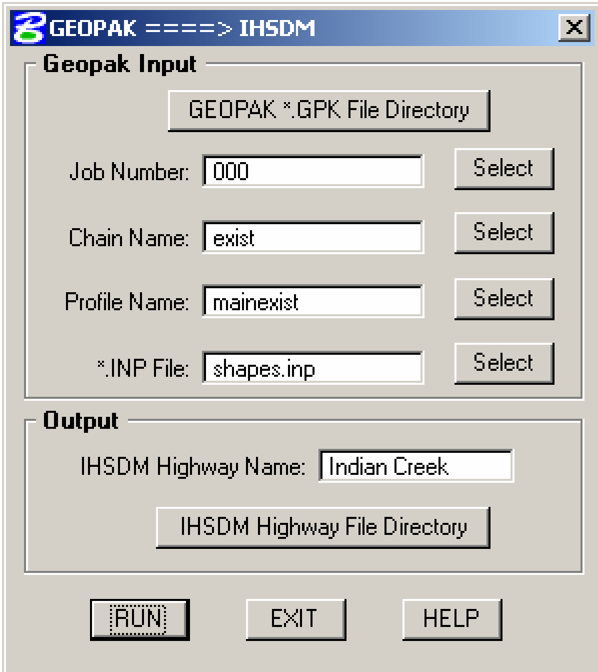
1. *While in MicroStation go to Utilities>MDL Applications.*

2. The MDL Applications dialog box will appear.



Browse for g2ihsdm.ma. It will be located in the IHSDM program directory, probably C:\IHSDM\geopak_to_ihsdm_api\.

3. The following dialog box will appear:



*Use the GEOPAK *.GPK File Directory button tool to pick the directory the .GPK file is located in.*

4. *Use the Select button to choose the Job Number. Even if the correct job number is highlighted, the user needs to single click on the correct number and pick OK. Otherwise the Select buttons for the Chain Name, Profile Name and shape input files will not work correctly.*
5. *Use the Select buttons to choose the correct Chain Name, Profile Name, and Shape input file name.*

The user can use either this method or the Excel method described in Chapter 4, Workflow 8 to enter the superelevation data.

6. *Type in the name of the highway that this alignment is created for. IHSDM will create an output file using that name.*
7. *Use the IHSDM Highway File Directory button to choose the directory the output file goes into. This will typically be in the IHSDM subdirectory for the project.*
8. *Pick RUN to create the output file.*

If a System Fault error occurs while running the MDL application, check if there are overlapping superelevation transitions. This could occur if the user is checking an existing alignment and using to high of an e max. Try decreasing the e max or enter the superelvation information using the Excel method described in Chapter 4, Workflow 8.

The output file will be an ASCII file with the highway name and a .txt extension. The user will use this file to import the geometric information into IHSDM.

If an error message appears while using the Select buttons the user can simply type in the correct information.

Creating an IHSDM Project

IHSDM has made the creation of a project easy by giving step-by-step instructions that work the same way the installation of new software would work. The following workflow will guide the user through this same process, but will add the information that is particular to the standard practices of FLH.

There are two different workflows for creating a project in IHSDM, depending on whether the user has already created another project or if this is their first time using the program. Workflow 3 will describe the process if the user is using IHSDM for the first time and Workflow 4 will describe the process for users creating another project.

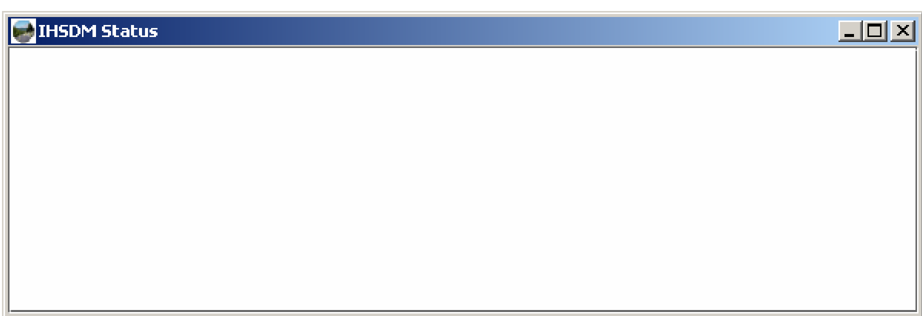
Workflow 3: Creating a Project in IHSDM for the First time

1. *Double click the IHSDM icon on your desktop.*

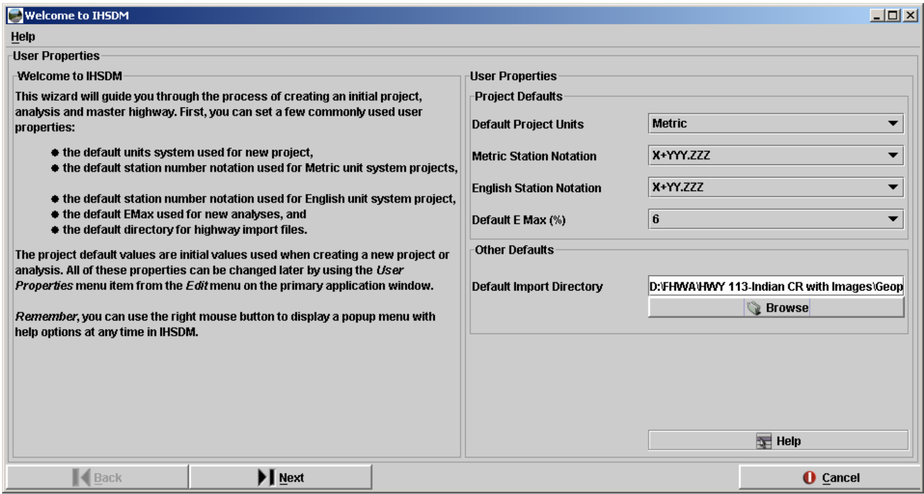
If the IHSDM icon is not on your desktop, contact your IT department to load IHSDM or go to http://www.ihsdm.org and follow the directions for downloading.

2. *Two windows will be activated:*

The IHSDM Status window. This is dialog box that IHSDM records all the activities during a run.

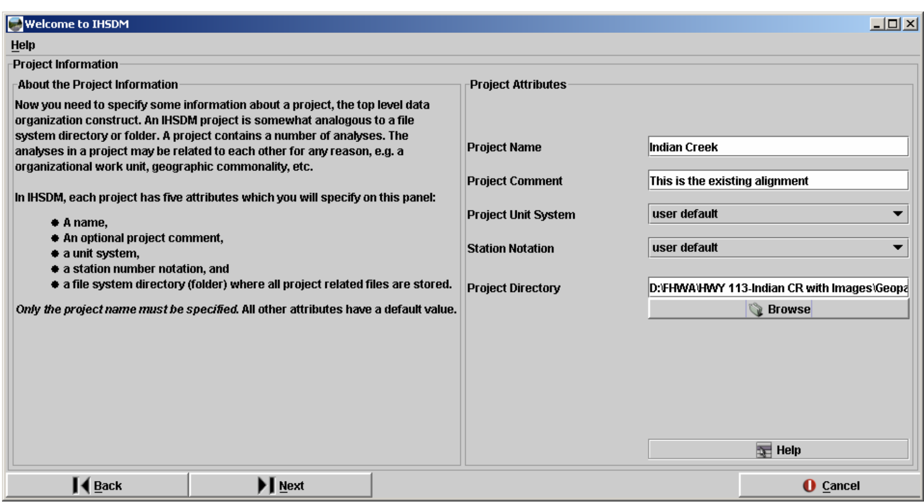


Welcome to IHSDM. This dialog contains the defaults that the user wants IHSDM to use. Set the defaults to the proper values and select Next.

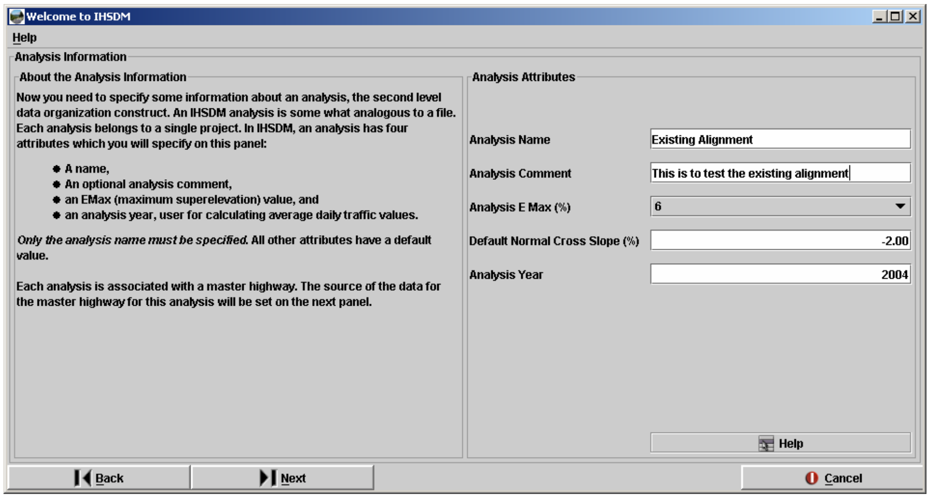


When the user sets the Default Import Directory using the browse key, make sure to just highlight the last directory in the structure and not double click on it. If the user double clicks on the last directory IHSDM will try to create another directory with the same name as the last directory.

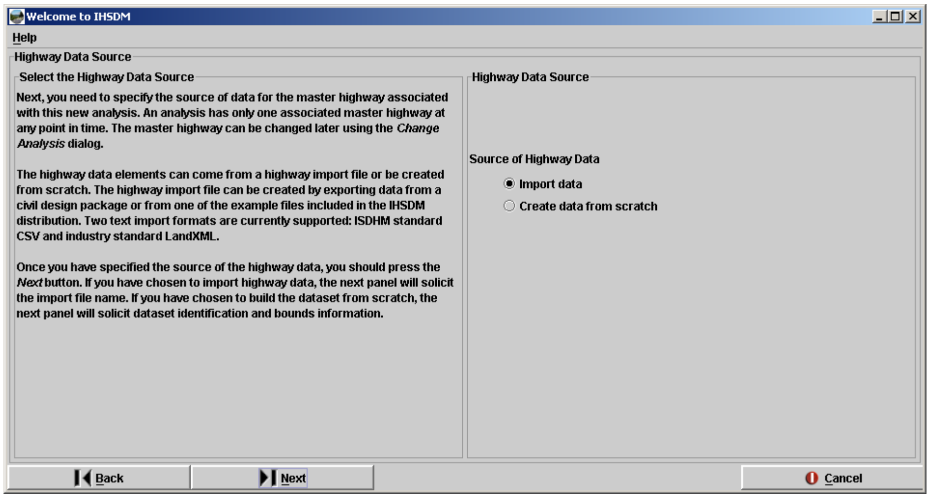
3. *The following dialog is the next one to pop up. Fill in the appropriate Project Information. If there is a need to change from the defaults set in Step 2 for Project Unit System or Station Notation, they can be changed here using the Options buttons. The above caution is valid for the Project Directory. Click on the Next button to go to the next dialog box.*



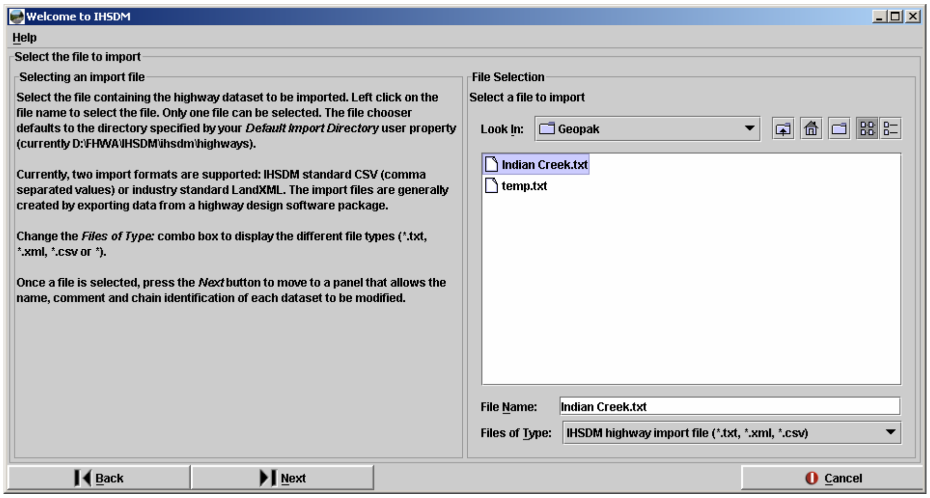
4. *The next dialog box is to create an IHSDM Analysis. This could be an analysis of the existing alignment, alternative alignment, or design phase. Also the user will input the year the analysis is to be done for. This is for the traffic module.*



5. The next dialog asks how the initial information is input into IHSDM. Mark the Import data button. The data to import was created in Workflow 2.

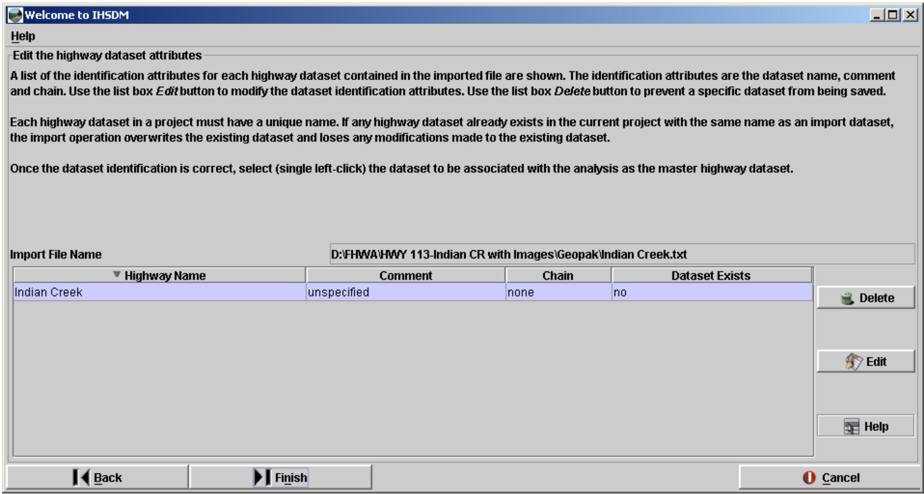


6. The next dialog box asks for the file that was created in Workflow 2. Browse to the file and pick it.

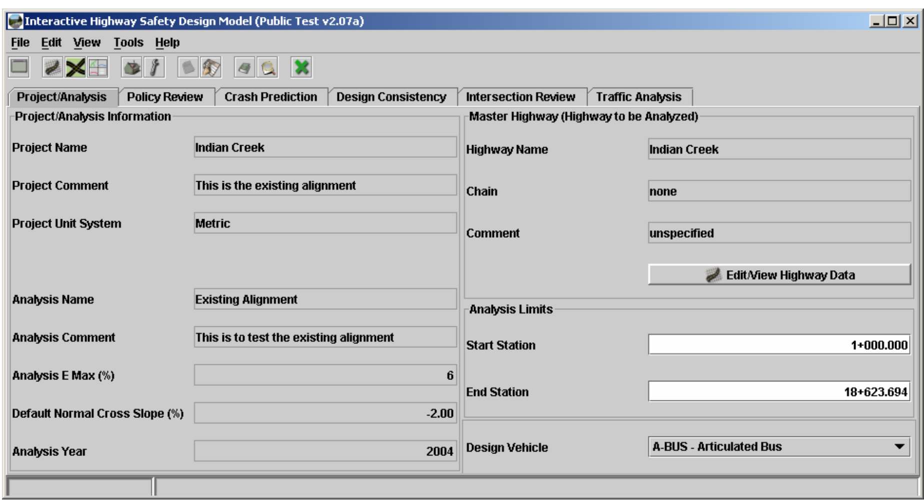


Select Next.

7. *The following dialog box will appear.*



8. *Next highlight the correct Master Highway and pick Finish. The following dialog box will appear:*

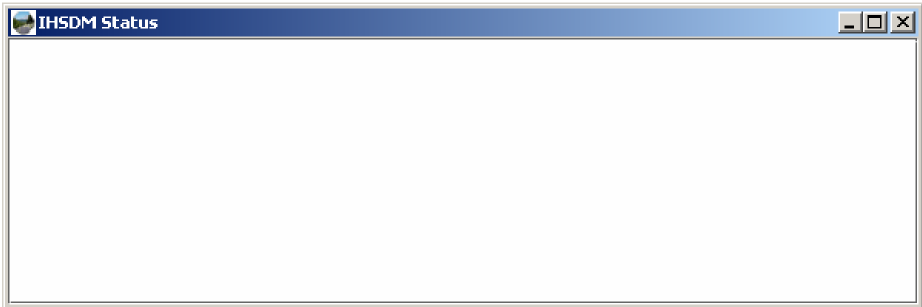


This is the main user interface, which shows the current Project, Analysis and Highway. Evaluation modules are accessed via the module tabs.

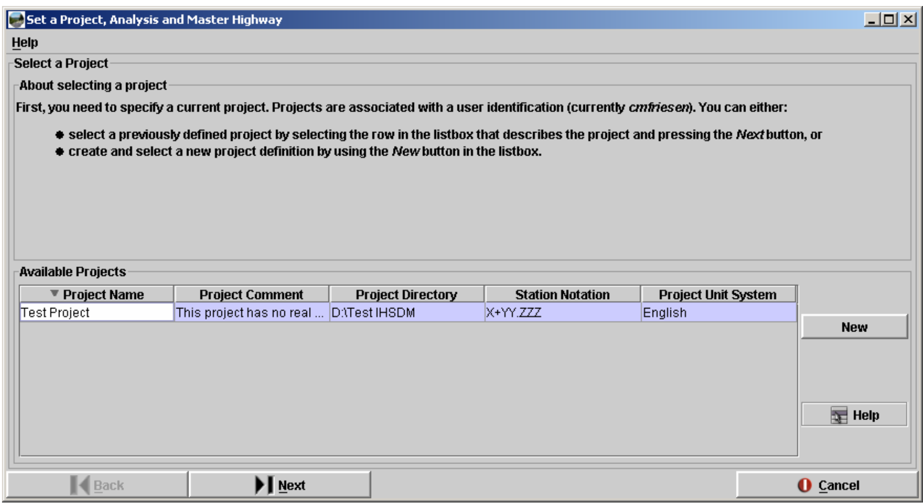
Workflow 4: Creating another Project in IHSDM

1. *Double click the IHSDM icon on your desktop.*
2. *Two windows will be activated:*

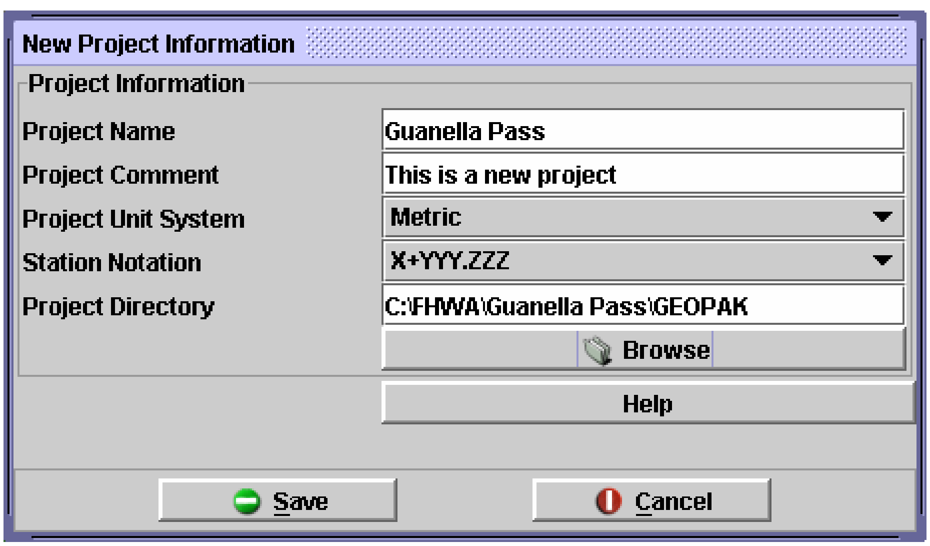
The IHSDM Status window. This is dialog box that IHSDM records all the activities during a run.



Set a Project, Analysis and Master Highway window. This dialog contains the instructions to the user and where the user enters required information.



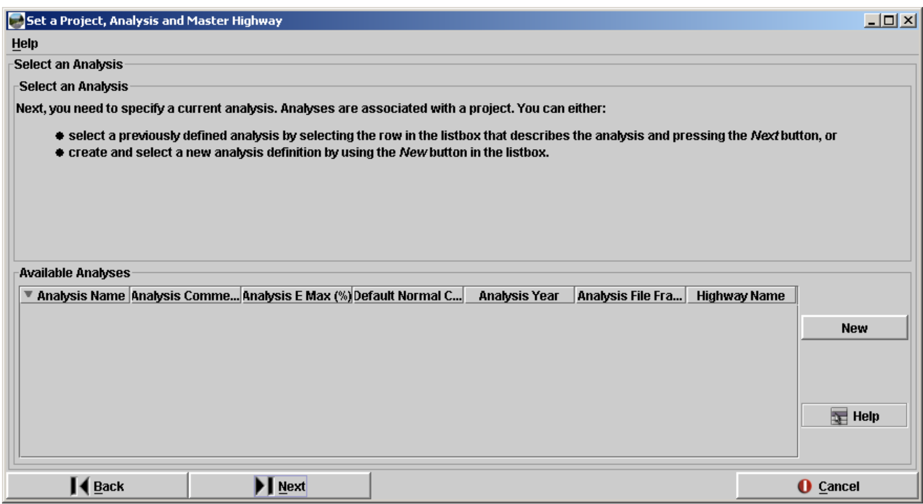
3. To create a new project, pick the New button on the right side of the dialog box. The following dialog box will appear.



4. Fill in the blocks as needed. Use the pull down menus for Project Unit System and Station Notation to set the desired values. Use the Browse button to select the project directory (or leave blank *and IHSDM will create a directory under the user's home directory).*

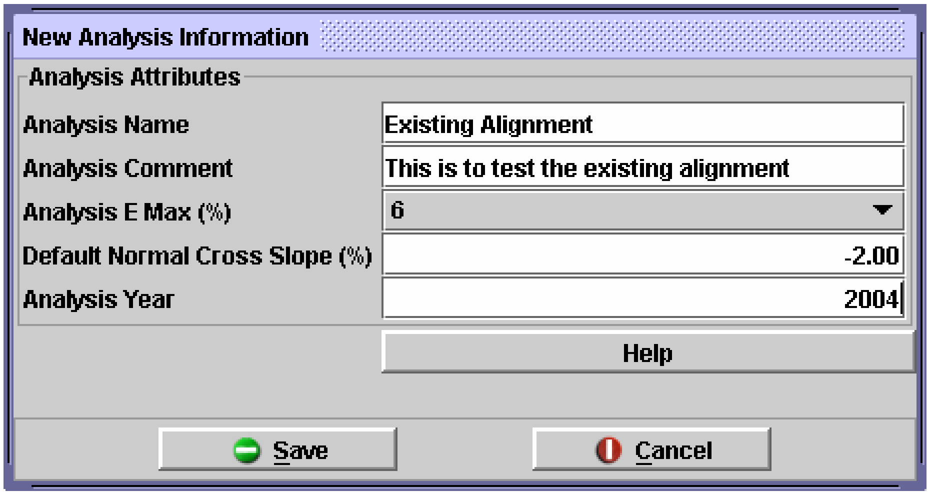
When the user sets the Project Directory using the browse key, make sure to just highlight the last directory in the structure and not double click on it. If the user double clicks on the last directory IHSDM will try to create another directory with the same name as the last directory.

5. *Pick the Save button. The project will now show up in the Set a Project, Analysis and Master Highway dialog box.*
6. *Make sure this new project is highlighted and select the Next button at the bottom of the dialog box.*
7. *The following dialog box will appear:*

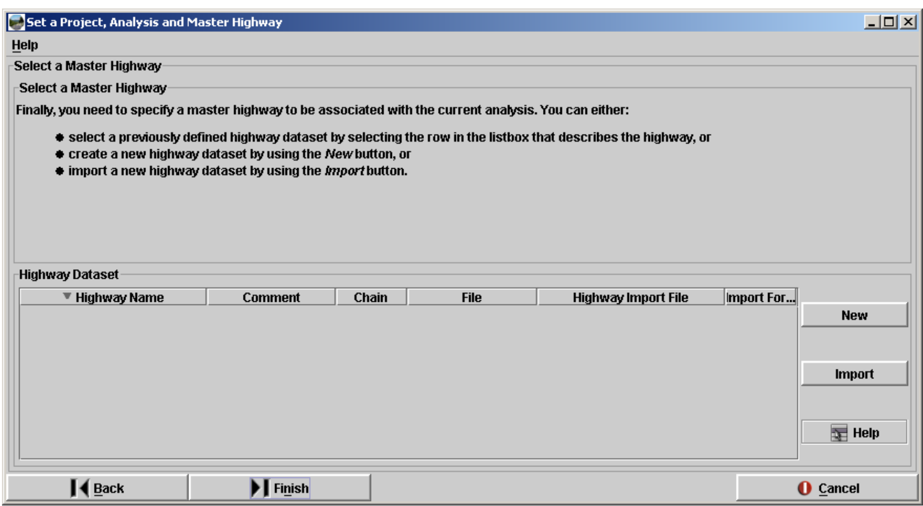


This dialog box allows the user to select and/or create and analysis. A different analysis will need to be run for each alignment change and each phase of the design. Since there have been no analysis on this new project yet, the only thing the user can do is pick the New button on the right.

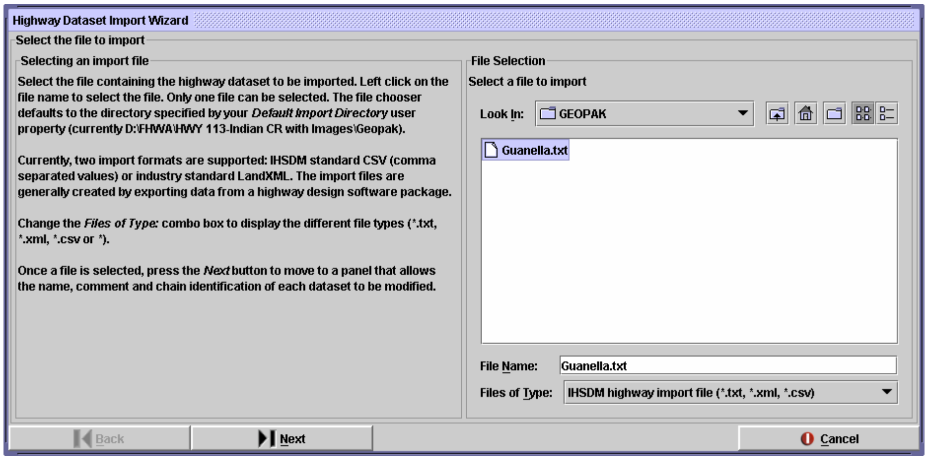
8. *The following dialog box will appear:*



9. *Fill in the appropriate information. Use the pull down menu to select the correct Analysis E Max (%). The analysis year is for the traffic module. Pick Save.*
10. *Make sure this analysis is highlighted in the Select an Analysis window of the Set a Project, Analysis and Master Highway dialog box and pick Next.*
11. *The following dialog box will appear:*

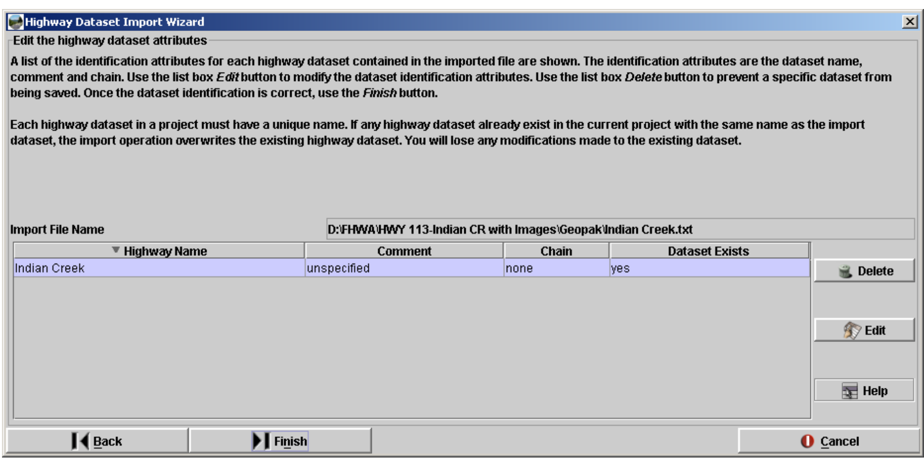


12. *This dialog box will allow you to select the highway the analysis is to be run on. The highway can be different versions or different roadways (i.e. side roads etc.). Since there are no highways yet, the user will have to Import a highway through GEOPAK. Pick the Import button.*
13. *The following dialog box will appear:*



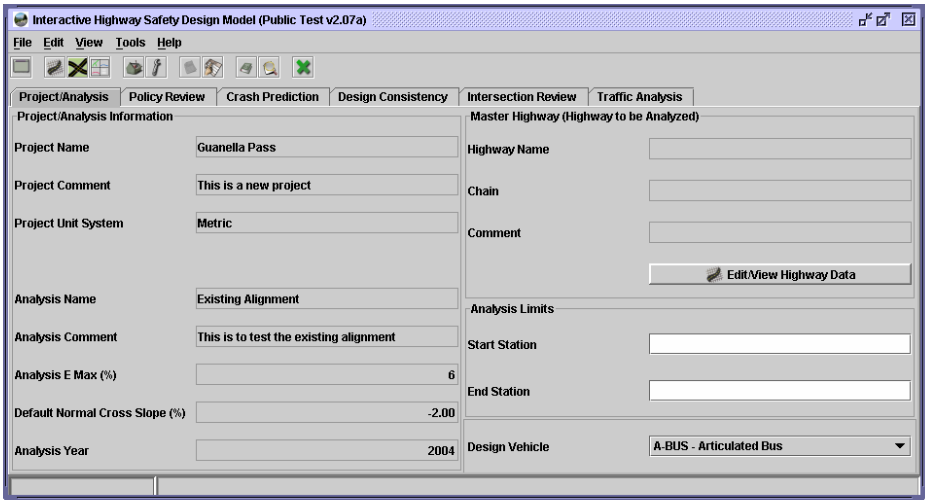
Use the browse tool to select the directory that the GEOPAK output file created in Step 3 of Workflow 2 is in. Then highlight the file. Pick Next.

14. Once the information is input, IHSDM will add a line in the Highway Data Set Import Wizard. The user can add another alignment or pick Finish to go back to the Set a Project, Analysis and Master Highway dialog box.



15. Once the user is back in the Set a Project, Analysis and Master Highway dialog box, highlight the Analysis and pick Next.

16. Next highlight the correct Master Highway and pick Finish. The following dialog box will appear:



This is the main Dialog box that all analysis will start from.

Opening an Existing Project

If the project and analysis has already been created, the process for accessing the project is much easier. The following workflow will describe the four steps needed.

Workflow 5: Opening an Existing Project in IHSDM

1. *Double click the IHSDM icon on your desktop.*
2. *Highlight the desired Project and pick Next.*
3. *Highlight the desired Analysis and pick Next.*
4. *Select the desired alignment and pick Finish. The same dialog box that is shown in Step 16 of Workflow 4 will appear.*

Once the project is created, the analysis and alignments can be changed in Steps 3 and 4 respectively prior to picking Next or Finish buttons.

Input of Design Data

This chapter described how to enter the horizontal, vertical, and superelevation data for use in IHSDM. The rest of the project data that is necessary to run the analysis can be input either by copying and pasting from a formatted Excel file or by using IHSDM's data entry tool (DEA). The next five chapters will describe the methods used for entering this data. The first part of each chapter will provide a workflow that will describe how to input the information using IHSDM. The second section will indicate the file name of the Excel spreadsheet to be used and explain the process for importing into IHSDM.

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Chapter 3 General Information Input

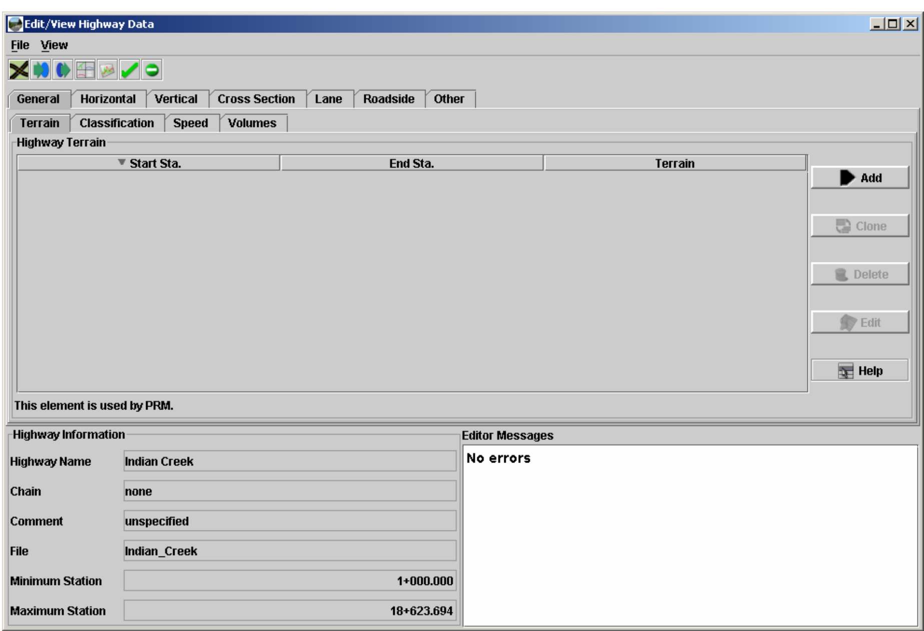
From the General Information tab in the Edit/Highway Data dialog box the following data may be set:

- Terrain
- Roadway Classification
- Design Speed
- 85th Percentile Speed
- Posted Speed
- AADVT
- Design Hourly Volume
- Peak Hourly Volume

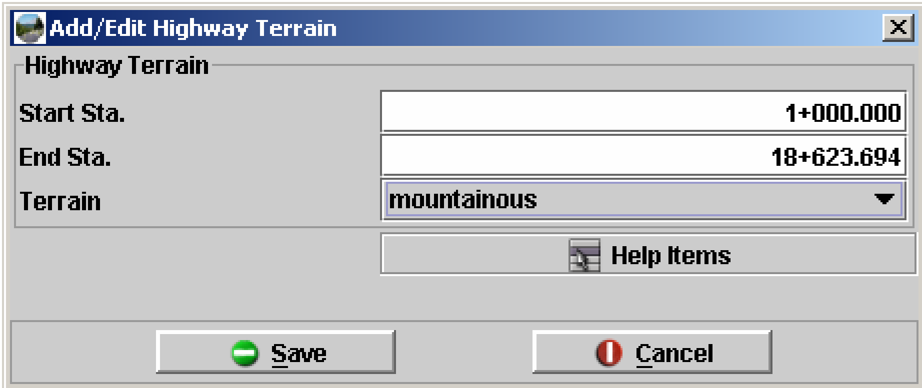
The following workflows will guide the user on how to input each set of data using IHSDM. The title of the workflow will also indicate the modules that use that data in parenthesis. Therefore, if the user does not want a certain module, they will not waste time importing data that is not needed.

Workflow 1: Terrain Data (PRM)

1. *Pick the Edit/View Highway Data button*  *while in the Main IHSDM Dialog box. This dialog box is shown in step 16 of* *workflow 2 in chapter 2**.*
2. *Click on the General>Terrain Tabs and the following dialog box will appear:*



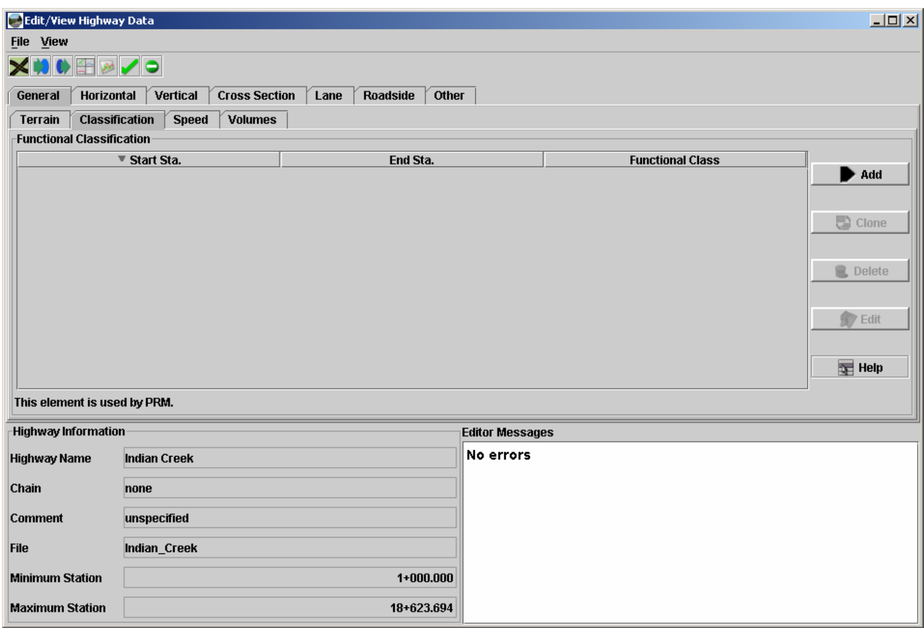
3. *Pick the Add button at the right of the dialog box to get the following dialog box:*



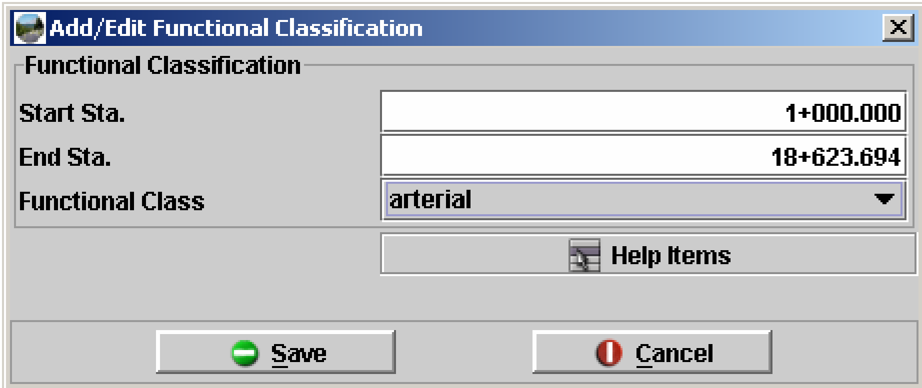
Fill in the proper information and pick Save. Notice that IHSDM filled the fields with the beginning and ending stations. If the terrain changes within the project, additional lines can be added by simply picking the add button again.

Workflow 2: Classification data (PRM)

1. *Click on the General>Classification Tabs of the Edit/View Highway Data dialog box to get the following dialog box:*



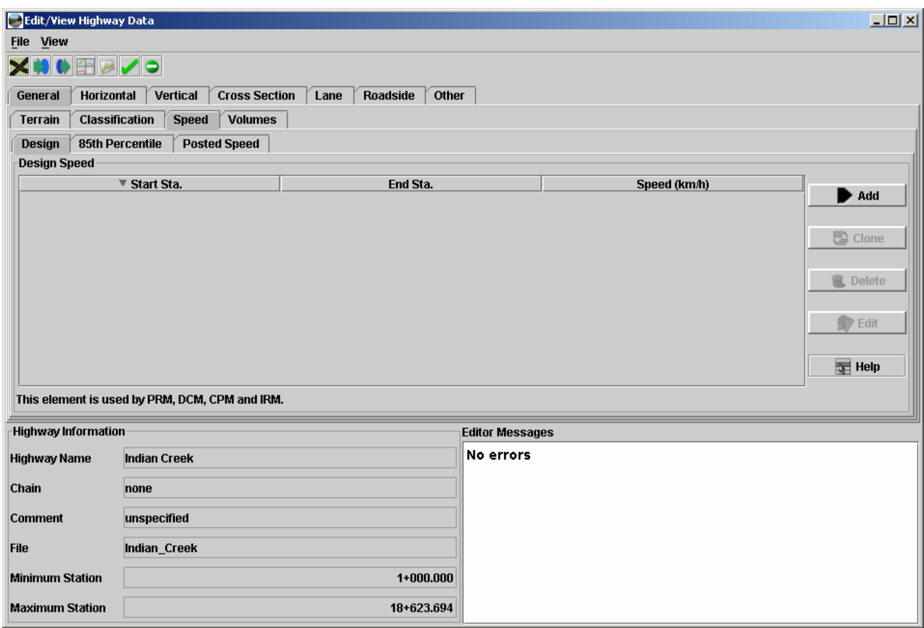
2. *Pick the Add button to get the following dialog box:*



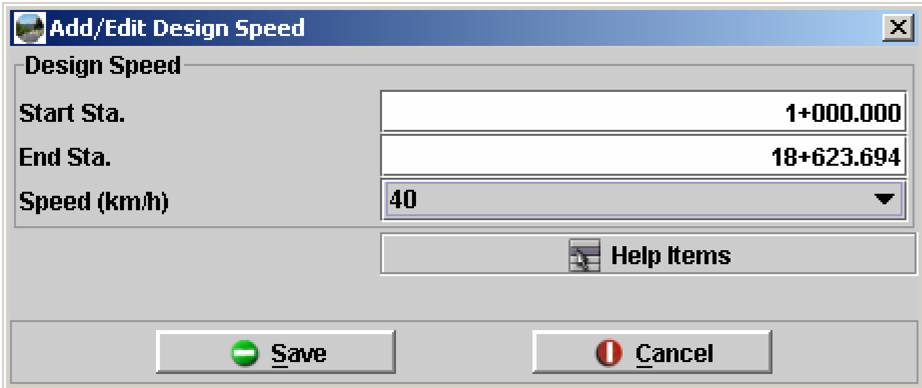
Fill in the proper information and pick Save. Notice that IHSDM filled the fields with the beginning and ending stations. If the Classification changes within the project, additional lines can be added by simply picking the Add button again.

Workflow 3: Design Speed (PRM, DCM, CPM, IRM)

1. *Click on the General>Speed>Design Tabs of the Edit/View Highway Data dialog box to get the following dialog box:*



2. *Pick the Add button to get the following dialog box:*

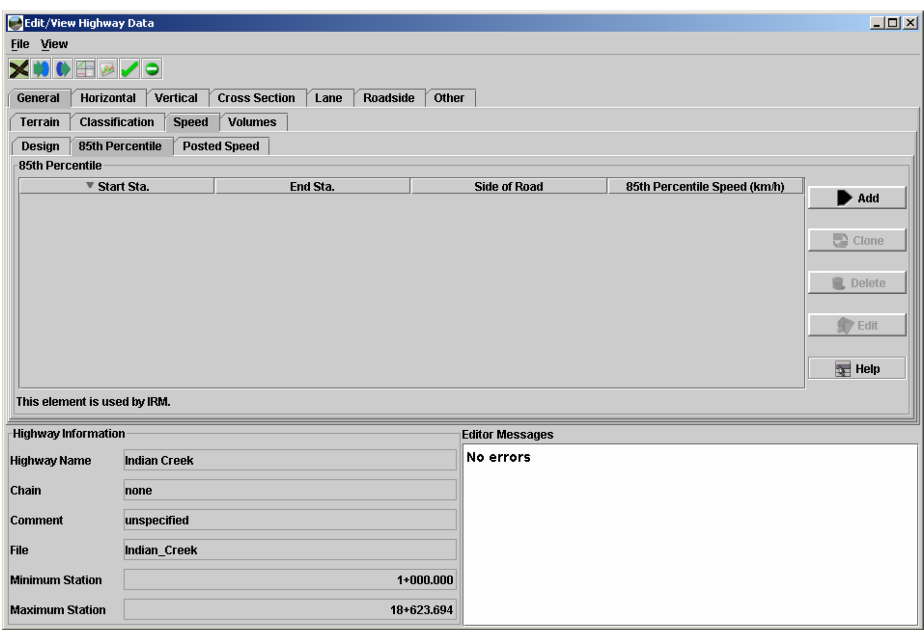


Fill in the proper information and pick Save. Notice that IHSDM filled the fields with the beginning and ending stations. If the Design Speed changes within the project, additional lines can be added by simply picking the Add button again.

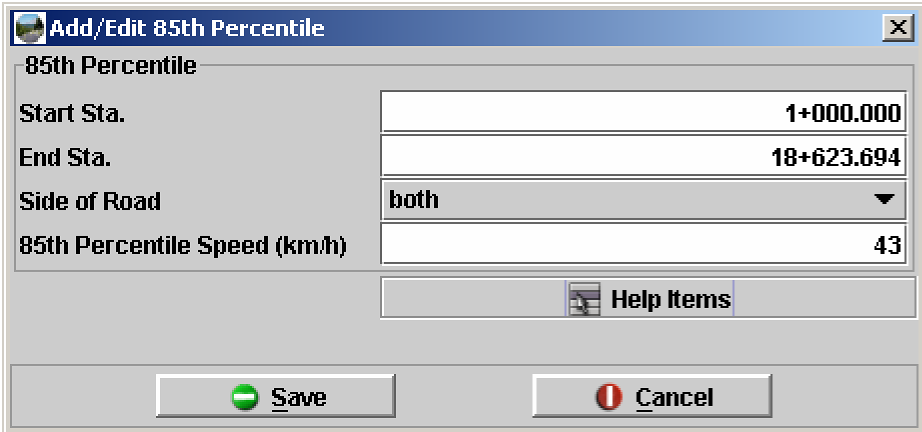
DCM output includes an estimated 85th percentile operating speed profile. The value the user can put into the following workflow will either be the predicted 85th percentile or an observed 85th percentile for the purposes of the Intersection Review Module.

Workflow 4: 85th Percentile Speed (IRM)

1. *Click on the General>Speed>85th Percentile Tabs of the Edit/View Highway Data dialog box to get the following dialog box:*



2. *Pick the Add button to get the following dialog box:*

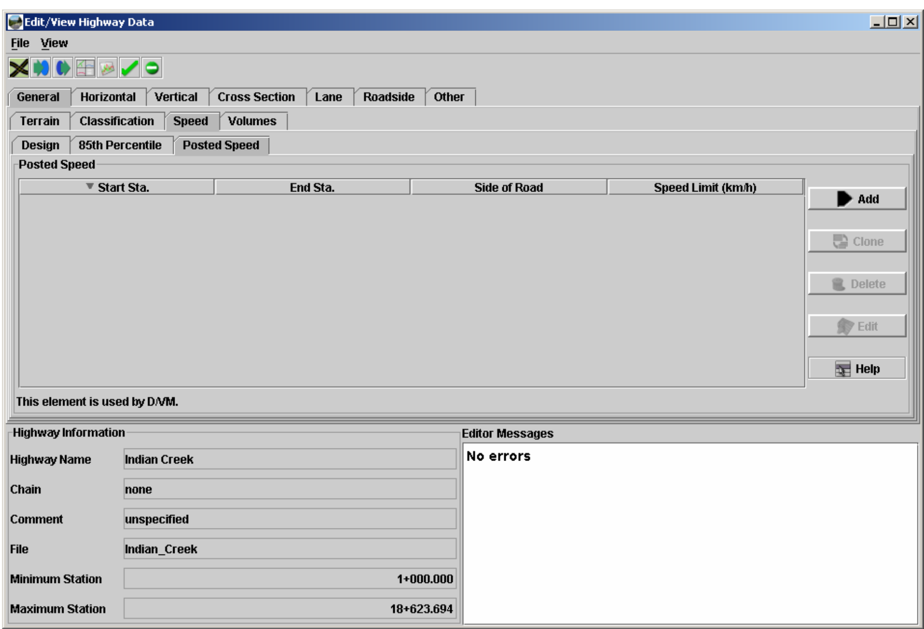


Fill in the proper information and pick Save. Notice that IHSDM filled the fields with the beginning and ending stations. If the 85th Percentile Speed changes within the project, additional lines can be added by simply picking the Add button again.

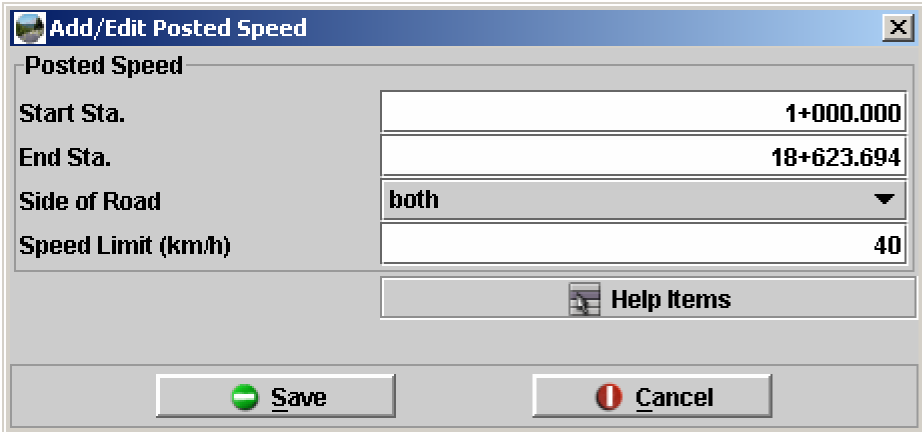
The following workflow is for use in the Driver/Vehicle module. The user will not need to add any information to the Posted Speed dialog box until this module is available.

Workflow 5: Posted Speed (D/VM)

1. *Click on the General>Speed>Posted Speed Tabs of the Edit/View Highway Data dialog box to get the following dialog box:*



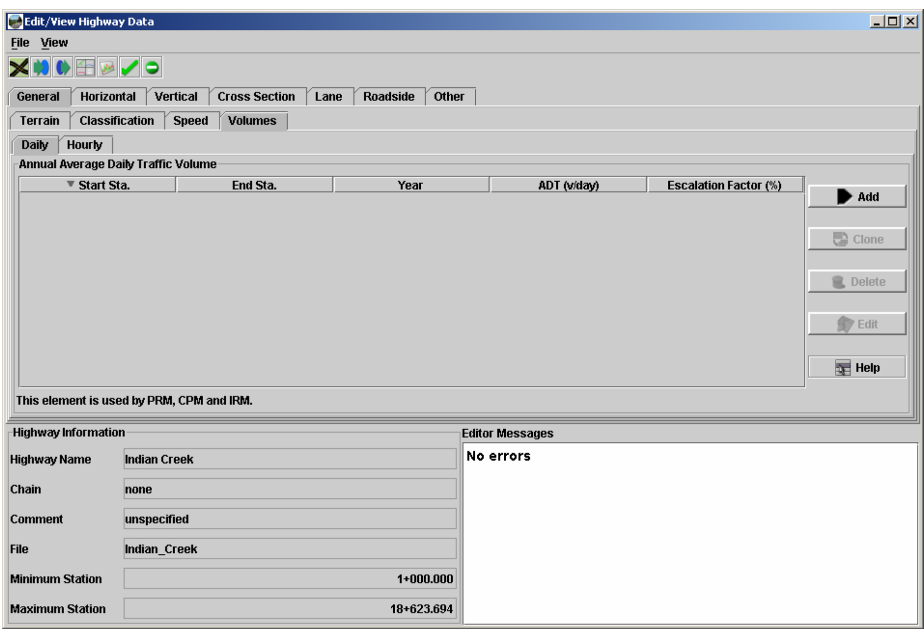
2. *Pick the Add button to get the following dialog box:*



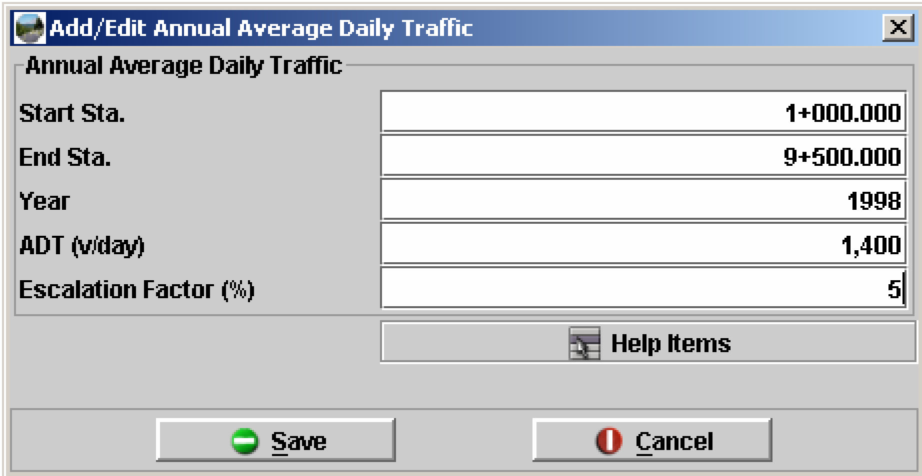
Fill in the proper information and pick Save. Notice that IHSDM filled the fields with the beginning and ending stations. If the Posted Speed changes within the project, additional lines can be added by simply picking the Add button again.

Workflow 6: AADTV (PRM, CPM, IRM)

1. *Click on the General>Volumes>Daily Tabs of the Edit/View Highway Data dialog box to get the following dialog box:*



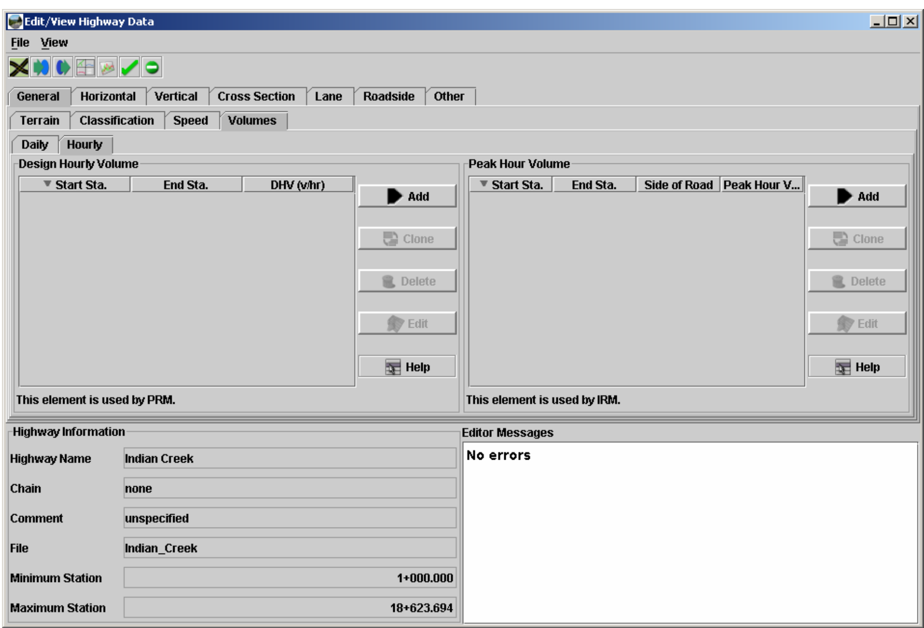
2. *Pick the Add button to get the following dialog box:*



Fill in the proper information and pick Save. If the AADVT changes within the project, additional lines can be added by simply picking the Add button again.

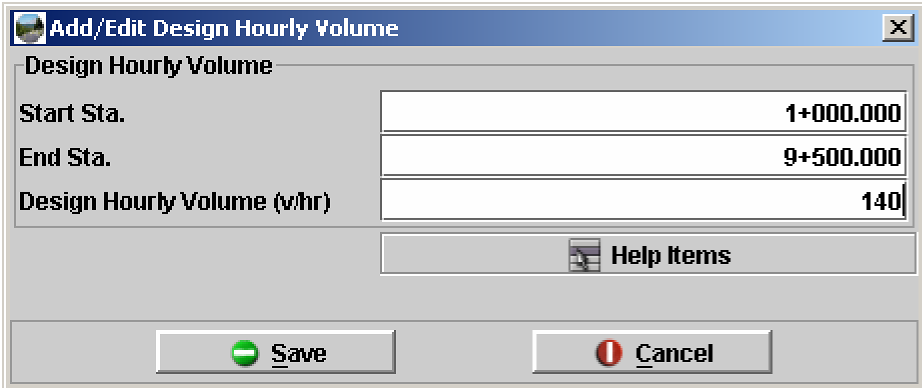
Workflow 7: Design and Peak Hourly Volumes (PRM, TAM, and IRM [PHV])

1. *Click on the General>Volumes>Hourly Tabs of the Edit/View Highway Data dialog box to get the following dialog box:*

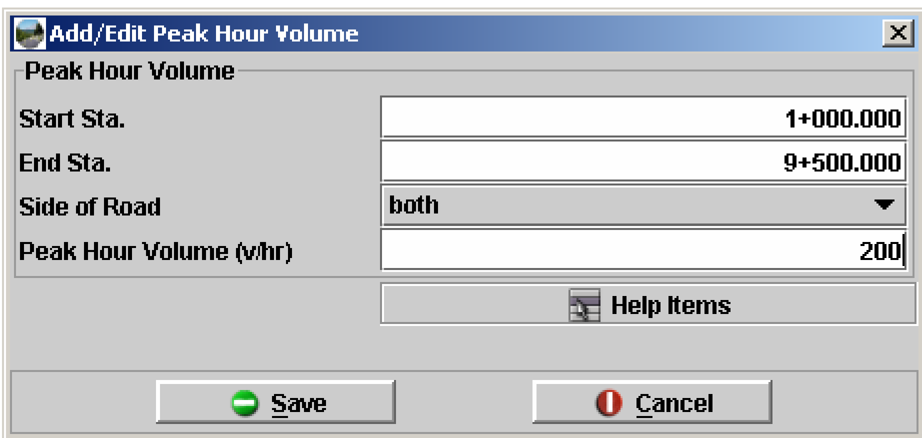


Notice that this dialog box has two sections. Design Hourly Volume and Peak Hour Volume.

2. *Pick the Add button in the Design Hourly Volume section to get the following dialog box:*



3. *Fill in the proper information and pick Save. If the Design Hourly Volume changes within the project, additional lines can be added by simply picking the Add button again.*
4. *Pick the Add button in the Peak Hour Volume to get the following dialog box:*



5. *Fill in the proper information and pick Save. If the Peak Hourly Volume changes within the project, additional lines can be added by simply picking the add button again.*

Using an Excel file

The Excel file with the correct format for importing General Information into IHSDM is DEA.General.xls. This file can be found in:

N:\Standards\IHSDM\

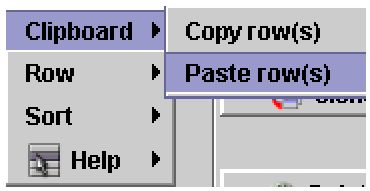
or on the CFLHD web site at the following link:

http://www.cflhd.gov/ihsdm.cfm

When you open this file, there is a read me worksheet along with 8 other worksheets that will be used to input all the general information. Each worksheet will describe what each variable is and what it is used for. The following workflow will describe the process for entering this information into IHSDM.

Workflow 8: Excel Input

1. *Enter the correct data in the Excel spreadsheet.*
2. *Highlight the entered data and go to Edit>Copy.*
3. *Click on the General Tab of the Edit/View Highway Data dialog box.*
4. *Pick the corresponding tab for the data to be inserted.*
5. *Pick the Add button.*
6. *Put dummy information in the data fields. Pick the Save button. This creates a line in the Edit/View Highway Data dialog box. The user will delete this line after the correct information is imported.*
7. *With the mouse over the line just put in, right mouse click to get the following dialog box:*



8. *Choose Clipboard>Paste row(s). The information will be loaded into IHSDM.*
9. *Delete the line with the incorrect data.*

Notice that this procedure is most useful when there are more than a couple of lines of data.

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Chapter 4 Cross Section Information Input

From the Cross Section Information tab in the Edit/Highway Data dialog box the following data may be set:

- Cross Slope (Superelevation)
- Pavement Type
- Surface Type
- Shoulder Slope
- Variable Shoulder Slope
- Shoulder Width
- Shoulder Material
- Shoulder Category

The Cross Slope Information was input in Chapter 2

The following workflows will guide the user on how to input each set of data using IHSDM. The title of the workflow will also indicate the modules that use that data in parenthesis. Therefore, if the user does not want a certain module, they will not waste time importing data that is not needed.

Pavement Type

IHSDM utilizes the following pavement types:

- High-type; Pavements are those that retain smooth riding qualities and good non-skid properties in all weather under heavy traffic volume and loadings with little maintenance. (i.e. use where there is > 10% commercial truck traffic or ADT > 2000)

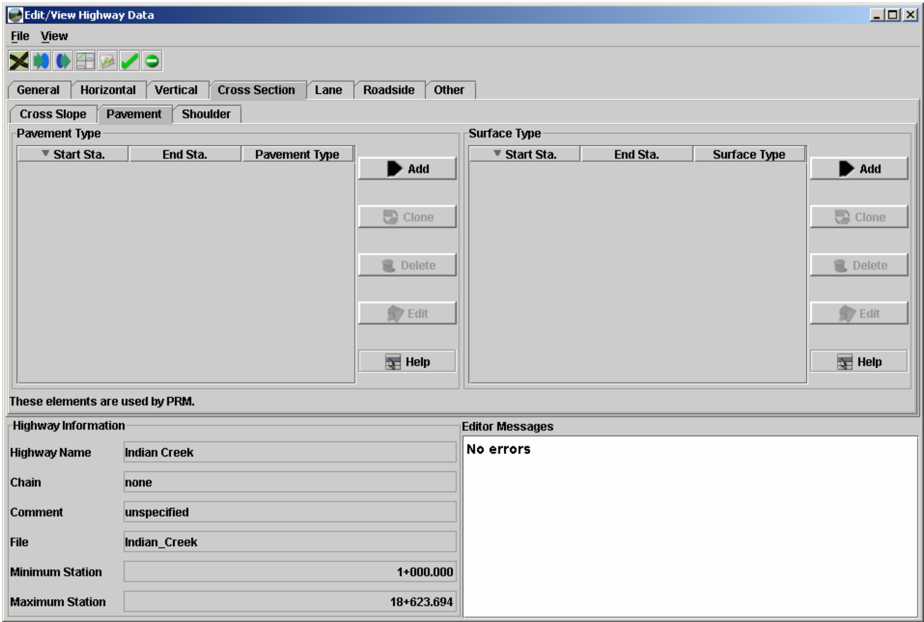
- Intermediate-type; Pavements are those designed to retain smooth riding qualities and good non-skid properties in all weather, but under lighter truck loads and lesser traffic volumes. (i.e. where commercial truck traffic < 10% and ADT < 2000)

- Low-type; Pavements are those with treated earth surfaces and those with loose aggregate surface.

Workflow 1: Pavement Type (PRM, IRM)

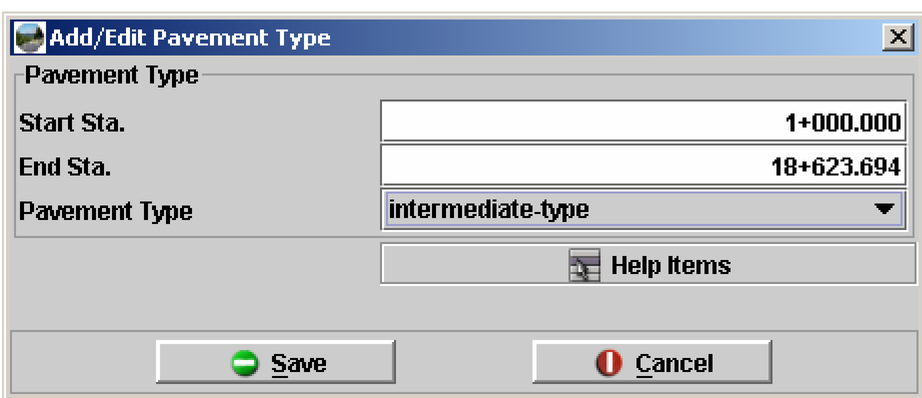
1. *Pick the Edit/View Highway Data button while in the Main IHSDM Dialog box. This dialog box is shown in step 16 of workflow 2 in chapter 2.*

2. *Click on the Cross Section>Pavement Tabs and the following dialog box will appear:*



If there is a large amount of superelvation data, do not pick the Cross Slope tab. The dialog box may take a little while to populate.

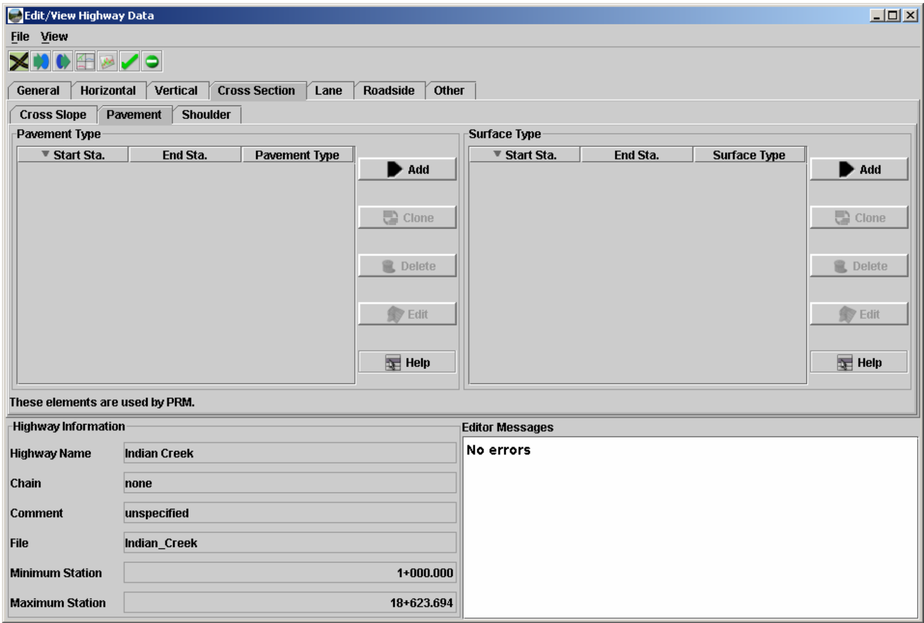
3. *Pick the Add button in the middle of the dialog box to get the following dialog box:*



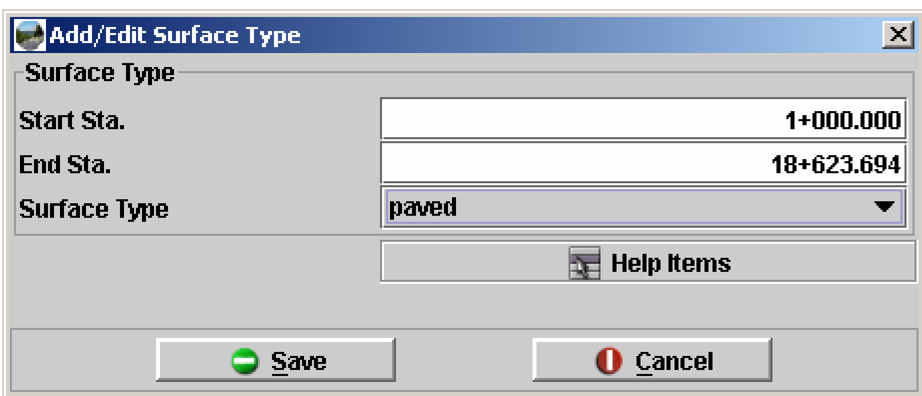
Fill in the proper information and pick Save. Notice that IHSDM filled the fields with the beginning and ending stations. If the pavement type changes within the project, additional lines can be added by simply picking the Add button again.

Workflow 2: Surface Type data (PRM)

1. *Click on the Cross Section>Pavement Tabs of the Edit/View Highway Data dialog box to get the following dialog box:*



2. *Pick the Add button on the right to get the following dialog box:*



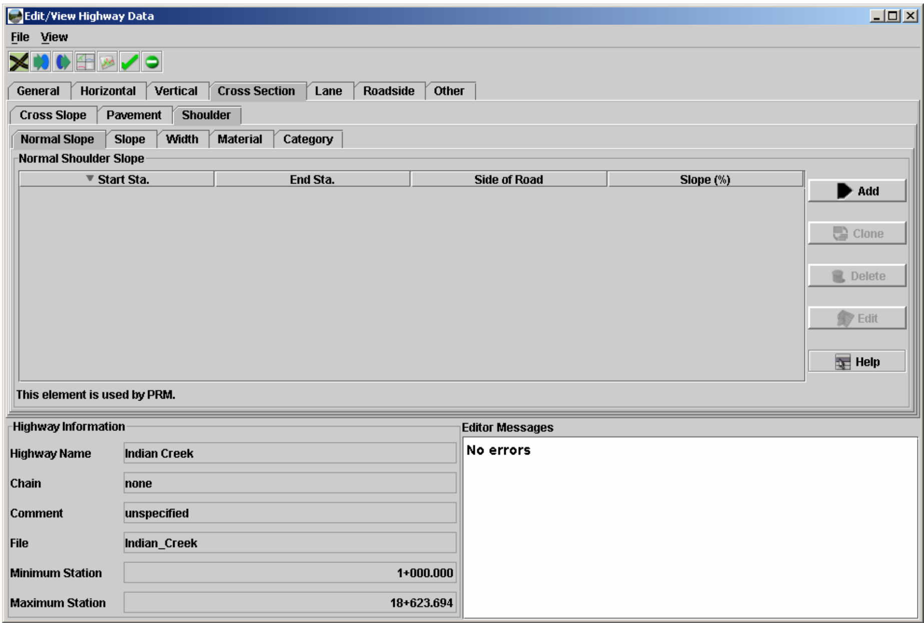
Fill in the proper information and pick Save. The two options for surface are paved and aggregate. Notice that IHSDM filled the fields with the beginning and ending stations. If the Surface type changes within the project, additional lines can be added by simply picking the Add button again.

Shoulder, Normal Slope

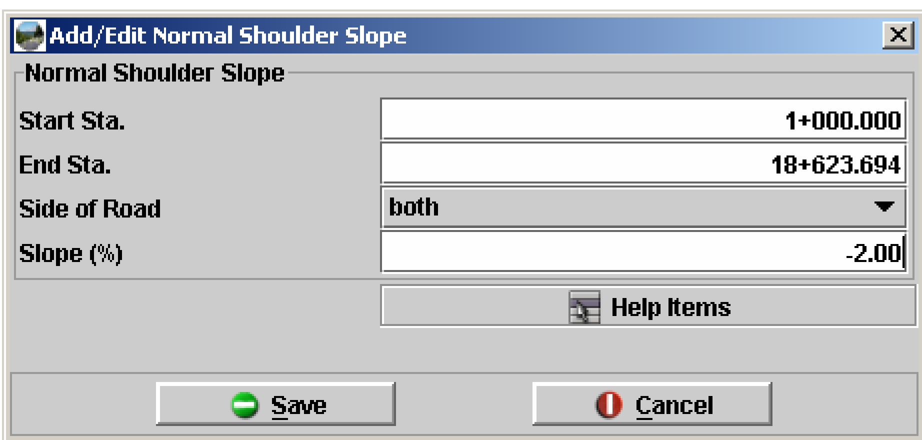
Shoulder, Normal Slope is the slope of the shoulder in tangent sections. Show the normal slope throughout the whole project and use the Shoulder Slope shown in Workflow 4 to model the shoulder slope through curves due to superelevation.

Workflow 3: Shoulder, Normal Slope (PRM)

1. *Click on the Cross Section>Shoulder>Normal Slope Tabs of the Edit/View Highway Data dialog box to get the following dialog box:*



2. *Pick the Add button to get the following dialog box:*

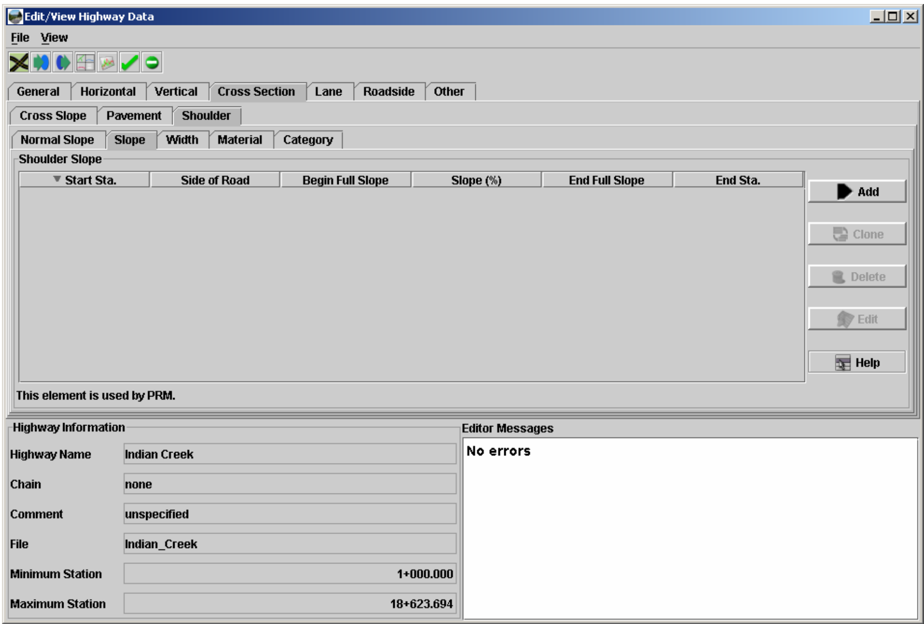


Fill in the proper information and pick Save. Notice that IHSDM filled the fields with the beginning and ending stations. If the normal shoulder slope changes within the project, additional lines can be added by simply picking the Add button again. For localized shoulder changes, use the Shoulder Slope workflow described in Workflow 4.

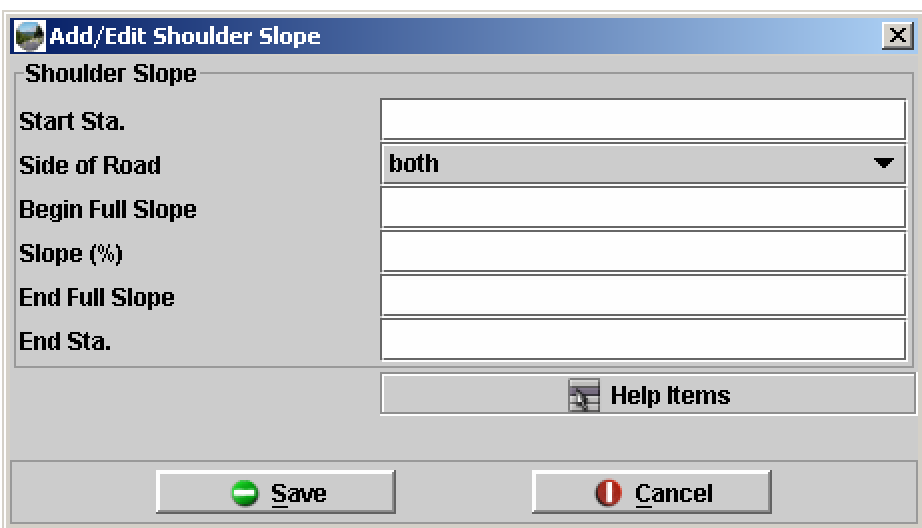
The next workflow allows the user to input areas that the shoulder slope would vary from normal shoulder slope due to superelevation. This would be a good situation to use the Excel input method shown in Workflow 8 if there are many curves in the alignment. The user can populate the fields using the cross section shape input file relatively quickly.

Workflow 4: Shoulder Slope (PRM)

1. *Click on the Cross Section>Shoulder>Slope tabs of the Edit/View Highway Data dialog box to get the following dialog box:*



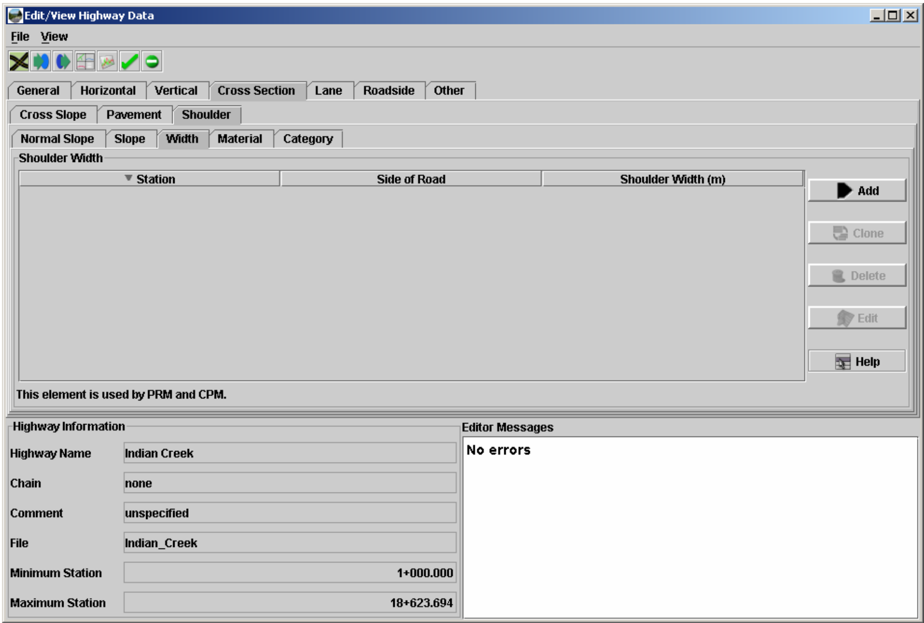
2. *Pick the Add button to get the following dialog box:*



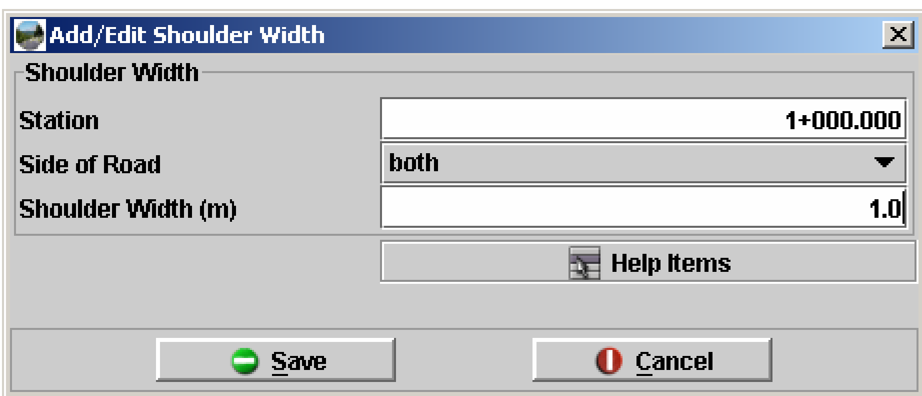
Fill in the proper information and pick Save. Start Sta. is where the shoulder slope starts to vary from the normal slope, Begin Full Slope is where the shoulder is done transitioning to new slope. If the Shoulder Slope changes within the project, additional lines can be added by simply picking the Add button again.

Workflow 5: Shoulder Width (PRM, CPM)

1. *Click on the Cross Section>Shoulder>Width Tabs of the Edit/View Highway Data dialog box to get the following dialog box:*



2. *Pick the Add button to get the following dialog box:*

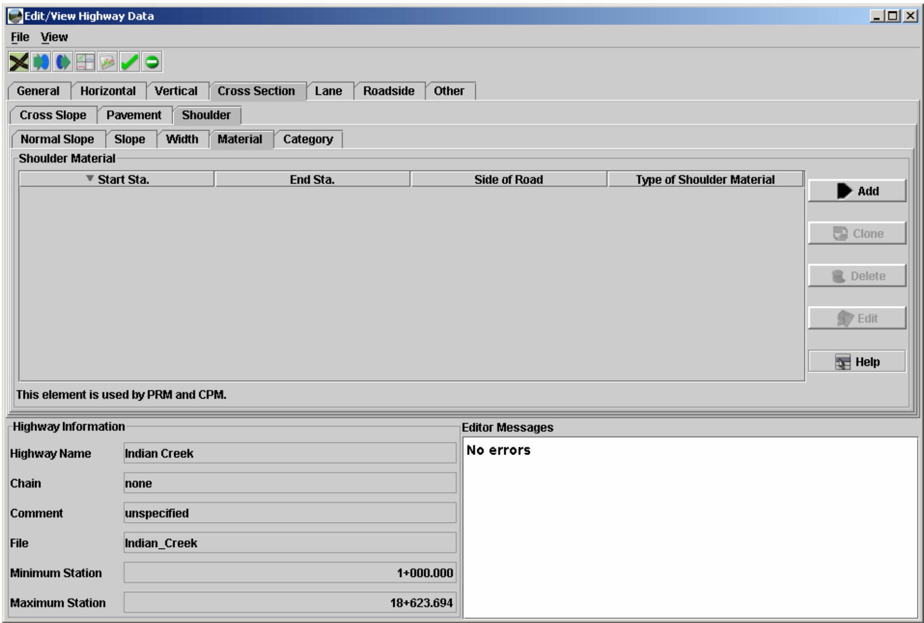


3. *Fill in the beginning station of the alignment, provide the correct Shoulder width and pick Save.*

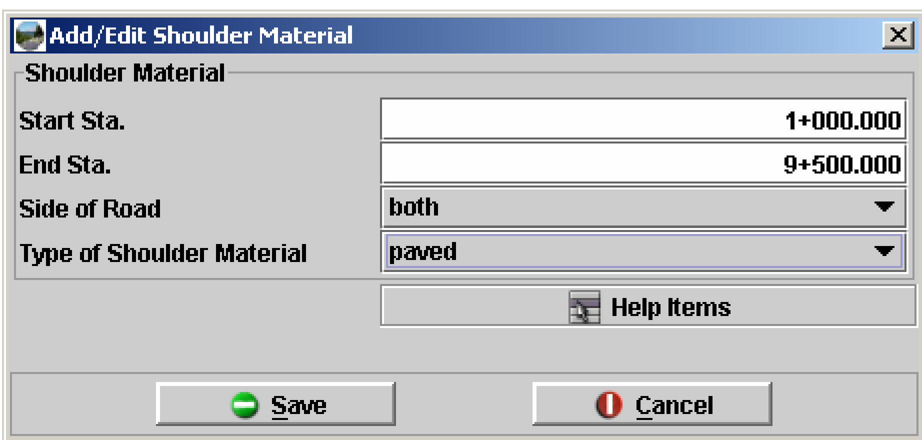
4. *Since IHSDM only allows one station in this dialog box, the user will have to pick Add again and fill in the end station of the constant shoulder width. If the shoulder width varies in the project, the user will need to repeat this process for each change in constant shoulder width. IHSDM will straight line interpolate between stations where the shoulder width changes.*

Workflow 6: Shoulder Material (PRM, CPM)

1. *Click on the Cross Section>Shoulder>Material Tabs of the Edit/View Highway Data dialog box to get the following dialog box:*



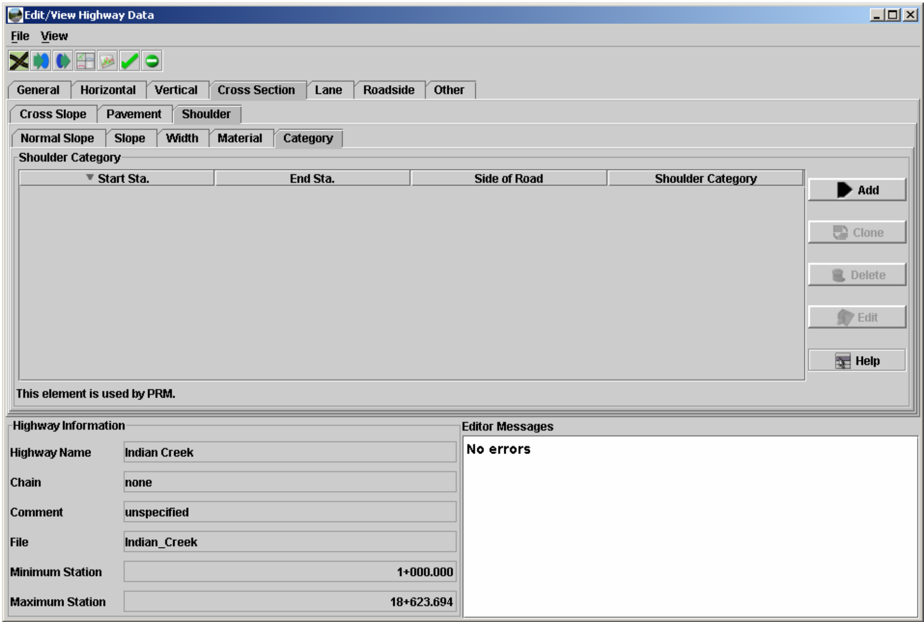
2. *Pick the Add button to get the following dialog box:*



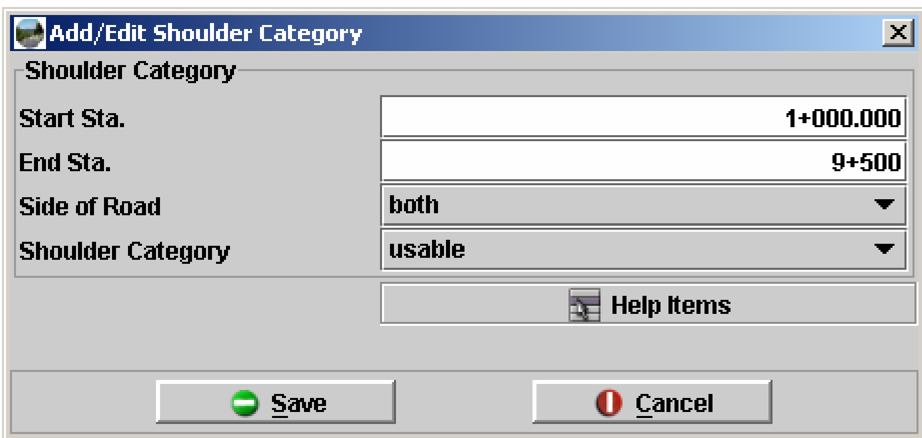
Fill in the proper information and pick Save. Notice that IHSDM automatically inserted the beginning and ending stations. If the Shoulder Material changes within the project, additional lines can be added by simply picking the Add button again.

Workflow 7: Shoulder Category (PRM)

1. *Click on the Cross Section>Shoulder>Category Tabs of the Edit/View Highway Data dialog box to get the following dialog box:*



2. *Pick the Add button to get the following dialog box:*



3. *Fill in the proper information and pick Save. The Shoulder Categories to choose from are useable and graded. A useable shoulder can be driven on and a graded shoulder cannot be. Notice that IHSDM automatically put the beginning and ending stations in. If the Shoulder Category changes within the project, additional lines can be added by simply picking the Add button.*

Using an Excel file

The Excel file with the correct format for importing Cross Section Information into IHSDM is DEA.Cross Section.xls. This file can be found in:

N:\Standards\IHSDM\

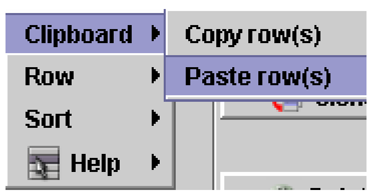
or on the CFLHD web site at the following link:

http://www.cflhd.gov/ihsdm.cfm

When you open this file, there is a read me worksheet along with 8 other worksheets that will be used to input all the general information. Each worksheet will describe what each variable is and what it is used for. The following workflow will describe the process for entering this information into IHSDM.

Workflow 8: Excel Input

1. *Enter the correct data in the Excel spreadsheet.*
2. *Highlight the entered data and go to Edit>Copy.*
3. *Click on the General Tab of the Edit/View Highway Data dialog box.*
4. *Pick the corresponding tab for the data to be inserted.*
5. *Pick the Add button.*
6. *Put dummy information in the data fields. Pick the Save button. This creates a line in the Edit/View Highway Data dialog box. The user will delete this line after the correct information is imported.*
7. *With the mouse over the line just put in, right mouse click to get the following dialog box:*



8. *Choose Clipboard>Paste row(s). The information will be loaded into IHSDM.*
9. *Delete the line with the incorrect data.*

Notice that this procedure is most useful when there are more than a couple of lines of data.

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Chapter 5 Lane Information Input

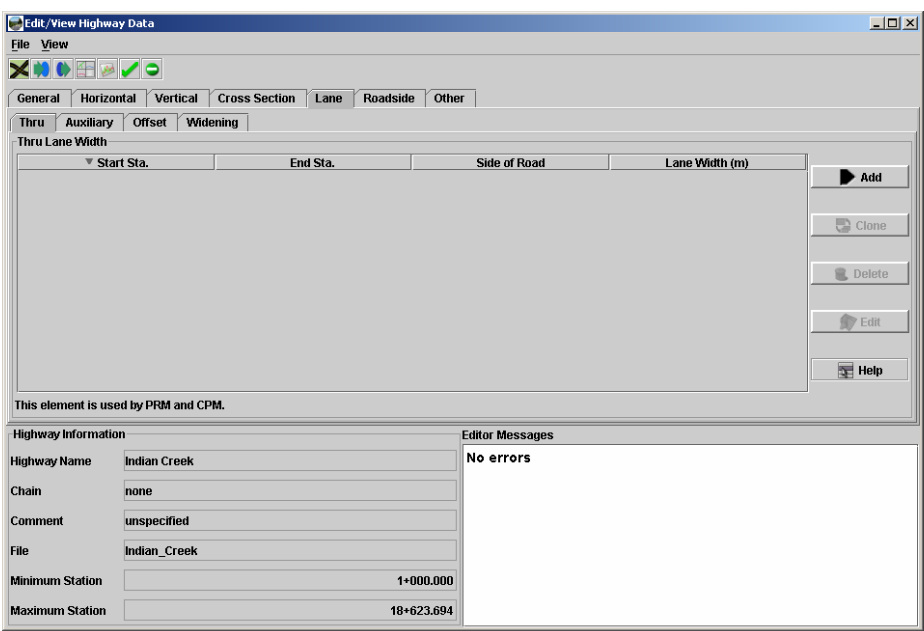
From the Lane Information tab in the Edit/View Highway Data dialog box the following information may be input:

- Through Lane widths.
- Passing Lane widths and locations
- Turn Lane widths and locations
- Two-way Left Turn widths and locations
- Climbing Lane widths and locations
- Highway offset widths and locations
- Curve widening widths and locations

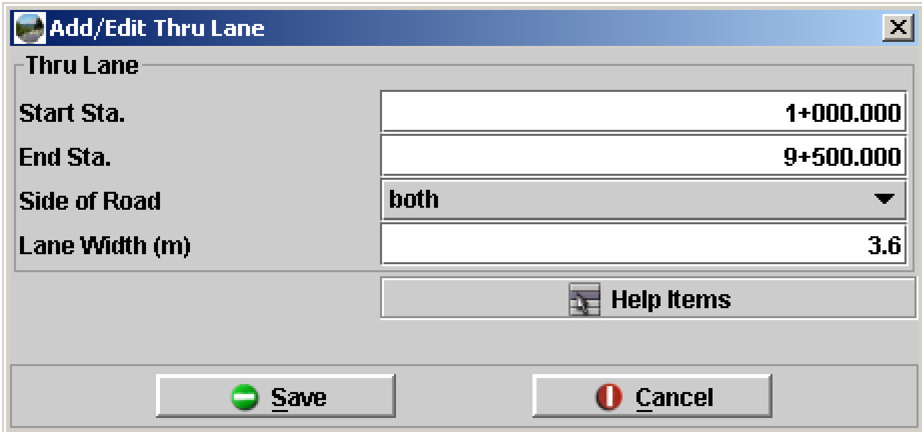
The following workflows will guide the user on how to input each set of data using IHSDM. The title of the workflow will also indicate the modules that use that data in parenthesis. Therefore, if the user does not want a certain module, they will not waste time importing data that is not needed.

Workflow 1: Through Lane Widths (PRM, CPM, IRM)

1. *Pick the Edit/View Highway Data button*  *while in the Main IHSDM Dialog box. This dialog box is shown in step 16 of [workflow 2 in chapter 2](#).*
2. *Click on the Lane>Thru tabs and the following dialog box will appear:*



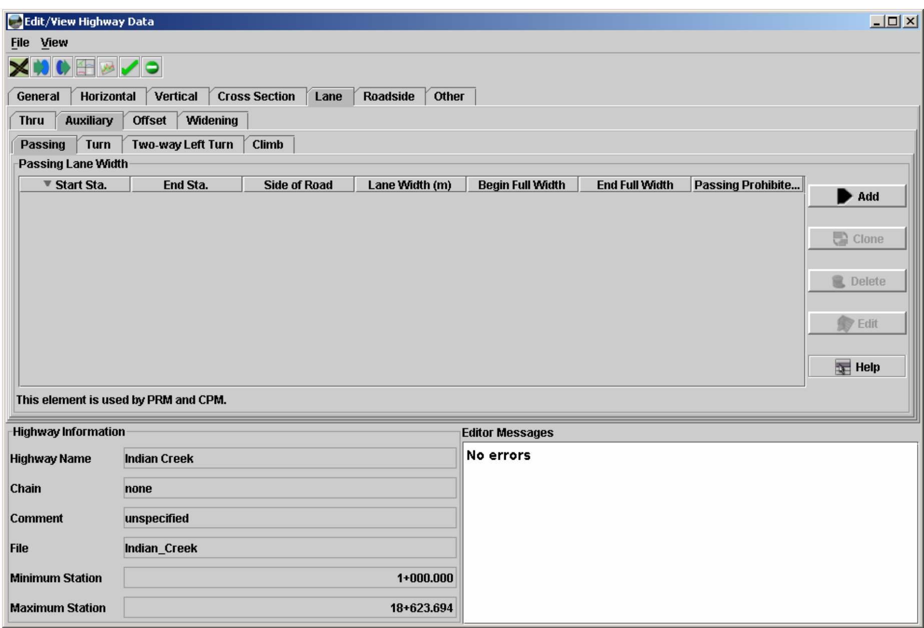
Pick the Add button at the right of the dialog box to get the following dialog box:



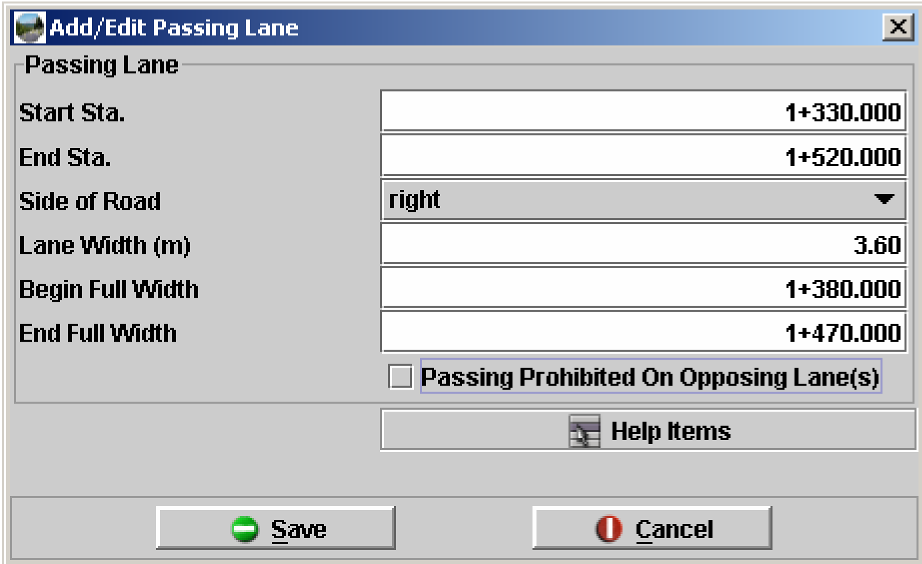
Fill in the proper information and pick Save. Notice that IHSDM filled the fields with the beginning and ending stations. If the Through Lane Widths change within the project, additional lines can be added by simply picking the Add button again.

Workflow 2: Passing Lane Width and Location (PRM, CPM, TAM, IRM)

1. *Click on the Lane>Auxillary>Passing Tabs of the Edit/View Highway Data dialog box to get the following dialog box:*



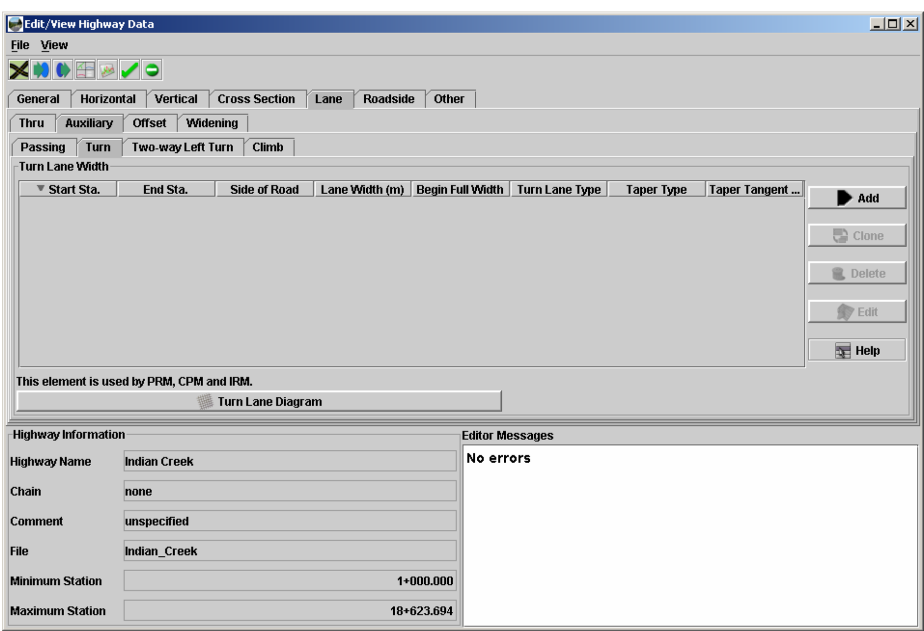
2. *Pick the Add button to get the following dialog box:*



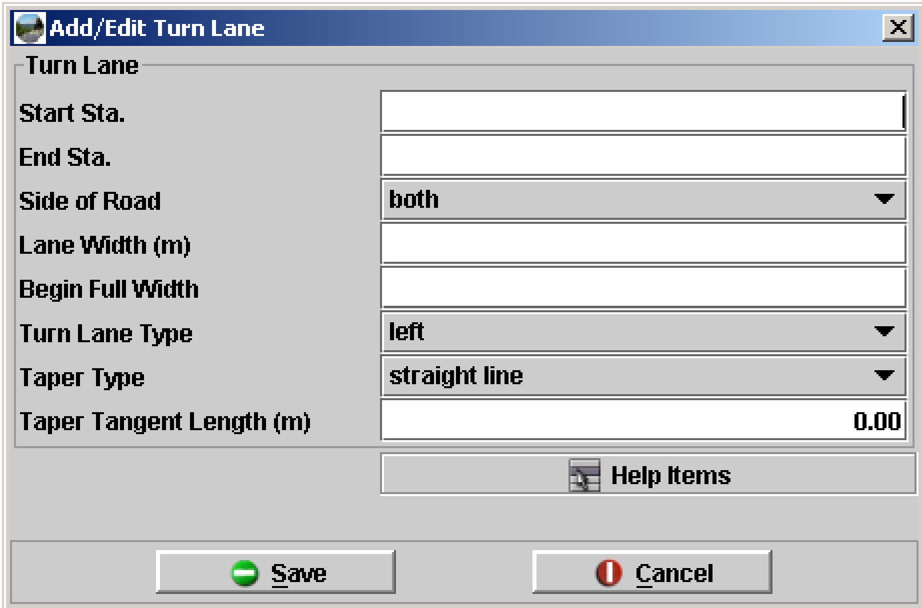
Fill in the proper information and pick Save. IHSDM uses linear as opposed to curvilinear lane transitions. Start Sta. is the station that the widening for the passing lane begins and Begin full width is the station at the end of the transition. The Check box is so IHSDM knows how the striping will be done through the passing lane section. If there are more than one Passing Lanes within the project, additional lines can be added by simply picking the Add button again.

Workflow 3: Turn Lane Width and Location (PRM, DCM, IRM)

1. *Click on the Lane>Auxiliary>Turn Tabs of the Edit/View Highway Data dialog box to get the following dialog box:*



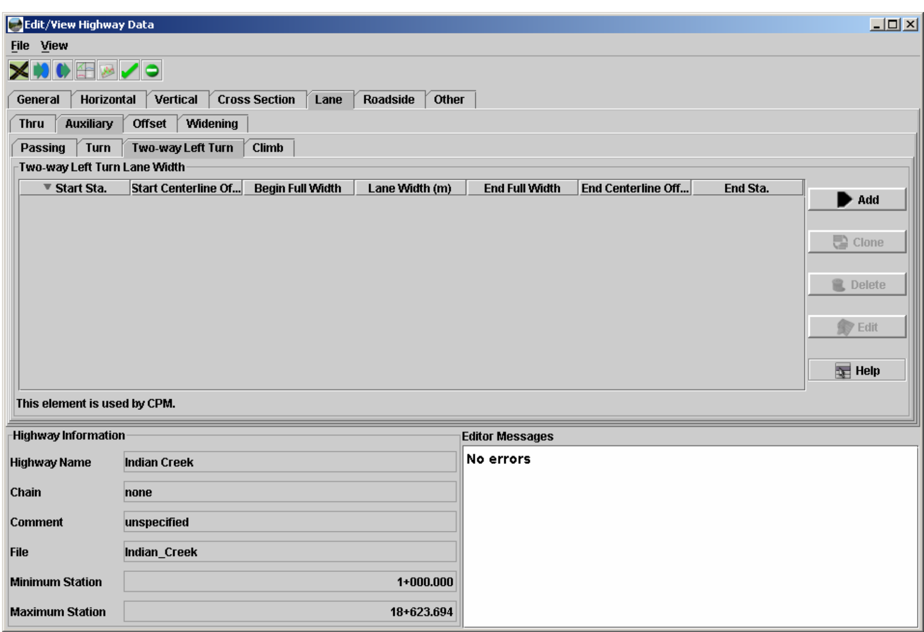
2. Pick the Add button to get the following dialog box:



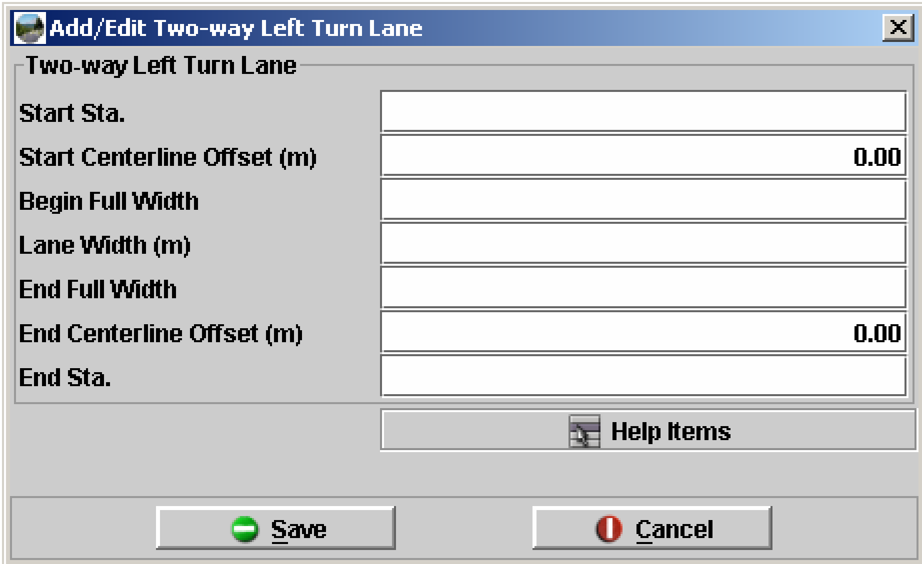
Fill in the proper information and pick Save. Start Sta. is the station that the widening for the turn lane begins and Begin full width is the station at the end of the transition. If there are multiple Turn Lanes within the project, additional lines can be added by simply picking the Add button again.

Workflow 4: Two Way Left Turn Lanes (PRM, CPM, IRM)

1. Click on the Lane>Auxillary>Two-way Left Turn Tabs of the Edit/View Highway Data dialog box to get the following dialog box:



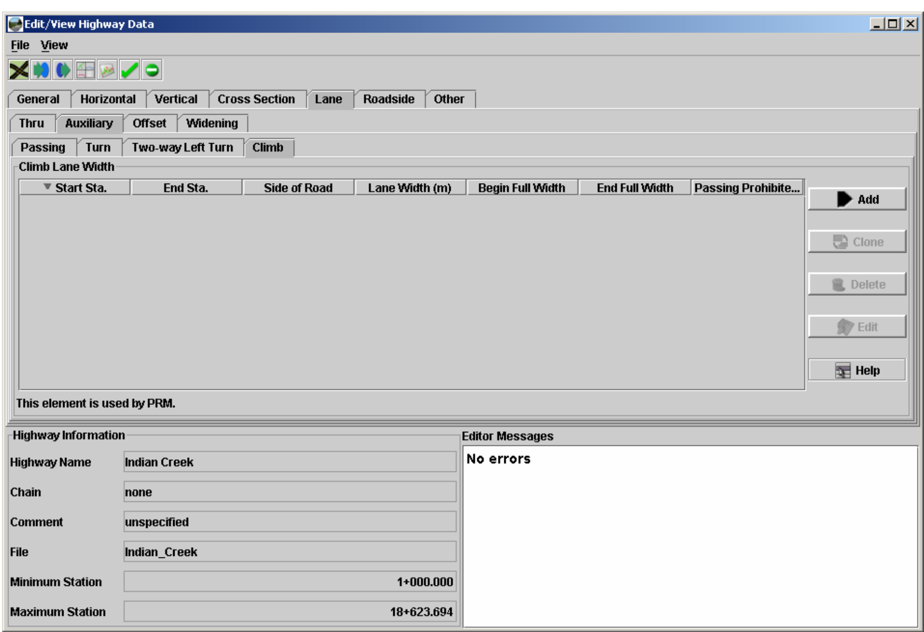
2. Pick the Add button to get the following dialog box:



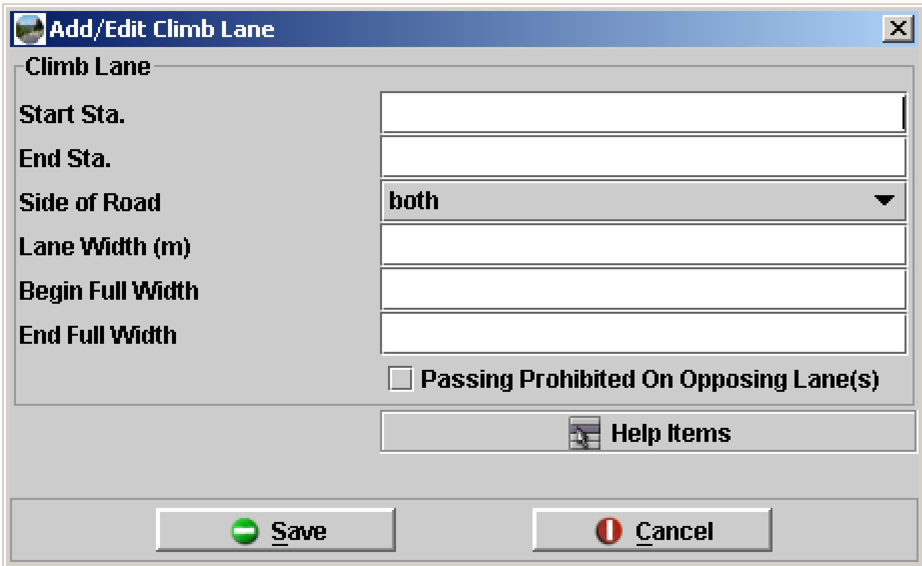
Fill in the proper information and pick Save. Start Sta. is the station that the widening for the turn lane begins and Begin full width is the station at the end of the transition. If there are additional Two-Way Left Turn Lanes within the project, additional lines can be added by simply picking the Add button again.

Workflow 5: Climbing Lane Width and Location (PRM, CPM, TAM, IRM)

1. Click on the Lane>Auxillary>Climb Tabs of the Edit/View Highway Data dialog box to get the following dialog box:



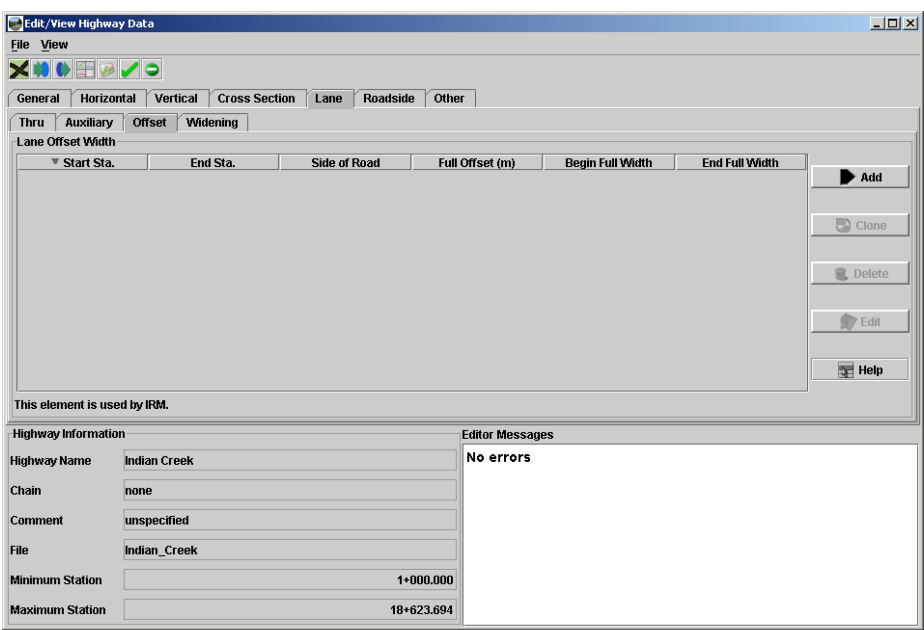
2. *Pick the Add button to get the following dialog box:*



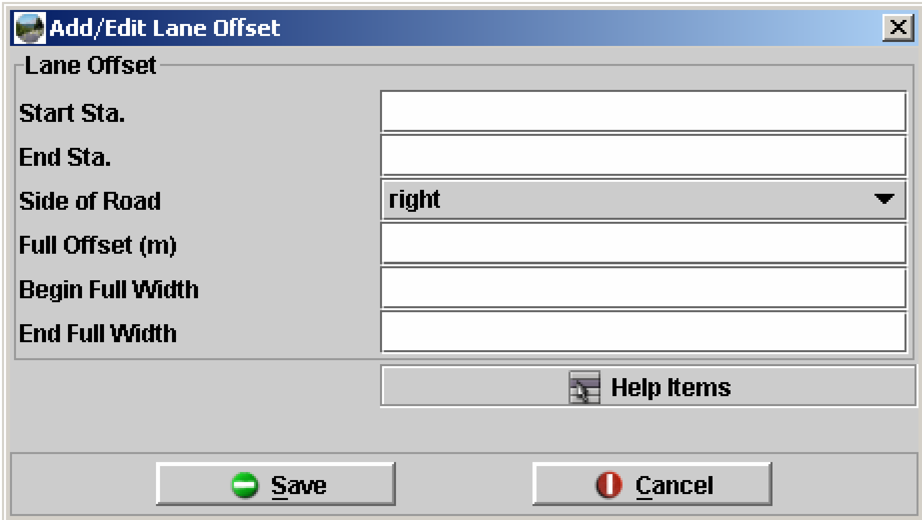
Fill in the proper information and pick Save. Start Sta. is the station that the widening for the climbing lane begins and Begin full width is the station at the end of the transition. The Check box is so IHSDM knows how the striping will be done through the climbing lane section. If there are multiple climbing lanes within the project, additional lines can be added by simply picking the Add button again.

Workflow 6: Offset (PRM, IRM)

1. *Click on the Lane>Offset tab of the Edit/View Highway Data dialog box to get the following dialog box:*



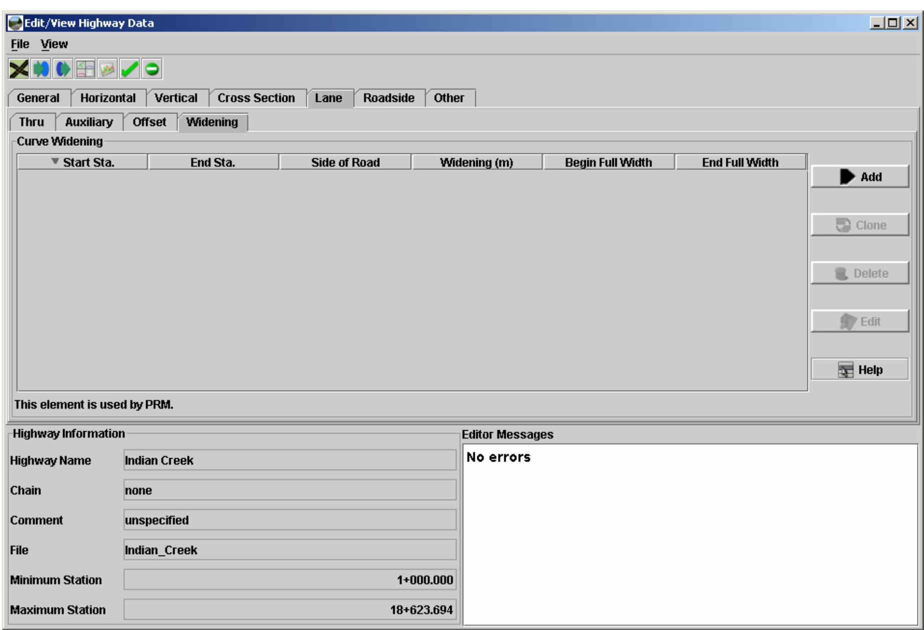
2. *Pick the Add button to get the following dialog box:*



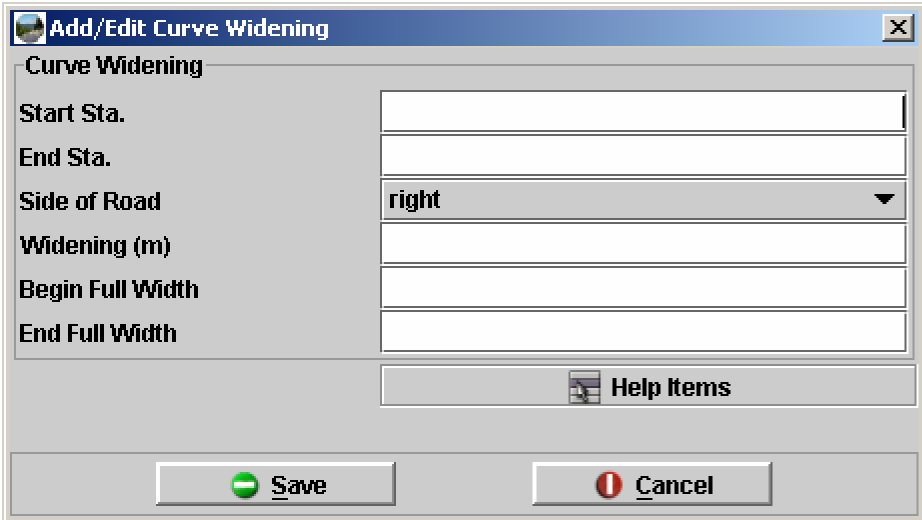
Fill in the proper information and pick Save. Start Sta. is the station that the offset from centerline begins and Begin full width is the station at the end of the transition. If the Offset changes within the project, additional lines can be added by simply picking the Add button again.

Workflow 7: Curve Widening (PRM)

1. *Click on the Lane>Widening Tabs of the Edit/View Highway Data dialog box to get the following dialog box:*



2. *Pick the Add button to get the following dialog box:*



3. *Fill in the proper information and pick Save. Start Sta. is the station that the Curve widening begins and Begin full width is the station is at the end of the transition. If there are multiple curve widenings within the project, additional lines can be added by simply picking the Add button again.*

This would be a situation where the user may want to use an Excel file if there are a large number of curves with curve widening.

Using an Excel file

The Excel file with the correct format for importing Lane Information into IHSDM is DEA.Lane.xls. This file can be found in:

N:\Standards\IHSDM\

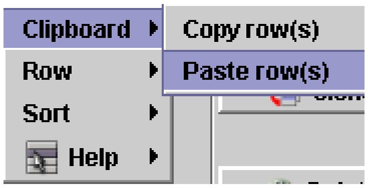
or on the CFLHD web site at the following link:

http://www.cflhd.gov/ihsdm.cfm

When you open this file, there is a read me worksheet along with 7 worksheets that will be used to input all the Lane information. Each worksheet will describe what each variable is and what it is used for. The following workflow will describe the process for entering this information into IHSDM.

Workflow 8: Excel Input

1. *Enter the correct data in the Excel spreadsheet.*
2. *Highlight the entered data and go to Edit>Copy.*
3. *Click on the General Tab of the Edit/View Highway Data dialog box.*
4. *Pick the corresponding tab for the data to be inserted.*
5. *Pick the Add button.*
6. *Put dummy information in the data fields. Pick the Save button. This creates a line in the Edit/View Highway Data dialog box. The user will delete this line after the correct information is imported.*
7. *With the mouse over the line just put in, right mouse click to get the following dialog box:*



8. *Choose Clipboard>Paste row(s). The information will be loaded into IHSDM.*
9. *Delete the line with the incorrect data.*

Notice that this procedure is most useful when there are more than a couple of lines of data.

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Chapter 6 Roadside Information Input

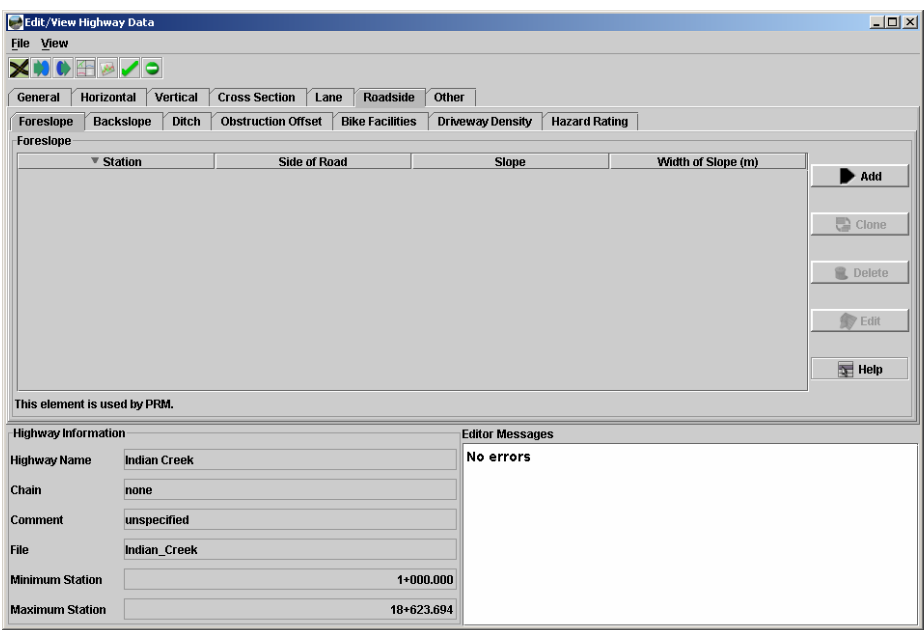
From the Roadside Information tab in the Edit/View Highway Data dialog box the following information may be input:

- Foreslopes
- Backslopes
- Ditches
- Obstruction locations
- Bike Facility locations
- Driveway Densities
- Hazard Ratings

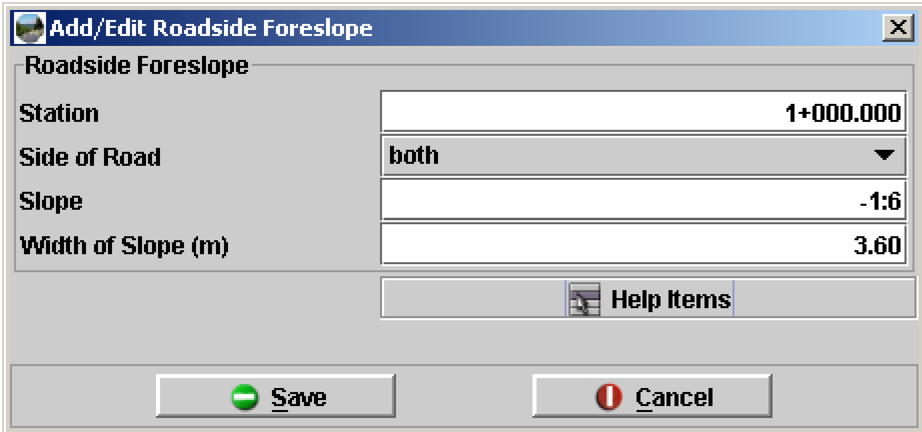
The following workflows will guide the user on how to input each set of data using IHSDM. The title of the workflow will also indicate the modules that use that data in parenthesis. Therefore, if the user does not want a certain module, he will not waste time importing data that is not needed.

Workflow 1: Foreslope Widths (PRM)

1. *Pick the Edit/View Highway Data button*  *while in the Main IHSDM Dialog box. This dialog box is shown in step 16 of* *workflow 2 in chapter 2*.
2. *Click on the Roadside>Foreslope tabs and the following dialog box will appear:*



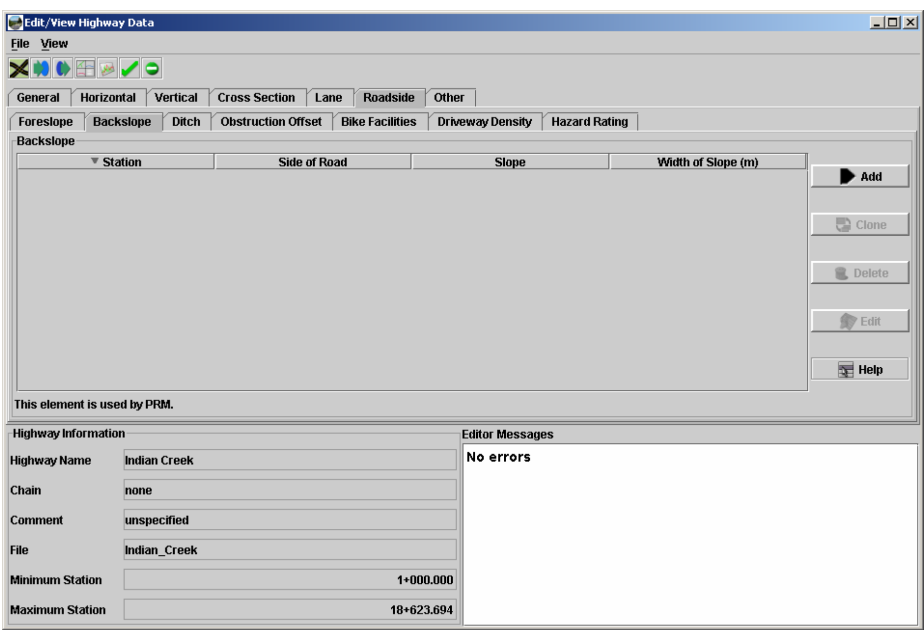
Pick the Add button at the right of the dialog box to get the following dialog box:



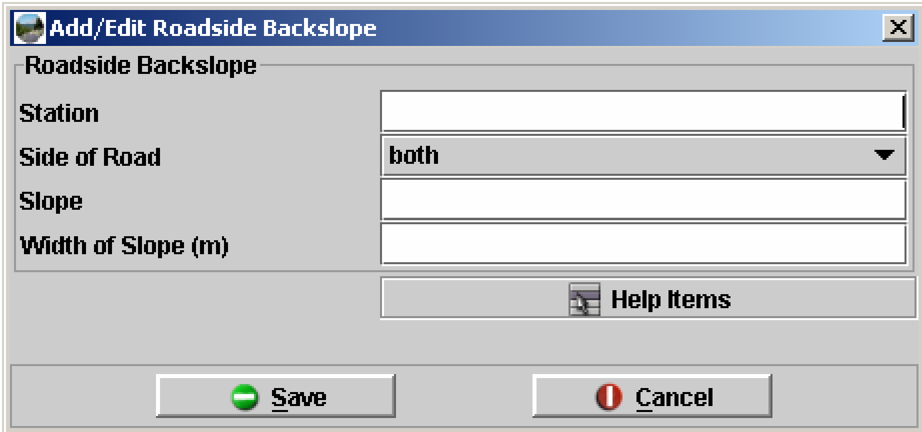
3. *Fill in the beginning station of the alignment, provide the correct foreslope information and pick Save.*
4. *Since IHSDM only allows one station in this dialog box, the user will have to pick Add again and fill in the end station of the constant foreslope. If the foreslope slope or width varies in the project, the user will need to repeat this process for each change in constant foreslope. IHSDM will straight line interpolate between stations where the foreslope changes.*

Workflow 2: Backslope Width (PRM, CPM)

1. *Click on the Roadside>Backslope Tabs of the Edit/View Highway Data dialog box to get the following dialog box:*



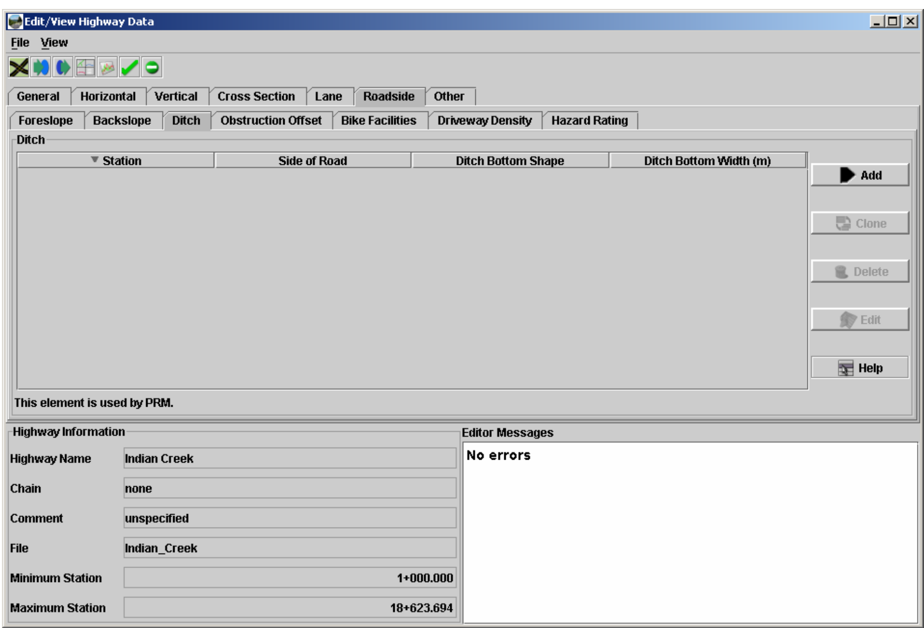
2. *Pick the Add button to get the following dialog box:*



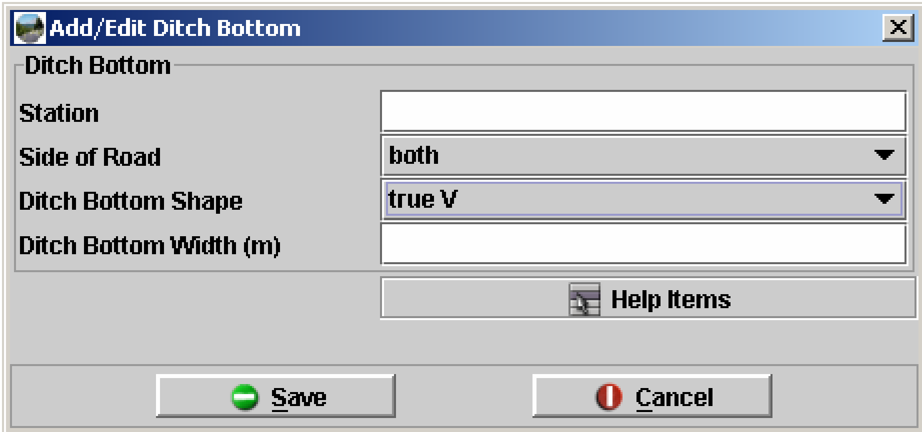
Fill in the proper information and pick Save. If the Backslopes change within the project, additional lines can be added by simply picking the Add button again.

Workflow 3: Ditch Shape (PRM)

1. *Click on the Roadside>Ditch Tabs of the Edit/View Highway Data dialog box to get the following dialog box:*



2. *Pick the Add button to get the following dialog box:*



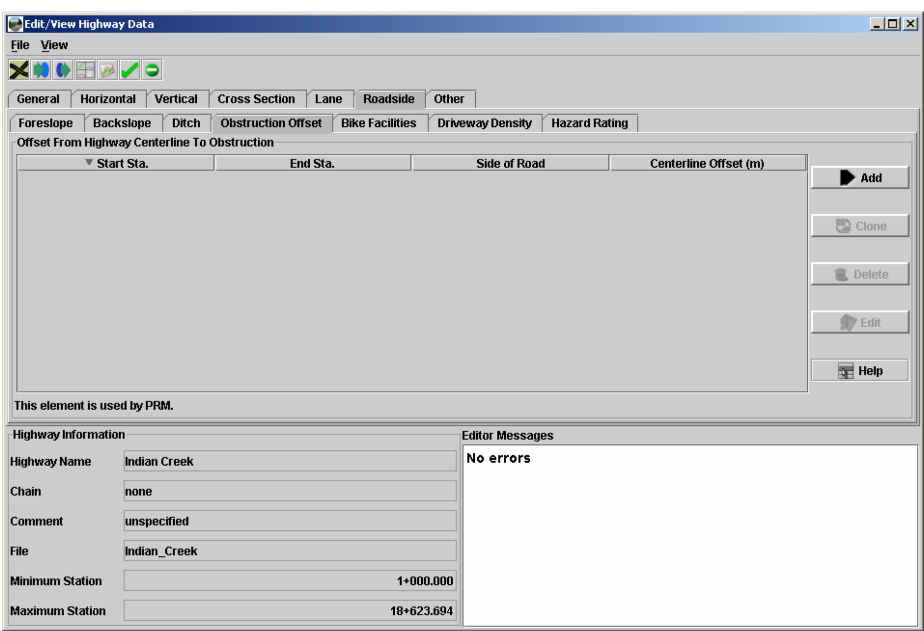
Fill in the proper information and pick Save. If there are multiple Ditch Sections within the project, additional lines can be added by simply picking the Add button again.

Obstruction Offset

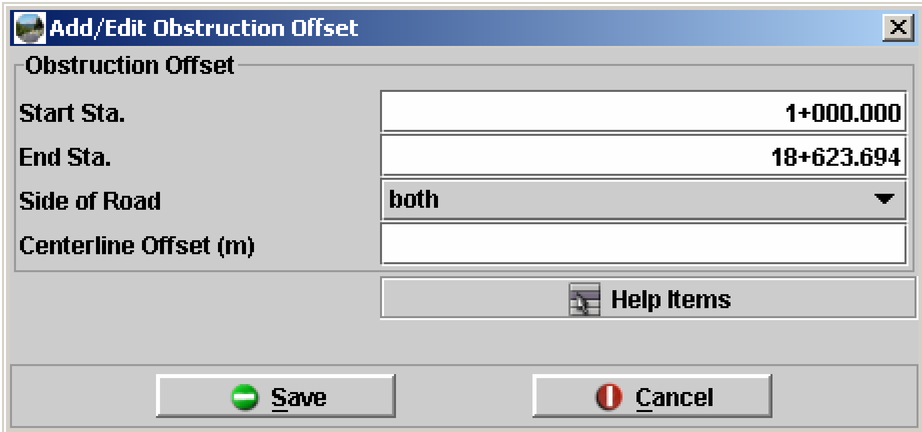
The Obstruction Offset dialog box is for any obstructions that may be in the line of sight for sight distance calculations. The offset is measured from centerline. If no Obstruction Offset is entered, IHSDM assumes a sight obstruction at the edge of shoulder (or edge of pavement if no shoulders are present).

Workflow 4: Obstruction Offset (PRM, TAM, CPM)

1. *Click on the Roadside>Obstruction Offset Tabs of the Edit/View Highway Data dialog box to get the following dialog box:*



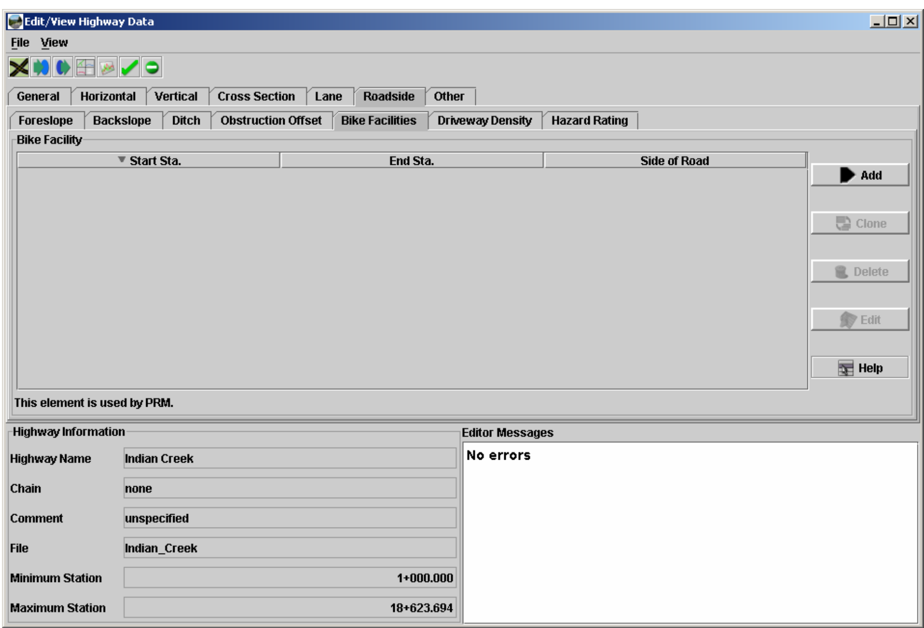
2. *Pick the Add button to get the following dialog box:*



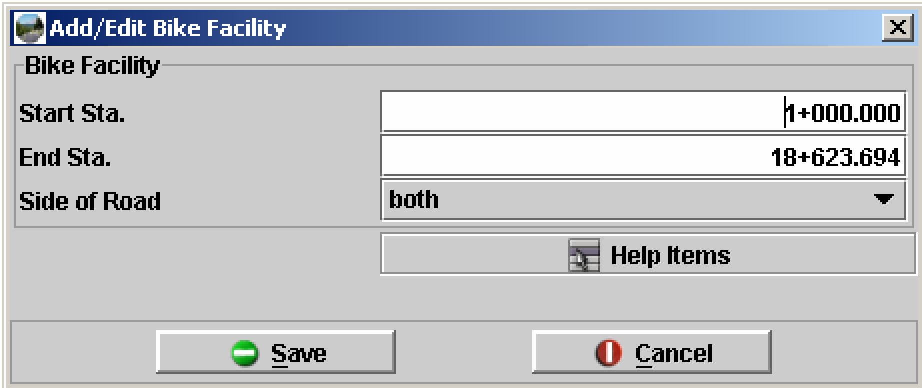
Fill in the proper information and pick Save. If there are multiple obstructions within the project, additional lines can be added by simply picking the Add button again.

Workflow 5: Bike Facilities Location (PRM)

1. *Click on the Roadside>Bike Facilities Tabs of the Edit/View Highway Data dialog box to get the following dialog box:*



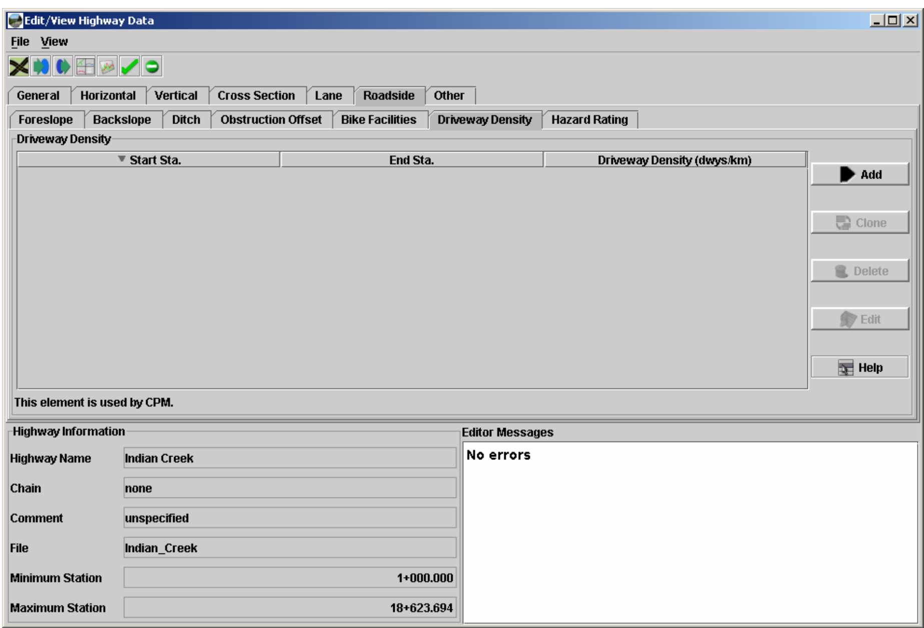
2. *Pick the Add button to get the following dialog box:*



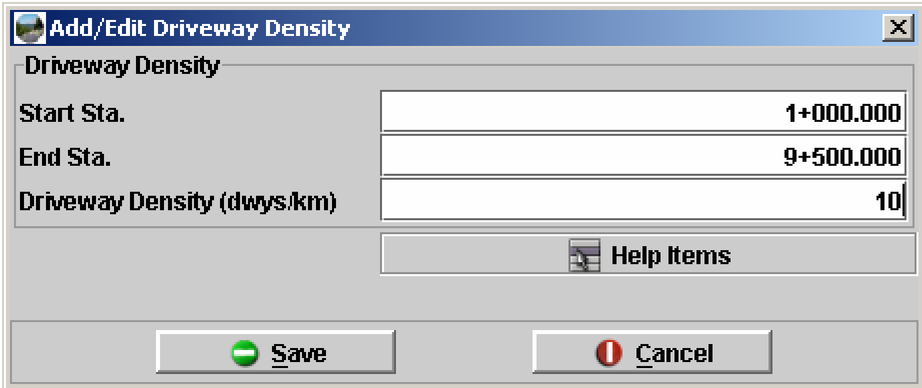
Fill in the proper information and pick Save. Notice that IHSDM defaulted to the beginning and ending station of the project. If there are multiple Bike Facilities within the project, additional lines can be added by simply picking the Add button again.

Workflow 6: Driveway Density (CPM)

1. *Click on the Roadside>Driveway Density tab of the Edit/View Highway Data dialog box to get the following dialog box:*



2. *Pick the Add button to get the following dialog box:*



Fill in the proper information and pick Save. If the Driveway Density varies within the project, additional lines can be added by simply picking the Add button again.

Roadside Hazard Rating

The Roadside Hazard Rating is used by the Crash Prediction Module to characterize the crash potential for roadside designs. The following list describes the 7 ratings:

Rating = 1

- Wide clear zones greater than or equal to 9 m (30 ft) from the pavement edgeline.
- Sideslope flatter than 1:4.
- Recoverable.

Rating = 2

- Clear zone between 6 and 7.5 m (20 and 25 ft) from pavement edgeline.
- Sideslope about 1:4.
- Recoverable.

Rating = 3

- Clear zone about 3 m (10 ft) from pavement edgeline.
- Sideslope about 1:3 or 1:4.
- Rough roadside surface.
- Marginally recoverable.

Rating = 4

- Clear zone between 1.5 and 3 m (5 to 10 ft) from pavement edgeline.
- Sideslope about 1:3 or 1:4.
- May have guardrail (1.5 to 2 m [5 to 6.5 ft] from pavement edgeline).
- May have exposed trees, poles, or other objects (about 3 m or 10 ft from pavement edgeline).
- Marginally forgiving, but increased chance of a reportable roadside collision.

Rating = 5

- Clear zone between 1.5 and 3 m (5 to 10 ft) from pavement edgeline.
- Sideslope about 1:3.
- May have guardrail (0 to 1.5 m [0 to 5 ft] from pavement edgeline).
- May have rigid obstacles or embankment within 2 to 3 m (6.5 to 10 ft) of pavement edgeline.
- Virtually non-recoverable.

Rating = 6

- Clear zone less than or equal to 1.5 m (5 ft).
- Sideslope about 1:2.
- No guardrail.
- Exposed rigid obstacles within 0 to 2 m (0 to 6.5 ft) of the pavement edgeline.
- Non-recoverable.

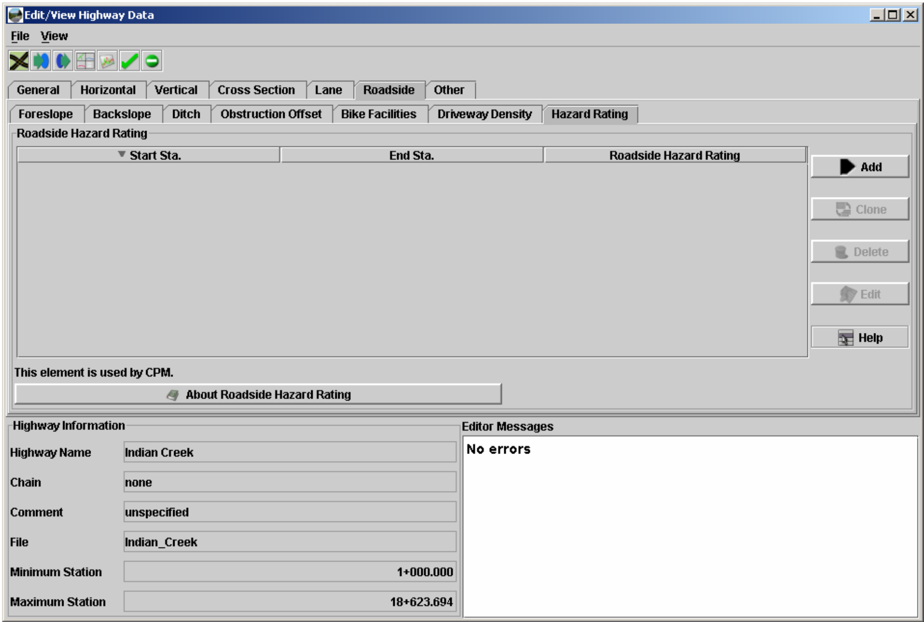
Rating = 7

- Clear zone less than or equal to 1.5 m (5 ft).
- Sideslope 1:2 or steeper.
- Cliff or vertical rock cut.
- No guardrail.
- Non-recoverable with high likelihood of severe injuries from roadside collision.

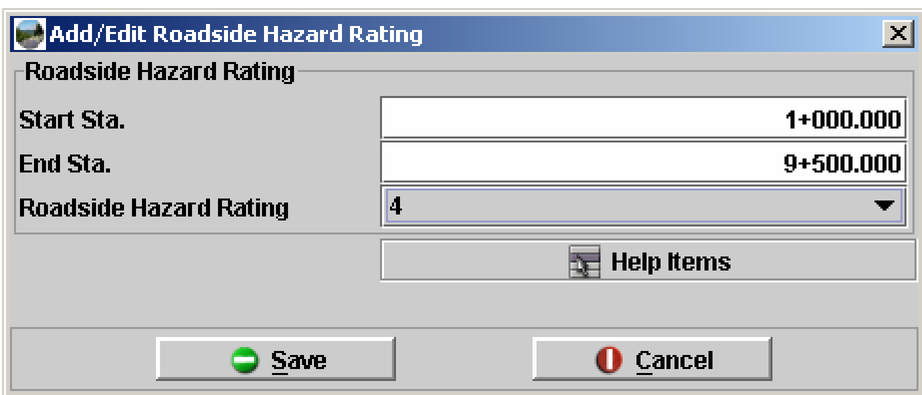
Refer to the Crash Prediction Module Engineer's Manual for a more detailed description or ratings (including photos).

Workflow 7: Roadside Hazard Rating (CPM)

1. *Click on the Roadside>Hazard Rating Tabs of the Edit/View Highway Data dialog box to get the following dialog box:*



2. Pick the Add button to get the following dialog box:



3. Fill in the proper information and pick Save. If there are multiple Roadside Hazard ratings within the project, additional lines can be added by simply picking the Add button again.

Using an Excel file

The Excel file with the correct format for importing Roadside Information into IHSDM is DEA.Roadside.xls. This file can be found in:

N:\Standards\IHSDM\

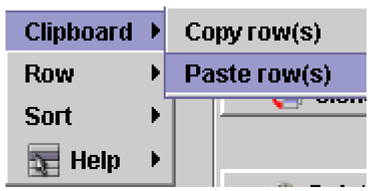
or on the CFLHD web site at the following link:

http://www.cflhd.gov/ihsdm.cfm

When you open this file, there is a read me worksheet and the 7 other worksheets that will be used to input all the roadside information. Each worksheet will describe what each variable is and what it is used for. The following workflow will describe the process for entering this information into IHSDM.

Workflow 8: Excel Input

1. *Enter the correct data in the Excel spreadsheet.*
2. *Highlight the entered data and go to Edit>Copy.*
3. *Click on the General Tab of the Edit/View Highway Data dialog box.*
4. *Pick the corresponding tab for the data to be inserted.*
5. *Pick the Add button.*
6. *Put dummy information in the data fields. Pick the Save button. This creates a line in the Edit/View Highway Data dialog box. The user will delete this line after the correct information is imported.*
7. *With the mouse over the line just put in, right mouse click to get the following dialog box:*



8. *Choose Clipboard>Paste row(s). The information will be loaded into IHSDM.*
9. *Delete the line with the incorrect data.*

Notice that this procedure is most useful when there are more than a couple of lines of data.

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Chapter 7 Other Information Input

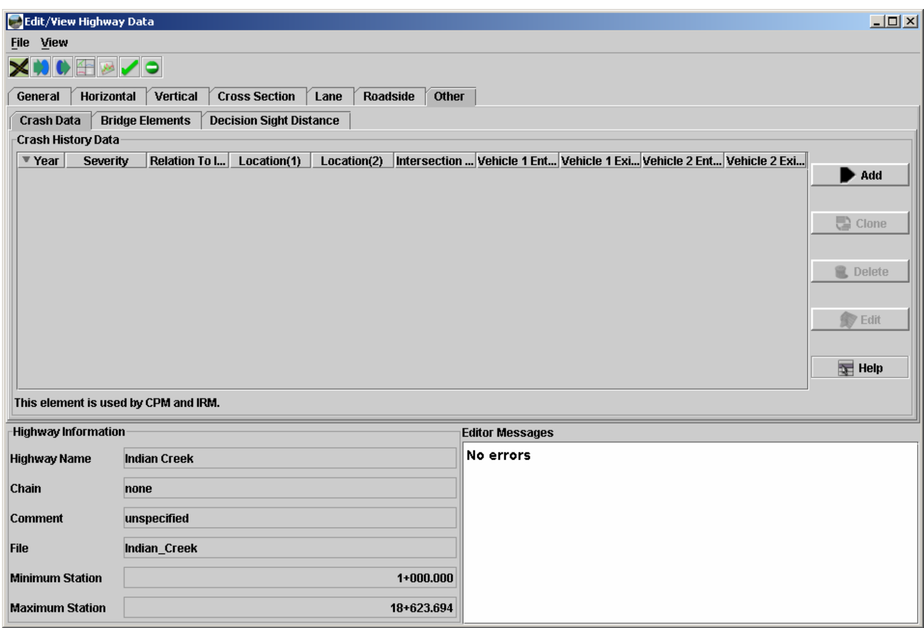
From the Other Information tab in the Edit/View Highway Data dialog box the following information may be input:

- Crash Data
- Bridge Elements
- Decision Sight Distance

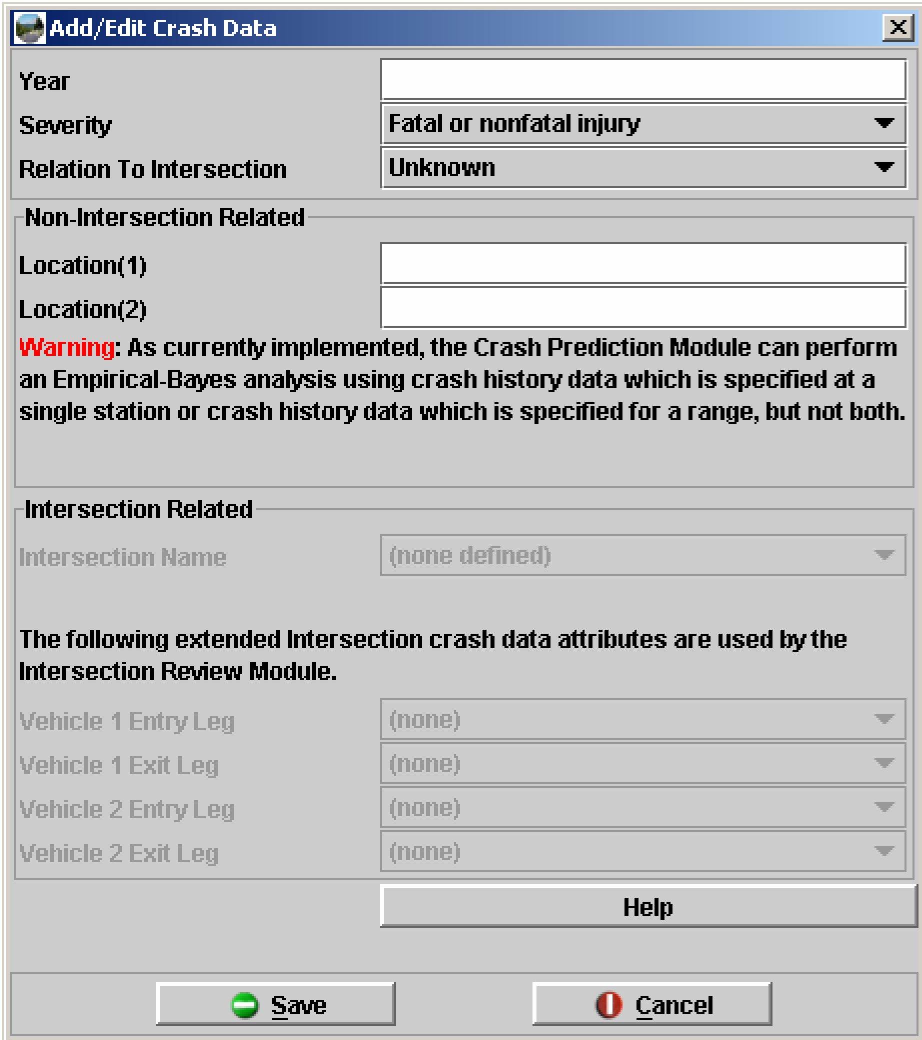
The following workflows will guide the user on how to input each set of data using IHSDM. The title of the workflow will also indicate the modules that use that data in parenthesis. Therefore, if the user does not want a certain module, they will not waste time importing data that is not needed.

Workflow 1: Crash Data (CPM, IRM)

1. *Pick the Edit/View Highway Data button*  *while in the Main IHSDM Dialog box. This dialog box is shown in step 16 of* *workflow 2 in chapter 2**.*
2. *Click on the Other>Crash Data tabs and the following dialog box will appear:*



Pick the Add button at the right of the dialog box to get the following dialog box:

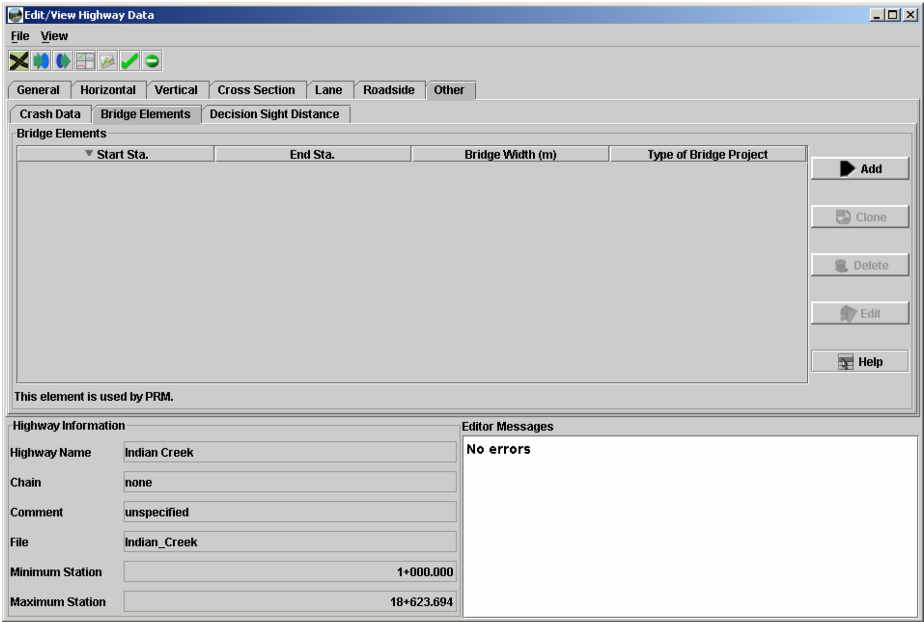


Fill in the proper information and pick Save. Notice the warning in the middle of the dialog box. All data needs to be within a station range or at single stations. Additional data can be added by simply picking the Add button again.

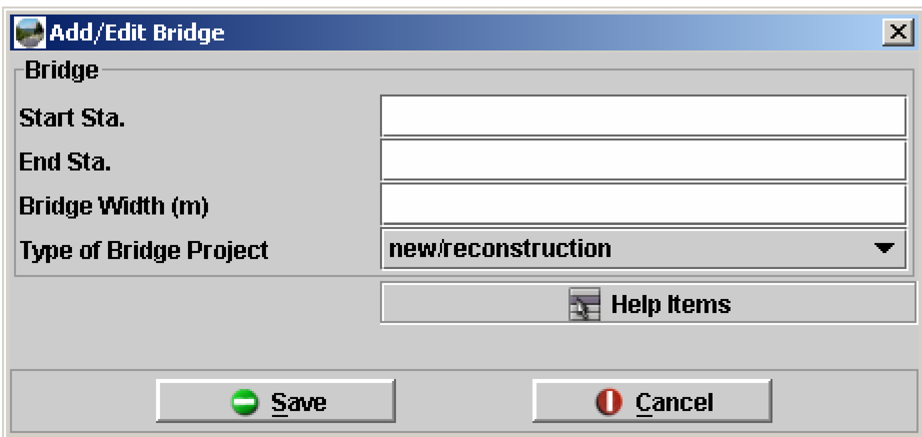
Since most projects have a large amount of accident data to import, it is recommended that the user uses the Excel method described in Workflow 4

Workflow 2: Bridge Elements (PRM)

1. *Click on the Other>Bridge Elements Tabs of the Edit/View Highway Data dialog box to get the following dialog box:*



Pick the Add button to get the following dialog box:



Fill in the proper information and pick Save. If there are additional Bridges within the project, additional lines can be added by simply picking the Add button again.

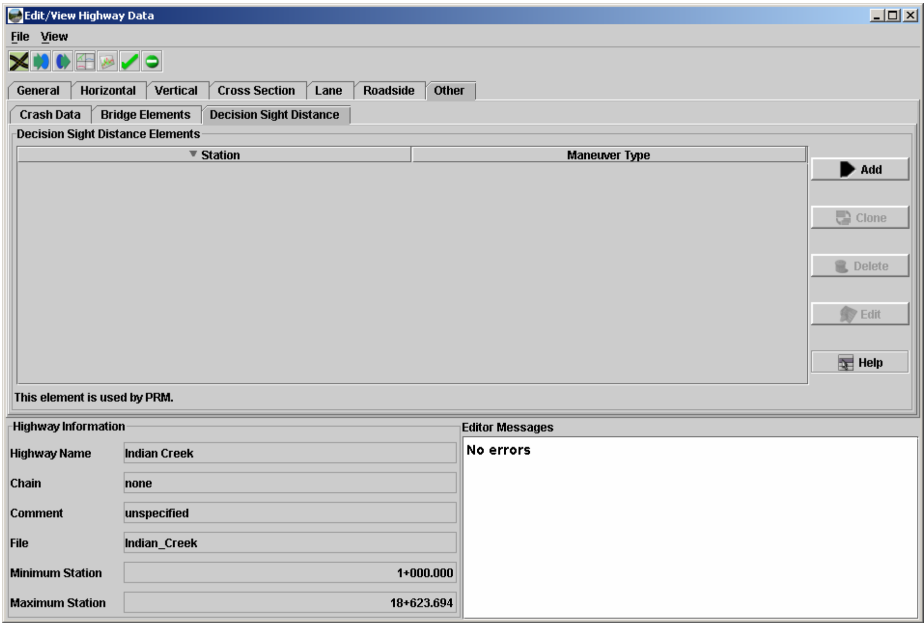
Decision Sight Distance

This tab allows the user to input locations where a stop or speed/path/direction change maneuver must be completed. The avoidance maneuver type a driver has to perform are described as follows:

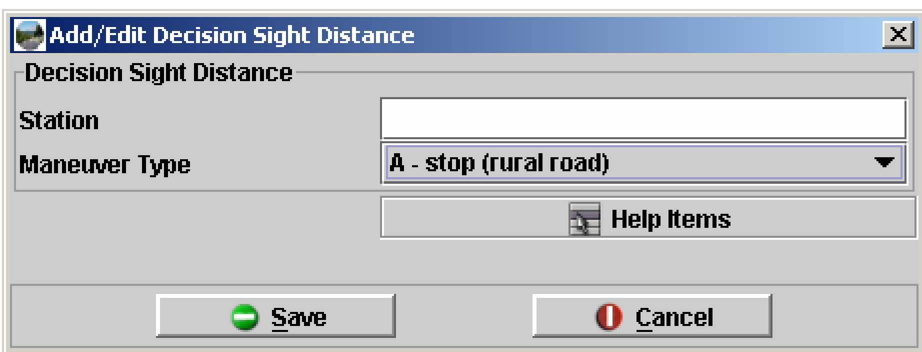
- A - stop on rural road
- B – Stop on urban road (Not Supported)
- C - speed/path/direction change on rural road
- D – Speed/path/direction change on suburban road (Not Supported)
- E – Speed/path/direction change on urban road (Not Supported)

Workflow 3: Decision Sight Distance (PRM)

1. *Click on the Other>Decision Sight Distance Tabs of the Edit/View Highway Data dialog box to get the following dialog box:*



2. *Pick the Add button to get the following dialog box:*



Fill in the proper information and pick Save. If there are multiple locations within the project, additional lines can be added by simply picking the Add button again.

Using an Excel file

The Excel file with the correct format for importing Other Information into IHSDM is DEA.Other.xls. This file can be found in:

N:\Standards\IHSDM\

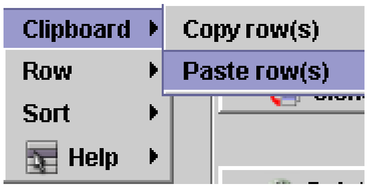
or on the CFLHD web site at the following link:

http://www.cflhd.gov/ihsdm.cfm

When you open this file, there is a read me worksheet and the 3 other worksheets that will be used to input all the other information. Each worksheet will describe what each variable is and what it is used for. The following workflow will describe the process for entering this information into IHSDM.

Workflow 4: Excel Input

1. *Enter the correct data in the Excel spreadsheet.*
2. *Highlight the entered data and go to Edit>Copy.*
3. *Click on the General Tab of the Edit/View Highway Data dialog box.*
4. *Pick the corresponding tab for the data to be inserted.*
5. *Pick the Add button.*
6. *Put dummy information in the data fields. Pick the Save button. This creates a line in the Edit/View Highway Data dialog box. The user will delete this line after the correct information is imported.*
7. *With the mouse over the line just put in, right mouse click to get the following dialog box:*



8. *Choose Clipboard>Paste row(s). The information will be loaded into IHSDM.*
9. *Delete the line with the incorrect data.*

Notice that this procedure is most useful when there are more than a couple of lines of data.

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Chapter 8 Cross Roads Input

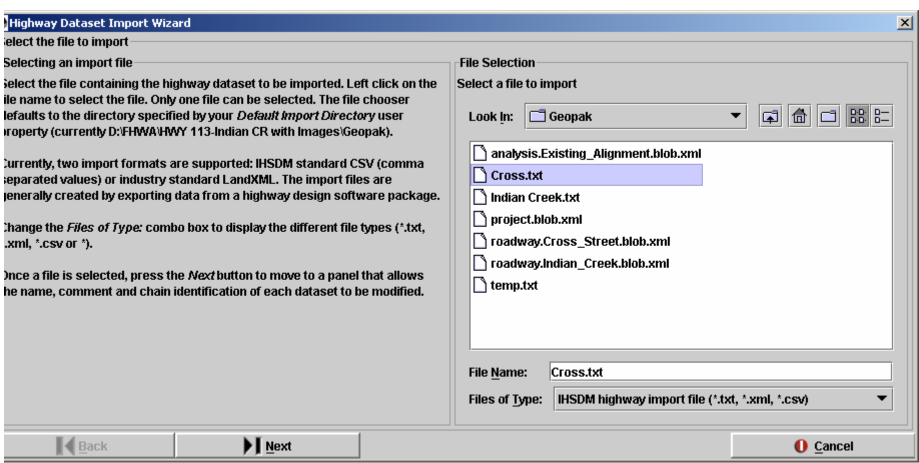
When a road crosses the mainline, the user will need to include that information into IHSDM for the CPM and IRM modules. This chapter will discuss the process for entering the cross road and for creating an intersection in IHSDM.

Adding a Cross Road into IHSDM

The following workflow will guide the user in the process of adding a cross Road:

Workflow 1: Entering a Cross Road

1. *Create an input file of the cross road using the G2IHSDM.ma macro as described in [Workflow 2 of Chapter 2](#).*
2. *Start IHSDM. In the Select a Project dialog box highlight the mainline project and pick next.*
3. *In the Select an Analysis Dialog box, highlight the appropriate analysis and pick next.*
4. *In the select a Master Highway dialog box select Import to get the following dialog box:*

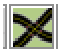


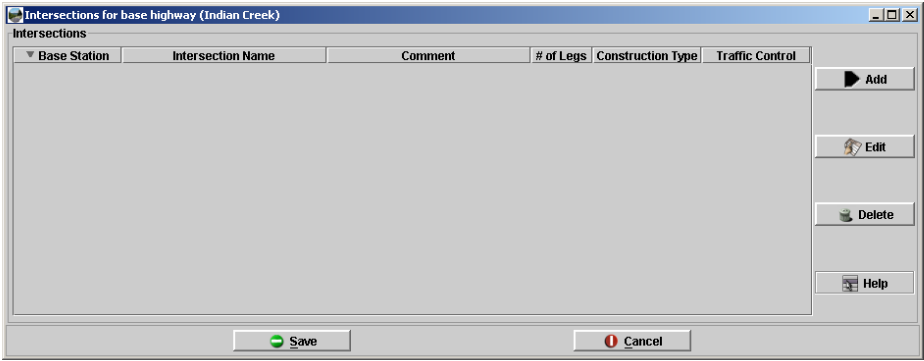
5. *Browse for the .txt file created with G2IHSDM.ma and highlight it. Pick next.*
6. *In the Select a Master Highway dialog box, highlight the new alignment and pick Finish.*
7. *Follow chapters 3 through 7 for the input of needed IHSDM data.*

Creating an Intersection

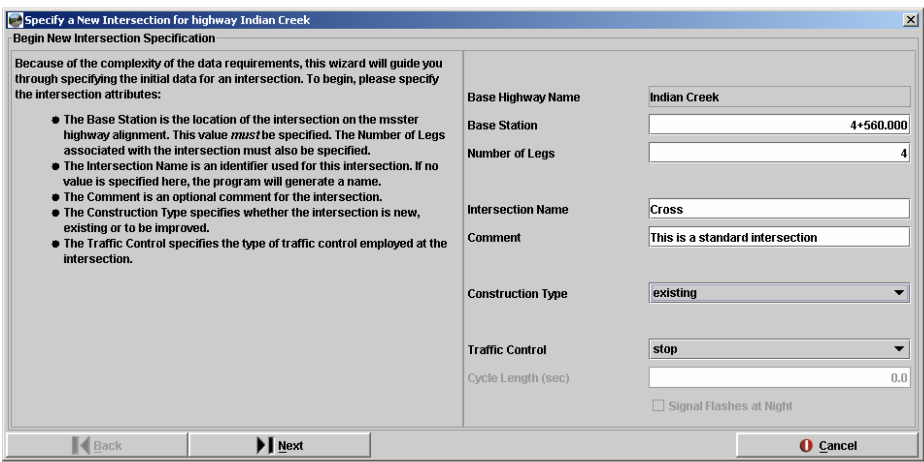
Once the cross road alignment is input, an intersection can be created in IHSDM. The following workflow will discuss the process:

Workflow 2: Adding an Intersection into IHSDM

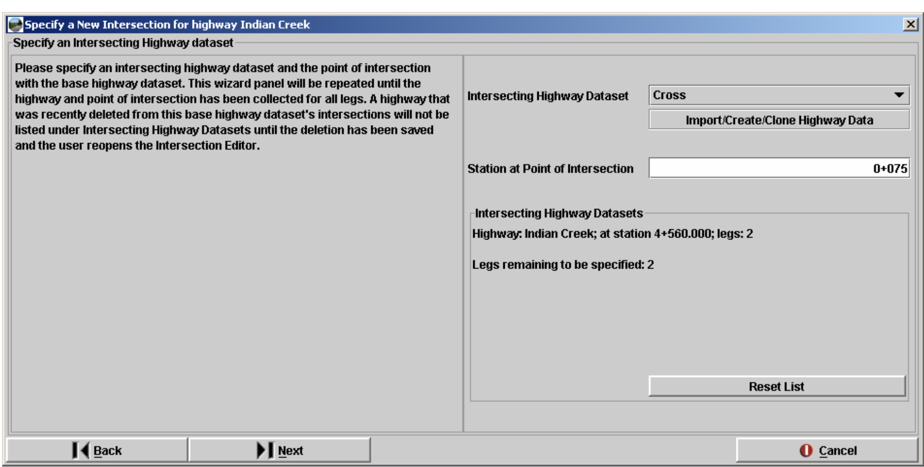
1. *From the IHSDM main dialog box, pick the Intersection button*  *to get the following:*



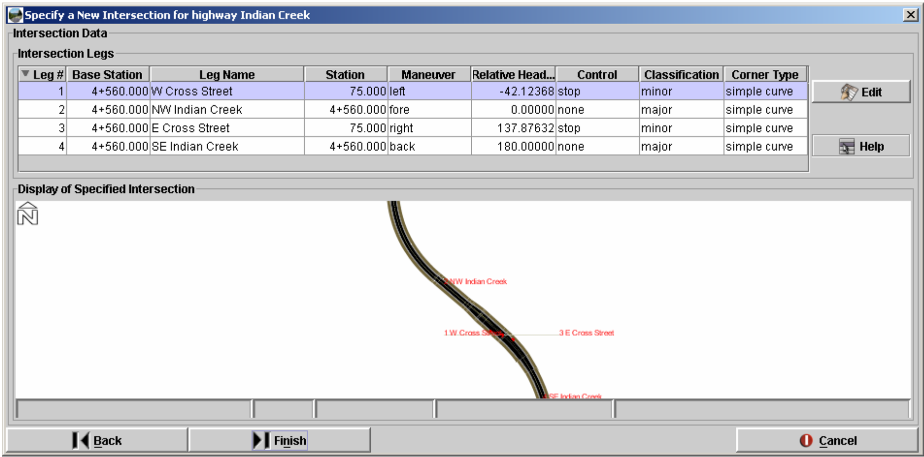
2. *Pick the add button to get the following dialog box:*



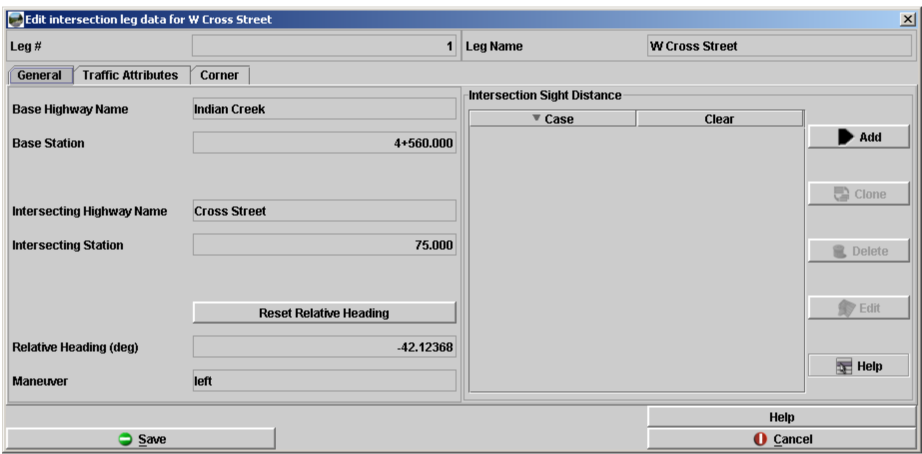
3. *Fill in the data fields as necessary. Once the fields are correct, press Next to get the following dialog box:*



4. *Select the intersecting road and the station on the cross road that the intersection is on, then press next for the following dialog box:*



5. *Review information in the top of the dialog box. Highlight each leg and press Edit. The following dialog box will appear:*



6. *Review each of the tabs; General, Traffic Attributes, and Corner to verify that all of the information is correct. Then pick Save.*
7. *Pick Finish.*
8. *Pick Save in the intersection dialog box.*

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Chapter 9 IHSDM Analysis Introduction

Chapters 3 through 8 discuss how to input data into IHSDM. Chapters 10 through 12 will discuss the process of running each module for each type of project (3R, 4R, reconstruction, and new construction). This chapter will discuss which module to run, at what point in each design to run the module, and the information the project manager or designer can expect from the module.

This chapter will be broken into the different types of projects from 3R to New Construction. Each section will be further broken into the stages of design from conceptual to final design. This will allow the user quick access to the different analyses that they need to run. This will also allow the user to determine exactly what information they have to input into IHSDM.

3R Projects

Conceptual Design

In 3R projects the conceptual design stage has very limited information and IHSDM will not be a valuable tool to help the designer. Generally the information that is used is more from observing the site and reading any available reports on the project.

Preliminary Design

Once the designer is in the preliminary phase of a 3R project there probably is an alignment along the existing centerline, average pavement and shoulder widths are calculated, and existing Cross slopes are measured. Any traffic counts and available accident data will also be acquired by this stage. IHSDM will be helpful in the designer's determination if there are any areas in the project that do not meet the existing policies. Therefore, the following modules should be run on the existing alignment:

- Policy Review
- Design Consistency
- Traffic analysis
- Intersection Review

The following data will be used to run the modules:

- Horizontal alignment (Chapter 2)
- Vertical Alignment (if available) (Chapter 2)
- Cross slope data (if available) (Chapter 2)
- Lane Widths (Chapter 5)
- Shoulder Widths and Slopes (Chapter 4)
- Accident History (if available) (Chapter 7)
- Traffic counts (if available) (Chapter 3)
- Terrain (Chapter 3)
- Design\Posted Speeds (Chapter 3)
- Functional Classification (Chapter 3)

- Pavement Type (Chapter 4)
- Surface Type (Chapter 4)
- Bridge Location (Chapter 7)

Final Design

Once the project gets into final design the deficient locations will have been located and the decision will have been made to either mitigate the problem or proceed with a variance. If there were enough locations that required shoulder widening or slight alignment changes, the Project Manager may decide to rerun the Policy Review module. In that case, the designer will have to update the following information:

- Horizontal alignment (Chapter 2)
- Vertical Alignment (if available) (Chapter 2)
- Cross slope data (if available) (Chapter 2)
- Lane Widths (Chapter 5)
- Shoulder Widths and Slopes (Chapter 4)

4R and Minor Reconstruction Projects

Conceptual Design

In 4R projects the conceptual design stage is used to determine where there is need for realignment, widening, or overlay. Therefore, the following modules should be run on the existing alignment:

- Policy Review
- Design Consistency
- Traffic analysis
- Intersection Review

To do the analysis, the designer will have to input the following data for the existing alignment:

- Horizontal alignment (Chapter 2)
- Vertical Alignment (Chapter 2)
- Cross slope data (Chapter 2)
- Lane Widths (Chapter 5)
- Shoulder Widths and Slopes (Chapter 4)
- Accident History (Chapter 7)
- Traffic counts (Chapter 3)
- Terrain (Chapter 3)
- Design\Posted Speeds (Chapter 3)
- Functional Classification (Chapter 3)
- Pavement Type (Chapter 4)
- Surface Type (Chapter 4)
- Bridge Location (Chapter 7)

Preliminary Design

Once the designer sets an alternative alignment, the design consistency and policy review modules should be run.

The design consistency module is a quick and simple run that requires the following information:

- Design Speed (Chapter 3)
- Horizontal Alignment (Chapter 2)
- Vertical Alignment (Chapter 2)

The policy review module should be run to determine that all of the elements of the typical section meet policy. Although it may take some effort to input all of the following necessary information the first time, most of this information can be carried into subsequent runs:

- Cross slope data (Chapter 2)
- Lane Widths (Chapter 5)
- Shoulder Widths and Slopes (Chapter 4)
- Traffic counts (Chapter 3)
- Terrain (Chapter 3)
- Design Speeds (Chapter 3)
- Functional Classification (Chapter 3)
- Pavement Type (Chapter 4)
- Surface Type (Chapter 4)
- Bridge Location (Chapter 7)
- Auxilliary/Passing lane information (Chapter 5)
- Turn lane information (Chapter 5)

Final Design

Once a preferred alignment is established, the designer will need to run the following modules:

- Policy Review
- Crash Prediction
- Traffic Analysis
- Intersection Review

The design consistency and most of the policy review checks from the preliminary design stage should still be valid. But the project manager and designer will need to look at locations that may have sight distance problems and input the obstruction offset information for long enough stretches to do a policy review check on sight distance. The following information is needed in addition to the information already input for each alignment:

- Obstruction Offset (Chapter 6)
- Roadway Width (Chapter 5)

Major Reconstruction and New Construction Projects

The same process can be used for both reconstruction and new construction projects because the design will not be based on an existing alignment in either case.

Conceptual Design

During the conceptual design phase there will more than likely be multiple alternatives. The designer will not have time to run a full policy review analysis on each alignment. The designer will be able to quickly check the horizontal and vertical alignment, Cross slope calculations, and lane and shoulder widths against the policy. To do this the designer will need to input the following information:

- Horizontal alignment (Chapter 2)
- Vertical Alignment (Chapter 2)
- Cross slope data (Chapter 2)
- Design Speed (Chapter 3)
- Lane Widths (Chapter 5)
- Shoulder Widths and Slopes (Chapter 4)

Preliminary Design

Once the conceptual design is complete, the number of alternative alignments will be pared down to two or three alignments and a more thorough policy review and design consistency review can be completed. The following data will need to be added into IHSDM to run the required modules:

- Accident History (Reconstruction) (Chapter 7)
- Traffic counts (Chapter 3)
- Terrain (Chapter 3)
- Design\Posted Speeds (Chapter 3)
- Functional Classification (Chapter 3)
- Pavement Type (Chapter 4)
- Surface Type (Chapter 4)
- Bridge Location (Chapter 7)
- Auxilliary/Passing lane information (Chapter 5)
- Turn lane information (Chapter 5)

Final Design

Once a preferred alignment is established, the designer will need to run the following modules:

- Policy Review
- Crash Prediction
- Traffic Analysis
- Intersection Review

The design consistency and most of the policy review checks from the preliminary design stage should still be valid. But the project manager and designer will need to look at locations that may have sight distance problems and input the obstruction offset information for long enough stretches to do a policy review check on sight distance. The following information is needed in addition to the information already input for each alignment:

- Obstruction Offset (Chapter 6)
- Roadway Width (Chapter 5)

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Chapter 10 3R Projects

This chapter will discuss the different modules that will be run during a 3R project. The workflows will describe how to tell IHSDM which reports to run and how to read the reports.

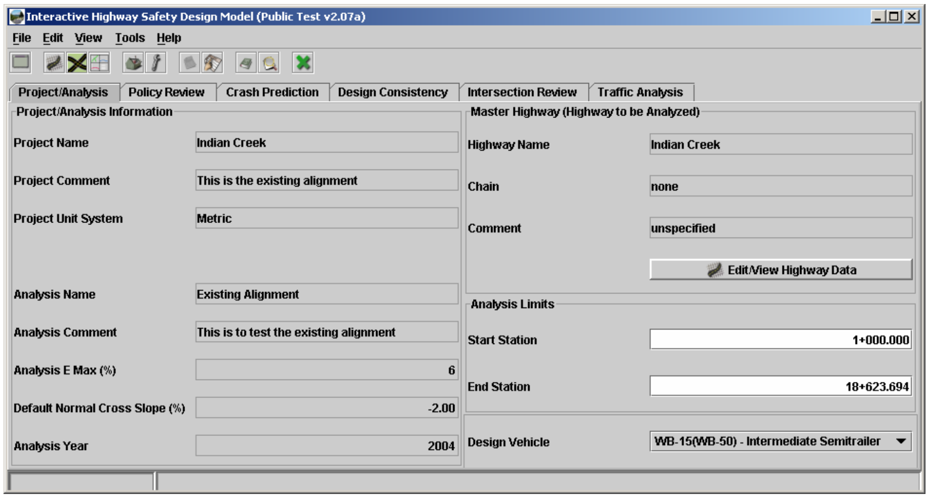
As stated in chapter 8 there is no need to run IHSDM for the conceptual design stage, so this chapter will begin with the preliminary design stage.

Preliminary Design

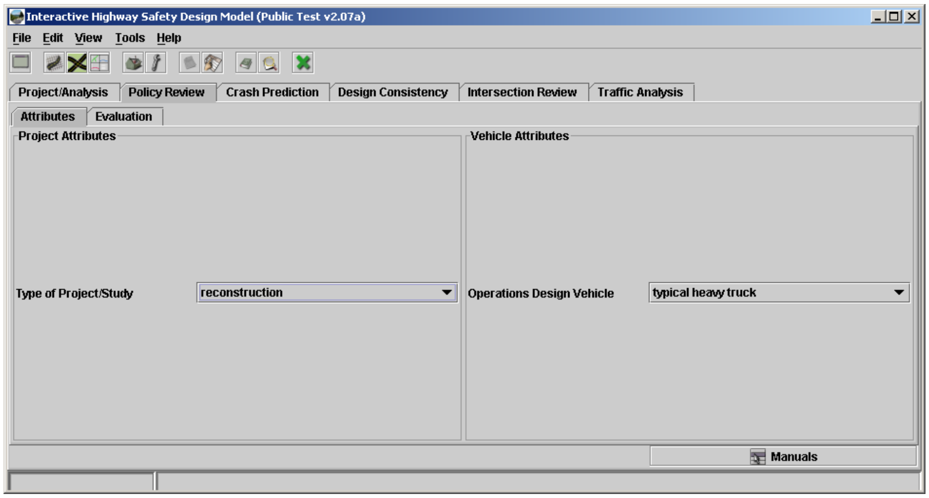
The following workflow will describe all of the possible reports for this stage of a 3R project. Some data may not be available for all projects, such as Vertical Alignment and Superelevation. The purpose of this workflow is to guide the user on creating as many reports as possible.

Workflow 1: Policy Review for 3R Preliminary Design

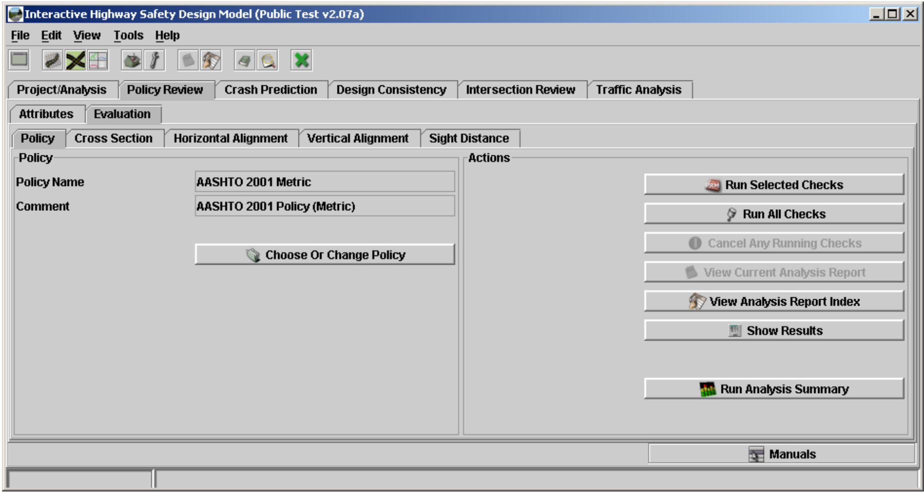
1. *Access the IHSDM main dialog box which look like this:*



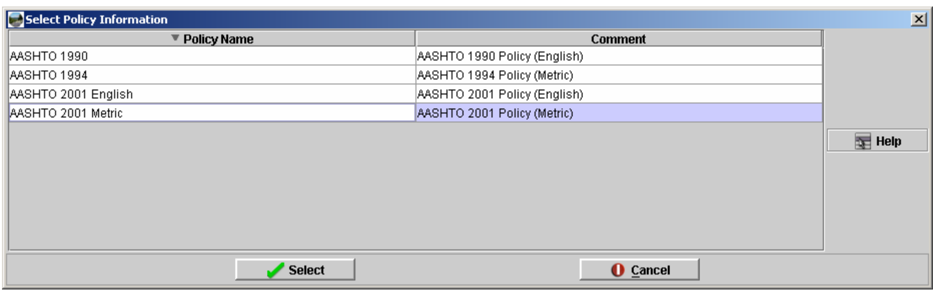
2. *Click on the Policy Review tab to get the following dialog box:*



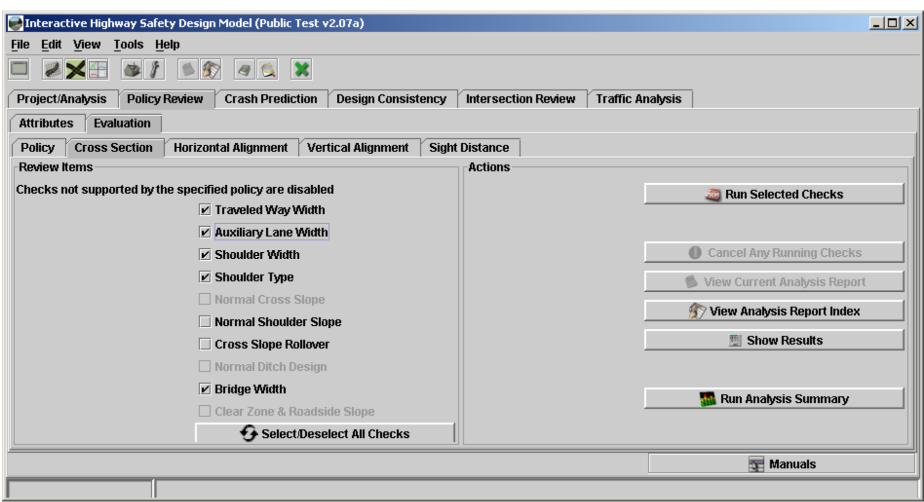
3. *Click on the Evaluation tab to get the following dialog box:*



4. *Make sure the correct policy is referenced. If it is not click on the Choose or Change Policy button to get the following dialog box:*

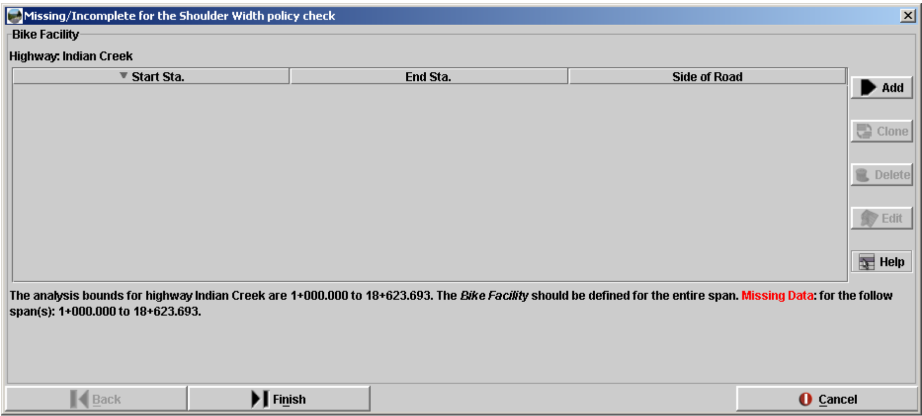


5. *Highlight the correct policy and choose select.*
6. *Pick the cross section tab to get the following dialog box:*



7. *Pick the items to check the design policy against. The designer should have the traveled way width, any auxillary lane widths, average shoulder width, shoulder type, and any bridge widths at a minimum for this type of project. If the designer has superelevation data, he will be able to run the normal shoulder slope and cross slope rollover checks.*

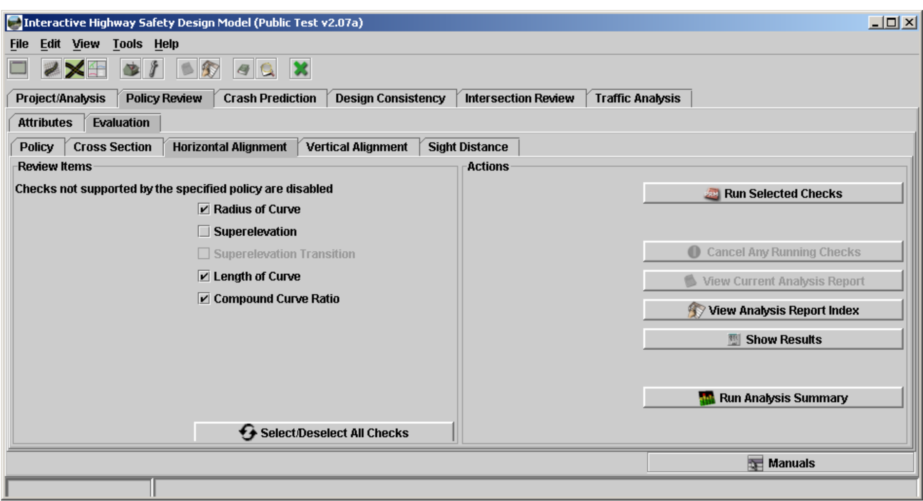
8. *Pick the Run Selected Checks button. IHSDM will start running and will indicate its progress in the lower left portion of the dialog box with a blue rectangle. Depending on the length of the project, the IHSDM calculations could take a couple of minutes.*
9. *If the following dialog box appears during the run, IHSDM is looking for some data to check an analysis. The user can either enter the data or choose finish and IHSDM will ignore that data in its analysis.*



10. *Once IHSDM has completed its analysis, pick the View Current Analysis Report [(Chapter 13)](). IHSDM will launch the web browser to view the report.*

The user can wait to view all the reports at once by selecting the Run All Selected PRM Checks button under the Policy tab.

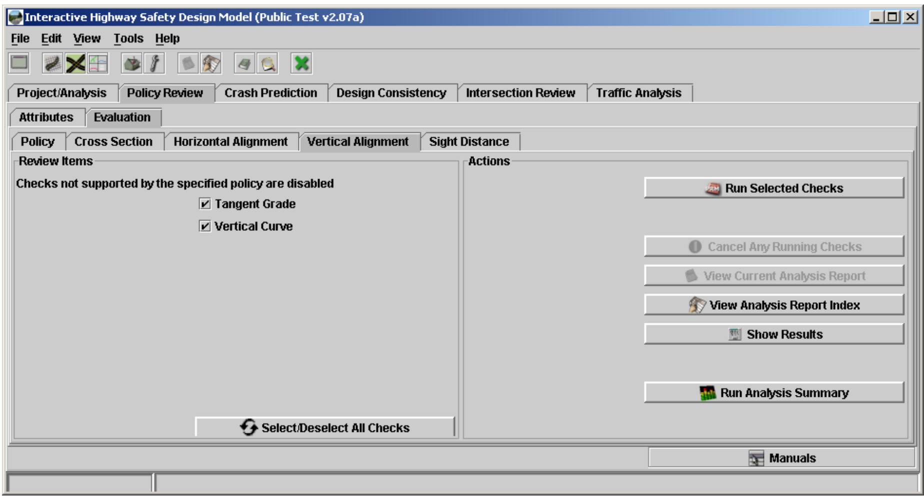
11. *Go back to the IHSDM main dialog box.*
12. *Pick the Horizontal Alignment tab:*



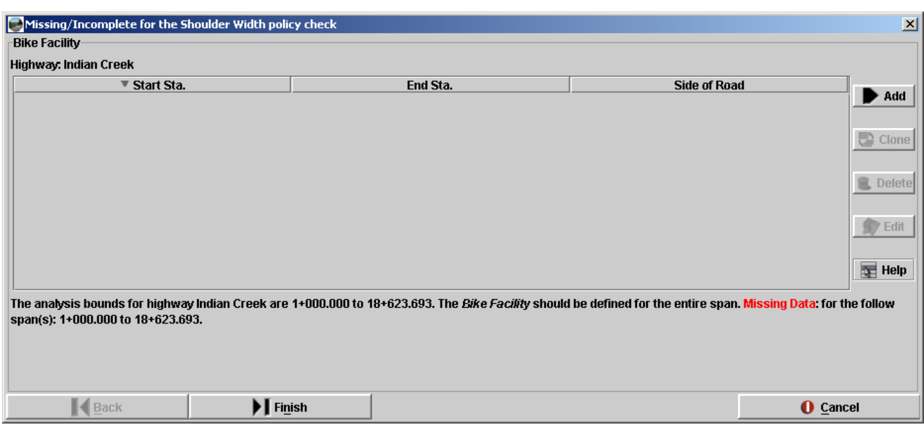
13. *At a minimum, the designer should check the Radius of Curve, Length of Curve, and Compound Curve Ratio. If the designer has*

the Superelevation information, the Superelevation button should be checked.

14. *Pick Run Selected Checks*
15. *After IHSDM is complete, pick the View Current Analysis Report button [(Chapter 13)](). Notice that IHSDM appended the new report to the previous report.*
16. *Pick the Vertical Alignment tab to get the following dialog box:*



17. *If the designer has vertical information, both buttons should be checked.*
18. *Pick the Run Selected Checks button.*
19. *If the following dialog box appears during the run, IHSDM is looking for some data to check an analysis. The user can either enter the data or choose finish and IHSDM will ignore that data in its analysis.*

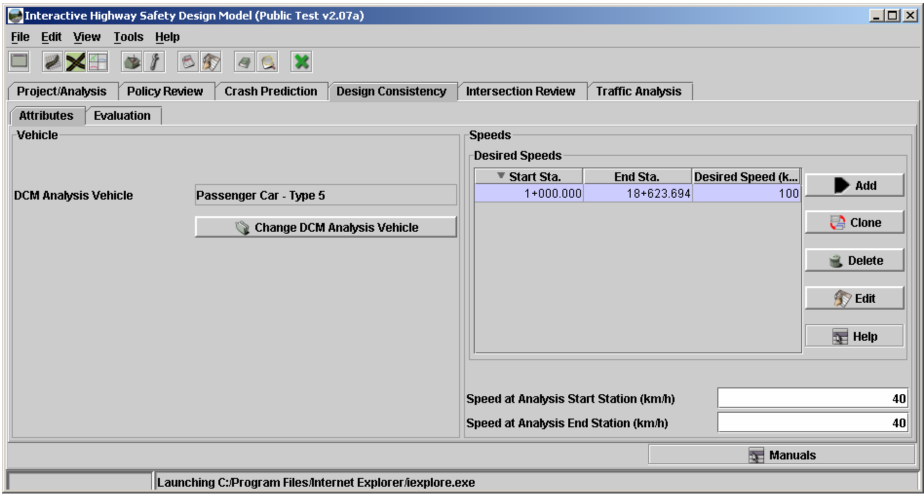


20. *Pick the View Current Analysis Report button [(Chapter 13)]().*
21. *Print the report for review.*

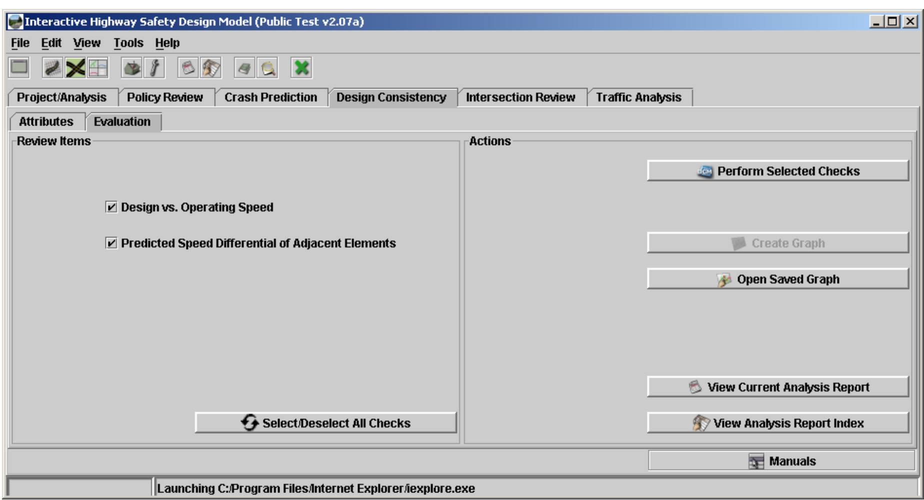
These reports will indicate possible deficient areas along the alignment that the project manager and designer may want to address further.

Workflow 2: Design Consistency Review for 3R PD

1. *From the IHSDM main dialog box, pick the Design Consistency Tab to get the following:*



2. *Make sure the DCM Analysis Vehicle, Desired Speed, and Speed at Analysis Start/End Stations are correct and pick the Evaluation Tab to get the following dialog box:*



3. *The user should be able to check both buttons and pick Perform Selected Checks.*

4. *Pick View Current Analysis Report to open a web browser and view the report.*

Final Design

Once the final design is completed the designer can update IHSDM based on the changes made and rerun workflows 1 and 2 to verify that the final design has corrected the deficiencies it was meant to.

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Chapter 11 4R & Minor Reconstruction Projects

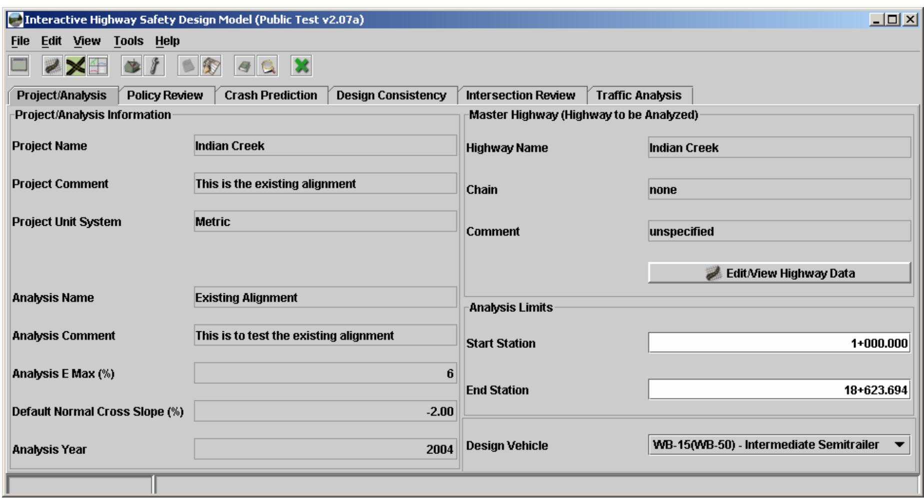
This chapter will discuss the different modules that will be run during 4R and minor reconstruction projects. The workflows will describe how to tell IHSDM which reports to run.

Conceptual Design

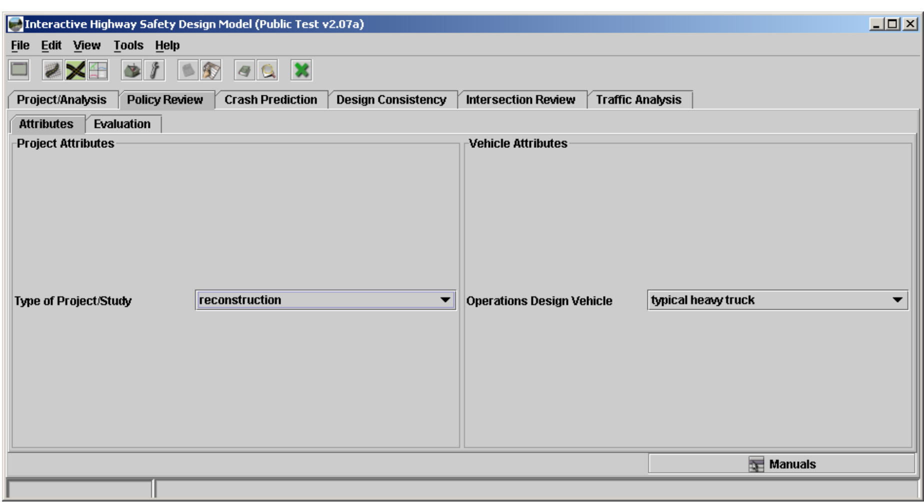
The following workflows will describe all of the possible reports for this stage of a 4R project. Some data may not be available for all projects, such as Vertical Alignment and Superelevation. The purpose of this workflow is to guide the user on using as many reports as possible. The user should use as-builts as much possible while entering data into IHSDM.

Workflow 1: Policy Review for 4R Conceptual Design

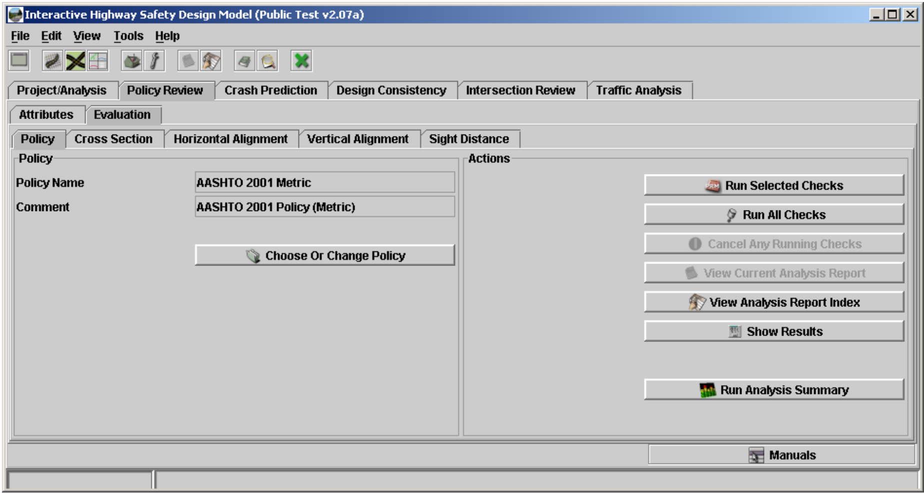
1. *Access the IHSDM main dialog box which look like this:*



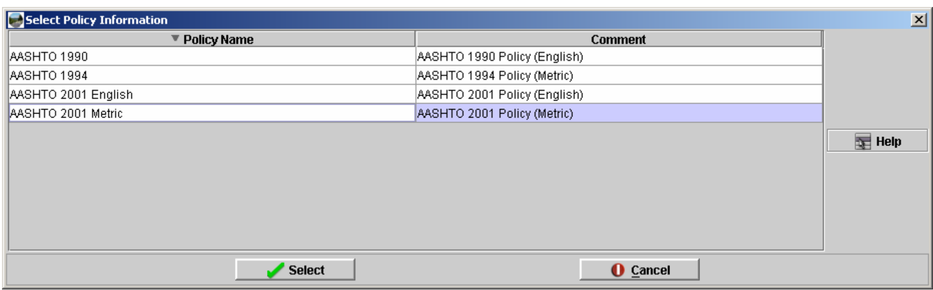
2. *Click on the Policy Review tab to get the following dialog box:*



3. *Click on the Evaluation tab to get the following dialog box:*

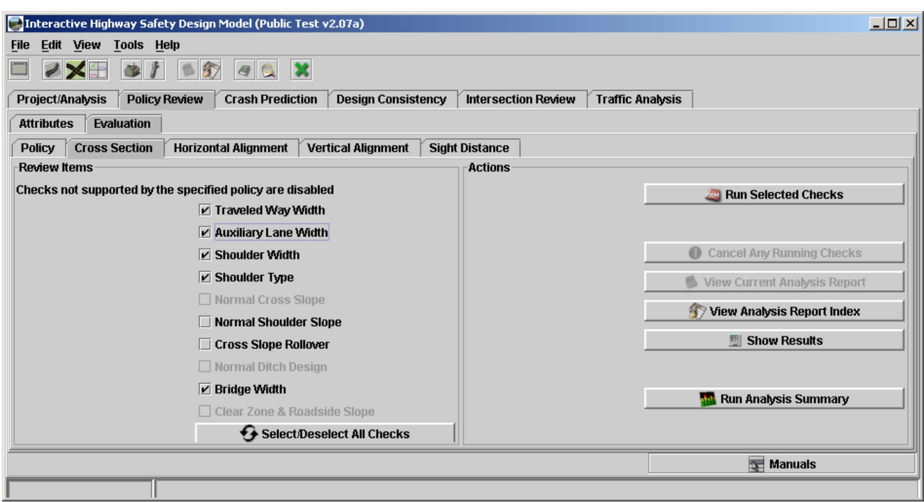


4. Make sure the correct policy is referenced. If it is not click on the Choose or Change Policy button to get the following dialog box:



5. Highlight the correct policy and choose Select.

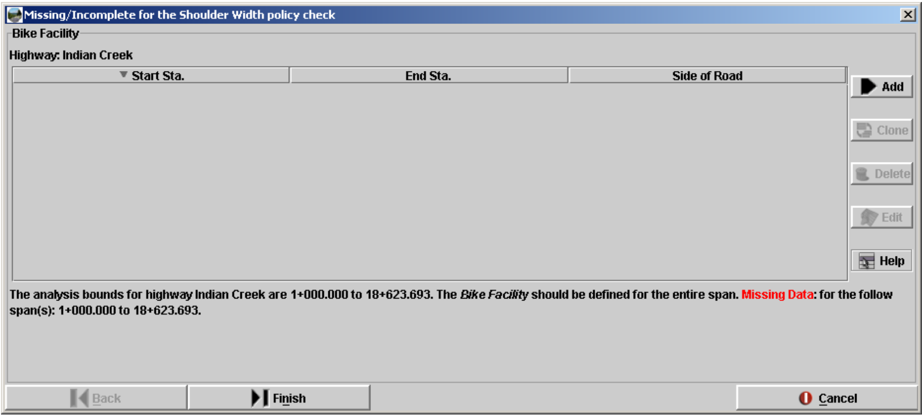
6. Pick the Cross Section tab to get the following dialog box:



7. Pick the items to check the design policy against. The designer should have the traveled way width, any auxillary lane widths, average shoulder width, shoulder type, and any bridge widths at a minimum for this type of project. If the designer has shoulder slope data, he will be able to run the normal shoulder slope and cross slope rollover checks.

8. *Pick the Run Selected Checks button. IHSDM will start running and will indicate its progress in the lower left portion of the dialog box with a blue rectangle. Depending on the length of the project, the IHSDM calculations could take a couple of minutes.*

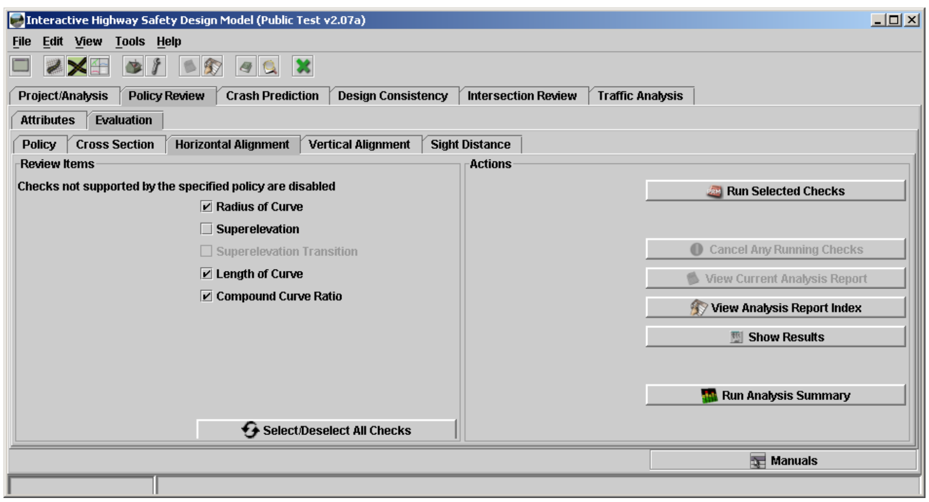
9. *If the following dialog box appears during the run, then IHSDM does not have enough data to run a check analysis. The user can either enter the data or choose Finish and IHSDM will ignore that analysis.*



10. *Once IHSDM has completed its analysis, pick the View Current Analysis Report. IHSDM will launch the web browser to view the report.*

11. *Go back to the IHSDM main dialog box.*

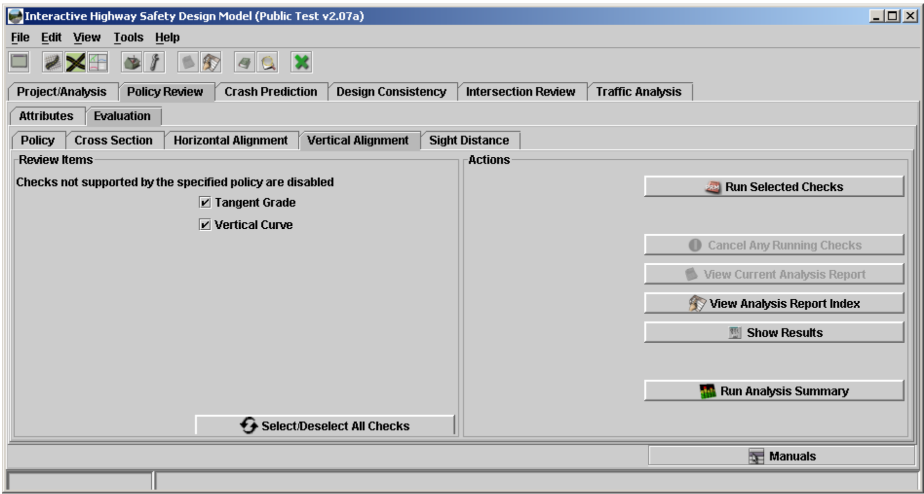
12. *Pick the Horizontal Alignment tab:*



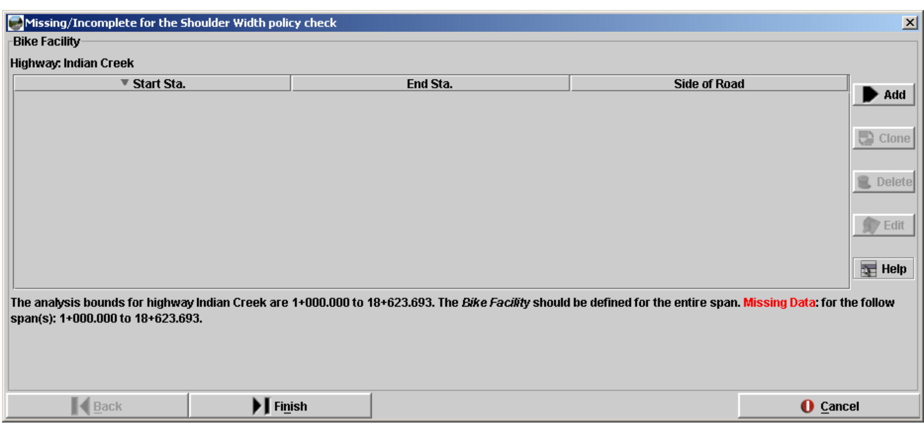
13. *At a minimum, the designer should check the Radius of Curve, Length of Curve, and Compound Curve Ratio. If the designer has the superelevation information, the Superelevation button should be checked.*

14. *Pick Run Selected Checks*

15. *After IHSDM is complete, pick the View Current Analysis Report button. Notice that IHSDM appended the new report to the previous report.*
16. *Pick the Vertical Alignment tab to get the following dialog box:*



17. *If the designer has vertical information, both buttons should be checked.*
18. *Pick the Run Selected Checks button.*
19. *If the following dialog box appears during the run, IHSDM does not have enough data to run a check analysis. The user can either enter the data or choose finish and IHSDM will ignore that analysis.*

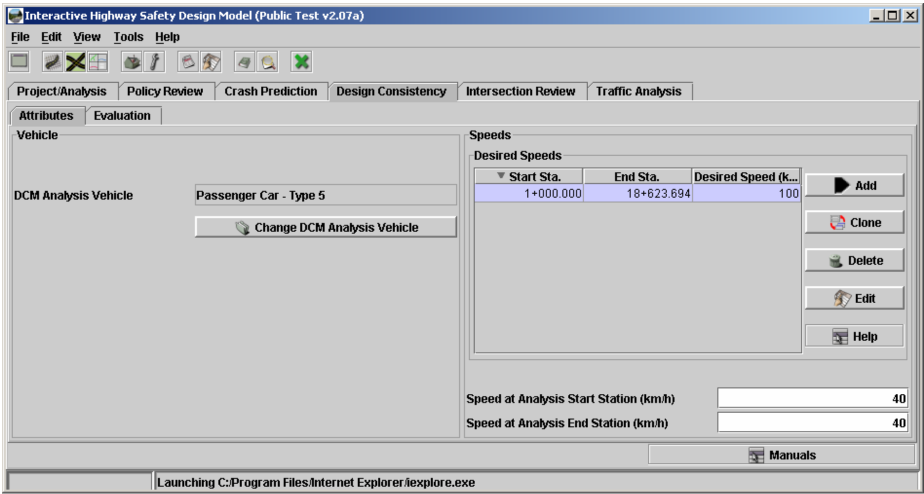


20. *Pick the View Current Analysis Report button.*
21. *Print the report for review.*

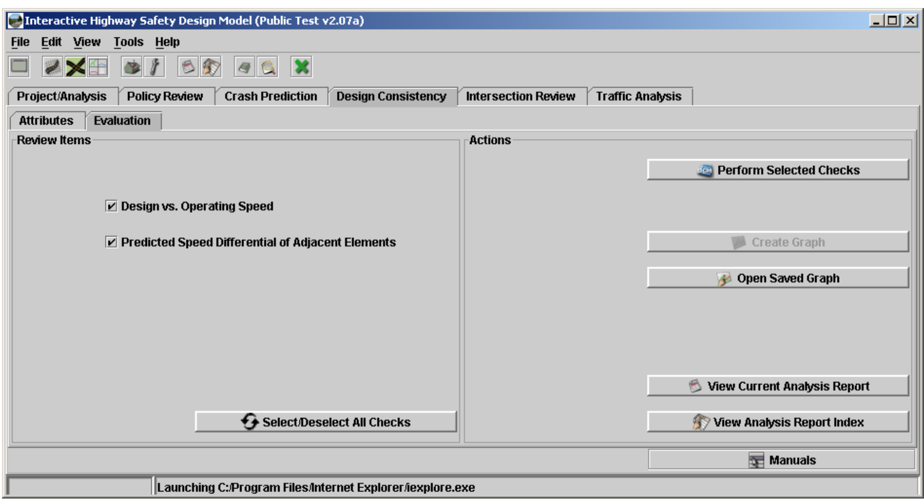
These reports will indicate possible deficient areas along the alignment that the project manager and designer may want to address further.

Workflow 2: Design Consistency Review for 4R CD

1. *From the IHSDM main dialog box, pick the Design Consistency Tab to get the following:*



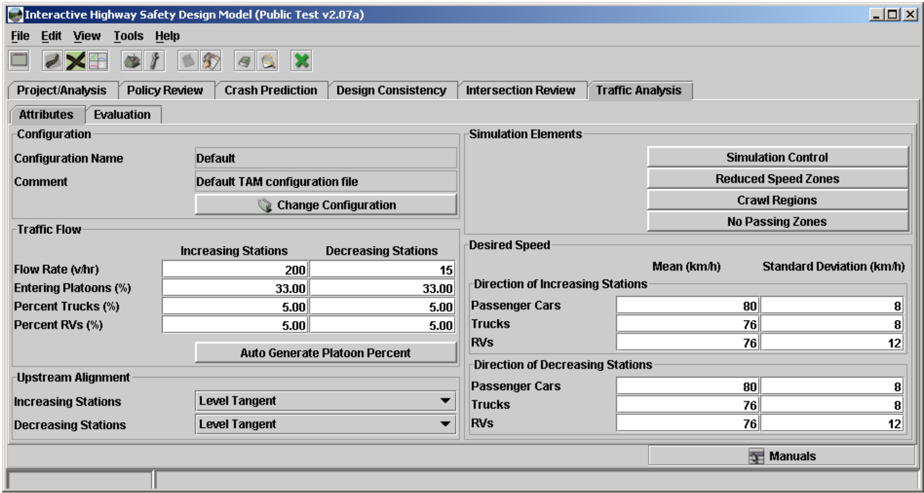
2. *Make sure DCM Analysis Vehicle, Desired Speed, and Speed at Analysis Start/End Stations are correct and pick the Evaluation Tab. To get the following dialog box:*



3. *The user should be able to mark both buttons and pick Perform Selected Checks.*
4. *Pick View Current Analysis Report to open a web browser and view the report.*

Workflow 3: Traffic Analysis for 4R CD

1. *From the IHSDM main dialog box, pick the Traffic Analysis Tab to get the following:*

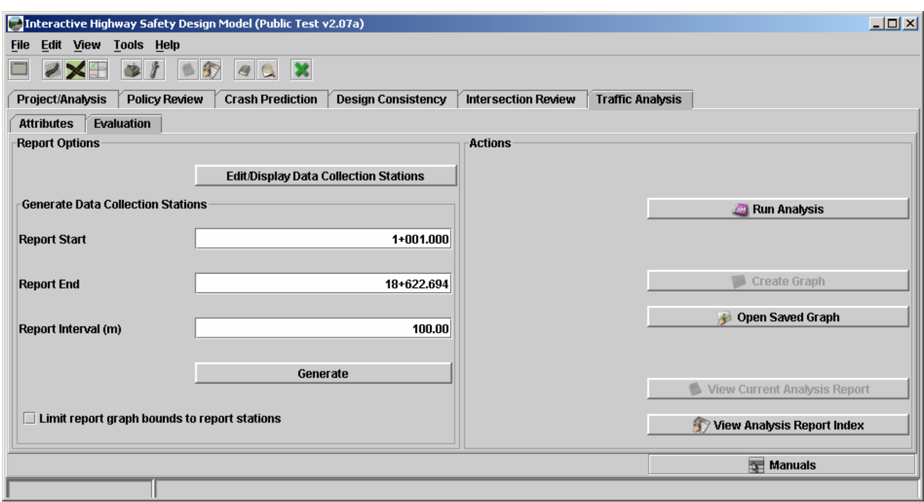


2. *Review/edit the data shown and pick the Evaluation Tab.*

Pick the Auto Generate Platoon Percent button **Auto Generate Platoon Percent** to update the traffic flow data fields.

To automatically calculate the no passing zones, select the No Passing Zones dialog box, then pick Automatic Calculation button.

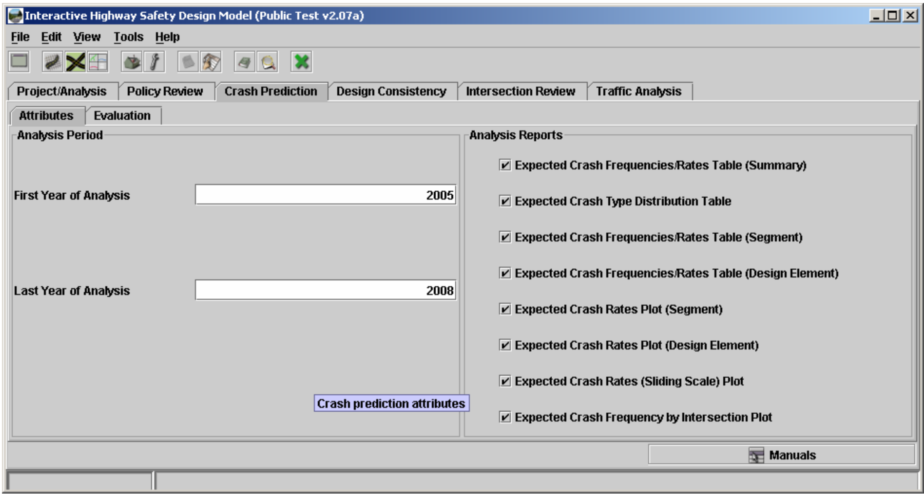
3. *The following dialog box appears:*



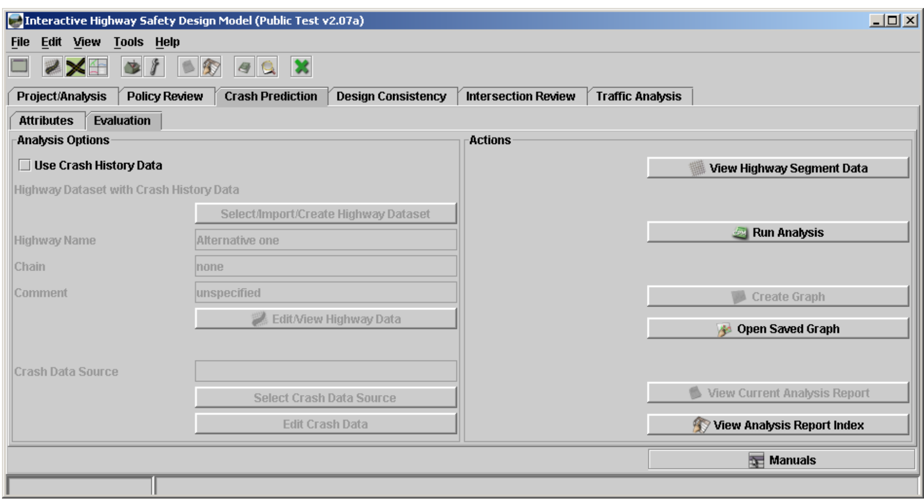
4. *Pick Run Analysis. Depending on the length of the project, analysis could take awhile.*
5. *Pick View Current Analysis Report to open a web browser and view the report.*

Workflow 4: Running Crash Prediction for CD

1. *From the IHSDM main dialog box pick the Crash Prediction tab to get the following dialog box:*



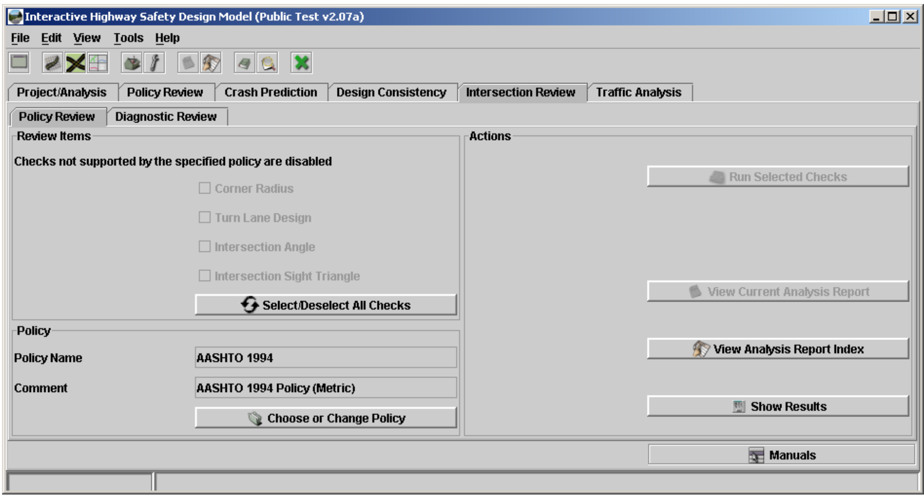
2. *Put in the desired Years for the analysis and mark the boxes for the reports. Then pick the evaluation tab to get the following dialog box:*



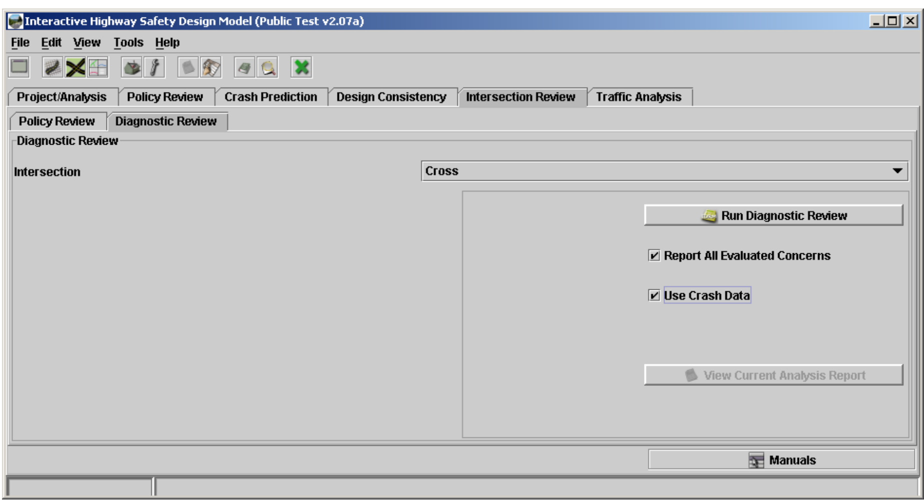
3. *If the Crash History Data is available and it is appropriate to use the data (see the CPM Engineer's Manual, section 3.5: "Crash Prediction When Site-Specific Crash History Data are Available"), then mark the Use Crash History Data box and verify that all the information is correct then pick Run Analysis.*
4. *IHSDM may ask some questions then tell the user when done with analysis.*
5. *After analysis is complete, pick View Current Analysis Report to view report.*

Workflow 5: Intersection Review for 4R CD

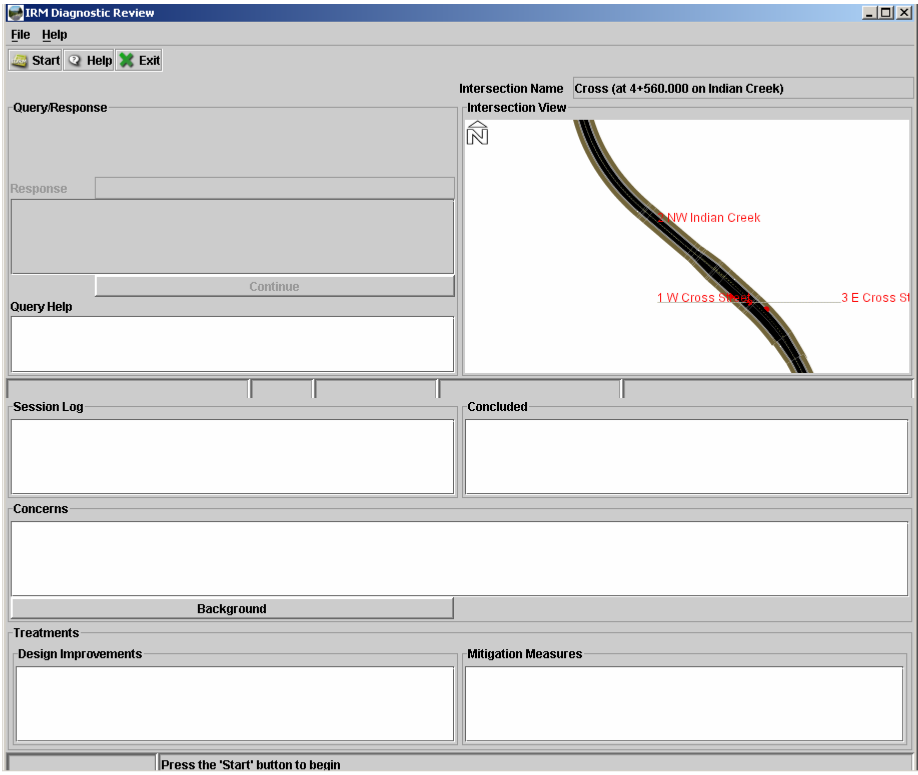
1. *From the IHSDM main dialog box, pick the Intersection Review Tab to get the following:*



2. *The Policy Review is not available in IHSDM yet so pick the Diagnostics Review tab to get the following dialog box:*



3. *Select the side road of the intersection, mark both check boxes and pick the Run Diagnostics Review button.*
4. *After a few seconds, IHSDM will come up with another dialog box that looks like this:*



5. Press the Start button  *in the upper left corner to start the analysis. IHSDM will query the user for required information not already input, e.g., whether a given sight triangle or line of sight is clear of obstructions.*

6. The words "The review is complete" will appear in the bottom of the dialog box when IHSDM is done. Press the Exit button  *to get back to the main dialog box.*

7. Pick the View Current Analysis Report Button to review the results of the analysis.

Preliminary Design

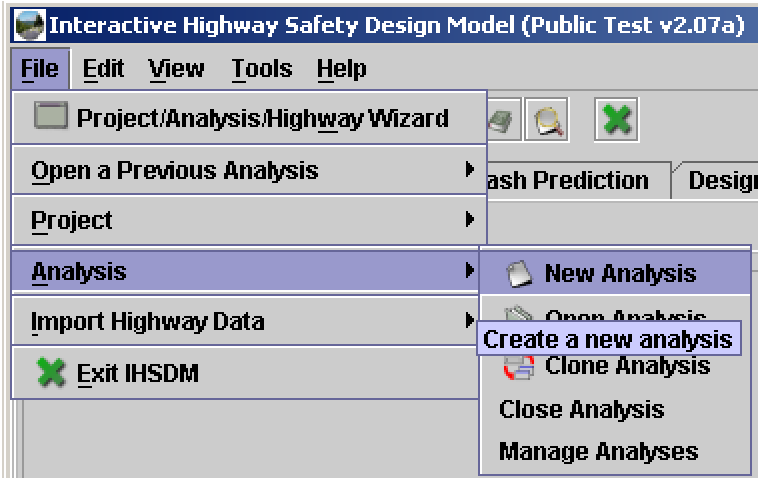
Once a couple of alternative alignments have been chosen, the user will need to create a new analysis for each alternative and run the Policy Review, Design Consistency and Crash Prediction Modules.

If there are areas of sight distance concern, the user will need to input the obstruction offsets for those areas prior to running the Policy Review Module.

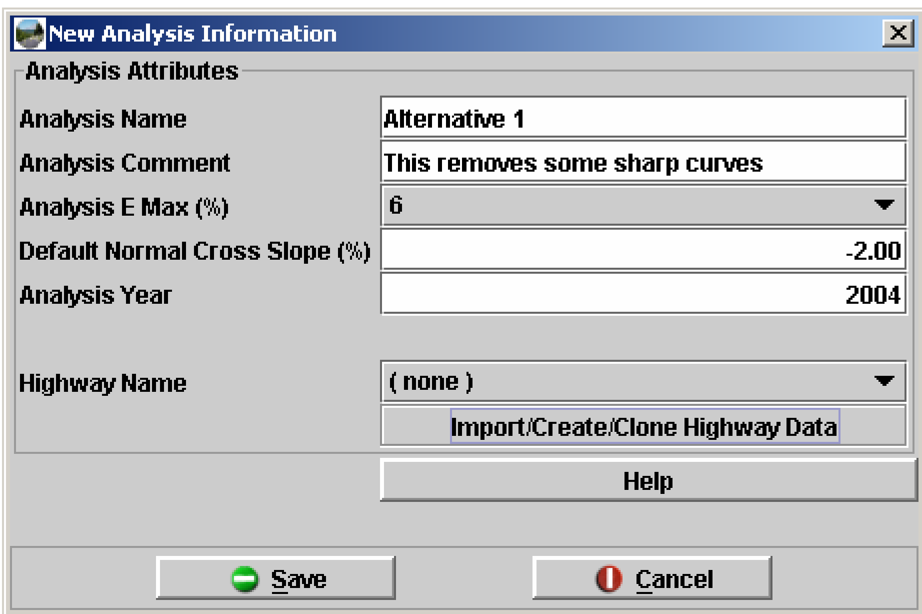
The following workflow will describe how to create a new analysis. Before beginning this process, the user will need to create an input file for the new alignment using G2IHSDM.ma. This process is defined in Workflow 2 of Chapter 2:

Workflow 6: Creating a new analysis for Alternatives

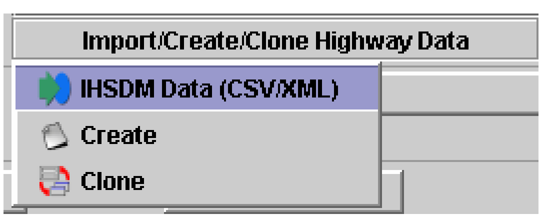
1. *From the IHSDM main dialog box pick File>Analysis>New Analysis.*



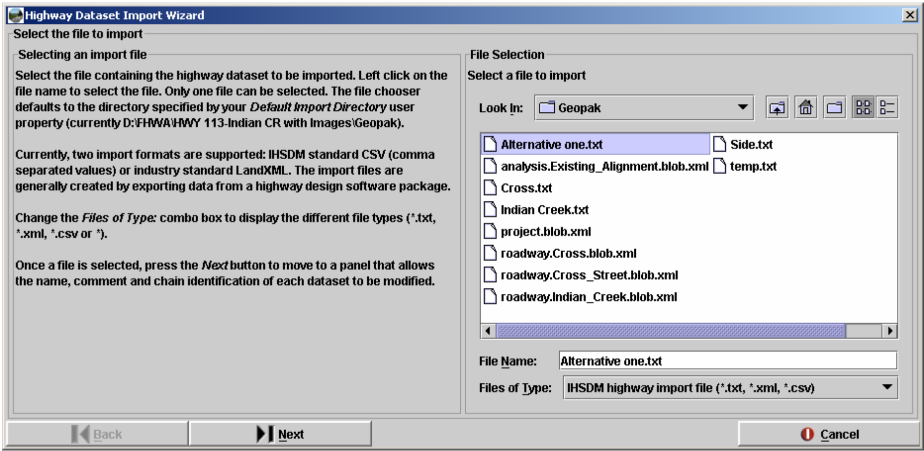
2. *This will bring up the following dialog box:*



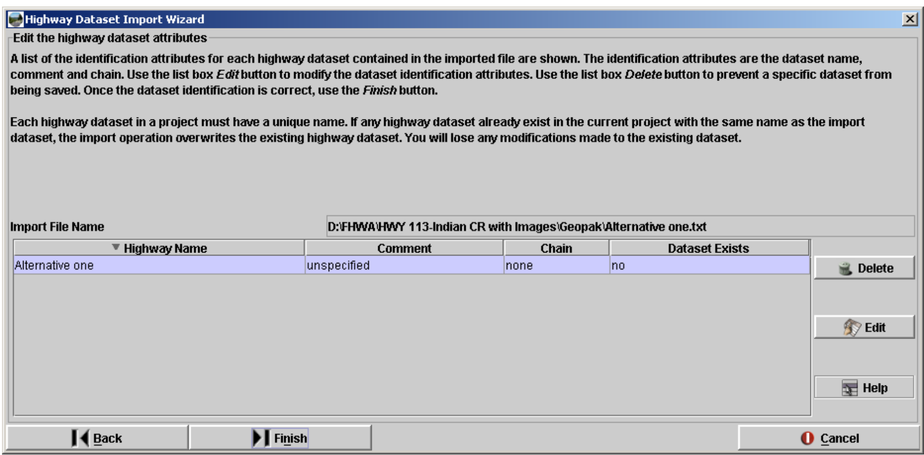
3. *Fill in the appropriate boxes and pick the Import/Create/Clone Highway Data button to get the following:*



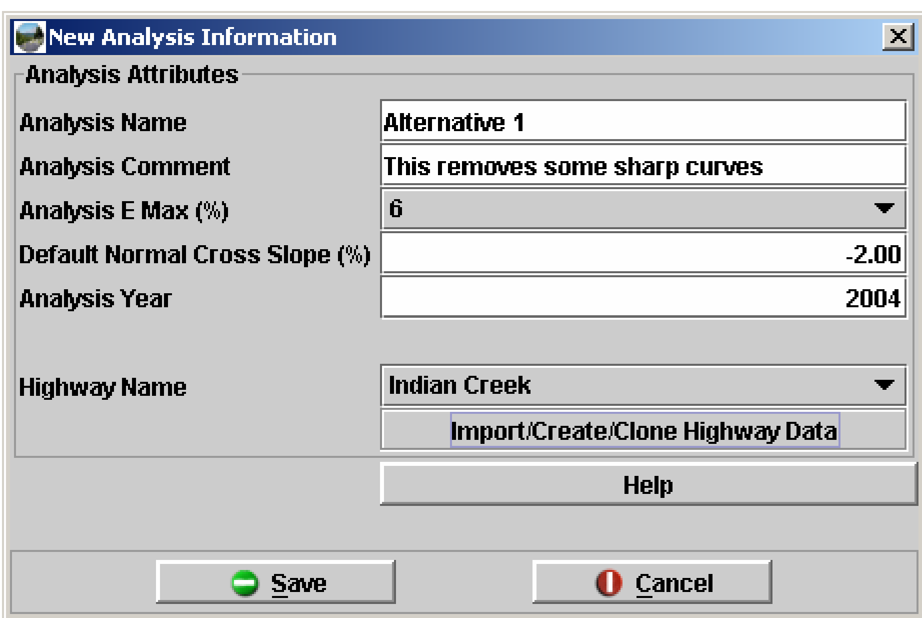
4. *Pick IHSDM Data (CSV/XML) to get the following dialog box:*



5. *Highlight the new alignment and pick Next to get the following:*



6. *Pick Finish to get to this dialog box:*



7. *Pick Save. The can go to the alternative alignment for analysis by selecting File>Analysis>Open Analysis.*

Once the alignment is entered the user will need to add the information described in chapters 3 through 8 before proceeding with the Policy Review and Design Consistency modules.

Final Design

Once the final design is completed the designer can update IHSDM based on the changes made and rerun workflows 1 through 5 to verify that the final design has corrected all the deficiencies it was meant to.

Remember to input the obstruction offsets for the areas of sight distance concern prior to running the modules.

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Chapter 12 Major Reconstruction and New Construction Projects

This chapter will discuss the different modules that will be run during major reconstruction and new construction projects. The workflows will describe how to tell IHSDM which reports to run.

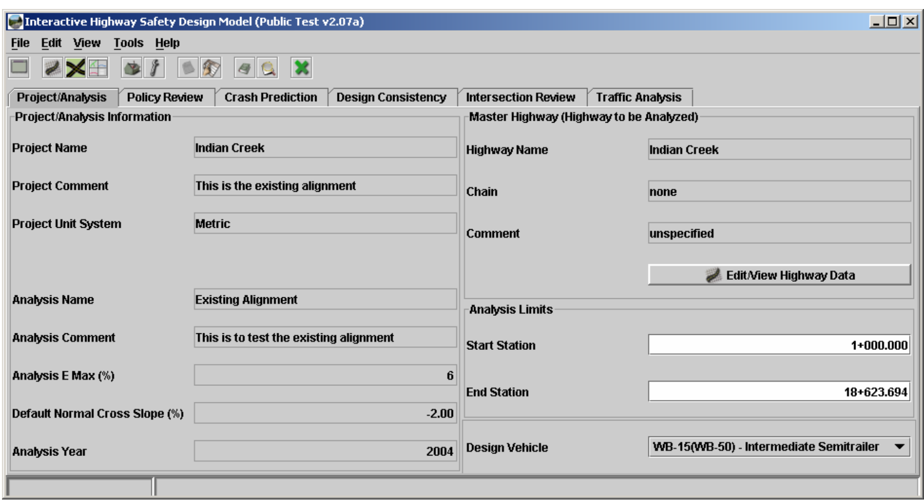
Conceptual Design

Since there is either no existing alignment or the existing alignment for this type of project is not of any use, the following will describe which modules to run on the conceptual design alternatives. Keep in mind that these are conceptual design and the goal is to find possible critical errors in the design prior to taking it to preliminary design.

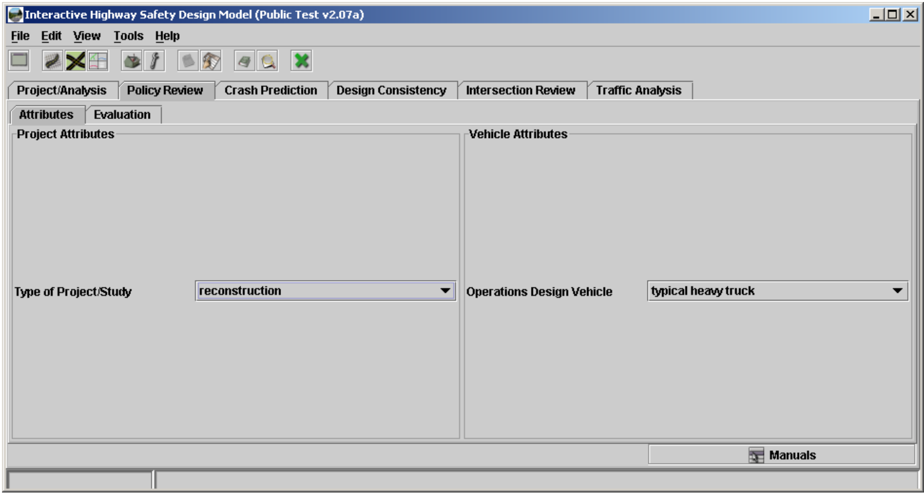
Use G2IHSDM.ma as described in workflow 2 of chapter 2 to create an input file of each alternative and input it into IHSDM as described in Workflow 3 of Chapter 2.

Workflow 1: Policy Review for Conceptual Design

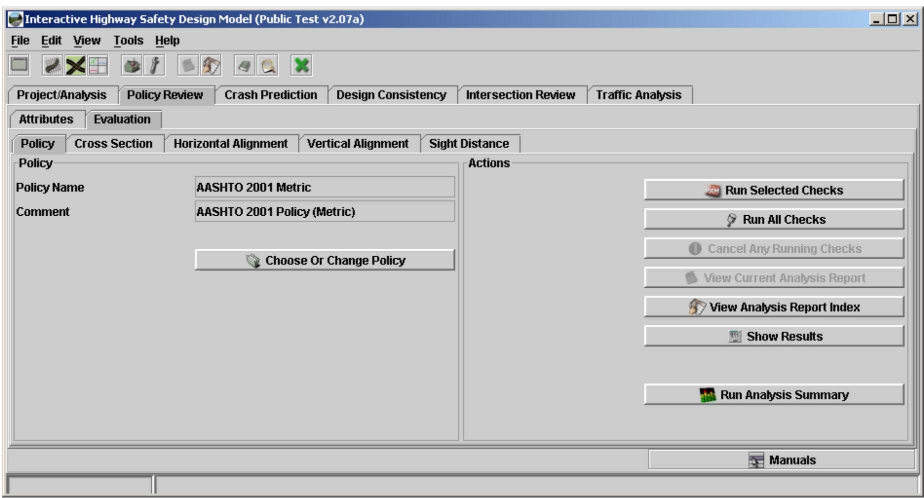
1. *Access the IHSDM main dialog box which look like this:*



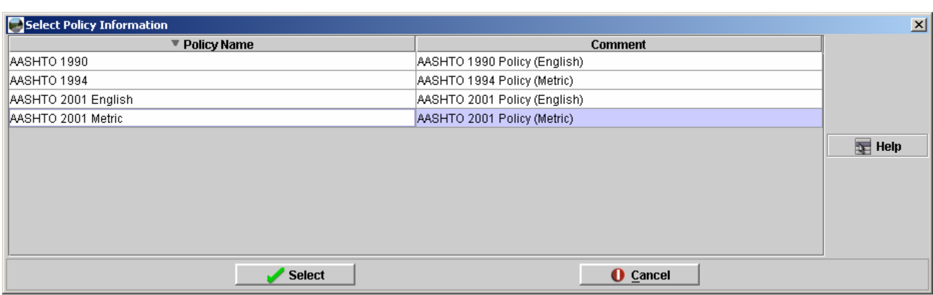
2. *Click on the Policy Review tab to get the following dialog box:*



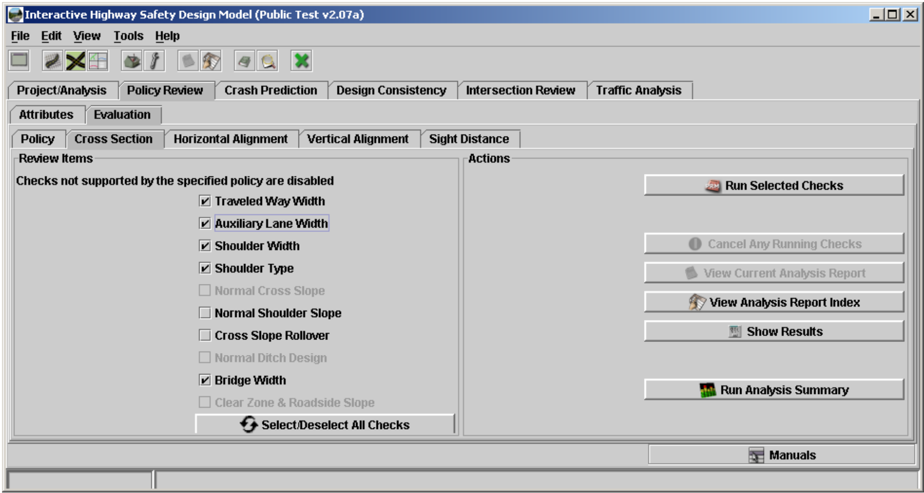
3. *Click on the Evaluation tab to get the following dialog box:*



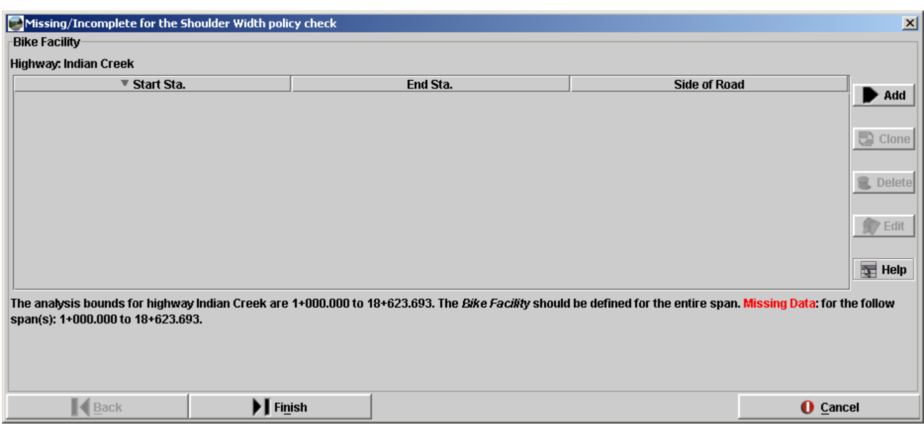
4. *Make sure the correct policy is referenced. If it is not click on the Choose or Change Policy button to get the following dialog box:*



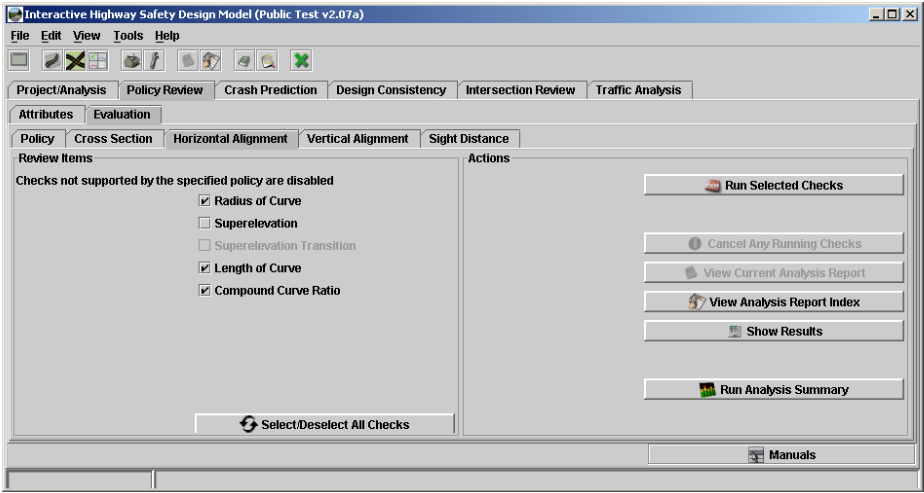
5. *Highlight the correct policy and choose select.*
6. *Pick the Cross Section tab to get the following dialog box:*



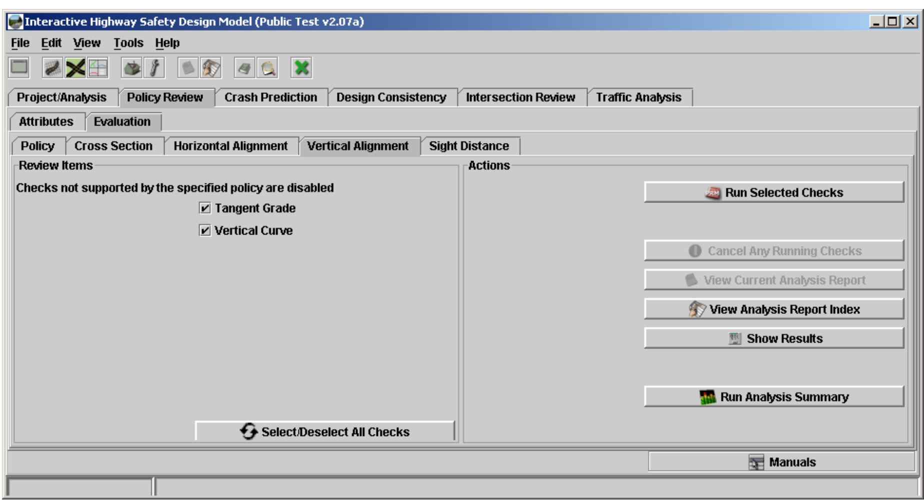
7. Pick the items to check the design policy against. The designer should have the traveled way width, any auxillary lane widths, average shoulder width, shoulder type, and any bridge widths at a minimum for this type of project. If the designer has shoulder slope data, he will be able to run the normal shoulder slope and cross slope rollover checks.
8. Pick the Run Selected Checks button. IHSDM will start running and will indicate its progress in the lower left portion of the dialog box with a blue rectangle. Depending on the length of the project, the IHSDM calculations could take a couple of minutes.
9. If the following dialog box appears during the run, IHSDM does not have enough data to run a check analysis. The user can either enter the data or choose finish and IHSDM will ignore that analysis.



10. Once IHSDM is complete with its analysis, pick the View Current Analysis Report (Chapter 13). IHSDM will launch the web browser to view the report.
11. Go back to the IHSDM main dialog box.
12. Pick the Horizontal Alignment tab:



13. At a minimum, the designer should check the radius of curve, length of curve, and compound curve ratio. If the designer has the Superelevation information, the superelevation button should be checked.
14. Pick Run Selected Checks
15. After IHSDM is complete, pick the View Current Analysis Report button. Notice that IHSDM appended the new report to the previous report.
16. Pick the Vertical Alignment tab to get the following dialog box:



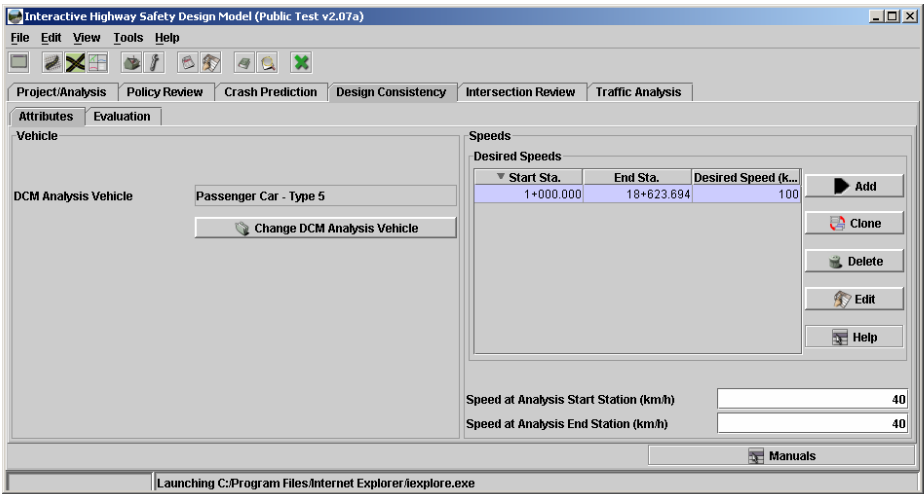
17. If the designer has vertical information, both buttons should be checked.
18. Pick the Run Selected Checks button.
19. If the following dialog box appears during the run, then IHSDM does not have enough data to run a check analysis. The user can either enter the data or choose finish and IHSDM will ignore that analysis.
20. Pick the View Current Analysis Report button (Chapter 13).

21. *Print the report for review.*

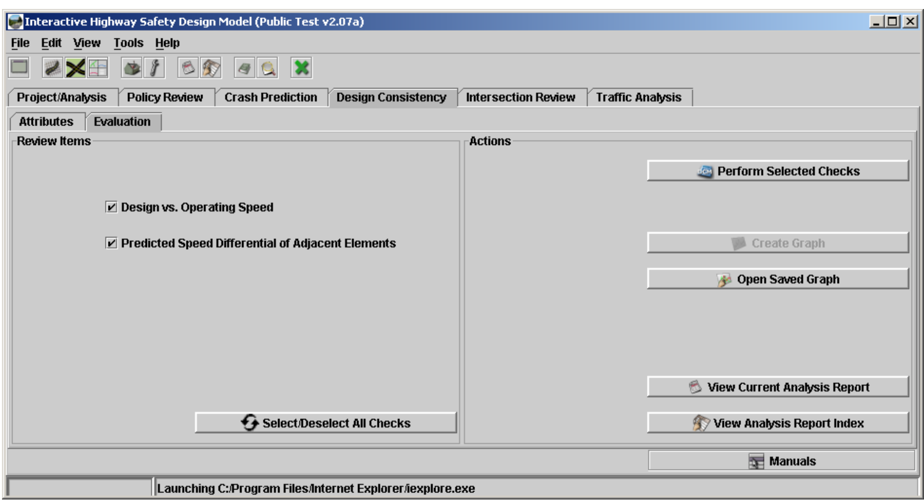
These reports will indicate design elements that do not meet policy along the alignment that the project manager and designer may want to address further.

Workflow 2: Design Consistency Review for CD

1. *From the IHSDM main dialog box, pick the Design Consistency Tab to get the following:*



2. *Make sure the DCM Analysis Vehicle, Desired Speed, and Speed at Analysis Start/End Stations are correct and pick the Evaluation Tab. To get the following dialog box:*



3. *The user should be able to mark both buttons and pick Perform Selected Checks.*

4. *Pick View Current Analysis Report to open a web browser and view the report.*

Preliminary Design

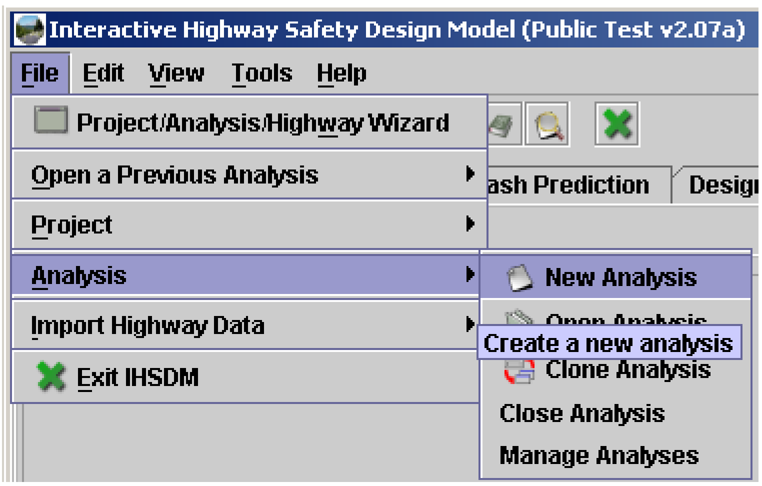
Once a couple of alternative alignments have been chosen, the user will need to create a new analysis for each alternative and and rerun workflows 1 and 2 along with the Crash Prediction, Traffic Analysis Modules.

If there are areas of sight distance concern, the user will need to input the obstruction offsets for those areas prior to running the Policy Review Module.

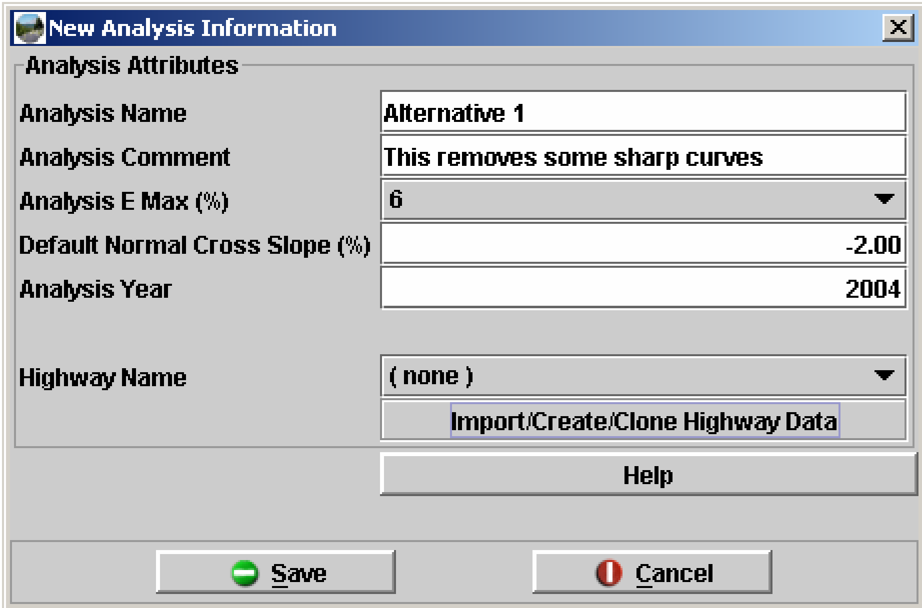
The following workflow will describe how to create a new analysis. Before beginning this process, the user will need to create an import file for the new alignment using G2IHSDM.ma. This process is defined in Workflow 2 of Chapter 2:

Workflow 3: Creating a New Analysis for Alternatives

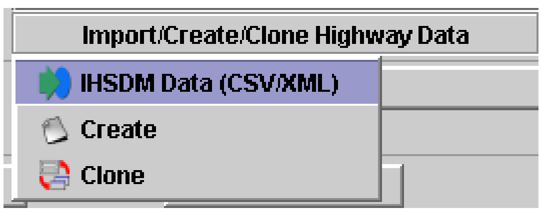
1. *From the IHSDM main dialog box pick File>Analysis>New Analysis.*



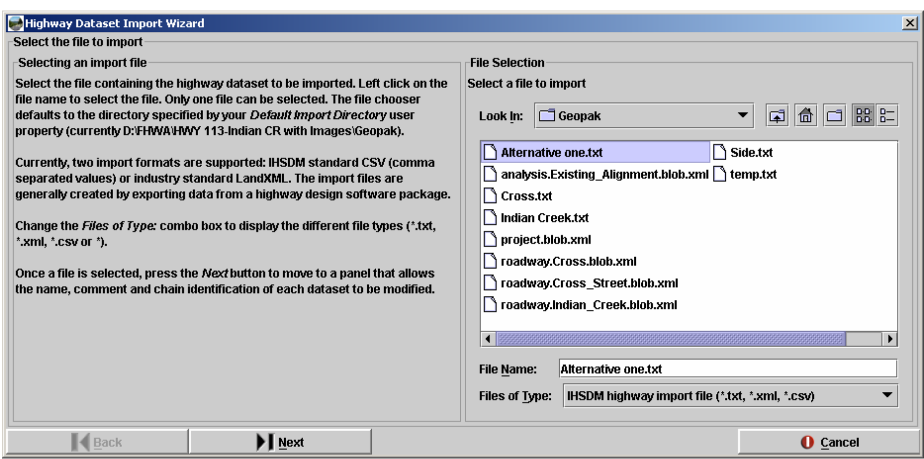
2. *This will bring up the following dialog box:*



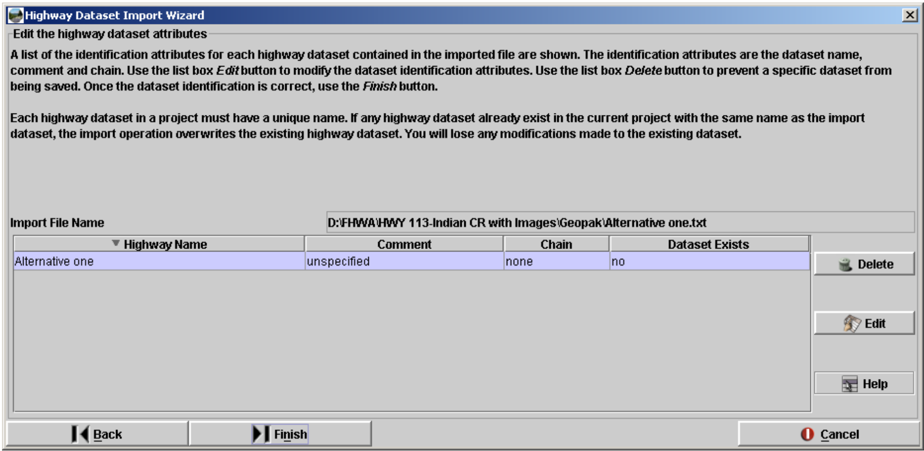
3. *Fill in the appropriate boxes and pick the Import/Create/Clone Highway Data button to get the following:*



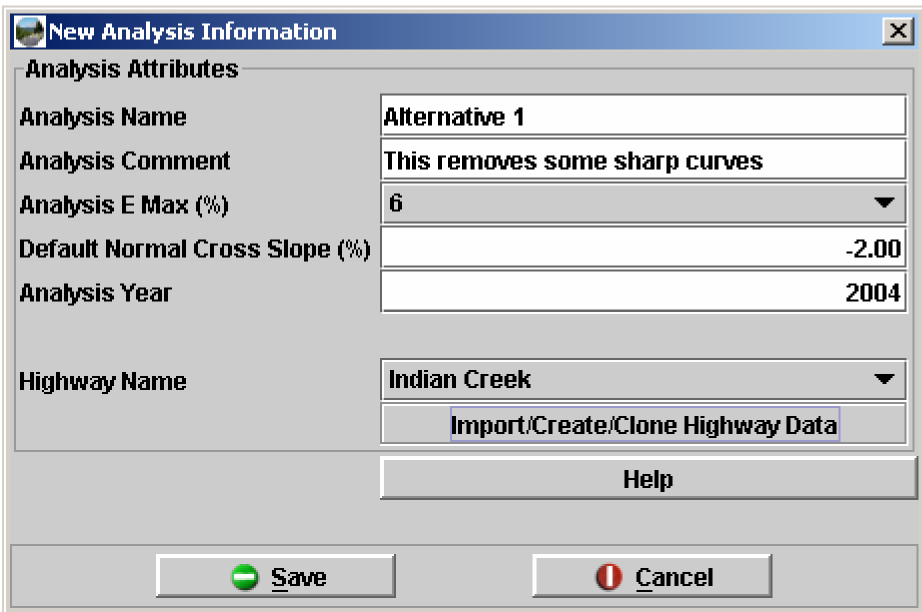
4. *Pick IHSDM Data (CSV/XML) to get the following dialog box:*



5. *Highlight the new alignment and pick Next to get the following:*



6. Pick Finish to get to this dialog box:

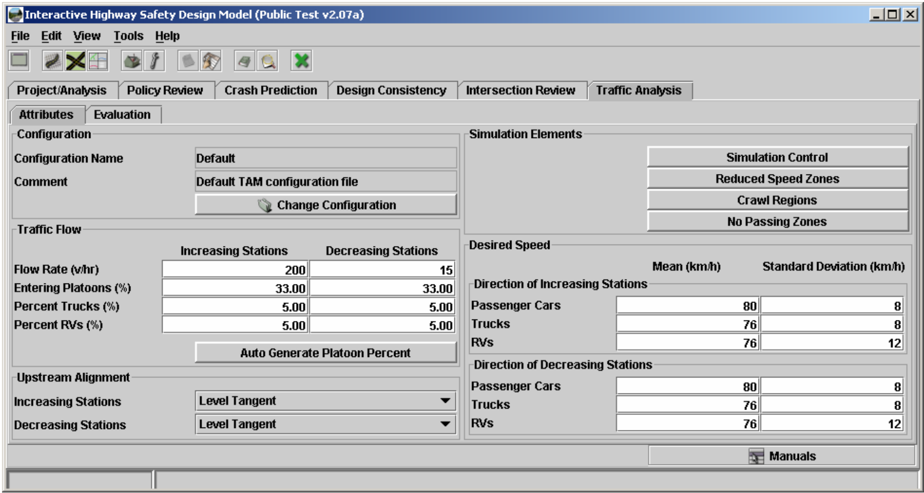


7. Pick Save. The can go to the alternative alignment for analysis by selecting File>Analysis>Open Analysis.

8. Once the alignment is entered the user will need to add the information described in chapters 3 through 8 before proceeding with the Policy Review and Design Consistency modules.

Workflow 4: Traffic Analysis for FD

1. From the IHSDM main dialog box, pick the Traffic Analysis Tab to get the following:

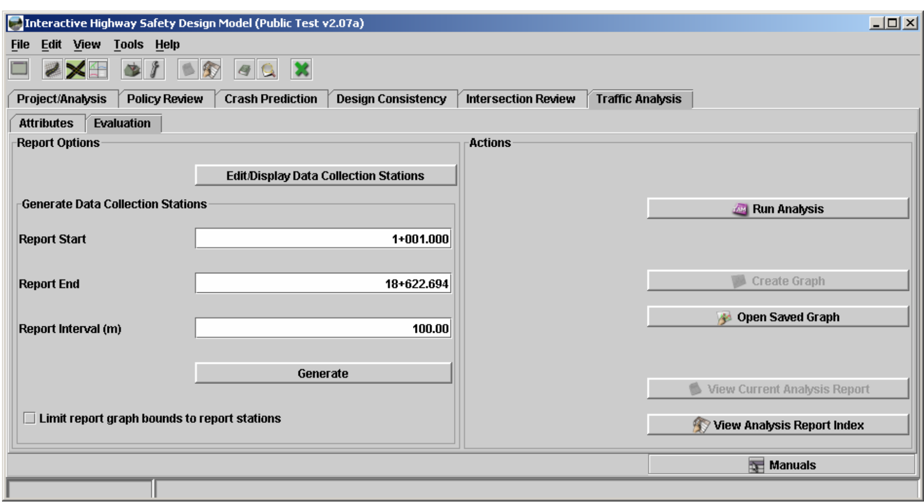


2. Review/edit the data shown and pick the Evaluation Tab.

Pick the Auto Generate Platoon Percent button **Auto Generate Platoon Percent** to update the traffic flow data fields.

To automatically calculate the no passing zones, select the No Passing Zones dialog box, then pick Automatic Calculation button.

3. The following dialog box appears:

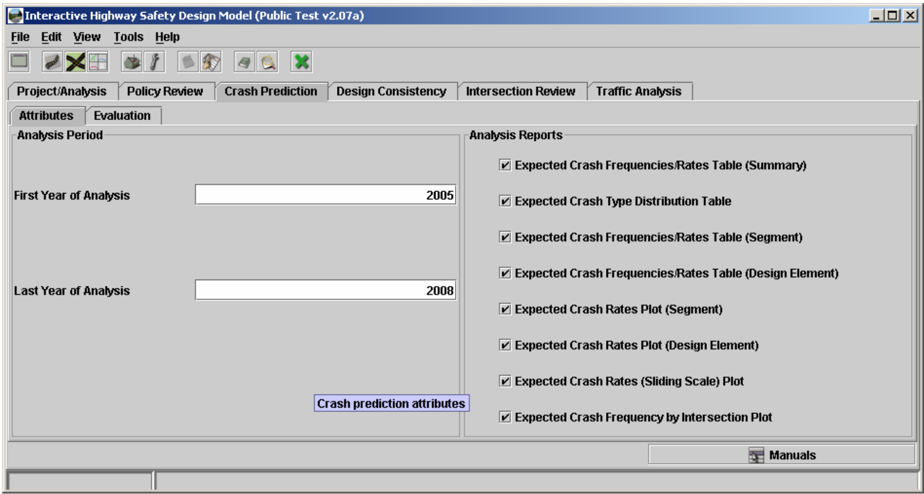


4. Pick Run Analysis. Depending on the length of the project, analysis could take a while.

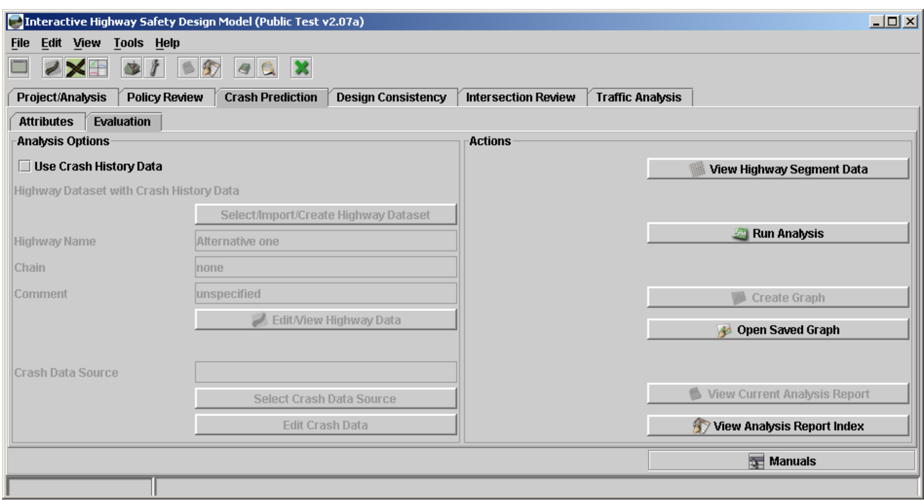
5. Pick View Current Analysis Report to open a web browser and view the report.

Workflow 5: Running Crash Prediction for FD

1. *From the IHSDM main dialog box pick the Crash Prediction tab to get the following dialog box:*



2. *Put in the desired Years for the analysis and mark the boxes for the reports. Then pick the Evaluation tab to get the following dialog box:*



3. *If the Crash History Data is available and it is appropriate to use the data (see the CPM Engineer's Manual, section 3.5: "Crash Prediction When Site-Specific Crash History Data are Available"), then mark the Use Crash History Data box and verify that all the information is correct then pick Run Analysis.*
4. *IHSDM may ask some questions then tell the user when done with analysis.*
5. *After analysis is complete, pick View Current Analysis Report to view report.*

Final Design

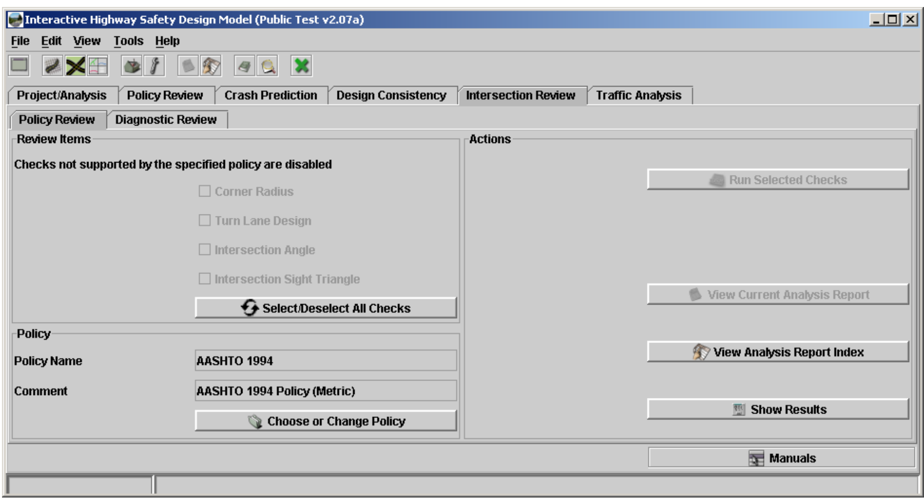
Once the final design is completed the designer can update IHSDM based on the changes made and rerun workflows 1, 2, 3 and 4 along with the Crash Intersection Review module to verify that the design meets criteria.

Remember to input the obstruction offsets for the areas of sight distance concern prior to running the modules.

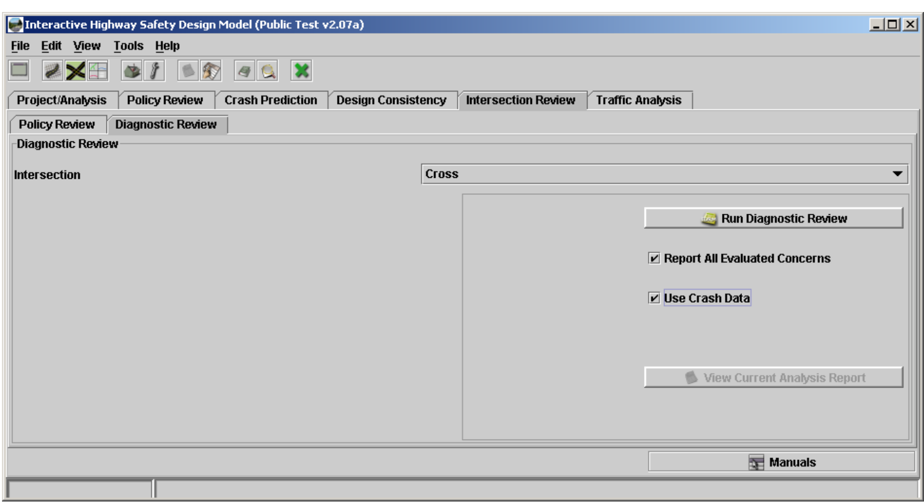
The following workflows will describe the process for running the Traffic Analysis, Intersection Review and Crash Prediction Modules.

Workflow 6: Intersection Review for FD

1. *From the IHSDM main dialog box, pick the Intersection Review Tab to get the following:*

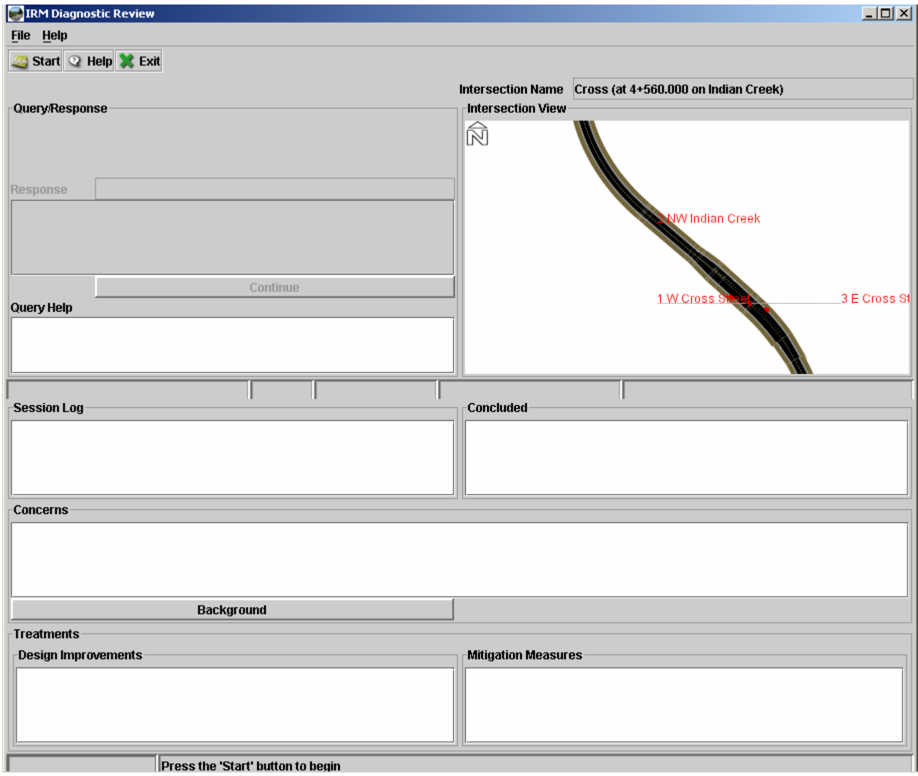


2. *The Policy Review is not available in IHSDM yet so pick the Diagnostics Review tab to get the following dialog box:*



3. *Select the side road of the intersection, mark both check boxes and pick the Run Diagnostics Review button.*

4. *After a few seconds, IHSDM will come up with another dialog box that looks like this:*



5. *Press the Start button*  *in the upper left corner to start the analysis. IHSDM will query the user for required information not already input, e.g., whether a given sight triangle or line of sight is clear of obstructions.*

6. *The words "The review is complete" will appear in the bottom of the dialog box when IHSDM is done. Press the Exit button*  *to get back to the main dialog box.*

7. *Pick the View Current Analysis Report Button to review the results of the analysis.*

Table of Contents

Chapter 13 Example Reports

This chapter will show examples of the reports IHSDM prepares and will give a brief description of how to read them. The next chapter will describe how to analyze and apply the results to the decision-making process.

Policy Review

The policy review model provides the following reports:

- Traveled Way and Auxiliary Lane Widths
- Shoulder Width
- Shoulder Type
- Normal Shoulder Slope
- Cross Slope Rollover
- Bridge Width
- Radius of Curve
- Superelevation
- Length of Curve
- Compound Curve Ratio
- Tangent Grade
- Vertical Curve
- Passing Sight Distance
- Stopping Sight Distance
- Decision Sight Distance

An example of each report follows:

Traveled Way and Auxiliary Lane Widths

4.1 Traveled Way Width Policy Check

[Through Traveled Way Width in the Policy Review Module (PRM) Engineer's Manual]
Processing Limits: 1+000.000 to 18+623.693
Traffic Volume Year: 2004
Design Vehicle: MH/B
Type Of Project: reconstruction

Traveled Way Width and Widening

Stations		Traveled Way Width and Widening (meters)		Comment	Attributes
Start	End	Road (width+widening)	Policy (width+widening)		
1+025.028	1+047.356	7.20 + 0.00	6.60 + 1.00	Road value varies from controlling criteria	Speed: 40 (km/h); class: arterial; terrain: mountainous; DHV: 140 (v/hr); ADT: 1,876 (v/day); radius: 200.00 (m); TWW:6.60 (m)
1+209.123	1+263.345	7.20 + 0.00	6.60 + ???	No policy values in AASHTO 2001 Metric: minimum curve widening	Speed: 40 (km/h); class: arterial; terrain: mountainous; DHV: 140 (v/hr); ADT: 1,876 (v/day); radius: 55.00 (m); TWW:6.60 (m)
1+284.606	1+400.306	7.20 + 0.00	6.60 + 1.00	Road value varies from controlling criteria	Speed: 40 (km/h); class: arterial; terrain: mountainous; DHV: 140 (v/hr); ADT: 1,876 (v/day); radius: 200.00 (m); TWW:6.60 (m)
1+453.724	1+533.639	7.20 + 0.00	6.60 + 2.55	Road value varies from controlling criteria	Speed: 40 (km/h); class: arterial; terrain: mountainous; DHV: 140 (v/hr); ADT: 1,876 (v/day); radius: 125.00 (m); TWW:6.60 (m); lanes: 3
1+580.228	1+781.660	7.20 + 0.00	6.60 + 0.70	Road value varies from controlling criteria	Speed: 40 (km/h); class: arterial; terrain: mountainous; DHV: 140 (v/hr); ADT: 1,876 (v/day); radius: 400.00 (m); TWW:6.60 (m)
1+831.131	1+949.954	7.20 + 0.00	6.60 + 1.40	Road value varies from controlling criteria	Speed: 40 (km/h); class: arterial; terrain: mountainous; DHV: 140 (v/hr); ADT: 1,876 (v/day); radius: 170.00 (m); TWW:6.60 (m)

This report checks the roadway width at each curve as well as at each change in width and will indicate if the design meets criteria. The table describes the location of change in width and curves at the P.C. (Start) and P.T (End), the design roadway width (Road), the policy rules for the roadway width (Policy), whether the design meets policy or not (Comment), and the design criteria used in determining the correct policy values. IHSDM will indicate where the design varies from policy.

Shoulder Width

4.3 Shoulder Width Policy Check

[Shoulder Width in the Policy Review Module (PRM) Engineer's Manual]
Processing Limits: 1+000.000 to 18+623.693
Traffic Volume Year: 2004

Shoulder Width

Station	Direction of Travel	Shoulder Width (meters)		Comment	Attributes
		Road	Policy		
1+000.000	left	1.00	1.80	Road value may vary from recommended values. Where volumes are low or a narrow section is needed to reduce construction impacts, the paved should may be reduced to 0.60 (m)	Functional class=arterial; ADT=1,876 (v/day) terrain=mountainous; material=paved
9+500.000	left	1.00	1.20	Road value may vary from recommended values. Where volumes are low or a narrow section is needed to reduce construction impacts, the paved should may be reduced to 0.60 (m)	Functional class=arterial; ADT=161 (v/day) terrain=mountainous; material=turf
9+600.000	left	0.30	1.20	Road value varies from controlling criteria	Functional class=arterial; ADT=161 (v/day) terrain=mountainous; material=turf
18+623.693	left	1.00	1.20	Road value may vary from recommended values. Where volumes are low or a narrow section is needed to reduce construction impacts, the paved should may be reduced to 0.60 (m)	Functional class=arterial; ADT=161 (v/day) terrain=mountainous; material=turf
1+000.000	right	1.00	1.80	Road value may vary from recommended values. Where volumes are low or a narrow section is needed to reduce construction impacts, the paved should may be reduced to 0.60 (m)	Functional class=arterial; ADT=1,876 (v/day) terrain=mountainous; material=paved

This report checks the shoulder width for the full length of the project. It will run down the left side of the alignment, then down the right. It breaks the stations where the shoulder width or materials change and where the shoulder width does not meet policy. Like the traveled way width table, it shows the design width, then the policy width, a comment on how the design compares to the policy and the values IHSDM used to determine the policy values.

Shoulder Type

4.4 Shoulder Type Policy Check

[Shoulder Type in the Policy Review Module (PRM) Engineer's Manual]
Processing Limits: 1+000.000 to 18+623.693

Shoulder Type

Stations		Direction of Travel	Shoulder Type		Comment	Attributes
Start	End		Road	Policy		
9+500.000	9+600.000	left	turf	paved	Road value varies from recommended values	Functional class=arterial; bike facility=no
9+600.000	18+623.693	left	turf	paved	Road value varies from recommended values	Functional class=arterial; bike facility=no
9+500.000	9+600.000	right	turf	paved	Road value varies from recommended values	Functional class=arterial; bike facility=no
9+600.000	18+623.693	right	turf	paved	Road value varies from recommended values	Functional class=arterial; bike facility=no

Normal Shoulder Slope

4.5 Normal Shoulder Slope Policy Check

[Normal Shoulder Slope in the Policy Review Module (PRM) Engineer's Manual]
Processing Limits: 1+000.000 to 18+623.693

Normal Shoulder Slope

Stations		Direction of Travel	Normal Shoulder Slope (%)		Comment	Attributes
Start	End		Road	Policy		
9+500.000	9+600.000	left	-2.00	-6.00 to -8.00	Road value varies from recommended values	Shoulder material=turf
9+600.000	18+623.693	left	-2.00	-6.00 to -8.00	Road value varies from recommended values	Shoulder material=turf
9+500.000	9+600.000	right	-2.00	-6.00 to -8.00	Road value varies from recommended values	Shoulder material=turf
9+600.000	18+623.693	right	-2.00	-6.00 to -8.00	Road value varies from recommended values	Shoulder material=turf

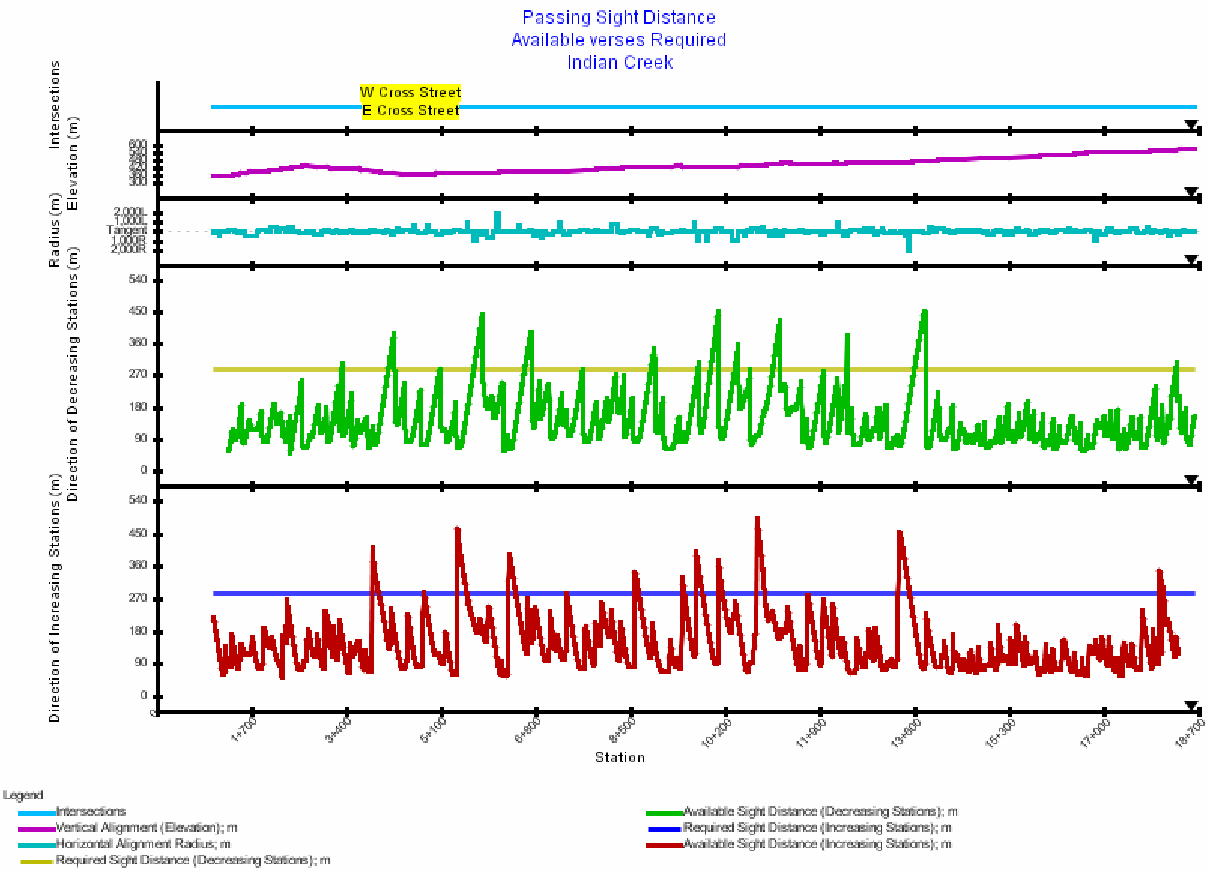
Passing Sight Distance

IHSDM creates two reports for Passing sight distance, a Passing Sight Distance Policy Check graph and a Passing Site Distance tabular report.

1.2 Passing Sight Distance Policy Check

[Passing Sight Distance in the Policy Review Module (PRM) Engineer's Manual]
Processing Limits: 1+000.000 to 18+623.693
Object height: 1,300.0 millimeters
Driver eye height: 1,070.0 millimeters
Driver Increment: 2.00 meters
Policy Table Bounds: 30 (km/h) to 120 (km/h)

Graph: Passing Sight Distance



This graph will show the location of any intersections, the profile, horizontal curve radiuses, and recommended passing sight distance along the highway. Sight distance limitations due to constraints in both the horizontal and vertical alignments are considered by IHSDM in determining available sight distances.

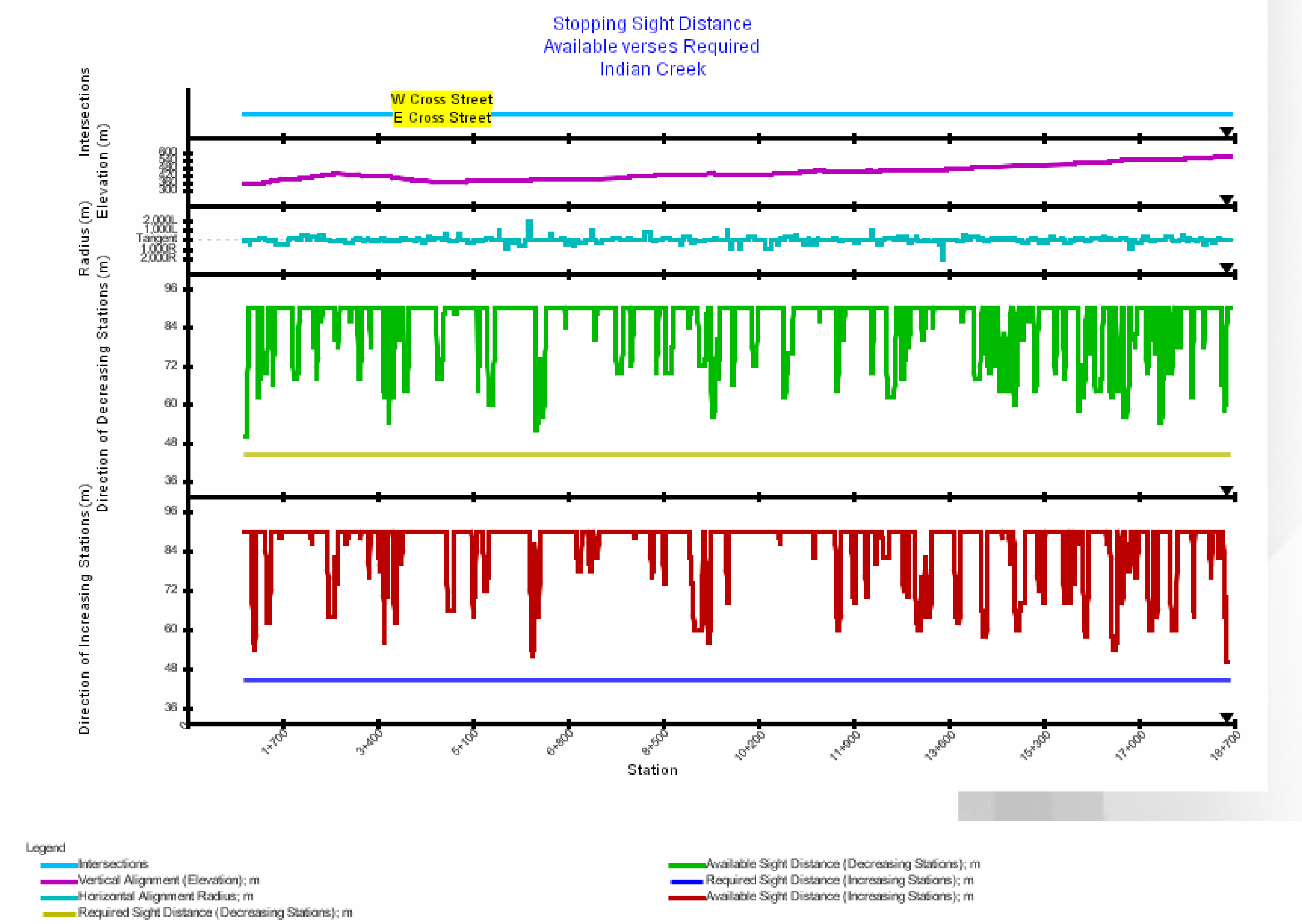
Notice how the majority of the curves show the passing sight distance is below policy. IHSDM only shows the sight line to the width that is input into the system. In the example project, no obstruction offsets were input, so IHSDM only calculates to the edge of shoulder.

Stopping Sight Distance

IHSDM creates two stopping sight distance stopping sight distance reports, a graph and a tabular report.

[Stopping Sight Distance in the Policy Review Module (PRM) Engineer's Manual]
Processing Limits: 1+000.000 to 18+623.693
Type of Project: new construction
Policy Table Bounds: 30 (km/h) to 120 (km/h)
Object height: 150.0 millimeters
Driver eye height: 1,070.0 millimeters
Driver Increment: 2.00 meters

Graph: Stopping Sight Distance



Like the passing sight distance, this graph shows the locations of the intersections, profile, horizontal curve radiuses, and actual stopping sight distance compared to the policy.

Stopping Sight Distance

Stations		Direction of Travel	Stopping Sight Distance (meters)		Comment	Attributes
Start	End		Road (minimum)	Policy		
1+000.000	1+050.000	Decreasing Stations			Can't calculate available vertical SD	Design speed=40 (km/h)
18+572.000	18+622.000	Increasing Stations			Can't calculate available vertical SD	Design speed=40 (km/h)

This table will only show the locations where the stopping sight distance does not meet policy or where it cannot calculate the sight distance because it is at the beginning or ending of the alignment.

Crash Prediction Module

The crash prediction model report contains a maximum of 9 tables and 1 graph. The first 5 tables describe the segments that the alignment was broken into and the information used to calculate the accident rates. This chapter will not describe these tables. The following will describe the other four tables and graphs:

Expected Crash Frequencies

1.2 Expected Crash Rates and Frequencies

Analysis Date:	September 22, 2004
Project Name:	Indian Creek
Project Comment:	This is the existing alignment
Analysis Name:	Existing Alignment
Analysis Comment:	This is to test the existing alignment
Proposed Highway:	Indian Creek
Chain:	none
Comment:	unspecified
Analysis Limits:	1+000.000 to 18+623.694
Analysis Length:	17.6237 kilometers
Analysis Period:	2005 to 2008 (4 years)
Crash History Data:	None
Unit System:	Metric

Expected Crash Frequencies and Rates (Summary)

Total Crashes	36.0
Fatal and Injury Crashes (32%)	11.6
Property-damage-only Crashes (68%)	24.4
Average Future Road ADT (vehicles/day)	1118.0
Crash Rate per kilometers per year	0.51
Fatal and Injury Crash Rate per kilometers per year	0.16
Property-damage-only Crash Rate per kilometers per year	0.35
Total travel (million vehicle-kilometers)	28.77
Crash Rate per million vehicle-kilometers	1.25
Fatal and Injury Crash Rate per million vehicle-kilometers	0.4
Property-damage-only Crash Rate per million vehicle-kilometers	0.85

This table gives a summary of the expected crash rates for the analysis period shown. The total crashes are broken into Fatal and Injury Crashes and Property-damage-only Crashes. The Crash Rate per kilometer per year is based on the Average Future ADT and is also broken into Fatal and Injury Crashes and Property-damage-only

Crashes. The Crash Rate per million vehicle-kilometers is based on the Total Travel (million vehicle-kilometers) and is also broken into Fatal and Injury Crashes and Property-damage-only Crashes.

Expected Crash Type Distribution

1.3 Expected Crash Type Distribution

Analysis Date:	September 22, 2004
Project Name:	Indian Creek
Project Comment:	This is the existing alignment
Analysis Name:	Existing Alignment
Analysis Comment:	This is to test the existing alignment
Proposed Highway:	Indian Creek
Chain:	none
Comment:	unspecified
Analysis Limits:	1+000.000 to 18+623.694
Analysis Length:	17.6237 kilometers
Analysis Period:	2005 to 2008 (4 years)
Crash History Data:	None
Unit System:	Metric

Expected Crash Type Distribution

Crash Type	Highway Segments	Intersections	Total
Single-vehicle accidents			
Collision with animal	11.0 (30.69%)	0.0 (0.0%)	11.0 (30.7%)
Collision with bicycle	0.1 (0.3%)	0.0 (0.0%)	0.1 (0.3%)
Collision with parked vehicle	0.3 (0.7%)	0.0 (0.0%)	0.3 (0.7%)
Collision with pedestrian	0.2 (0.5%)	0.0 (0.0%)	0.2 (0.5%)
Overturned	0.8 (2.28%)	0.0 (0.0%)	0.8 (2.29%)
Ran off road	10.0 (27.91%)	0.0 (0.03%)	10.0 (27.94%)
Other single-vehicle accident	1.3 (3.58%)	0.0 (0.01%)	1.3 (3.59%)
Total single-vehicle accidents	23.7 (65.95%)	0.0 (0.05%)	23.7 (66.0%)
Multiple-vehicle accidents			
Angle collision	1.4 (3.87%)	0.1 (0.35%)	1.5 (4.22%)
Head-on collision	0.7 (1.89%)	0.0 (0.01%)	0.7 (1.9%)
Left-turn collision	1.5 (4.17%)	0.0 (0.04%)	1.5 (4.21%)
Right-turn collision	0.2 (0.6%)	0.0 (0.0%)	0.2 (0.6%)
Rear-end collision	5.0 (13.81%)	0.0 (0.12%)	5.0 (13.92%)
Sideswipe opposite-direction	0.9 (2.38%)	0.0 (0.01%)	0.9 (2.4%)
Sideswipe same-direction	0.9 (2.58%)	0.0 (0.03%)	0.9 (2.61%)
Other multiple-vehicle collision	1.5 (4.07%)	0.0 (0.07%)	1.5 (4.14%)
Total multiple-vehicle collisions	12.0 (33.37%)	0.2 (0.62%)	12.2 (34.0%)
Total accidents	35.7 (99.33%)	0.2 (0.67%)	36.0 (100.0%)

This report shows the expected crash type distribution. CPM applies a default distribution (see CPM Engineers Manual, section 9), which can be modified via the Administration Tool (AdminTool).

Expected Crash Rates and Frequencies

1.4 Expected Crash Rates and Frequencies

Analysis Date: September 22, 2004
Project Name: Indian Creek
Project Comment: This is the existing alignment
Analysis Name: Existing Alignment
Analysis Comment: This is to test the existing alignment
Proposed Highway: Indian Creek
Chain: none
Comment: unspecified
Analysis Limits: 1+000.000 to 18+623.694
Analysis Length: 17.6237 kilometers
Analysis Period: 2005 to 2008 (4 years)
Crash History Data: None
Unit System: Metric

Expected Crash Frequencies and Rates (Segment)

Intersection Name/Cross Road	Stations		Length (km)	Expected no. of Crashes for analysis period	Expected Crash Rate			Expected no. of crashes/year for intersection
	From	To			/km/yr	/million-veh-km	/million entering veh	
	1+000.000	1+006.500	0.0065	0.0143	0.5499	0.7097		
	1+006.500	1+025.028	0.0185	0.0380	0.5124	0.6614		
	1+025.028	1+045.800	0.0208	0.2238	2.6934	3.4764		
	1+045.800	1+047.356	0.0016	0.0169	2.7144	3.5034		
	1+047.356	1+124.949	0.0776	0.1603	0.5164	0.6665		
	1+124.949	1+132.214	0.0073	0.0400	1.3764	1.7765		
	1+132.214	1+141.520	0.0093	0.0192	0.5164	0.6665		
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		

This table indicates the expected crash frequencies and rates for homogeneous highway segments. The table shows crashes/km/yr and crashes/million vehicle-km for segments, as well as crashes/million entering vehicles and crashes/yr for each intersection.

Expected Crash Frequencies and Rates by Horizontal Design Element

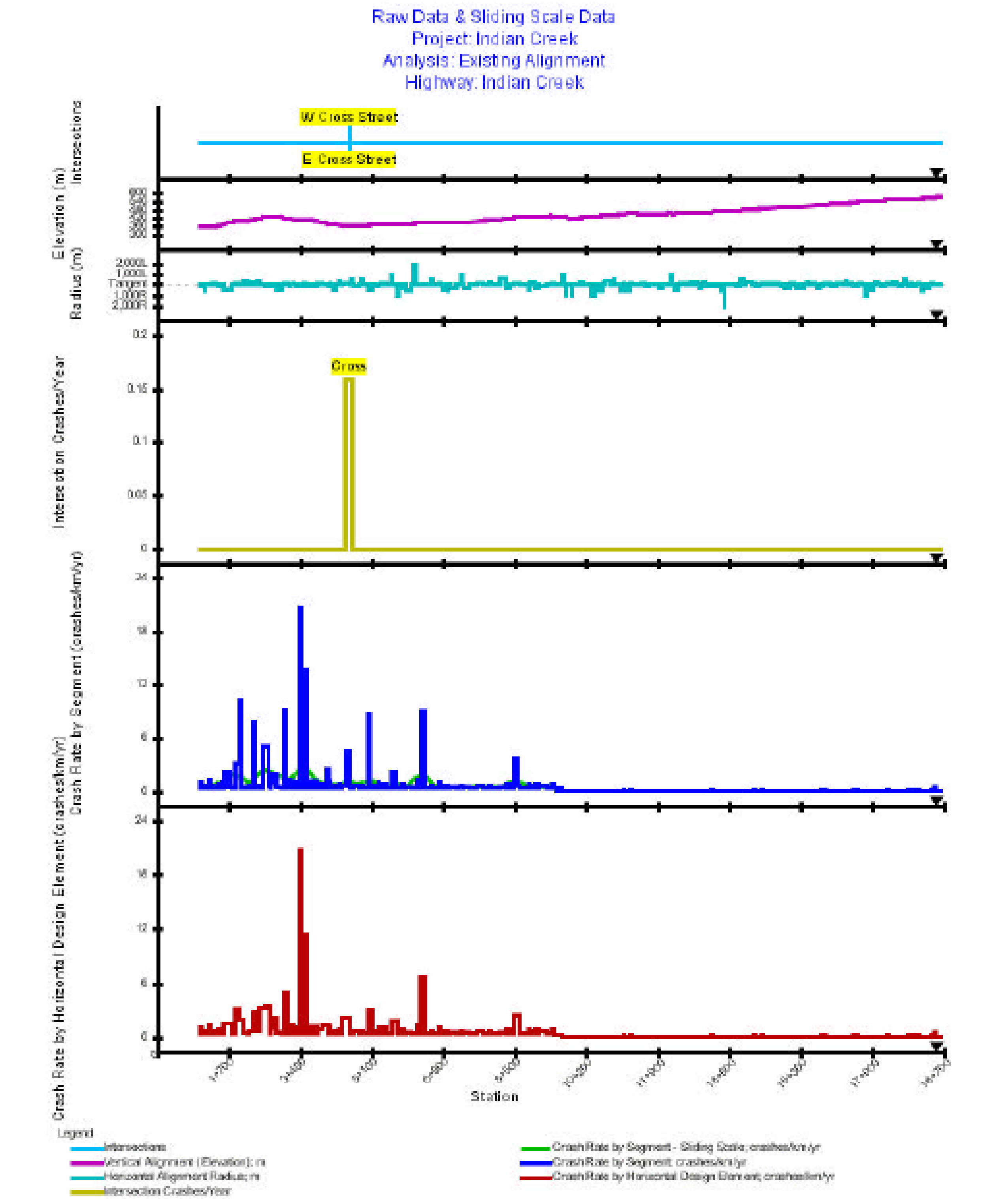
Expected Crash Frequencies and Rates by Horizontal Design Element

Design Element (Horizontal Curve Number or Tangent	Stations		Length (km)	Expected no. of Crashes for analysis period	Expected Crash Rate	
	From	To			/km/yr	/million-veh-km
Tangent	1+000.000	1+025.028	0.0250	0.0523	0.5221	0.6739
Curve 1	1+025.028	1+047.356	0.0223	0.2407	2.6949	3.4783
Tangent	1+047.356	1+124.949	0.0776	0.1603	0.5164	0.6665
Curve 2	1+124.949	1+132.214	0.0073	0.0400	1.3764	1.7765
Tangent	1+132.214	1+209.123	0.0769	0.1578	0.5128	0.6619
Curve 3	1+209.123	1+263.345	0.0542	1.0659	4.9146	6.3433
Tangent	1+263.345	1+284.606	0.0213	0.0462	0.5429	0.7007
Curve 4	1+284.606	1+400.306	0.1157	0.4779	1.0327	1.3328
Tangent	1+400.306	1+453.724	0.0534	0.0975	0.4563	0.5890
Curve 5	1+453.724	1+533.639	0.0799	0.5248	1.6416	2.1188
Tangent	1+533.639	1+580.228	0.0466	0.1074	0.5761	0.7436
Curve 6	1+580.228	1+781.660	0.2014	0.6002	0.7450	0.9615
Tangent	1+781.660	1+831.131	0.0495	0.1052	0.5314	0.6859
Curve 7	1+831.131	1+949.954	0.1188	0.5751	1.2099	1.5616
Tangent	1+949.954	2+043.574	0.0936	0.2002	0.5345	0.6899
Curve 8	2+043.574	2+135.747	0.0922	0.3145	0.8530	1.1010
Tangent	2+135.747	2+185.838	0.0501	0.1152	0.5751	0.7423
Curve 9	2+185.838	2+296.655	0.1108	0.4728	1.0666	1.3767
Tangent	2+296.655	2+364.670	0.0680	0.1533	0.5636	0.7274

This table gives the expected crash frequencies and rates for each tangent and curve.

Crash Rate Plots

Below is a graphical presentation of the above tables. The user can view this graph and quickly go to the corresponding location in the tables to see what is happening.


Raw Data & Sliding Scale Data
Project: Indian Creek
Analysis: Existing Alignment
Highway: Indian Creek
Intersections
W Cross Street
E Cross Street
Elevation (m)
Radius (m)
Tangent
Intersection Crashes/Year
Cross
0.2
0.15
0.1
0.05
0
Crash Rate by Segment (crashes/km/yr)
Crash Rate by Horizontal Design Element (crashes/km/yr)
24
18
12
6
0
Station
Legend
Intersections
Vertical Alignment (Elevation); m
Horizontal Alignment Radius; m
Intersection Crashes/Year
Crash Rate by Segment - Sliding Scale; crashes/km/yr
Crash Rate by Segment; crashes/km/yr
Crash Rate by Horizontal Design Element; crashes/km/yr

Design Consistency

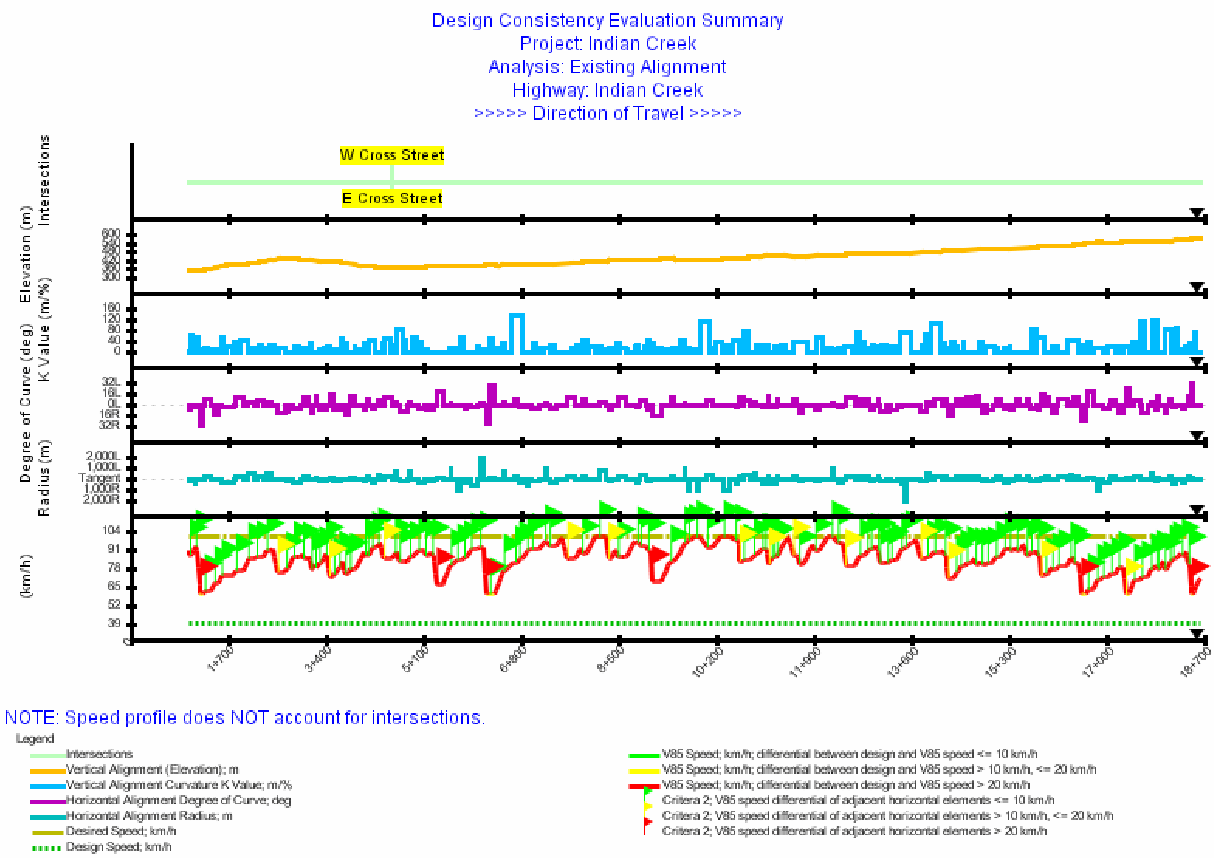
This model will provide a total of two graphs and six reports, one graph and three reports for each direction of travel. This chapter will only give example reports for one direction of travel.

Design Consistency Results Graph

Design Consistency Module Version: 2.01d (DCM Nov 15, 2002)
DCM Analysis Vehicle: Passenger Car - Type 5
Vehicle Start Speed: 100
Vehicle End Speed: 100

[DCM Graphical Output in the Design Consistency Module (DCM) Engineer's Manual]

Graph: Design Consistency Results (in the direction of increasing stations)



This graph is a good way for the user to see where the spikes in the K Value and Radius of curve seem out of place. An estimated 85th percentile operating speed (V85) profile is plotted, with color-coding and flagging related to the two design consistency criteria, i.e., the design speed versus operating speed assumption check and the speed differential of adjacent horizontal design elements check, respectively. See the CDM Engineer's Manual section 4 for more details.

V85 Speed Profile Coordinates

V85 Speed Profile Coordinates (in the direction of increasing stations)

Station	Speed (km/h)
1+000.000	90.7
1+025.028	87.4
1+027.778	87.4
1+047.356	87.4
1+124.949	93.4
1+132.214*	93.4
1+209.123	60.0
1+263.345	60.0
1+277.778	61.7

This table contains the (Station, Estimated V85) coordinates that are plotted in the graph shown on p. 13-12. Locations where he predicted deceleration rate is greater than the approximated comfortable deceleration rate are noted by and asterisk.

Design Speed Assumption Check

Design Speed Assumption Check (in the direction of increasing stations)

Station		V85 - Vdesign Speed (km/h)		Condition
From	To	Min	Max	
1+000.000	1+209.123	20.0	53.4	3
1+209.123	1+263.345	20.0	20.0	2
1+263.345	6+181.539	20.0	55.9	3
6+181.539	6+234.884	20.0	20.0	2
6+234.884	6+252.922	20.0	21.5	3
6+252.922	6+336.662	20.0	20.0	2

This table compares the estimated V85 speed to the design speed, using the following conditions:

Design Speed Assumption Check Conditions Key
Condition 1: 0 km/h <= (V85 - Vdesign) <= 10 km/h
Condition 2: 10 km/h < (V85 - Vdesign) <= 20 km/h
Condition 3: 20 km/h < (V85 - Vdesign)
Condition 4: (V85 - Vdesign) < 0 km/h
where:

V85 = estimated 85th percentile operating speed (km/h)
Vdesign = design speed (km/h)

Speed Differential of Adjacent Design Elements Check

Speed Differential of Adjacent Design Elements Check (in the direction of increasing stations)

Station of max speed on preceding element	Max speed on preceding element (km/h)	Start Station of curve	Speed on curve (km/h)	Speed Differential (km/h)	Condition
1+000.000	90.7	1+025.028	87.4	3.2	1
1+124.949	93.4	1+124.949	93.4	0.0	1
1+132.214	93.4	1+209.123	60.0	33.4	3
1+284.606	62.4	1+284.606	62.4	0.0	1
1+453.724	68.2	1+453.724	68.2	0.0	1
1+580.228	72.8	1+580.228	72.8	0.0	1
1+831.131	76.5	1+831.131	76.5	0.0	1
2+043.574	84.6	2+043.574	84.6	0.0	1
2+184.243	86.2	2+185.838	86.0	0.1	1
2+364.670	90.3	2+364.670	90.3	0.0	1
2+473.111	91.3	2+554.799	75.4	15.9	2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

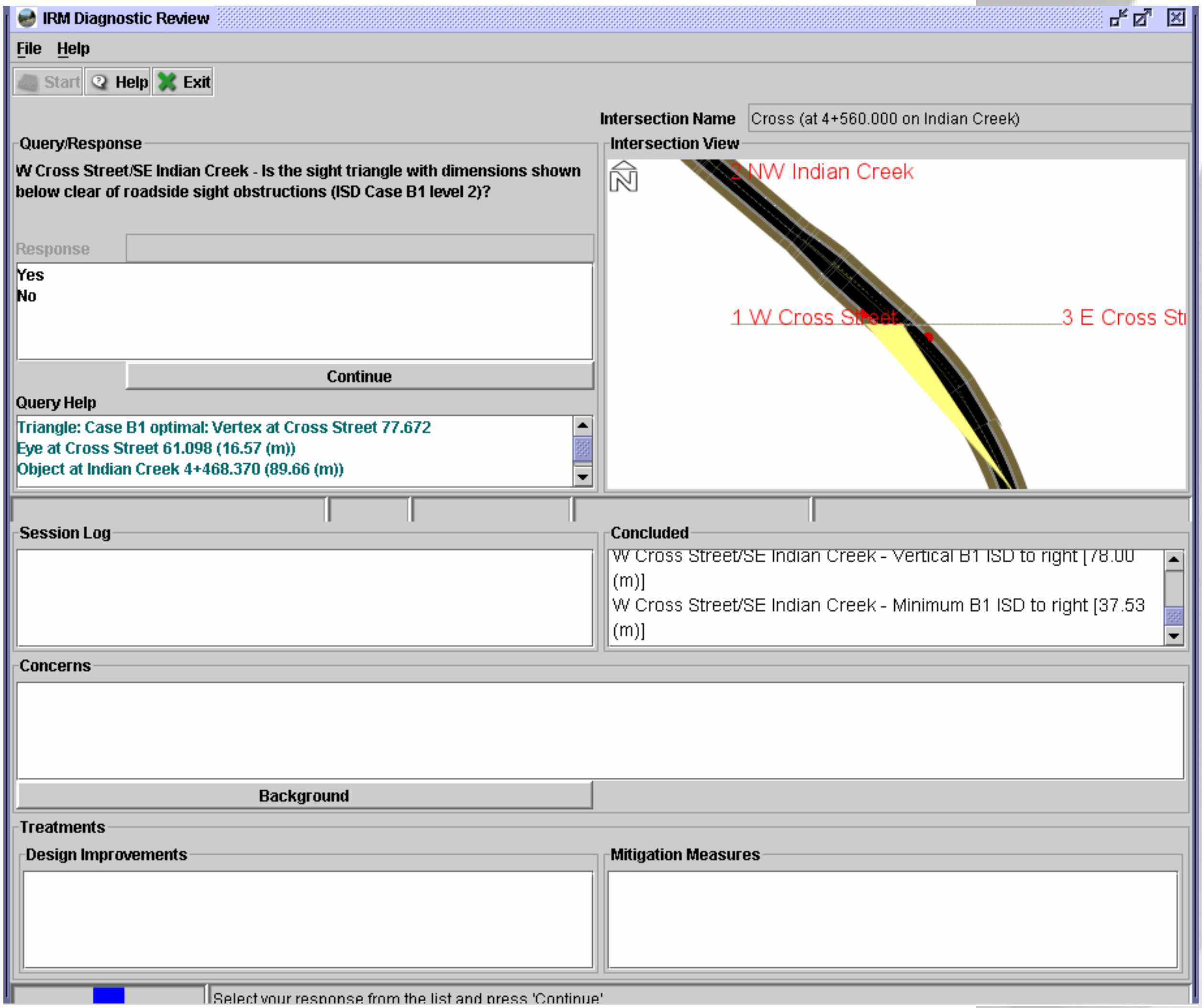
This table shows speed differentials between adjacent design elements (e.g., speed reduction from a tangent to a curve) meets the following Condition criteria:

Speed Differential of Adjacent Design Elements Check Conditions Key
Condition 1: (V85Tangent - V85Curve) <= 10 km/h
Condition 2: 10 km/h < (V85Tangent - V85Curve) <= 20 km/h
Condition 3: 20 km/h < (V85Tangent - V85Curve)

where:
V85Tangent = estimated 85th percentile operating speed on tangent (km/h)
V85Curve = estimated 85th percentile operating speed at the beginning of the curve (km/h)

Intersection Review

This report is more interactive. The following dialog box will come up and ask the user a series of questions. Answer the questions by clicking on Yes or No and picking Continue. After the questions are answered, IHSDM will provide the reports.



The Analysis Report gives the intersection information, a schematic of the intersection, the answers the user provided, and a table of the results. An example of each element is shown below:

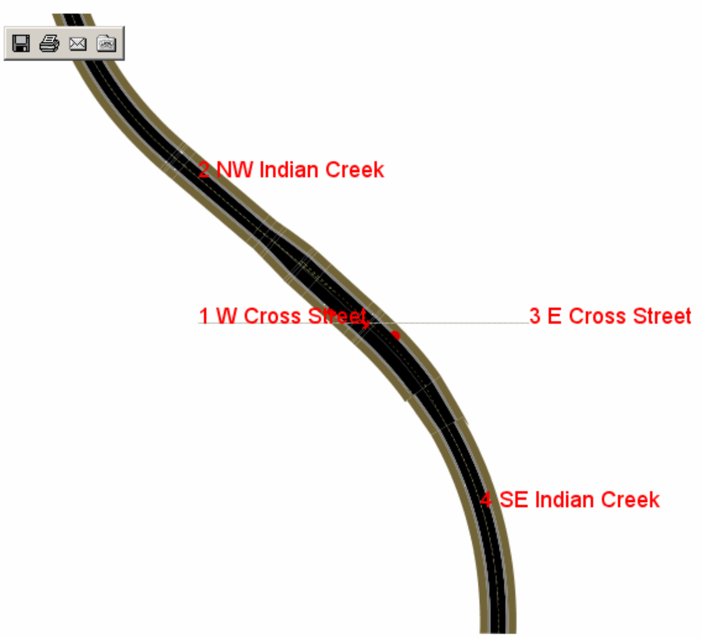
3.1 Diagnostic Review for Cross (at 4+560.000 on Indian Creek)

Intersection: Cross (at 4+560.000 on Indian Creek)
Analysis vehicle: P - Passenger Car
Design vehicle: A-BUS - Articulated Bus
Checking 23 potential concerns

3.1.1 Summary: Cross

Intersection Name: Cross; **Base Highway:** Indian Creek at 4+560.000
Traffic Control: stop; **Construction Type:** existing
Leg #1: W Cross Street; **PI:** Cross Street at 75.000
Relative Heading: -42.12 deg.; **Classification:** minor
Control: stop; **Control position:** side at 66.349
Corner: simple curve; radius=5.00 (m); turn angle=137.9 (deg); turn speed=20 (km/h)
Leg #2: NW Indian Creek; **PI:** Indian Creek at 4+560.000
Relative Heading: 0.0 deg.; **Classification:** major
Control: none; **Control position:** side at 4+566.000
Corner: simple curve; radius=5.00 (m); turn angle=42.1 (deg); turn speed=20 (km/h)
Leg #3: E Cross Street; **PI:** Cross Street at 75.000
Relative Heading: 137.88 deg.; **Classification:** minor
Control: stop; **Control position:** side at 83.651
Corner: simple curve; radius=5.00 (m); turn angle=137.9 (deg); turn speed=20 (km/h)
Leg #4: SE Indian Creek; **PI:** Indian Creek at 4+560.000
Relative Heading: 180.0 deg.; **Classification:** major
Control: none; **Control position:** side at 4+554.000
Corner: simple curve; radius=5.00 (m); turn angle=42.1 (deg); turn speed=20 (km/h)

Graph: Intersection Diagram for Cross



3.1.2 Queried Values

W Cross Street/SE Indian Creek - Clear of sight obstructions, right of intersection Case B1(level 2) [yes]
E Cross Street/NW Indian Creek - Clear of sight obstructions, right of intersection Case B1(level 2) [yes]
W Cross Street/NW Indian Creek - Clear of sight obstructions, left of intersection Case B2(level 2) [yes]
E Cross Street/SE Indian Creek - Clear of sight obstructions, left of intersection Case B2(level 2) [yes]

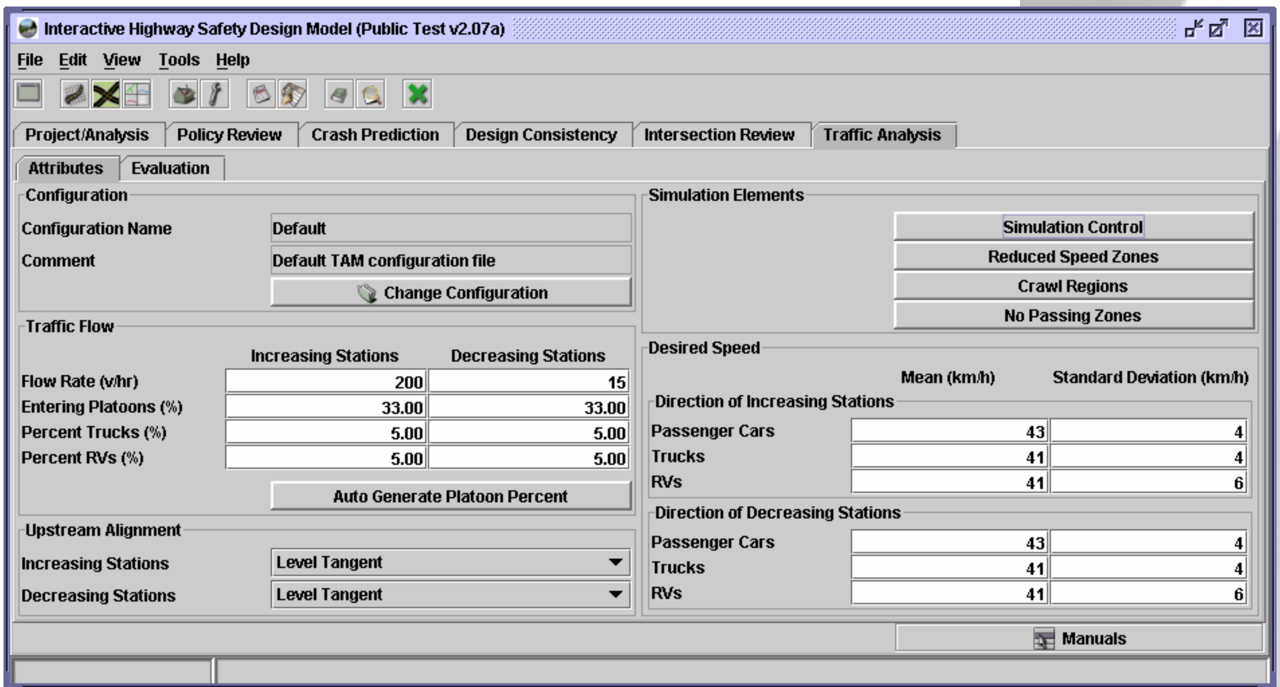
Diagnostic Review Summary - Cross

Scope	Status	Concern	Feature			Comment	Treatment	
			Category	Road	Threshold		Design Improvement	Mitigation Measures
Intersection concern	Level 2	Large intersection pavement area	Skewed angle	42.12368 degrees	60.00000 degrees	Skewed intersection, large vehicle turn path	1. Realign one or more legs. 2. Add channelizing islands. 3. Relocate one or more legs. 4. Close one or more legs. 5. Consider smaller design vehicle. 6. Improve drainage. 7. Realign approach. 8. Increase throat width.	1. Move stop bar.
Leg #1 - W Cross Street	Level 2	Insufficient ISD to right (Case B1)	ISD (vertical)	78.00 meters	89.66 meters	The required time for the maneuver used in the ISD calculations are for passenger cars only ; crest vertical curve, skewed intersection	1. Remove roadside obstacles within sight triangle. 2. Close approach. 3. Relocate approach. 4. Make leg one-way away from intersection. 5. Lengthen vertical curve. 6. Realign one or more legs. 7. Relocate one or more legs. 8. Close one or more legs.	1. Remove roadside obstacles within sight triangle. 2. Signalize intersection. 3. Convert to all-way STOP. 4. Post advisory speed on major road. 5. Review speed limit on major road. 6. Install warning sign on major road. 7. Install flashing beacons. 8. Prohibit left turns. 9. Provide intersection lighting.
	Not a concern	Insufficient ISD to left (Case B2)				The required time for the maneuver used in the ISD calculations are for passenger cars only		

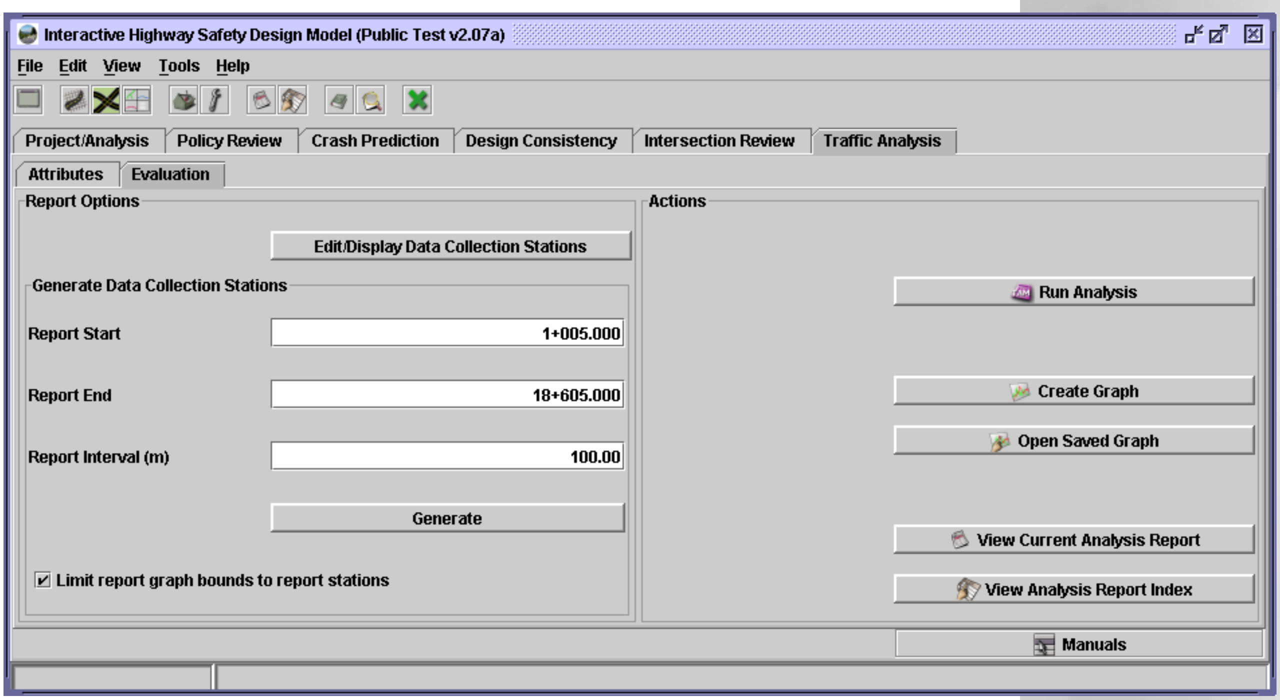
This table will point out areas of concern, describe why they are a concern and offer potential treatments to address each concern.

Traffic Analysis Module

The traffic analysis is the most calculation intensive module. The below figure is an example of the evaluation dialog box. Check that each item has the information necessary to get a detailed analysis.



Once the user is satisfied with the Attributes, pick the Evaluation Tab to get the following dialog box:



Set the desired Report Start station, the Report End station, and the Report Interval and pick Run Analysis. After the calculations are completed, the following reports are provided:

The first three reports describe the data used for the calculations.

Simulation Data

Traffic Analysis Module Version: 1.00f (TAM Jan 09, 2004)
Highway Information: Indian Creek, chain: none (unspecified, file: Indian_Creek)
Processing Limits: 1+000.000 to 18+623.694

Simulation Data

Simulation Time (min)	60		**Test Road Length (km)**	17,623.6936
Warm-up Time (min)	10			
Total Time (min)	70			
Computer Time (sec)	4.7			

Random Number Seeds

Random Number Seeds

Entering Traffic in Platoons / Direction of Increasing Stations	81,250,132		**Desired Speed / Direction of Increasing Stations**	70,867,724
Entering Traffic in Platoons / Direction of Decreasing Stations	33,333,334		**Desired Speed / Direction of Decreasing Stations**	16,532,240
Passing Decisions	52,338,126			

Traffic Input Data

Traffic Input Data

Traffic Input Data	Direction of Travel	
	Increasing Station	Decreasing Station
Flow Rate (v/hr)	200	15
Distribution (%) CARS	90.0	90.0
Distribution (%) TRUCKS	5.00	5.00
Distribution (%) RVs	5.00	5.00
Mean Desired Speed (km/h) CARS	43	43
Mean Desired Speed (km/h) TRUCKS	41	41
Mean Desired Speed (km/h) RVs	41	41
Desired Speed Standard Speed Deviation (km/h) CARS	4	4
Desired Speed Standard Speed Deviation (km/h) TRUCKS	4	4
Desired Speed Standard Speed Deviation (km/h) RVs	6	6
Entering Traffic in Platoons (%)	33.00	33.00
No Passing Zone (%)	0.00	0.00

Section Summary

1.1 Section Summary

Traffic Output Data / Main Section (1+005.000 to 18+605.000 increasing; 18+605.000 to 1+005.000 decreasing)

Traffic Output Data	Direction of Travel		
	Increasing Station	Decreasing Station	Combined
Flow Rate from Simulation (v/hr)	197	11	208
Percent Time Spent Following (%)	42.4	17.4	41.1
Average Travel Speed (km/h)	39.6	41.0	39.7
Trip Time (min/veh)	26.6	25.7	26.5
Traffic Delay (min/veh)	1.64	0.82	1.60
Geometric Delay (min/veh)	0.02	0.00	0.02
Total Delay (minutes/vehicle)	1.66	0.82	1.61
Number of Passes	340	4	344
Vehicle km Traveled	3,449	199	3,648
Total Travel Time (veh-hrs)	87.2	4.9	92.1

This table summarizes the traffic analysis.

Station Summary

1.2 Station Summary

Station Summary (direction of increasing stations)

Station Number	Station	Number of Lanes	Traffic Volume (v/hr)	Simulation Speed Characteristic Mean (km/h)				Percent Following (%)	Platoon Size	Number of Passes
				CARS	TRUCKS	RVs	ALL			
1	1+005.000	1	200	43	42	42	43	33.00	2.8	0
2	1+105.000	1	201	42	39	39	42	33.30	2.8	0
3	1+205.000	1	201	41	39	39	41	33.80	2.8	0
4	1+305.000	1	200	42	38	39	41	35.00	2.8	0
5	1+405.000	2	203	42	35	38	42	32.50	2.7	0
6	1+505.000	1	203	41	34	39	41	36.50	2.8	0
7	1+605.000	1	203	41	36	39	41	36.90	2.8	0
8	1+705.000	1	203	41	37	38	41	37.90	2.8	0
9	1+805.000	1	204	41	39	38	41	38.70	2.8	0
10	1+905.000	1	204	41	39	38	41	40.20	2.7	0
11	2+005.000	1	202	41	38	38	41	40.60	2.8	0
12	2+105.000	1	205	41	38	37	40	42.90	2.8	0
13	2+205.000	1	207	40	37	37	40	44.40	2.7	0
14	2+305.000	1	207	41	38	38	40	44.90	2.8	0
15	2+405.000	1	207	41	38	38	41	45.40	2.8	1.0
16	2+505.000	1	209	41	38	37	40	46.40	2.8	4.0

These two tables break the report into the interval set on the Evaluation dialog box. There is one table for increasing stations and one for decreasing stations.

Graphs

There are two graphs, one for the increasing station direction and one for the decreasing station direction. Plots of percentage of vehicles following in platoons, flow (veh/hr) and mean speeds by vehicle type (km/hr [mi/hr]) are provided. They summarize the above tables.

1.3 Graphs

Graph: Traffic Analysis - Increasing Stations