



# Warrants

*Version 10*

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# Warrants 10 User Guide

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# Chapter 1 – Introduction

## Introduction

Warrants 10 is a simple, easy-to-use tool to analyze traffic signal and All Way Stop Control (AWSC) warrants using the methods prescribed in the 2003 and 2009 Manual on Uniform Traffic Control Devices (MUTCD) and includes amendments for the 2012 California MUTCD. Trafficware Warrants 10 is unique in that multiple intersections can be stored in a single file. This allows the analyst to quickly review the warrant status for the intersections in their study area/jurisdiction.

Warrants 10 also interacts with Synchro. If a user has a model created in Synchro, intersection name/node data can be transferred to Warrants. In return, the traffic volume data from Warrants can be imported into Synchro (user defined interval).

According to the MUTCD, the investigation of the need for a traffic control signal shall include an analysis of the applicable factors contained in nine traffic signal warrants (eight if using the 2003 MUTCD methods) and other factors related to existing operation and safety at the study location.

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal. Warrants 10 faithfully implements all nine MUTCD warrants that include:

- Warrant 1, Eight-Hour Vehicular Volume.
- Warrant 2, Four-Hour Vehicular Volume.
- Warrant 3, Peak Hour.
- Warrant 4, Pedestrian Volume.
- Warrant 5, School Crossing.
- Warrant 6, Coordinated Signal System.
- Warrant 7, Crash Experience.
- Warrant 8, Roadway Network.
- Warrant 9, Intersections Near a Grade Crossings (new in the 2009 MUTCD)

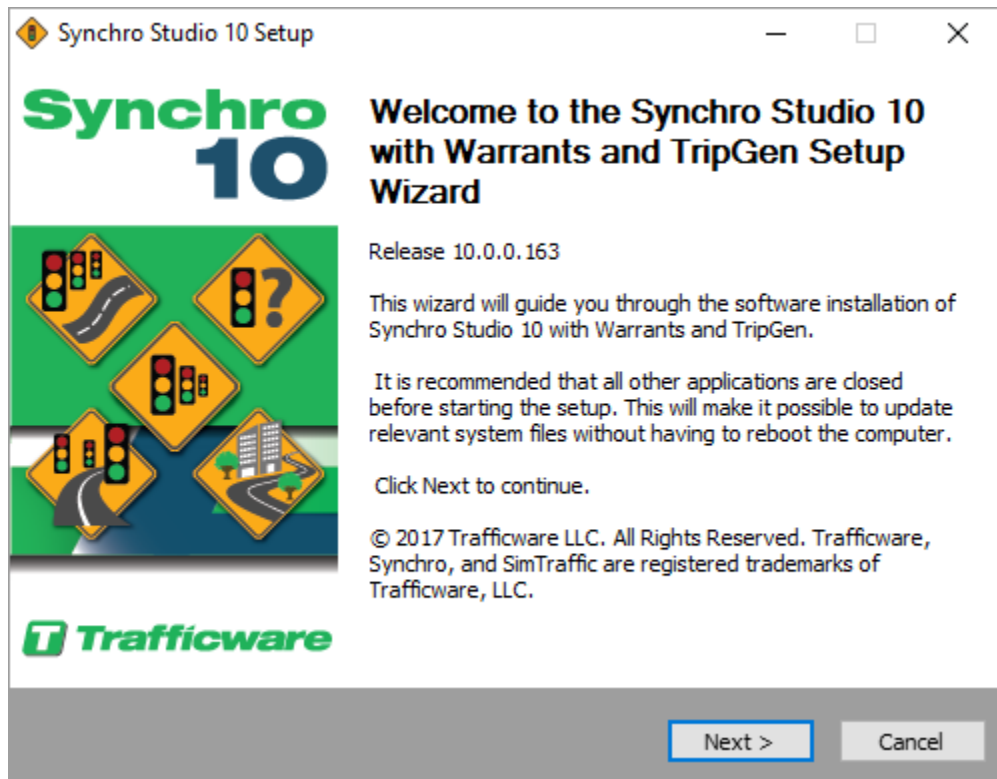
In Addition, Warrants includes the MUTCD warrant for an AWSC control and the California warrant for bicycles.

## Warrants 10 Installation

Warrants 10 is included in the Synchro Studio installation file. A unique License Key is necessary to use Warrants 10.

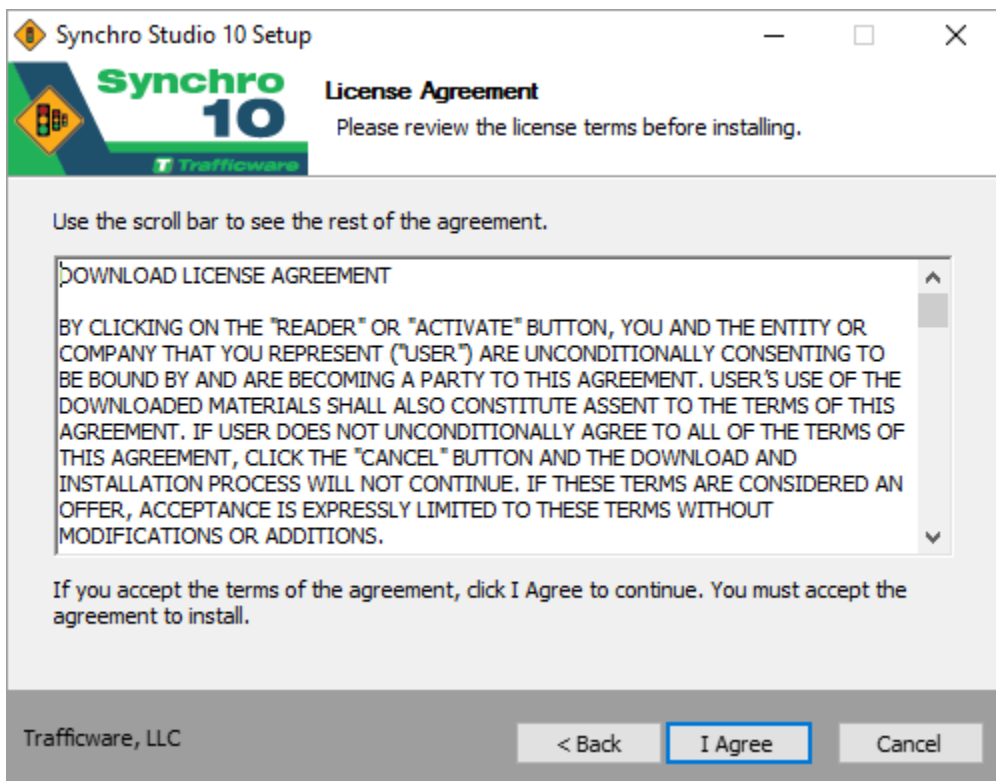
If you have downloaded Synchro Studio with Warrants 10 from the Internet, run *setup.exe* from your download directory.

The Installation Wizard will guide you through the installation process (after you download the setup file). It is recommended that you close all other applications before starting installation. Press [Next] to begin.



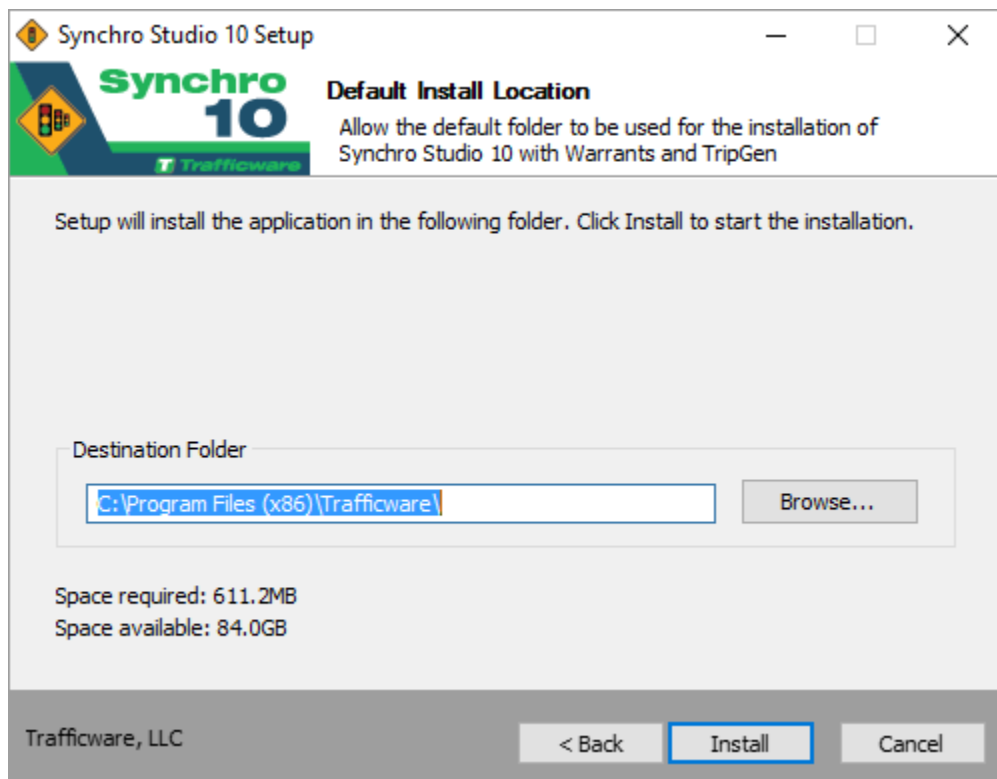


1. Read the license agreement carefully.



Select the [I Agree] button to accept the terms of the license agreement and proceed with the installation. You must accept the license agreement to install Synchro Studio 10, Warrants 10, and TripGen 10.

2. The Installation Wizard saves all files to the default directory C:\Program Files (x86)\Trafficware.



Synchro Studio 10, Warrants 10, and TripGen 10 are now ready to install. Select the [Install] button to install in the selected directory.

3. When the installation is complete, you will be promoted to reboot your computer. It is recommended that you do this immediately, but you may reboot manually later. Select the [Finish] button to exit the Installation Wizard.



## To Activate Warrants

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When you activate Warrants, activate under the user's profile on the PC. Log on to the laptop/PC as the User Profile of the individual that will be using Synchro Studio 10.

---

1. Select the Start Menu, then choose Programs→Trafficware→Warrants 10 or double click on the shortcut from your desktop.
2. Read the license agreement carefully.



Check the 'I Accept the Trafficwre® License Agreement and Microsoft® Bing™ Maps Terms of Use' box to proceed.

Select [Activate] to proceed with the activation. Press [Reader] if you want to use the read only version. The read only version will allow you to try out the features by viewing the sample files. The sample files are located in the directory where you have installed Synchro Studio 10. You will not be able to create your own network with the demo mode.

3. The first time using Warrants, you will be asked to activate your software. Enter the requested information on the Application Activation dialog shown here.



The information entered in the Application Activation dialog is used to setup the profile for online support with Trafficware. Be sure to enter the information for the individual that will be using the software.

Application Activation

License Key\*

First Name\* Last Name\*

Address\*

City\* State\* Zip Code\* Country\*

Telephone\* Fax Email\*

OK Cancel

The License Key is provided by Trafficware and will be shown on your license certificate and will be emailed to you. The License Key is in the format (Serial Number / Company Name - Product Key).

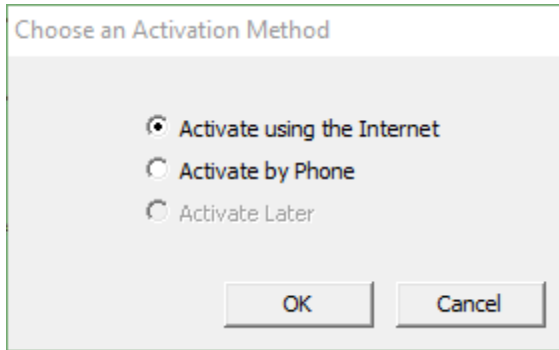


To ensure accurate entry into the Application Activation dialog, copy the entire string from your email message and paste into the License Key box.

The entries with the asterisk "\*" are required to activate Warrants.

After entering the necessary information, select [OK].

4. The next dialog gives you two options to activate and an option to activate later.



'Activate using the Internet' is the preferred method for activating your software. Choose this option and select [OK] to automatically and quickly activate your software.

If you do not have an internet connection, use the 'Activate by Phone' option and press [OK]. Follow the instructions on the Phone Activation dialog. Before calling, make sure invoice has been paid and have your license key available. Trafficware staff will ask for the Machine Key listed in the Phone Activation dialog. With this information, an Activation Code will be provided.

## To View Sample Files

Warrants comes with sample files so that you can see how intersections are modeled in Synchro. To view the sample files:

1. From Warrants, choose the **File→Open** command.
2. Navigate to the C:/Program Files(x86)/Trafficware/Version 10/Sample Files folder.
3. Select "DemoWarrants.swn" from the list.

## Getting Help

Trafficware offers a variety of options for you to learn **Warrants** as presented in this section.

## Warrants Digital User Guide

The **Digital User Guide** (online manual) is designed to open in the Adobe® Acrobat® Reader. If you do not have the Acrobat Reader, you can download the application from:

<http://www.adobe.com/products/acrobat/readstep2.html>.

To load the Warrants Digital User Guide file within Warrants, press [F1]. The Help file will appear.

In the Acrobat window, press on the **Bookmarks** tab to show the contents of the Help. You can click the plus/minus icon to the left to expand or collapse the outline. Select a topic bookmark to jump to the section of the Synchro Studio Digital User Guide.

Use the Acrobat **Search** feature to search for words in the Help system and locate topics containing those words. Type the word in the text box and click Search. The results list shows the titles of all topics in which the search word appears, listed in the order that they appear within the document.

## Contacting Trafficware

Before contacting Trafficware, you can find answers to many of your questions in the on-line Help file. Additional sources of information are also available on the Trafficware web site.

## Online Support

Warrants 10 support is available by going to <http://online.trafficware.com/support/> and logging into the support system. You can also get to the support center by using the command Help→Support. Submit your question and the necessary Warrants (\*.swf) file to the support ticket. Trafficware will be happy to answer your technical question, usually within a 24-hour period.

## Technical Articles

Read articles regarding Trafficware products on our Resources Page of our website (<http://www.trafficware.com/resources.html>).

## Discussion Web

Access our Discussion Web for Trafficware Software.

## Build History

Check out Trafficware Software's History on our Build History Page.

Use the command Help→Check for New Version. A dialog box appears that will indicate if your build is up to date. The version check is made over the internet with HTTP protocol. This communication should pass through most firewalls.

## Training Classes

Check out classes being offered by Trafficware University:  
<http://www.trafficwareuniversity.com/>.

## Providing Documentation Feedback

Trafficware strives to produce the highest quality online help and printed documentation. We want to help you learn about our products and get your work done quickly. We welcome your feedback. Please send your comments to [training@trafficware.com](mailto:training@trafficware.com).

## Keeping Up to Date

To keep this information up to date, Trafficware might issue new printings of this manual. New printings reflect minor changes and technical corrections. You can keep this information up to date by visiting and installing the latest revision of the Trafficware software; the **Warrants User Guide** is replicated in the Help Menu of the program.

## System Requirements

Warrants has the following requirements for the computer.

- CPU: Pentium 4 or higher
- Operating System: Windows 7, Windows 8, or Windows 10
- Mouse: Required
- Memory: 4GB RAM minimum
- Hard Disk: 50M Free Space
- Monitor: Accelerated graphics adapter recommended

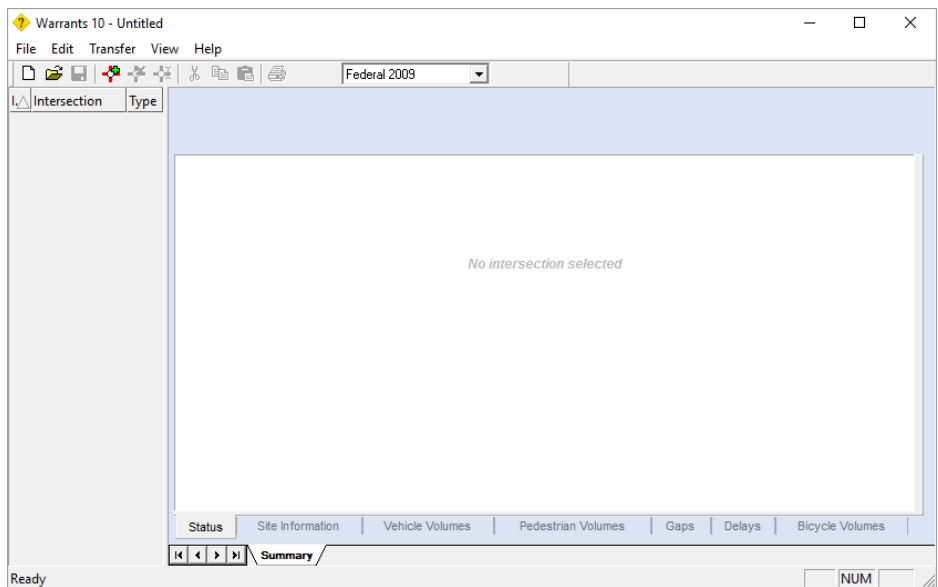


## Chapter 2 – Getting Started

This section provides an overview of Warrants 10, introducing you to some of the main features. To launch Warrants 10, Select the Start Menu, then choose Programs→Trafficware→Warrants 10 or double-click on the warrants shortcut from your desktop.


### Getting Started

1. Select the **File→New** command to start with a new file.

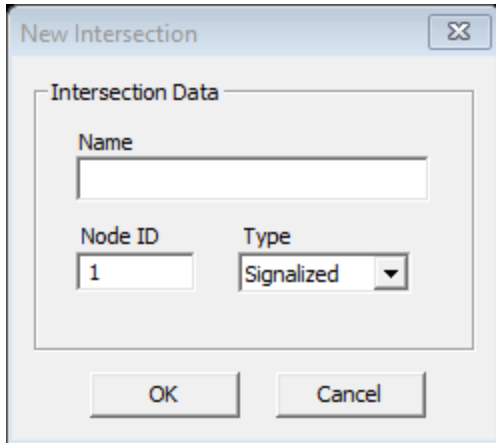


2. On the toolbar, select the Federal 2003 or 2009 option for the Federal MUTCD warrants or the California 2012 for the California MUTCD warrants.



3. To add an intersection, click the “New Intersection” toolbar button , and enter the applicable information in the popup window. If you are a Synchro user, the ID

should match the Node Number used in any Synchro network. Add additional intersections as desired.



The image shows a 'New Intersection' dialog box. It has a title bar with the text 'New Intersection' and a close button. The main area is titled 'Intersection Data' and contains three input fields: 'Name' (a text box), 'Node ID' (a text box containing the number '1'), and 'Type' (a dropdown menu with 'Signalized' selected). At the bottom of the dialog are two buttons: 'OK' and 'Cancel'.

4. Select an intersection from the left Intersection List pane and select the 'Summary' tab in the right pane. The summary tab has sub-tabs for 'Status', 'Site Information', 'Vehicle Volumes', 'Pedestrian Volumes', 'Gaps', and 'Delays'. Choose the 'Site Information' sub-tab.



- From the 'Summary' tab, select the 'Vehicle Volumes' sub-tab and enter the appropriate Normal Weekday volumes and/or Weekend Volumes.

13 - Main Street & 1st Street

### Intersection Summary

**Vehicle Volumes**
☒ Normal
 ☐ Weekend

Time Period		EB			WB			NB			SB			SE			
Begin	End	L	T	R	L	T	R	L	T	R	L	T	R	L	T	R	
7:30	7:45	11	0	39	0	0	0	3	193	3	0	440	2				
7:45	8:00	10	0	38	2	0	0	5	218	4	3	469	2				
8:00	8:15	7	0	30	0	0	0	7	205	2	2	370	7				
8:15	8:30	8	1	23	0	0	0	6	214	3	4	229	3				
8:30	8:45	2	0	24	0	0	0	4	167	5	3	218	1				
8:45	9:00	8	1	18	0	0	0	4	167	9	3	190	6				
9:00	9:15	5	0	17	3	0	1	7	153	12	9	205	4				
9:15	9:30	3	0	13	3	0	0	7	147	12	3	172	3				
9:30	9:45	2	0	12	1	1	1	4	138	8	0	156	2				
9:45	10:00	4	0	9	4	0	0	6	165	4	0	127	2				
10:00	10:15	3	1	11	3	0	2	5	172	2	3	163	2				
10:15	10:30	6	0	3	0	0	5	8	175	12	2	146	2				
10:30	10:45	1	1	9	7	0	2	12	169	12	10	151	2				
10:45	11:00	2	1	13	19	1	7	6	161	12	2	157	1				
11:00	11:15	0	0	0	0	0	0	0	0	0	0	0	0				
11:15	11:30	0	0	0	0	0	0	0	0	0	0	0	0				
11:30	11:45	0	0	0	0	0	0	0	0	0	0	0	0				
11:45	12:00	0	0	0	0	0	0	0	0	0	0	0	0				
12:00	12:15	0	0	0	0	0	0	0	0	0	0	0	0				

Status | Site Information | **Vehicle Volumes** | Pedestrian Volumes | Gaps | Delays | Bicycle Volumes

Summary | Warrant 1 | Warrant 2 | Warrant 3 | Warrant 4 | Warrant 6 | Warrant 9 | AWSC Warrant | Warrant 5 | Warrant 7 | Warrant

- Continue by entering available data for 'Pedestrian Volumes', 'Gaps' and 'Delays'. Not all data is needed to analyze warrants. However, some warrants will not be performed if data is not available.
- Additional warrant specific data can be entered on the 'Warrant 1' through 'Warrant 9' tabs. The tabs will also show the status of the given warrant.

9. Refer back to the 'Status' tab for the current warrant analysis status. Choosing a new intersection from the left pane will update the Status view for the selected intersection.

13 - Main Street & 1st Street

### Intersection Summary

#### Warrant Status

<input checked="" type="checkbox"/> <a href="#">Warrant 1 - Eight-hour Vehicular Volume</a>	Not Met	Notes
<ul style="list-style-type: none"><li>- Warrant 1 (A or B) not met</li><li>- Warrant 1 (A and B) not met</li></ul>		
<input checked="" type="checkbox"/> <a href="#">Warrant 2 - Four-hour Vehicular Volume</a>	Not Met	
<ul style="list-style-type: none"><li>- Warrant not met</li></ul>		
<input checked="" type="checkbox"/> <a href="#">Warrant 3 - Peak Hour Delay/Volumes</a>	Not Met	
<ul style="list-style-type: none"><li>- Warrant 3A not met</li><li>- Warrant 3B not met</li></ul>		
<input type="checkbox"/> Warrant 4 - Pedestrian Volume	N/A	
<input type="checkbox"/> Warrant 5 - School Crossing	N/A	
<input type="checkbox"/> Warrant 6 - Coordinated Signal System	N/A	
<input checked="" type="checkbox"/> <a href="#">Warrant 7 - Crash Experience</a>	Not Met	
<ul style="list-style-type: none"><li>- Warrant not met</li></ul>		
<input type="checkbox"/> Warrant 8 - Roadway Network	N/A	
<input checked="" type="checkbox"/> <a href="#">Warrant 9 - Grade Crossing</a>	Not Met	
<ul style="list-style-type: none"><li>- Warrant not met</li></ul>		
<input checked="" type="checkbox"/> <a href="#">AWSC Warrant - Multiway Stop Applications</a>	Not Met	
<ul style="list-style-type: none"><li>- Warrant not met</li></ul>		

Status

Site Information

Vehicle Volumes

Pedestrian Volumes

Gaps

Delays

Bicycle Volumes

Summary

Warrant 1

Warrant 2

Warrant 3

Warrant 4

Warrant 6

Warrant 9

AWSC Warrant

Warrant 5

Warrant 7

Warrant 8

# Warrants Layout

Figure 1 illustrates the layout of Warrants.

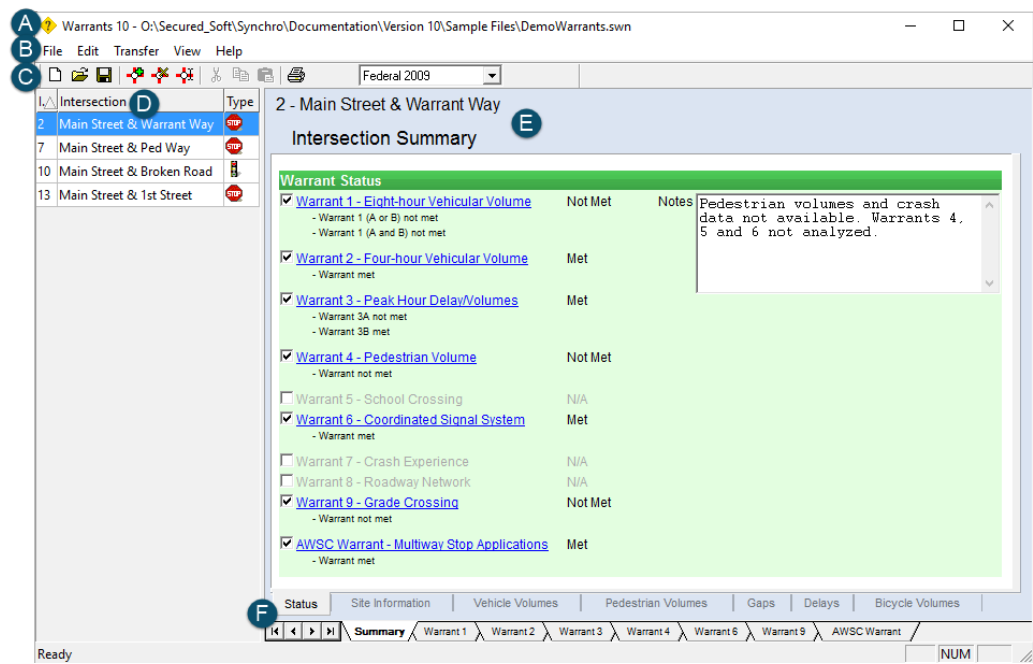


Figure 1 Warrants 10 Layout

In Figure 1,

A is the title bar for the current file. It will illustrate the name of the active file.

B shows the menu commands. Refer to the next section for a complete summary of the menu commands.

The toolbar is noted as C. Hold your mouse cursor over a button for pop-up text indicating the button feature. In the toolbar, you can select to analyze Federal 2003, Federal 2009 or California MUTCD warrants.

D is the left-side pane of the Warrants window, containing the intersection list. For details, refer to page 3-1.

E is the right-side pane that includes the summary view or data entry screens. The data shown on the right-side pane is dependent on the tab selected (F in the figure). Refer to the remainder of this User Guide for details on each data entry tab.

## Summary of Menu Commands

Warrants 10 has a variety of commands that can be accessed with button clicks, left mouse-click commands or menu commands. This section will summarize the available commands (listed in order shown in the menu commands).

**Table 1 File Commands**

Menu Command	Action	Keystrokes
File→New	Start a new file	[Ctrl]+[N]
File→Open	Open an existing file	[Ctrl]+[O]
File→Save	Save the file you are working on	[Ctrl]+[S]
File→Save-As	Save the current file with a new name	-
File→Print	Creates a report of the active tab	[Ctrl]+[S]
File→Print-All-Reports	Creates a report of all intersections, all reports	[Ctrl]+[R]
File→'list of files'	Shows the list of the last four files that were opened	-
File→Exit	Exits the program	-

**Table 2 Edit Commands**

Menu Command	Action	Keystrokes
Edit→Undo	Use to undo multiple changes	[Ctrl]+[Z]
Edit→Cut	Cut the current data and send to the clipboard	[Ctrl]+[X]
Edit→Copy	Copy the selected data to the clipboard	[Ctrl]+[C]
Edit→Paste	Paste the data in the clipboard to Warrants	[Ctrl]+[P]

**Table 3 Transfer Commands**

<b>Menu Command</b>	<b>Action</b>	<b>Keystrokes</b>
Transfer→Import→UTDF→Layout...	Imports a UTDF Database Access layout file (layout.csv)	-
Transfer→Import→UTDF→Volumes...	Imports a UTDF Database Access volume file (volume.csv)	-
Transfer→Import→UTDF→Combined File...	Imports a UTDF Database Access combined file (filename.csv)	-
Transfer→Import→Vol file(s)...	Imports multiple UTDF TMC.vol files (TMC#.vol)	-
Transfer→Export→UTDF→Combined File...	Exports a UTDF Database Access combined file (filename.csv)	-

**Table 4 View Commands**

<b>Menu Command</b>	<b>Action</b>	<b>Keystrokes</b>
View→Multiple-Intersection Reports	Create reports for multiple intersections	-
View→Toolbar	View/hide the toolbar	-
View→Status Bar	View/hide the Status bar	-

**Table 5 Help Commands**

<b>Menu Command</b>	<b>Action</b>	<b>Keystrokes</b>
Help→Contents	Open the Help file	[Shift]+[F1]
Help→About Warrants	Shows the current version, build and copyright	-
Help→License Key	Shows your Product Key	-
Help→Support	Opens the Trafficware support site	-



## Support for Federal and California Warrants

Warrants 10 includes support for the 2003 Federal, 2009 Federal and 2012 California Manual on Uniform Traffic Control Devices (MUTCD). On the toolbar, select the dropdown for the analysis type.

The Federal 2009 Warrants include 9 signal warrants, listed on page 1-1. Warrant 9 was newly added to the 2009 MUTCD for intersections near rail crossings. In addition, warrant 4 was updated for the 2009 warrants.

In general, the California Warrants mimic the Federal warrants with a few exceptions. The most significant difference between the methods is to how vehicular volumes are compared. That is, how to define the minor street volumes and the major street volumes. Vehicular Volumes are used by Warrant 1, 2, 3, 7 and 8.

Refer to the following information.

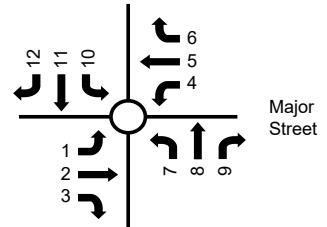
### Federal Warrant

#### Traditional Method

1F	Major Street Volume	$1+2+3+4+5+6$	User may exclude any movement(s)
	Minor Street Volume	Max of $7+8+9$ or $10+11+12$	User may exclude any movement(s)

#### Check Major Street Lefts

2F	Major Street Volume	If $4 > 1$ , $1+2+3$ If $1 > 4$ , $4+5+6$	User may exclude any movement(s)
	Minor Street Volume	Max 4 or 1	User may exclude any movement(s)



### California Warrant

#### Traditional Method (same as federal warrant)

1C	Major Street Volume	$1+2+3+4+5+6$	User may exclude any movement(s)
	Minor Street Volume	Max of $7+8+9$ or $10+11+12$	User may exclude any movement(s)

#### Check Major Street Lefts

2C	Major Street Volume	If $4 > 1$ , $1+2+3+5+6$ If $1 > 4$ , $2+3+4+5+6$	User may exclude any movement(s)
	Minor Street Volume	If $4 > 1$ , $4 + \text{Max of } 7+8+9 \text{ or } 10+11+12$ If $1 > 4$ , $1 + \text{Max of } 7+8+9 \text{ or } 10+11+12$	User may exclude any movement(s)

For the California method, method 1C is the same as 1F. However, 2F (checking mainstreet lefts) differs as noted above.

The California MUTCD adds a bicycle warrant that is not included in the Federal MUTCD. This warrant is only available when the California Option is selected. It looks at vehicle volumes, bicycle volumes, collisions and geometry and is detailed on page 5-41.

# Chapter 3 – Intersection List Pane

The Intersection List pane is always in view on the left side of Warrants 10.



I.△	Intersection	Type
2	Main Street & Warrant Way	
7	Main Street & Ped Way	
10	Main Street & Broken Road	
13	Main Street & 1st Street	

Figure 2 Intersection List

Use the Intersection List to activate an intersection for analysis. To enter data for an intersection, select the ID/Intersection Name to activate. Then, choose the appropriate tab at the lower portion of the right pane. To edit the information seen in the Intersection List, use the New, Edit, and Delete toolbar buttons (see page 3-2 for more details).

## ID Number

All intersections analyzed are assigned a unique **ID Number**. This is used to identify intersections in the reports and for transferring data to and from Synchro's Universal Traffic Data Format (UTDF). Therefore, the Warrants ID number should match any Node (ID) number used in Synchro.

Synchro accepts node numbers up to 9999, so it is recommended that the ID used in Warrants not exceed this value.


## Intersection

The **Intersection** column can be used to provide a longer description of the intersection such as "1st and Main", whereas **ID Number** identifies the same intersection by number. If the data is imported from a Synchro network, the east/west street will be listed first and the north/south street will be listed second. For details on importing layout data from Synchro, refer to page 7-1.


## Type

The **Type** column specifies whether the intersection is currently signalized, unsignalized or roundabout.


## Adding a New Intersection

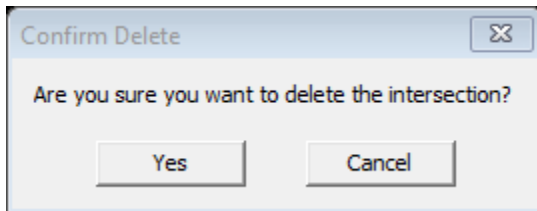
To add a new intersection to the study, click the “New Intersection” toolbar button  and enter the applicable information in the popup window.

## Editing an Existing Intersection

To edit an existing intersection, select an intersection in the list and click the “Edit Intersection” toolbar button .

## Deleting an Intersection

To delete the selected intersection, click the “Delete Intersection” toolbar button . A prompt will ask for confirmation.

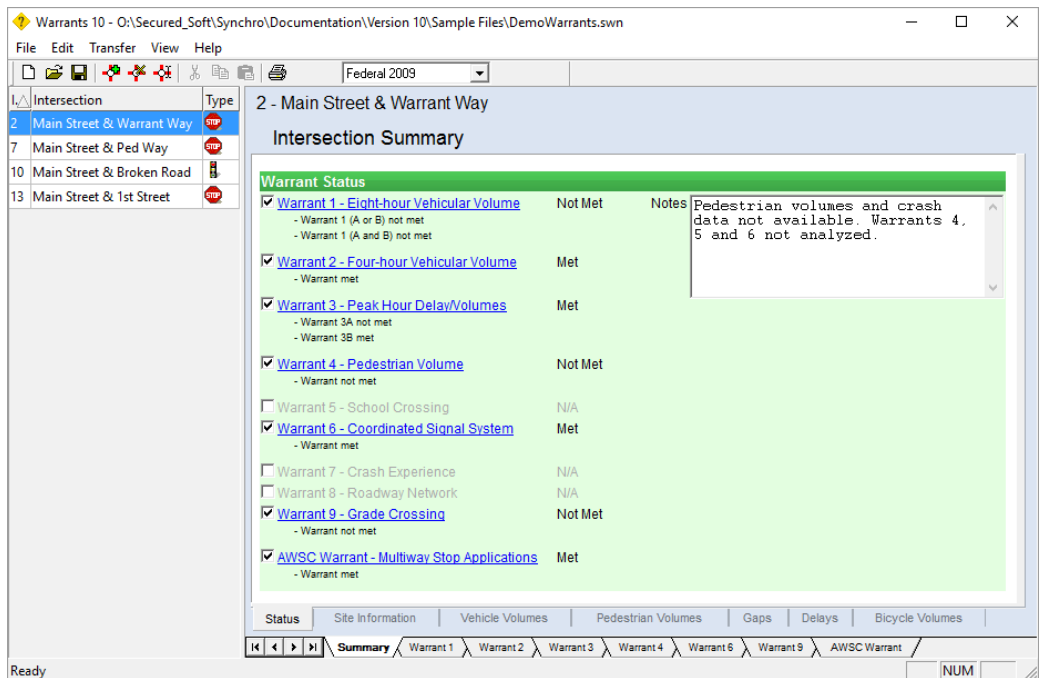


# Chapter 4 – Summary Tab

The summary tab is the view the user will see when the software is opened. Select an intersection from the Intersection List, then select the **Summary** tab at the bottom of the right-hand pane. The screen will show the current status of the warrant (met, not met or not applicable (N/A)). The status will be for the Federal 2009, Federal 2003 or California 2012 warrants, as selected by the user.

This view includes a series of sub-tabs as shown in **Figure 3**. This chapter discusses the settings in the Summary tab.

## Status



**Figure 3 Status View**

The Status view shows the status of the warrants for the selected intersection (the number of warrants will depend on the method used). The status will indicate “Met”, “Not Met”, or “N/A” if the warrant is not selected for inclusion in the analysis.

The top of the Status tab will show the active intersection ID and name. For example, “13 - Main Street and 1<sup>st</sup> Street”.

To see the data for a particular warrant, click on the hyperlink warrant name in the right-side pane, or choose the appropriate tab at the bottom of the right-side pane.

The Status view also includes a Notes box. This is a convenient location for the analyst to enter notes specific to the project/intersection.

## Site Information

13 - Main Street & 1st Street

Intersection Summary

**Present Intersection**

Community Population < 10,000? ☐ Pedestrian Crossing Speed (ft/s)

Alternatives Failed to Reduce Crash Frequency? ☐ Crashes Correctable by Signal Within 12-Month Period

New Signal will Restrict Flow of Traffic? ☐ Student Crossing Time Interval (minutes)

Measures to Reduce Student Ped Danger Considered? ☐

**Projected Intersection**

Total Entering Volume Growth Percentage (per year)  Projected Time Period (in years)

**Approach Information**

	EB			WB			NB			
Include in Analyses	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>			
Name	1st Street			1st Street			Pellet Street			
Major	<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>			
Acceptable Platooning	<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>			
Adj. Coord. Signal	<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>			
Adj. Intersection Distance	556.00			627.00			1145.00			
Median Refuge	<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>			
Speed Limit (mph)	30			30			40			
85th Percentile Speed	0.00			0.00			0.00			
Include in Analyses	L	T	R	L	T	R	L	T	R	
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Lanes & Sharing	↔			↔			↔			
Yearly Growth Pct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0

Status **Site Information** Vehicle Volumes Pedestrian Volumes Gaps Delays Bicycle Volumes

Summary Warrant 1 Warrant 2 Warrant 3 Warrant 4 Warrant 6 Warrant 9 AWSC Warrant Warrant 5 Warrant 7 Warrant 10

**Figure 4 Summary Tab, Site Information Sub-Tab**

To enter the primary data for your intersection, choose the intersection from the left side Intersection List pane and choose the **Summary** tab. The Summary tab has subtabs for entry of Site Information, Vehicle Volumes, Pedestrian Volumes, Gaps and Delays. Not all data is required to perform a warrant analysis.

## **Site Information Sub-Tab**

This tab includes site-specific information for the selected intersection.

### **Community Size**

This value is used to determine which MUTCD tables and figures are to be used. Lower thresholds are required when the intersection is in an isolated community of less than 10,000 people in Warrant 1, Warrant 2, Warrant 3 and Warrant 7.

### **Pedestrian Crossing Speed**

This is the walking speed of pedestrians (ft/sec) used for Warrant 4.

### **Crashes Correctable by Signal**

This number is compared to the five crashes required in the Crash Experience warrant, but only those crashes susceptible to correction by signal installation should be included as described in Warrant 7 (see page 5-26).

### **Alternatives Failed to Reduce Crash Frequency**

Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency. Refer to Warrant 7 on page 5-26.

### **New Signal will Restrict Flow of Traffic**

Check if the new signal will restrict the flow of traffic.

### **Student Crossing Time Interval**

The need for a traffic control signal shall be considered when an engineering study of the frequency and adequacy of gaps in the vehicular traffic stream as related to the number and size of groups of school children at an established school crossing across the major street shows that the number of adequate gaps in the traffic stream during the period when the children are using the crossing is less than the number of minutes in the same period (see Section 7A.03 of the 2009 MUTCD) and there are a minimum of 20 students during the highest crossing hour.

### **Total Entering Volume Growth Percentage**

Used for the Roadway Network Warrant.



## **Projected Time Period**

Used for Roadway Network Warrant.

## **Include in Analyses**

Check to include the approach in the analysis. At least 2 approaches must be selected to begin a warrant analysis.

## **Name**

Enter the Name of the roadway approach (i.e., “Main Street”).

## **Major**

Check this box to define the Major street direction(s). The remaining are Minor approaches.

## **Acceptable Platooning**

Progressive movement in a coordinated signal system sometimes necessitates installing traffic control signals at intersections where they would not otherwise be needed in order to maintain proper platooning of vehicles.

## **Adj. Coord. Signal**

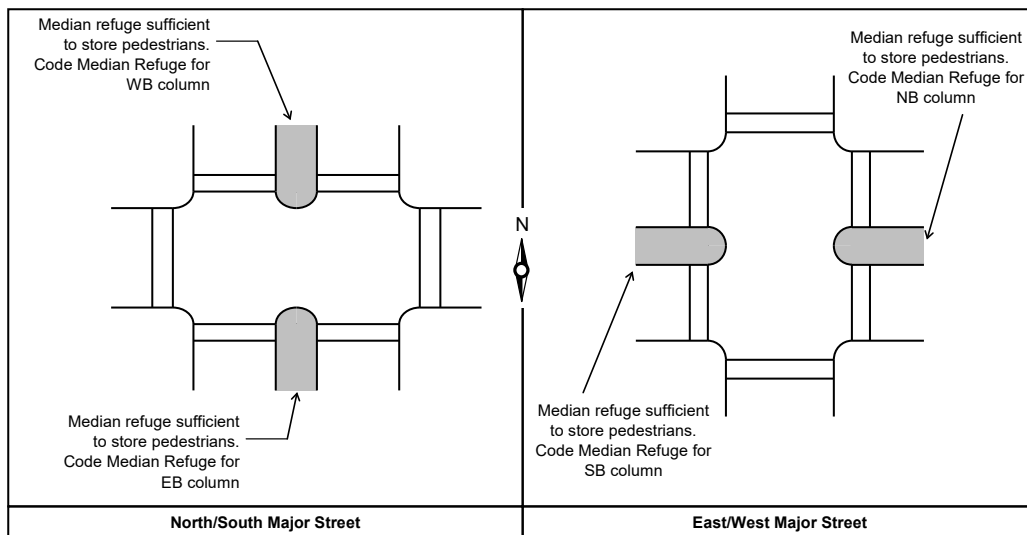
Select this option if there is an existing adjacent coordinated intersection.

## **Adj. Intersection Distance**

Distance in feet to adjacent signalized intersection. Entered distance is only analyzed if the Adjacent Coordinating Signal box is checked.

## **Median Refuge**

Select this option if the approach is a divided street having a median of sufficient width for pedestrians to wait. Set this for the direction that pedestrians will walk. For instance, EB peds are defined as those that cross the south leg of an intersection. If EB pedestrians have a median refuge, set this for the EB column. Refer to **Figure 5**.



**Figure 5 Coding Median Refuge**

## Speed Limit and 85<sup>th</sup> Percentile Speed

This speed is used to determine which MUTCD tables and figures are to be used. Lower thresholds are required when the major street speed is above 40 mph (70 km/h) in Warrant 1, Warrant 2, Warrant 3, Warrant 7 and Warrant 9.

## Include in Analysis

This setting gives the analyst the option to include/exclude a specific movement from the analysis.

The study should consider the effects of the right-turn vehicles from the minor-street approaches. Engineering judgment should be used to determine what, if any, portion of the right-turn traffic is subtracted from the minor-street traffic count when evaluating the count against the above signal warrants.

Engineering judgment should also be used in applying various traffic signal warrants to cases where approaches consist of one lane plus one left-turn or right-turn lane. The site-specific traffic characteristics dictate whether an approach should be considered as one lane or two lanes. For example, for an approach with one lane for through and right-turning traffic plus a left-turn lane, engineering judgment could indicate that it should be considered

a one-lane approach if the traffic using the left-turn lane is minor. In such a case, the total traffic volume approaching the intersection should be applied against the signal warrants as a one-lane approach. The approach should be considered two lanes if approximately half of the traffic on the approach turns left and the left-turn lane is of sufficient length to accommodate all left-turn vehicles.

Similar engineering judgment and rationale should be applied to a street approach with one lane plus a right-turn lane. In this case, the degree of conflict of minor-street right-turn traffic with traffic on the major street should be considered. Thus, right-turn traffic should not be included in the minor-street volume if the movement enters the major street with minimal conflict. The approach should be evaluated as a one-lane approach with only the traffic volume in the through/left-turn lane considered.

## **Lanes & Sharing**

This setting indicates the number of lanes and sharing for the movement.

## **Yearly Growth Pct.**

This is the percent growth rate for Warrant 8.

## **Rail Crossing**

Check this box if a rail crossing exists for this movement. This is used for the Federal 2009 Warrant 9.

## **Site Information Tab Needs Summary**

**Table 6** lists the Site Information Data requirements. In the table, an 'R' indicates that the data is required for the warrant. The 'O' indicates that the data is optional. A blank indicates that the data is not required for the given warrant in the column. Column "A" is for the AWSC and column "B" is for the California Bicycle warrant.

**Table 6 Site Information Data Requirements**

Data Item	Warrant											
	1	2	3	4	5	6	7	8	9	A	B	
Community Size	R	R	R				R			R		
Pedestrian Crossing Speed				R								
Crashes Correctable by Signal/AWSC							R			O		
Alternatives Failed to Reduce Crash Frequency							R					
New Signal will Restrict Flow of Traffic				R	R	R						
Student Crossing Time Interval					R							
Total Entering Volume Growth Percentage								R				
Projected Time Period								R				
Include in Analyses (Approach)	R	R	R	R	R	R	R	R		R	R	
Name	O	O	O	O	O	O	O	O		O	O	
Major	R	R	R	R	R	R	R	R		R	R	
Acceptable Platooning						R						
Adj. Coord. Signal				R	R	R						
Adj. Intersection Distance					R	R	R					
Median Refuge				O								
Speed Limit	R	R	R				R	R	R	R	R	
85 <sup>th</sup> Percentile Speed	O	O	O				O	O	O	O	O	
Include in Analysis (Movement)	R	R	R					R				
Lanes & Sharing	R	R	R					R				
Yearly Growth Pct.								R				
Rail Crossing									R			



Normal Volumes

These are the normal, weekday 15-minute traffic volumes. Up to 24 hours of data can be entered for an intersection.

Weekend Volumes

These are weekend 15-minute traffic volumes. They may be influenced by entertainment or recreation.

Vehicle Volume Data Needs Summary

**Table 7** lists the Vehicle Volume Data requirements. In the table, an ‘R’ indicates that the data is required for the warrant. The ‘O’ indicates that the data is optional. A blank indicates that the data is not required for the given warrant in the column. Column “A” is for the AWSC and column “B” is for the California Bicycle warrant.

Table 7 Vehicle Volume Data Requirements

Data Item	Warrant										
	1	2	3	4	5	6	7	8	9	A	B
Normal Volumes	R	R	R	R			R	R	R	R	R
Weekend Volumes	O	O	O	O			O	O	O	O	O



Pedestrian Volumes

These are the normal pedestrian volumes crossing the roadway. Use **Figure 8** to determine the approach heading to use for entering pedestrian volumes.

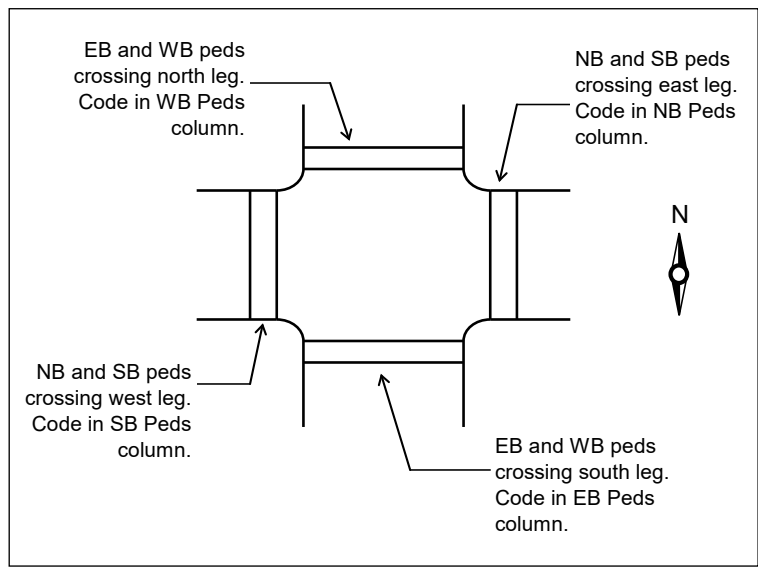


Figure 8 Summary Tab, Site Information Sub-Tab

Pedestrian Volume Data Needs Summary

**Table 8** lists the Pedestrian Volume Data requirements. In the table, an ‘R’ indicates that the data is required for the warrant. The ‘O’ indicates that the data is optional. A blank indicates that the data is not required for the given warrant in the column. Column “A” is for the AWSC and column “B” is for the California Bicycle warrant.

Table 8 Pedestrian Volume Data Requirements

Data Item	Warrant										
	1	2	3	4	5	6	7	8	9	A	B
Student Pedestrians During Crossing Interval					R						
Pedestrian Volumes				R			O				O





Gaps

Gaps in the traffic stream of adequate length to allow pedestrians to cross during the same period when the pedestrian volume criterion is satisfied. Where there is a divided street having a median of sufficient width for pedestrians to wait, the requirement applies separately to each direction of vehicular traffic. If the direction is set to have a Median Refuge, then code the gap for both sides of the median. Refer to **Figure 10**.

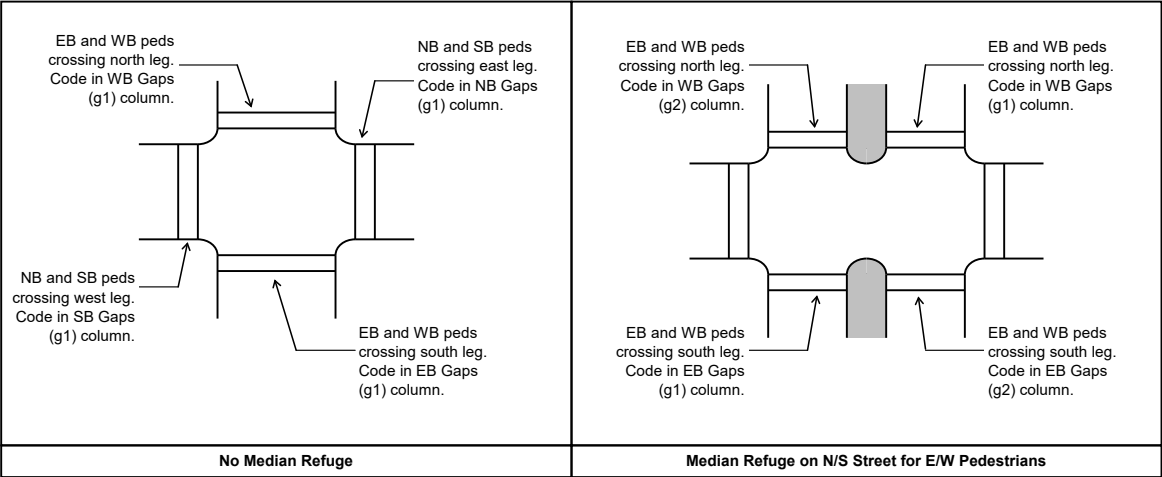


Figure 10 Coding Pedestrian Gaps

Gap Data Needs Summary

**Table 9** lists Gap Data requirements. In the table, an ‘R’ indicates that the data is required for the warrant. The ‘O’ indicates that the data is optional. A blank indicates that the data is not required for the given warrant in the column. Column “A” is for the AWSC and column “B” is for the California Bicycle warrant.

Table 9 Gap Data Requirements

Data Item	Warrant										
	1	2	3	4	5	6	7	8	9	A	B
Acceptable Gaps During Student Crossing Interval					R						
Gap Data				R							

## Delays

The Delays sub-tab is shown in **Figure 11**.

13 - Main Street & 1st Street

Intersection Summary

Time Period		EB	WB	NB	SB	SE	NW	NE	SW
Begin	End								
7:00	7:15								
7:15	7:30								
7:30	7:45								
7:45	8:00								
8:00	8:15								
8:15	8:30								
8:30	8:45								
8:45	9:00								
9:00	9:15								
9:15	9:30								
9:30	9:45								
9:45	10:00								
10:00	10:15								
10:15	10:30								
10:30	10:45								
10:45	11:00								
11:00	11:15								
11:15	11:30								
11:30	11:45								
11:45	12:00								
12:00	12:15								

Summary Warrant 1 Warrant 2 Warrant 3 Warrant 4 Warrant 6 Warrant 9 AWSC Warrant Warrant 5 Warrant 7 Warrant 8

**Figure 11 Summary Tab, Delays Sub-Tab**

## Delay Data

The average stopped delay for each approach is coded in minutes per vehicle. The appropriate volumes will be used to calculate the total stopped delay in vehicle hours.

Delay Data Needs Summary

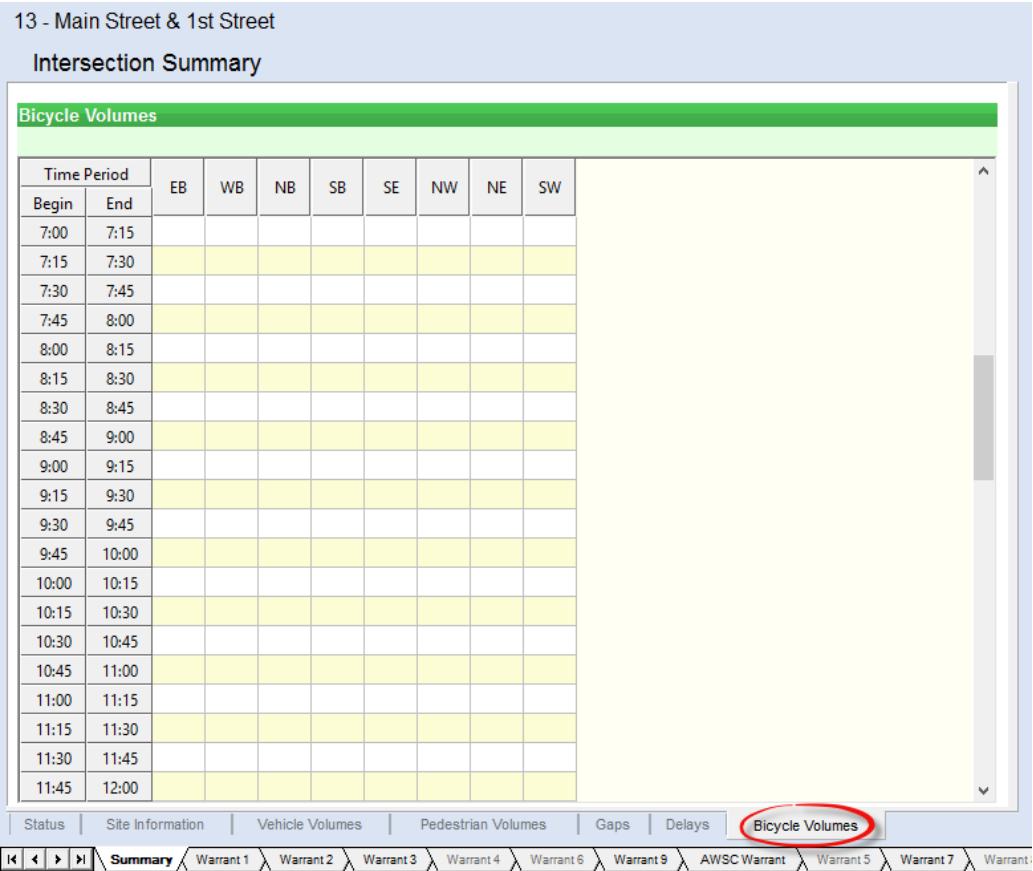
Table 10 lists the Delay Data requirements. In the table, an ‘R’ indicates that the data is required for the warrant. The ‘O’ indicates that the data is optional. A blank indicates that the data is not required for the given warrant in the column. Column “A” is for the AWSC and column “B” is for the California Bicycle warrant.

Table 10 Delay Data Requirements

Data Item	Warrant										
	1	2	3	4	5	6	7	8	9	A	B
Delay Data			O					O		O	

# Bicycles

The Bicycles sub-tab is shown in **Figure 12**.



**Figure 12 Summary Tab, Bicycles Sub-Tab**

## Bicycle Data

These are the bicycle volumes crossing the roadway.

**Bicycle Data Needs Summary**

**Table 10** lists the Bicycle Data requirements. In the table, an ‘R’ indicates that the data is required for the warrant. The ‘O’ indicates that the data is optional. A blank indicates that the data is not required for the given warrant in the column. Column “A” is for the AWSC and column “B” is for the California Bicycle warrant.

**Table 11 Bicycle Data Requirements**

Data Item	Warrant										
	1	2	3	4	5	6	7	8	9	A	B
Bicycle Data											R

## Chapter 5 – Warrants Tabs

This chapter details the warrant specific tabs. All data can be entered in the **Summary** tab. However, warrant-specific data can be entered on the appropriate tab for Warrants 1 through 9 (1 through 8 if using 2003 Federal Warrants), AWSC, and Bicycle (if the California option is selected).

### Traffic Volumes Used for Warrants

Vehicular Volumes are used by Warrants 1, 2, 3, 7, 8 and 9. The user has the option to compare main street volumes to side street volumes. There is also an option to compare left turn volumes which will differ depending on the selection of the Federal or California MUTCD warrant. From the Federal MUTCD:

“Option: At an intersection with a high volume of left-turn traffic from the major street, the signal warrant analysis may be performed in a manner that considers the higher of the major-street left-turn volumes as the “minor-street” volume and the corresponding single direction of opposing traffic on the major street as the “major-street” volume.”

For Warrants 1, 2, 3, 7 and 8, the user may select the “Use Left Volume” check-box to compare the option above.

If the “Use Left Volume” is selected and the California 2012 option is selected, the volumes are compared differently. Refer to the following for differences on how volumes are used for the Federal and California warrants.

**Federal Warrant**

**Traditional Method**

1F	Major Street Volume	1+2+3+4+5+6	User may exclude any movement(s)
	Minor Street Volume	Max of 7+8+9 or 10+11+12	User may exclude any movement(s)

**Check Major Street Lefts**

2F	Major Street Volume	If 4>1, 1+2+3 If 1>4, 4+5+6	User may exclude any movement(s)
	Minor Street Volume	Max 4 or 1	User may exclude any movement(s)

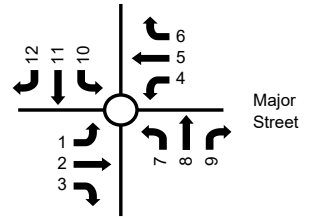
**California Warrant**

**Traditional Method (same as federal warrant)**

1C	Major Street Volume	1+2+3+4+5+6	User may exclude any movement(s)
	Minor Street Volume	Max of 7+8+9 or 10+11+12	User may exclude any movement(s)

**Check Major Street Lefts**

2C	Major Street Volume	If 4>1, 1+2+3+5+6	User may exclude any movement(s)
	Major Street Volume	If 1>4, 2+3+4+5+6	
	Minor Street Volume	If 4>1, 4+Max of 7+8+9 or 10+11+12 If 1>4, 1+Max of 7+8+9 or 10+11+12	User may exclude any movement(s)





# Warrant 1: Eight-Hour Vehicular Volume

Figure 13 illustrates the Warrant 1 data tab.

13 - Main Street & 1st Street

Warrant 1: Eight-Hour Vehicular Volume

Federal 2009 Warrant NOT MET

Warrant Status

Condition A:

0 hours met (8 required)

Condition B:

0 hours met (8 required)

Combination A and B:

0 hrs of A and 0 hrs of B

Use Left Volume:

☐

Present Intersection

Community Population < 10,000? ☐

Approach Information

	EB			WB			NB			SB		
Include in Analyses	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		
Name	1st Street			1st Street			Pellet Street			Pellet Street		
Major	<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>		
Speed Limit (mph)	30			30			40			40		
85th Percentile Speed	0.00			0.00			0.00			0.00		
Include in Analyses	L	T	R	L	T	R	L	T	R	L	T	R
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Lanes & Sharing	↕			↕			↕			↕		

Vehicle Volumes

Raw Volumes

Hourly Volumes (non-editable)

Time Period		EB			WB			NB			SB		
Begin	End	L	T	R	L	T	R	L	T	R	L	T	R
7:00	7:15	7	0	37	0	0	0	4	113	0	1	240	3
7:15	7:30	9	0	25	1	0	0	4	162	1	0	342	1
7:30	7:45	11	0	39	0	0	0	3	193	3	0	440	2
7:45	8:00	10	0	38	2	0	0	5	218	4	3	469	2
8:00	8:15	7	0	30	0	0	0	7	205	2	2	370	7
8:15	8:30	8	1	23	0	0	0	6	214	3	4	229	3
8:30	8:45	2	0	24	0	0	0	4	167	5	3	218	1
8:45	9:00	8	1	18	0	0	0	4	167	9	3	190	6
9:00	9:15	5	0	17	3	0	1	7	153	12	9	205	4
9:15	9:30	3	0	13	3	0	0	7	147	12	3	172	3
9:30	9:45	2	0	12	1	1	1	4	138	8	0	156	2
9:45	10:00	4	0	9	4	0	0	6	165	4	0	127	2
10:00	10:15	3	1	11	3	0	2	5	172	2	3	163	2
10:15	10:30	6	0	3	0	0	5	8	175	12	2	146	2
10:30	10:45	1	1	9	7	0	2	12	169	12	10	151	2
10:45	11:00	2	1	13	19	1	7	6	161	12	2	157	1

Summary

Warrant 1

Warrant 2

Warrant 3

Warrant 4

Warrant 6

Warrant 9

AWSC Warrant

Warrant 5

Warrant 7

Warrant 8

Figure 13 Warrant 1 Tab

The Warrant 1 tab is the Eight Hour Vehicular Volume warrant. At least eight (8) hours must meet the requirements for condition A or condition B.

There is also a combination of warrants test. For this test, the volumes used for the first part are reduced by 20% (uses 80% of the volume). If eight hours are met for condition A and B, then the warrant is met.

This tab will indicate if Warrant Condition A or B has been met. If the warrant is met, the text will be shown in green. If the warrant is not met, the text will appear in red.

Whether the condition is met or not, the number of hours actually met will be listed.

Hours do not need to be on the hour. For instance, one hour could be from 7:15 a.m. to 8:15 a.m. However, hours are not allowed to overlap. That is, if one hour is 7:15 to 8:15 a.m., then the next hour used cannot start before 8:30 a.m.

The following data items are included on the Warrant 1 tab:

## **Warrant 1 Information from MUTCD**

### **Support:**

The Minimum Vehicular Volume, Condition A, is intended for application at locations where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal. The Interruption of Continuous Traffic, Condition B, is intended for application at locations where Condition A is not satisfied and where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street. It is intended that Warrant 1 be treated as a single warrant. If Condition A is satisfied, then the criteria for Warrant 1 is satisfied and Condition B and the combination of Conditions A and B are not needed. Similarly, if Condition B is satisfied, then the criteria for Warrant 1 is satisfied and the combination of Conditions A and B is not needed.

### **Standard:**

The need for a traffic control signal shall be considered if an engineering study finds that one of the following conditions exist for each of any 8 hours of an average day:

A. The vehicles per hour given in both of the 100 percent columns of Condition A in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection; or

B. The vehicles per hour given in both of the 100 percent columns of Condition B in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches,

respectively, to the intersection. In applying each condition the major-street and minor-street volumes shall be for the same 8 hours. On the minor street, the higher volume shall not be required to be on the same approach during each of these 8 hours.

**Option:**

If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 70 km/h or exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the traffic volumes in the 70 percent columns in Table 4C-1 may be used in place of the 100 percent columns.

**Table 4C-1. Warrant 1, Eight-Hour Vehicular Volume**

**Condition A—Minimum Vehicular Volume**

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>
1	1	500	400	350	280	150	120	105	84
2 or more	1	600	480	420	336	150	120	105	84
2 or more	2 or more	600	480	420	336	200	160	140	112
1	2 or more	500	400	350	280	200	160	140	112

**Condition B—Interruption of Continuous Traffic**

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>
1	1	750	600	525	420	75	60	53	42
2 or more	1	900	720	630	504	75	60	53	42
2 or more	2 or more	900	720	630	504	100	80	70	56
1	2 or more	750	600	525	420	100	80	70	56

<sup>a</sup> Basic minimum hourly volume

<sup>b</sup> Used for combination of Conditions A and B after adequate trial of other remedial measures

<sup>c</sup> May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

<sup>d</sup> May be used for combination of Conditions A and B after adequate trial of other remedial measures when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

The combination of Conditions A and B is intended for application at locations where Condition A is not satisfied and Condition B is not satisfied and should be applied only after

an adequate trial of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems.

**Standard:**

The need for a traffic control signal shall be considered if an engineering study finds that both of the following conditions exist for each of any 8 hours of an average day:

A. The vehicles per hour given in both of the 80 percent columns of Condition A in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection; and

B. The vehicles per hour given in both of the 80 percent columns of Condition B in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection.

These major-street and minor-street volumes shall be for the same 8 hours for each condition; however, the 8 hours satisfied in Condition A shall not be required to be the same 8 hours satisfied in Condition B. On the minor street, the higher volume shall not be required to be on the same approach during each of the 8 hours.

**Option:**

If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 70 km/h or exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the traffic volumes in the 56 percent columns in Table 4C-1 may be used in place of the 80 percent columns.

## Warrant 2: Four-Hour Vehicular Volume

Figure 14 illustrates the Warrant 2 data tab.

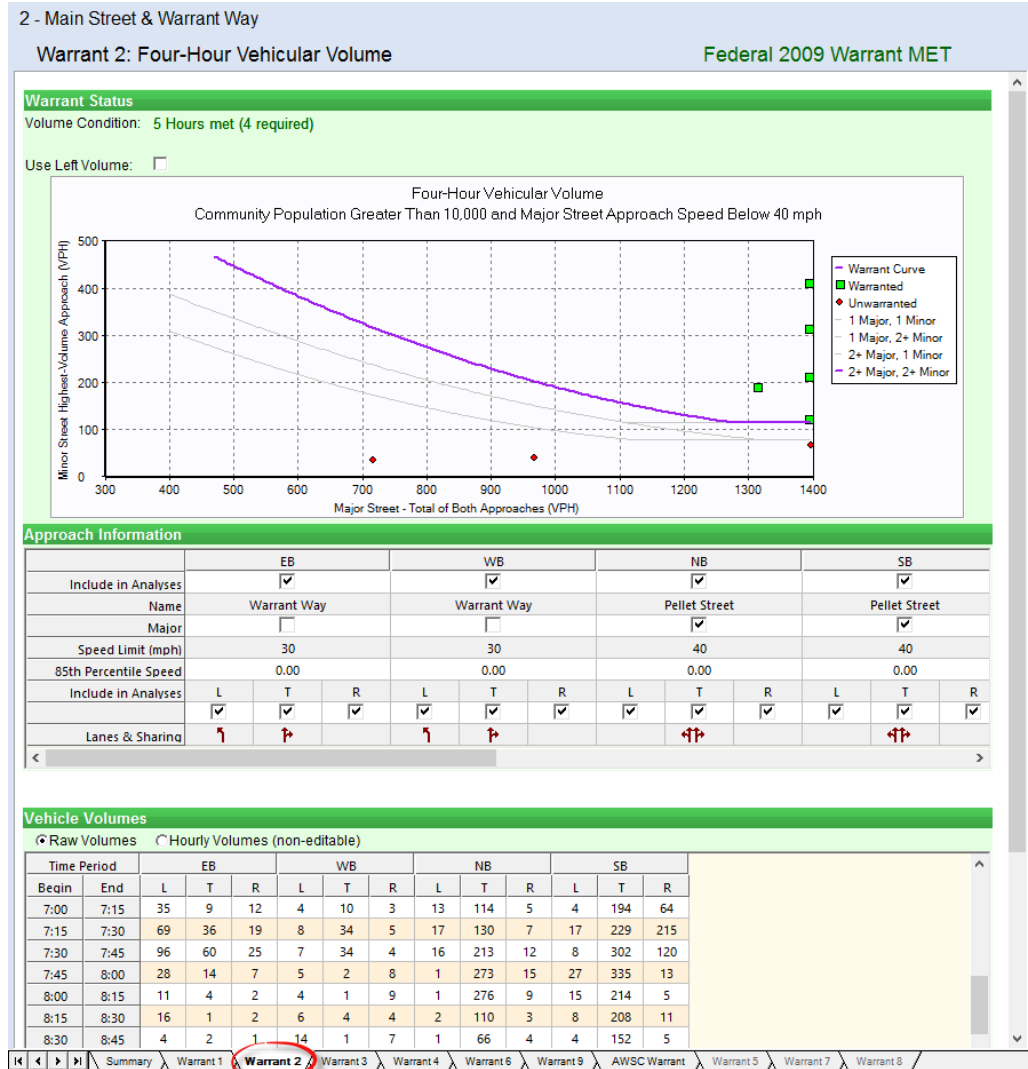


Figure 14 Warrant 2 Tab

In this example, warrant data is plotted on Figure 4C-1 or 4C-2 from the MUTCD to see if the warrant is met. The plotted points represent the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only).

The MUTCD figure includes three (3) lines based on the given lane geometry. Based on the data entered, the warrant will be compared to the appropriate curve. The selected curve will be highlighted. When a plotted point meets the warrant, it will display as a green square. A point that is not met will be shown as a red triangle.

The MUTCD warrants do not have a specific equation to determine the curves. However, the following equations have been used for the determination of the curves in Warrants 2.

Four Hour Warrant (#2)

	<u>R<sup>2</sup></u>	<u>Range</u>	<u>Lanes</u>
Y = 557.978 – 0.73003 x + 0.00027 x <sup>2</sup>	0.999885	400-1160	1-1
Y = 643.445 – 0.73144 x + 0.00023 x <sup>2</sup>	0.999908	400-1350	2-1
Y = 858.973 – 0.97877 x + 0.00031 x <sup>2</sup>	0.999940	470-1320	2-2

Minimum Y for minor street with 2 lanes is 115 vph  
Minimum Y for minor street with 1 lane is 80 vph

Four Hour Warrant (#2–with 70% Factor)

Y = 396.803 – 0.76930 x + 0.00044 x <sup>2</sup>	0.999900	270-800	1-1
Y = 457.134 – 0.76954 x + 0.00037 x <sup>2</sup>	0.999887	280-940	2-1
Y = 614.734 – 1.03083 x + 0.00049 x <sup>2</sup>	0.999957	330-900	2-2

Minimum Y for minor street with 2 lanes is 80 vph  
Minimum Y for minor street with 1 lane is 60 vph

When any plotted point is within 5 vehicles from the curve, this point will be flagged. The curves in the program are based on a mathematical representation of the MUTCD curves. The mathematical curves do not always accurately predict the curve from the MUTCD and user discretion is advised when within the 5-vehicle threshold.

Sometimes the data point will fall off of the graph. When the X coordinate is greater than the maximum value listed, the point will be shown on the edge of the graph.

## **Warrant 2 Information from MUTCD**

### **Support:**

The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

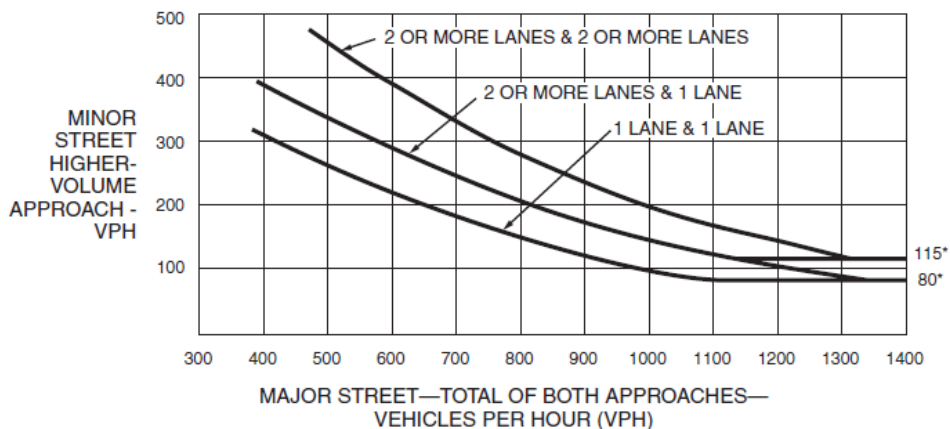
### **Standard:**

The need for a traffic control signal shall be considered if an engineering study finds that, for each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) all fall above the applicable curve in Figure 4C-1 for the existing combination of approach lanes. On the minor street, the higher volume shall not be required to be on the same approach during each of these 4 hours.

### **Option:**

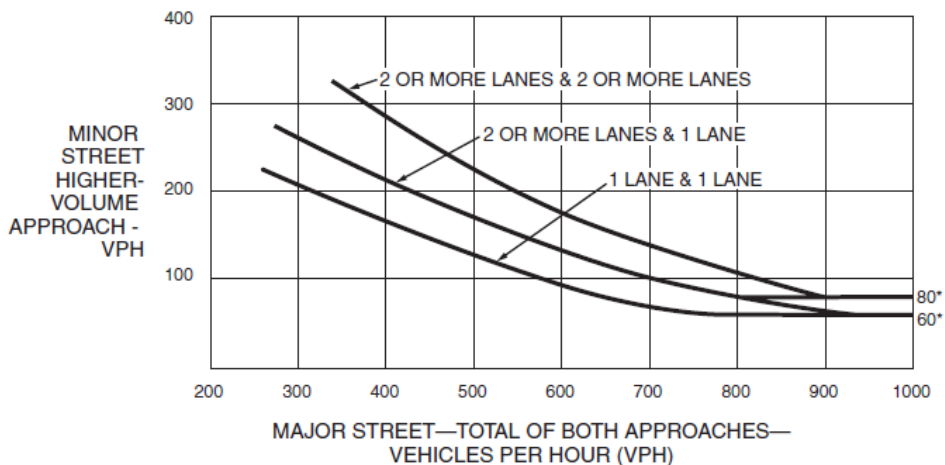
If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 70 km/h or exceeds 40 mph or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-2 may be used in place of Figure 4C-1.

**Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume**



\*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

**Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)**  
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



\*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.



## Warrant 3: Peak Hour

Figure 15 illustrates the Warrant 3 data tab.

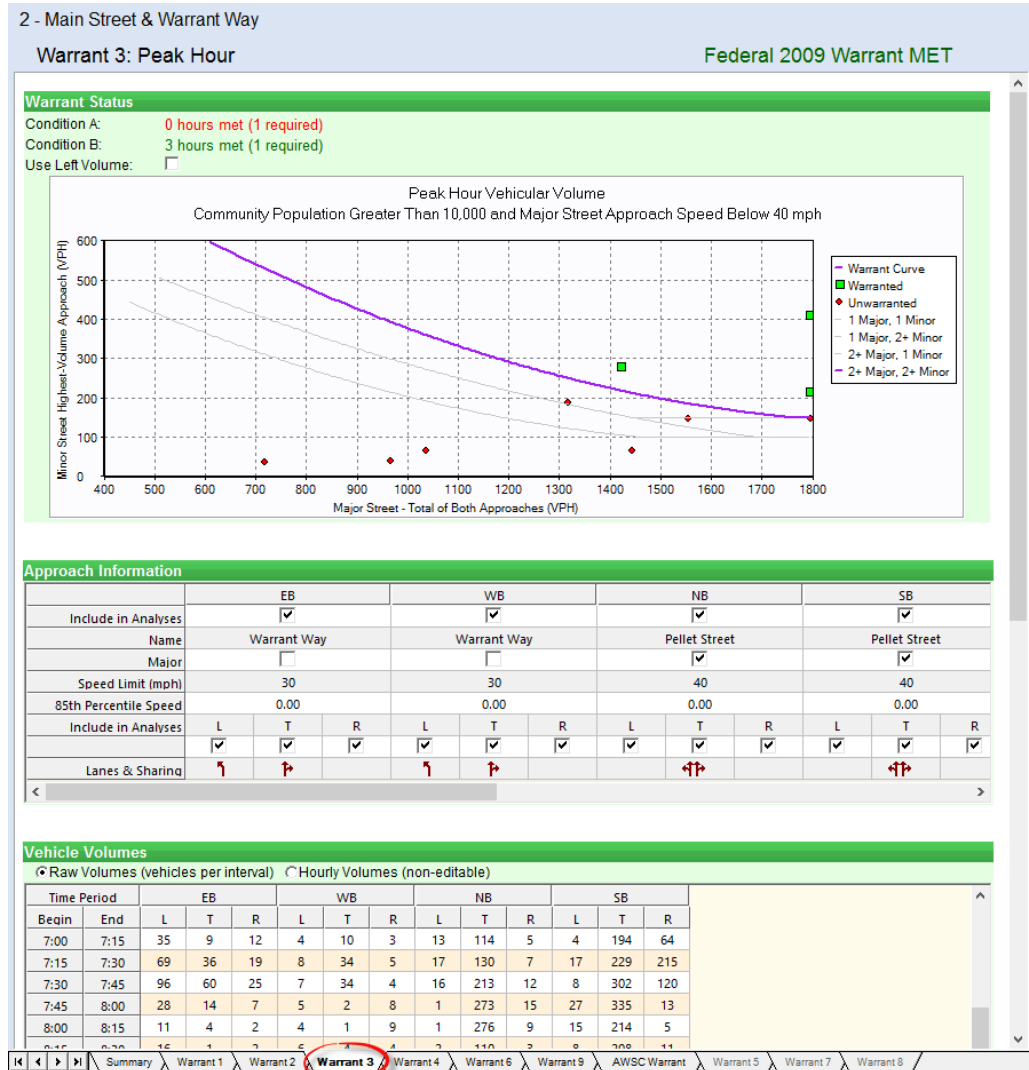


Figure 15 Warrant 3 Tab

In this warrant data is plotted on Figure 4C-3 or 4C-4 from the MUTCD to see if the warrant is met. The plotted points represent the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only).

The MUTCD figure includes three (3) lines based on the given lane geometry. Based on the data entered, the warrant will be compared to the appropriate curve. The selected curve will be highlighted. When a plotted point meets the warrant, it will display as a green square. A point that is not met will be shown as a red triangle.

The MUTCD warrants do not have a specific equation to determine the curves. However, the following equations have been used for the determination of the curves in Warrants 3.

Peak Hour Warrant (#3)

$Y = 734.125 - 0.74072 x + 0.00021 x^2$	0.999909	450-1450	1-1
$Y = 809.779 - 0.67328 x + 0.00015 x^2$	0.999879	510-1740	2-1
$Y = 1081.658 - 0.93419 x + 0.00023 x^2$	0.999913	610-1650	2-2

Minimum Y for minor street with 2 lanes is 150 vph  
Minimum Y for minor street with 1 lane is 100 vph

Peak Hour Warrant (#3 with 70% Factor)

$Y = 529.197 - 0.80083 x + 0.00035 x^2$	0.999693	320-1010	1-1
$Y = 586.099 - 0.73111 x + 0.00025 x^2$	0.999943	360-1200	2-1
$Y = 762.050 - 0.95887 x + 0.00033 x^2$	0.999920	420-1170	2-2

Minimum Y for minor street with 2 lanes is 100 vph  
Minimum Y for minor street with 1 lane is 75 vph

When any plotted point is within 5 vehicles from the curve, this point will be flagged. The curves in the program are based on a mathematical representation of the MUTCD curves. The mathematical curves do not always accurately predict the curve from the MUTCD and user discretion is advised when within the 5-vehicle threshold.

Sometimes the data point will fall off of the graph. When the X coordinate is greater than the maximum value listed, the point will be shown on the edge of the graph.

The following data items are included on the Warrant 3 tab:

## **Warrant 3 Information from MUTCD**

### **Support:**

The Peak Hour signal warrant is intended for use at a location where traffic conditions are such that for a minimum of 1 hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street.

### **Standard:**

This signal warrant shall be applied only in unusual cases, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time. The need for a traffic control signal shall be considered if an engineering study finds that the criteria in either of the following two categories are met:

A. If all three of the following conditions exist for the same 1 hour (any four consecutive 15-minute periods) of an average day:

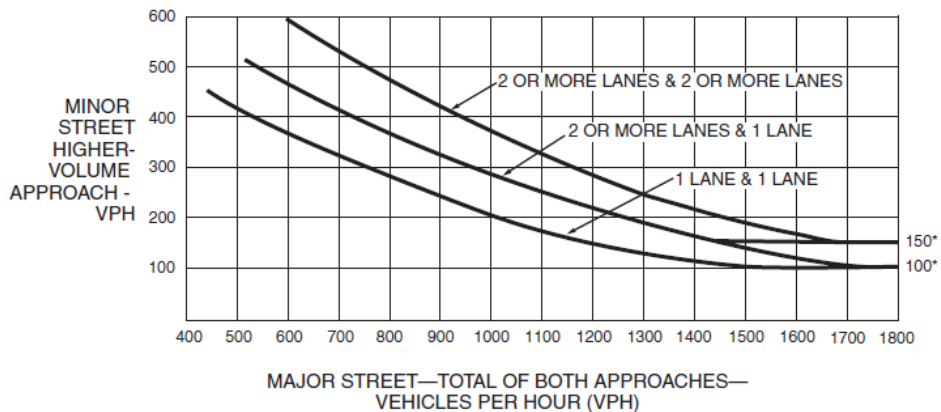
1. The total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equals or exceeds: 4 vehicle-hours for a one-lane approach; or 5 vehicle-hours for a two-lane approach, and
2. The volume on the same minor-street approach (one direction only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes, and
3. The total entering volume serviced during the hour equals or exceeds 650 vehicles per hour for intersections with three approaches or 800 vehicles per hour for intersections with four or more approaches.

B. The plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4C-3 for the existing combination of approach lanes.

### **Option:**

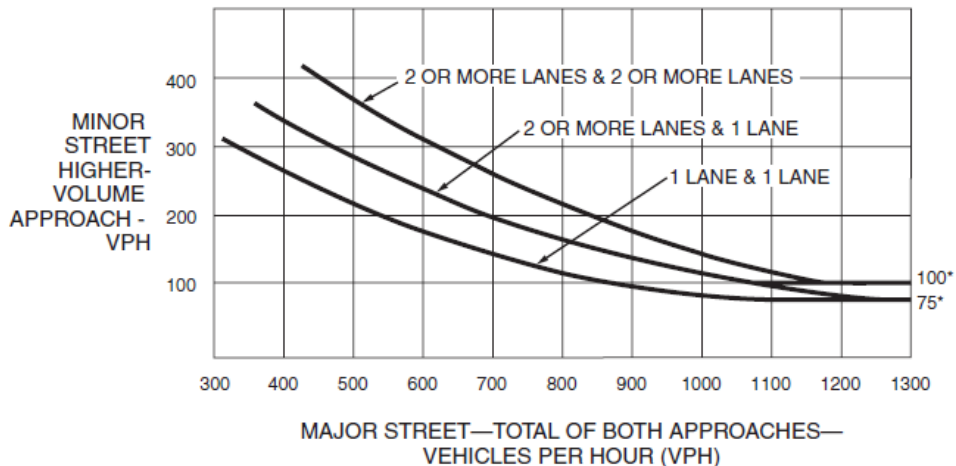
If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 70 km/h or exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-4 may be used in place of Figure 4C-3 to satisfy the criteria in the second category of the Standard.

**Figure 4C-3. Warrant 3, Peak Hour**



\*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

**Figure 4C-4. Warrant 3, Peak Hour (70% Factor)**  
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



\*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

## Warrant 4: Pedestrian Volume (2003 Federal)

Figure 16 illustrates the Warrant 4 data tab.

7 - Main Street & Ped Way

**Warrant 4: Pedestrian Volume** Federal 2003 Warrant NOT MET

Warrant Status		Present Intersection	
Low Peds:	0 hours met (4 required)	New Signal will Restrict Flow of Traffic?	<input type="checkbox"/>
High Peds:	0 hours met (1 required)	Pedestrian Crossing Speed (ft/s)	3.5

Approach Information				
	EB	WB	NB	SB
Include in Analyses	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Name	Venture Way	Venture Way	Pellet Street	Pellet Street
Major	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Adj. Coord. Signal	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Adj. Intersection Distance	536.00	591.00	1953.00	1290.00
Median Refuge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Gaps					
Time Period		EB	WB	NB	SB
Begin	End	q1	q1	q1	q1
7:00	7:15			10	10
7:15	7:30			10	10
7:30	7:45			10	10
7:45	8:00			10	10
8:00	8:15			10	10
8:15	8:30			10	10
8:30	8:45			10	10
8:45	9:00			10	10
9:00	9:15			10	10
9:15	9:30			10	10
9:30	9:45			10	10
9:45	10:00			10	10
10:00	10:15			10	10
10:15	10:30			10	10
10:30	10:45			10	10
10:45	11:00			10	10

Pedestrian Volumes					
<input checked="" type="radio"/> Raw Volumes <input type="radio"/> Hourly Volumes (non-editable)					
Time Period		EB	WB	NB	SB
Begin	End				
7:00	7:15	50	10	50	10
7:15	7:30	50	10	50	10
7:30	7:45	50	10	50	10

Summary   Warrant 1   Warrant 2   Warrant 3   **Warrant 4**   Warrant 5   Warrant 6

Figure 16 Warrant 4 Tab (2003 Federal)

This is the Pedestrian Volume warrant. Two conditions are required to be considered met.

Pedestrian volumes are treated similar to traffic volumes. Four (4) hours of 100 peds or more are required. Hours will not overlap. The warrant can also have 190 peds for 1 or more hours to meet the first part of the condition.

The following additional data items are included on the Warrant 4 tab:

**New Signal will Restrict Flow of Traffic** is a check if the new signal will restrict the flow of traffic.

**Pedestrian Crossing Speed** is the walking speed of pedestrians (ft/sec).

**Adjacent Coordinated Signal and Adjacent Distance** is used to determine the presence and distance of adjacent signals. The signal warrant should not be applied where the resultant spacing of traffic control signals would be less than 300 ft (90 m).

**Median Refuge** is a divided street having a median of sufficient width for pedestrians to wait.

**Pedestrian Volumes** are the normal pedestrian volumes crossing the roadway.

**Gaps** in the traffic stream of adequate length to allow pedestrians to cross during the same period when the pedestrian volume criterion is satisfied. Where there is a divided street having a median of sufficient width for pedestrians to wait, the requirement applies separately to each direction of vehicular traffic.

## **Warrant 4 Information from 2003 MUTCD**

### **Support:**

The Pedestrian Volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street.

### **Standard:**

The need for a traffic control signal at an intersection or midblock crossing shall be considered if an engineering study finds that both of the following criteria are met:

A. The pedestrian volume crossing the major street at an intersection or midblock location during an average day is 100 or more for each of any 4 hours or 190 or more during any 1 hour; and

B. There are fewer than 60 gaps per hour in the traffic stream of adequate length to allow pedestrians to cross during the same period when the pedestrian volume criterion is satisfied.

Where there is a divided street having a median of sufficient width for pedestrians to wait, the requirement applies separately to each direction of vehicular traffic. The Pedestrian Volume signal warrant shall not be applied at locations where the distance to the nearest traffic control signal along the major street is less than 90 m (300 ft), unless the proposed traffic control signal will not restrict the progressive movement of traffic. If this warrant is met and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads conforming to requirements set forth in Chapter 4E.

**Guidance:**

If this warrant is met and a traffic control signal is justified by an engineering study, then:

A. If at an intersection, the traffic control signal should be traffic-actuated and should include pedestrian detectors.

B. If at a non-intersection crossing, the traffic control signal should be pedestrian-actuated, parking and other sight obstructions should be prohibited for at least 30 m (100 ft) in advance of and at least 6.1 m (20 ft) beyond the crosswalk, and the installation should include suitable standard signs and pavement markings. C. Furthermore, if installed within a signal system, the traffic control signal should be coordinated.

**Option:**

The criterion for the pedestrian volume crossing the major roadway may be reduced as much as 50 percent if the average crossing speed of pedestrians is less than 1.2 m/sec (4 ft/sec). A traffic control signal may not be needed at the study location if adjacent coordinated traffic control signals consistently provide gaps of adequate length for pedestrians to cross the street, even if the rate of gap occurrence is less than one per minute.

## **Warrant 4: Pedestrian Volume (2009 Federal)**

The 2009 Federal MUTCD includes a significant change in Warrant 4, the Pedestrian Volume Warrant and is based on an extensive NCHRP research study. The 2003 Warrant required that two criteria be met in order to satisfy Warrant 4. The 2009 Warrant includes two new criteria that are based on a combination of vehicular and pedestrian volumes for either 4-hours or a single peak hour, and only one of the criteria needs to be met.

## 7 - Main Street & Ped Way

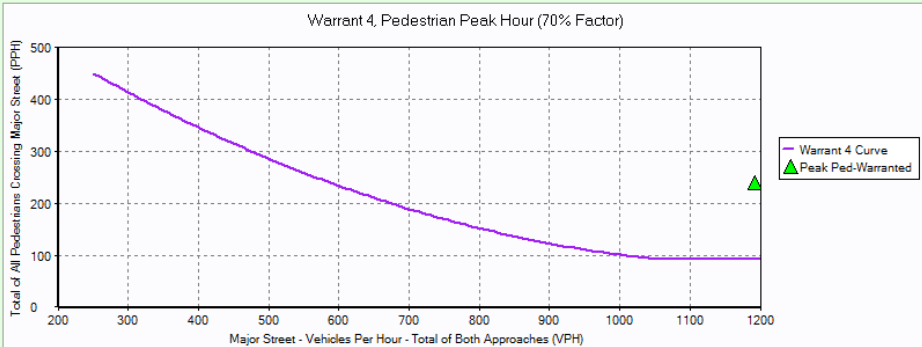
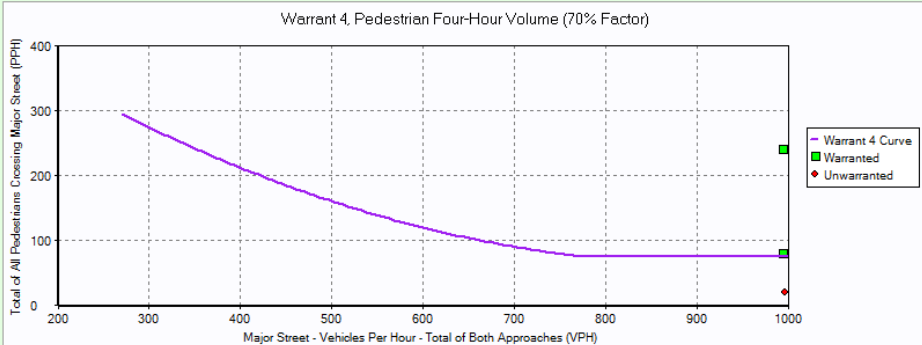
### Warrant 4: Pedestrian Volume

Federal 2009 Warrant MET

#### Warrant Status

Volume Condition: 7 Hours met (4 required)

Peak Hour: Time: 07:30 With Vehicle Volume: 2633 and Pedestrian Volume of: 240



#### Present Intersection

☐ Community Population < 10,000?

#### Approach Information

	EB	WB	NB	SB
Include in Analysis	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Summary | Warrant 1 | Warrant 2 | Warrant 3 | **Warrant 4** | Warrant 5 | Warrant 9 | AWSC Warrant

Figure 17 Warrant 4 Tab (2009 Federal)



## **Warrant 4 Information from 2009 MUTCD**

### **Support:**

The Pedestrian Volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street.

### **Standard:**

The need for a traffic control signal at an intersection or midblock crossing shall be considered if an engineering study finds that one of the following criteria is met:

A. For each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) all fall above the curve in Figure 4C-5; or

B. For 1 hour (any four consecutive 15-minute periods) of an average day, the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) falls above the curve in Figure 4C-7.

### **Option:**

If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 35 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-6 may be used in place of Figure 4C-5 to evaluate Criterion A in Paragraph 2, and Figure 4C-8 may be used in place of Figure 4C-7 to evaluate Criterion B in Paragraph 2.

### **Standard:**

The Pedestrian Volume signal warrant shall not be applied at locations where the distance to the nearest traffic control signal or STOP sign controlling the street that pedestrians desire to cross is less than 300 feet, unless the proposed traffic control signal will not restrict the progressive movement of traffic.

If this warrant is met and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E.

### **Guidance:**

If this warrant is met and a traffic control signal is justified by an engineering study, then:

A. If it is installed at an intersection or major driveway location, the traffic control signal should also control the minor-street or driveway traffic, should be traffic-actuated, and should include pedestrian detection.

B. If it is installed at a non-intersection crossing, the traffic control signal should be installed at least 100 feet from side streets or driveways that are controlled by STOP or YIELD signs, and should be pedestrian-actuated. If the traffic control signal is installed at a non-intersection crossing, at least one of the signal faces should be over the traveled way for each approach, parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the crosswalk or site accommodations should be made through curb extensions or other techniques to provide adequate sight distance, and the installation should include suitable standard signs and pavement markings.

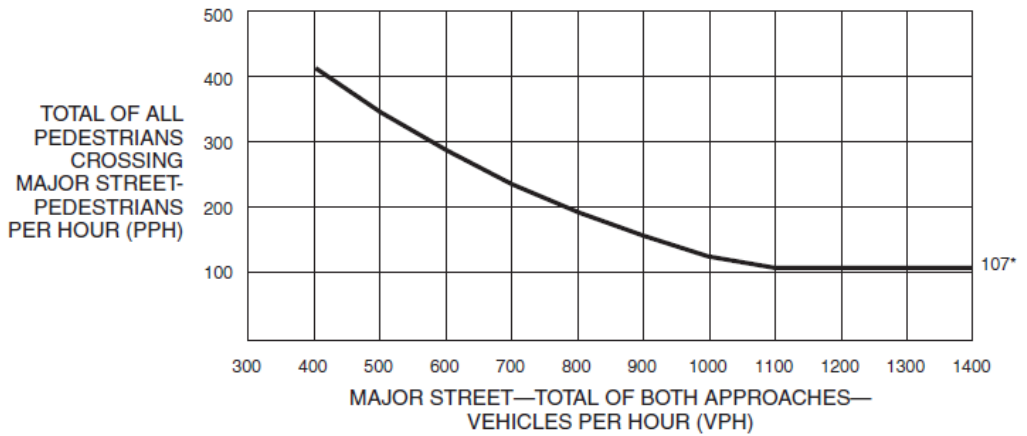
C. Furthermore, if it is installed within a signal system, the traffic control signal should be coordinated.

**Option:**

The criterion for the pedestrian volume crossing the major street may be reduced as much as 50 percent if the 15th-percentile crossing speed of pedestrians is less than 3.5 feet per second.

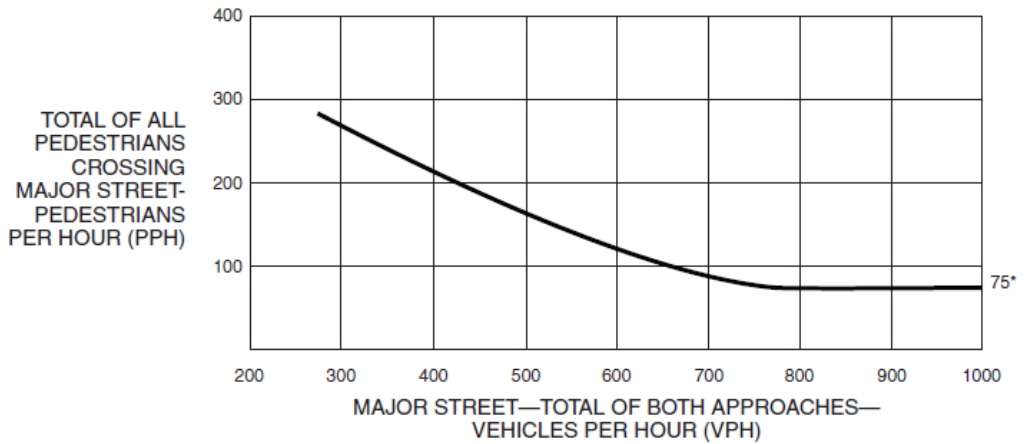
08 A traffic control signal may not be needed at the study location if adjacent coordinated traffic control signals consistently provide gaps of adequate length for pedestrians to cross the street.

**Figure 4C-5. Warrant 4, Pedestrian Four-Hour Volume**



\*Note: 107 pph applies as the lower threshold volume.

**Figure 4C-6. Warrant 4, Pedestrian Four-Hour Volume (70% Factor)**



\*Note: 75 pph applies as the lower threshold volume.

# Warrant 5: School Crossing

Figure 18 illustrates the Warrant 5 data tab.

7 - Main Street & Ped Way

Warrant 5: School Crossing

Federal 2009 Warrant NOT MET

Warrant Status

Student Peds > 20: Yes

Gaps < Interval Mins: No

Present Intersection

Student Crossing Time Interval (minutes)0

Student Pedestrians During Crossing Interval50

Acceptable Gaps During Student Crossing Interval0

New Signal will Restrict Flow of Traffic?

Measures to Reduce Student Ped Danger Considered?

Approach Information

	EB	WB	NB	SB
Include in Analyses	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Name	Venture Way	Venture Way	Pellet Street	Pellet Street
Major	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Adj. Coord. Signal	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Adj. Intersection Distance	536.00	591.00	1953.00	1290.00

Summary

Warrant 1

Warrant 2

Warrant 3

Warrant 4

Warrant 5

Warrant 9

AWSC Warrant

Figure 18 Warrant 5 Tab

This Warrant is to be applied where school children cross a major street.

The following additional data items are included on the Warrant 5 tab:

**Student Crossing Time Interval** is the time interval (in minutes) that students are present.

**Student Pedestrians During Crossing Interval** is the number of students crossing during the defined time period.

**New Signal will Restrict Flow of Traffic** is checked if the new signal will restrict the flow of traffic.

**Acceptable Gaps During Student Crossing Interval** is the number of gaps acceptable for a students to cross by direction.

**Adjacent Coordinated Signal and Adjacent Distance** is used to determine the presence and distance of adjacent signals. The signal warrant should not be applied where the resultant spacing of traffic control signals would be less than 300 ft (90 m).

## **Warrant 5 Information from MUTCD**

### **Support:**

The School Crossing signal warrant is intended for application where the fact that school children cross the major street is the principal reason to consider installing a traffic control signal.

### **Standard:**

The need for a traffic control signal shall be considered when an engineering study of the frequency and adequacy of gaps in the vehicular traffic stream as related to the number and size of groups of school children at an established school crossing across the major street shows that the number of adequate gaps in the traffic stream during the period when the children are using the crossing is less than the number of minutes in the same period (see Section 7A.03) and there are a minimum of 20 students during the highest crossing hour. Before a decision is made to install a traffic control signal, consideration shall be given to the implementation of other remedial measures, such as warning signs and flashers, school speed zones, school crossing guards, or a grade-separated crossing. The School Crossing signal warrant shall not be applied at locations where the distance to the nearest traffic control signal along the major street is less than 90 m (300 ft), unless the proposed traffic control signal will not restrict the progressive movement of traffic.

### **Guidance:**

If this warrant is met and a traffic control signal is justified by an engineering study, then:

- A. If at an intersection, the traffic control signal should be traffic-actuated and should include pedestrian detectors.
- B. If at a nonintersection crossing, the traffic control signal should be pedestrian-actuated, parking and other sight obstructions should be prohibited for at least 30 m (100 ft) in advance of and at least 6.1 m (20 ft) beyond the crosswalk, and the installation should include suitable standard signs and pavement markings.
- C. Furthermore, if installed within a signal system, the traffic control signal should be coordinated.

## Warrant 6: Coordinated Signal System

Figure 19 illustrates the Warrant 6 data tab.

2 - Main Street & Warrant Way

Warrant 6: Coordinated Signal System

Federal 2009 Warrant MET

Warrant Status

Unacceptable Platooning: Yes

Distance to Closest Signalized Intersection (ft): 1953.00 (> 1000)

Approach Information

	EB	WB	NB	SB
Include in Analyses	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Name	Warrant Way	Warrant Way	Pellet Street	Pellet Street
Major	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Acceptable Platooning	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Adj. Coord. Signal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Adj. Intersection Distance	817.00	877.00	713.00	1953.00

< >

Summary Warrant 1 Warrant 2 Warrant 3 Warrant 4 Warrant 5 Warrant 6 AWSC Warrant

Figure 19 Warrant 6 Tab

This is the data tab for the coordinated signal system warrant.

The following additional data items are included on the Warrant 6 tab:

**Acceptable Platooning** indicates whether the adjacent traffic control signals provide the necessary degree of vehicular platooning.

**Adjacent Coordinated Signal and Adjacent Distance** is used to determine the presence and distance of adjacent signals. The signal warrant should not be applied where the resultant spacing of traffic control signals would be less than 1000 ft (300 m).

## Warrant 6 Information from MUTCD

### Support:

Progressive movement in a coordinated signal system sometimes necessitates installing traffic control signals at intersections where they would not otherwise be needed in order to maintain proper platooning of vehicles.

**Standard:**

The need for a traffic control signal shall be considered if an engineering study finds that one of the following criteria is met:

A. On a one-way street or a street that has traffic predominantly in one direction, the adjacent traffic control signals are so far apart that they do not provide the necessary degree of vehicular platooning.

B. On a two-way street, adjacent traffic control signals do not provide the necessary degree of platooning and the proposed and adjacent traffic control signals will collectively provide a progressive operation.

**Guidance:**

The Coordinated Signal System signal warrant should not be applied where the resultant spacing of traffic control signals would be less than 300 m (1,000 ft).

## Warrant 7: Crash Experience

Figure 20 illustrates the Warrant 7 data tab.

10 - Main Street & Broken Road

**Warrant 7: Crash Experience** Federal 2009 Warrant NOT MET

Warrant Status		Present Intersection	
Vehicle Volumes:	5 hours met (8 required)	Community Population < 10,000?	<input type="checkbox"/>
Ped Volumes:	0 hours met (8 required)	Crashes Correctable by Signal Within 12-Month Period	<input type="text" value="0"/>
Use Left Volume:	<input type="checkbox"/>	Alternatives Failed to Reduce Crash Frequency?	<input type="checkbox"/>

**Approach Information**

	EB			WB			NB			SB		
Include in Analyses	<input type="checkbox"/>			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		
Name				Broken Road			Pellet Street			Pellet Street		
Major	<input type="checkbox"/>			<input type="checkbox"/>			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		
Speed Limit (mph)	30			30			40			40		
85th Percentile Speed	0.00			0.00			0.00			0.00		
Include in Analyses	L	T	R	L	T	R	L	T	R	L	T	R
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Lanes & Sharing				1		1	1		1	1		1

**Vehicle Volumes**

☒ Raw Volumes ☐ Hourly Volumes (non-editable)

Time Period		WB			NB			SB		
Begin	End	L	T	R	L	T	R	L	T	R
10:00	10:15	14	0	53	0	134	30	39	172	0
10:15	10:30	26	0	73	0	151	24	40	164	0
10:30	10:45	48	0	57	0	148	25	31	149	0
10:45	11:00	22	0	57	0	151	30	39	162	0
11:00	11:15									
11:15	11:30									
11:30	11:45									
11:45	12:00									
12:00	12:15									
12:15	12:30									
12:30	12:45									
12:45	13:00									
13:00	13:15									
13:15	13:30									
13:30	13:45									
13:45	14:00									

**Pedestrian Volumes**

☒ Raw Volumes ☐ Hourly Volumes (non-editable)

Time Period	WB	NB	SB

Summary Warrant 1 Warrant 2 Warrant 3 Warrant 4 Warrant 5 Warrant 9 AWSC Warrant Warrant 6 **Warrant 7** Warrant 8

Figure 20 Warrant 7 Tab



This is the Crash Experience warrant.

The following additional data items are included on the Warrant 7 tab:

**Community Size** determines which MUTCD tables and figures are to be used. Lower thresholds are required when the intersection is in an isolated community of less than 10,000 people.

**Crashes Correctable by Signal** is compared to the five crashes required in the Crash Experience warrant, but only those crashes susceptible to correction by signal installation.

**Alternatives Failed to Reduce Crash Frequency** indicates if a trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency.

**Speed Limit and 85<sup>th</sup> Percentile Speed** determine which MUTCD tables and figures are to be used. Lower thresholds are required when the major street speed is above 40 mph (70 km/h).

**Pedestrian Volumes** are the normal pedestrian volumes crossing the roadway.

**Vehicle Volumes** are used to determine the hourly volumes required by the warrant.

## **Warrant 7 Information from MUTCD**

### **Support:**

The Crash Experience signal warrant conditions are intended for application where the severity and frequency of crashes are the principal reasons to consider installing a traffic control signal.

### **Standard:**

The need for a traffic control signal shall be considered if an engineering study finds that all of the following criteria are met:

A. Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency; and

B. Five or more reported crashes, of types susceptible to correction by a traffic control signal, have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for a reportable crash; and

C. For each of any 8 hours of an average day, the vehicles per hour (vph) given in both of the 80 percent columns of Condition A in Table 4C-1 (see Section 4C.02), or the vph in both of

the 80 percent columns of Condition B in Table 4C-1 exists on the major-street and the higher-volume minor-street approach, respectively, to the intersection, or the volume of pedestrian traffic is not less than 80 percent of the requirements specified in the Pedestrian Volume warrant. These major-street and minor-street volumes shall be for the same 8 hours. On the minor street, the higher volume shall not be required to be on the same approach during each of the 8 hours.

**Option:**

If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 70 km/h or exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the traffic volumes in the 56 percent columns in Table 4C-1 may be used in place of the 80 percent columns.

## Warrant 8: Roadway Network

Figure 21 illustrates the Warrant 8 data tab.

10 - Main Street & Broken Road

Warrant 8: Roadway Network Federal 2009 Warrant MET

---

**Warrant Status**

Condition A: Met  
 Condition B: Not Met  
 Use Left Volume: ☐

**Projected Intersection**

Community Population < 10,000? ☐  
 Total Entering Volume Growth Percentage (per year) 0.00  
 Projected Time Period (in years) 0.00

---

**Approach Information**

	EB			WB			NB			SB		
Include in Analyses	<input type="checkbox"/>			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		
Name				Broken Road			Pellet Street			Pellet Street		
Major	<input type="checkbox"/>			<input type="checkbox"/>			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		
Speed Limit (mph)	30			30			40			40		
85th Percentile Speed	0.00			0.00			0.00			0.00		
Include in Analyses	L	T	R	L	T	R	L	T	R	L	T	R
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Lanes & Sharing				1			1			1		
Yearly Growth Pct	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

---

**Vehicle Volumes**

☒ Raw Volumes ☐ Hourly Volumes (non-editable)

Time Period		WB			NB			SB		
Begin	End	L	T	R	L	T	R	L	T	R
10:00	10:15	14	0	53	0	134	30	39	172	0
10:15	10:30	26	0	73	0	151	24	40	164	0
10:30	10:45	48	0	57	0	148	25	31	149	0
10:45	11:00	22	0	57	0	151	30	39	162	0
11:00	11:15									
11:15	11:30									
11:30	11:45									
11:45	12:00									
12:00	12:15									
12:15	12:30									
12:30	12:45									
12:45	13:00									
13:00	13:15									
13:15	13:30									
13:30	13:45									
13:45	14:00									

---

**Weekend Volumes**

☒ Raw Volumes ☐ Hourly Volumes (non-editable)

Navigation: Summary | Warrant 1 | Warrant 2 | Warrant 3 | Warrant 4 | Warrant 5 | Warrant 9 | AWSW Warrant | Warrant 6 | Warrant 7 | **Warrant 8**

Figure 21 Warrant 8 Tab

This is the Roadway Network warrant. This warrant utilizes Warrants 1, 2 and 3.

The following data items are included on the Warrant 8 tab:

**Community Size** determines which MUTCD tables and figures are to be used. Lower thresholds are required when the intersection is in an isolated community of less than 10,000 people.

**Total Entering Volume Growth Percentage** is the yearly growth rate.

**Projected Time Period** is used to project the Growth Percentage by this number of years into the future.

**Speed Limit and 85<sup>th</sup> Percentile** determine which MUTCD tables and figures are to be used. Lower thresholds are required when the major street speed is above 40 mph (70 km/h)

**Vehicle Volumes** are used to determine the hourly volumes required by the warrant.

**Delay Data** is the average stopped delay for each approach is coded in minutes per vehicle. The appropriate volumes will be used to calculate the total stopped delay in vehicle-hours.

## **Warrant 8 Information from MUTCD**

### **Support:**

Installing a traffic control signal at some intersections might be justified to encourage concentration and organization of traffic flow on a roadway network.

### **Standard:**

The need for a traffic control signal shall be considered if an engineering study finds that the common intersection of two or more major routes meets one or both of the following criteria:

A. The intersection has a total existing, or immediately projected, entering volume of at least 1,000 vehicles per hour during the peak hour of a typical weekday and has 5-year projected traffic volumes, based on an engineering study, that meet one or more of Warrants 1, 2, and 3 during an average weekday; or

B. The intersection has a total existing or immediately projected entering volume of at least 1,000 vehicles per hour for each of any 5 hours of a non-normal business day (Saturday or Sunday).

A major route as used in this signal warrant shall have one or more of the following characteristics:

- A. It is part of the street or highway system that serves as the principal roadway network for through traffic flow; or
- B. It includes rural or suburban highways outside, entering, or traversing a City; or
- C. It appears as a major route on an official plan, such as a major street plan in an urban area traffic and transportation study.

## **Warrant 9: Intersection Near a Grade Crossing**

This is a new warrant within the 2009 Federal MUTCD for Intersections near a Highway-Rail Grade Crossing. This warrant is for use at locations where the proximity of the intersection to a highway-rail grade crossing is the principal reason to consider installing a traffic control signal, and other warrants are not met.

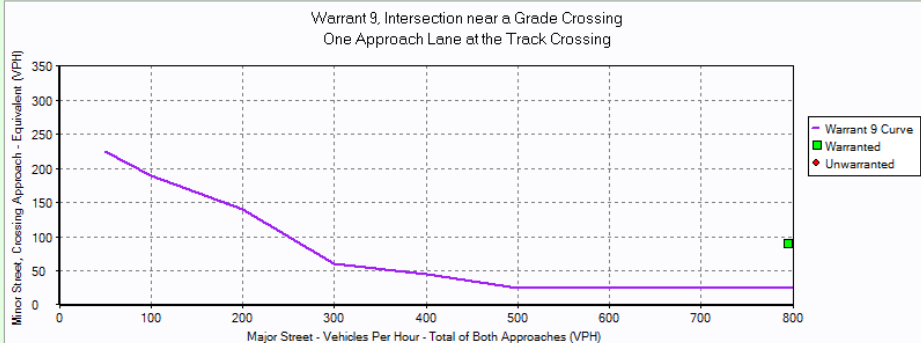
### 13 - Main Street & 1st Street

#### Warrant 9: Intersection Near Grade Crossing

Federal 2009 Warrant MET

##### Warrant Status

The warrant is met at 8:00 with minor-street volume adjustment factor 0.730



##### Approach Information

	EB			WB			NB			SB		
Include in Analyses	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		
Name	1st Street			1st Street			Pellet Street			Pellet Street		
Major	<input type="checkbox"/>			<input type="checkbox"/>			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		
Speed Limit (mph)	30			30			40			40		
85th Percentile Speed	0.00			0.00			0.00			0.00		
Include in Analyses	L	T	R	L	T	R	L	T	R	L	T	R
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Lanes & Sharing	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		
Rail Crossing	<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>			<input type="checkbox"/>		

##### Minor-Street Approach Crossing the Track

Approach direction	EB
Distance from Rail Track to Intersection (ft)	130
Percentage of High-Occupancy Buses (%)	2.00
Percentage of Tractor-Trailer Trucks (%)	10.00

##### Vehicle Volumes

Raw Volumes Hourly Volumes (non-editable)

Time Period		EB			WB			NB			SB		
Begin	End	L	T	R	L	T	R	L	T	R	L	T	R
12:15	12:30	0	0	0	0	0	0	0	0	0	0	0	0
12:30	12:45	0	0	0	0	0	0	0	0	0	0	0	0

Figure 22 2009 Federal Warrant 9

## **Warrant 9 Information from 2009 MUTCD**

### **Support:**

The Intersection Near a Grade Crossing signal warrant is intended for use at a location where none of the conditions described in the other eight traffic signal warrants are met, but the proximity to the intersection of a grade crossing on an intersection approach controlled by a STOP or YIELD sign is the principal reason to consider installing a traffic control signal.

### **Guidance:**

This signal warrant should be applied only after adequate consideration has been given to other alternatives or after a trial of an alternative has failed to alleviate the safety concerns associated with the grade crossing.

Among the alternatives that should be considered or tried are:

- A. Providing additional pavement that would enable vehicles to clear the track or that would provide space for an evasive maneuver, or
- B. Reassigning the stop controls at the intersection to make the approach across the track a non-stopping approach.

### **Standard:**

The need for a traffic control signal shall be considered if an engineering study finds that both of the following criteria are met:

- A. A grade crossing exists on an approach controlled by a STOP or YIELD sign and the center of the track nearest to the intersection is within 140 feet of the stop line or yield line on the approach; and
- B. During the highest traffic volume hour during which rail traffic uses the crossing, the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the minor-street approach that crosses the track (one direction only, approaching the intersection) falls above the applicable curve in Figure 4C-9 or 4C-10 for the existing combination of approach lanes over the track and the distance D, which is the clear storage distance as defined in Section 1A.13.

**Guidance:**

The following considerations apply when plotting the traffic volume data on Figure 4C-9 or 4C-10:

A. Figure 4C-9 should be used if there is only one lane approaching the intersection at the track crossing location and Figure 4C-10 should be used if there are two or more lanes approaching the intersection at the track crossing location.

B. After determining the actual distance D, the curve for the distance D that is nearest to the actual distance D should be used. For example, if the actual distance D is 95 feet, the plotted point should be compared to the curve for D = 90 feet.

C. If the rail traffic arrival times are unknown, the highest traffic volume hour of the day should be used.

**Option:**

The minor-street approach volume may be multiplied by up to three adjustment factors as provided in Paragraphs 6 through 8.

Because the curves are based on an average of four occurrences of rail traffic per day, the vehicles per hour on the minor-street approach may be multiplied by the adjustment factor shown in Table 4C-2 for the appropriate number of occurrences of rail traffic per day.

Because the curves are based on typical vehicle occupancy, if at least 2% of the vehicles crossing the track are buses carrying at least 20 people, the vehicles per hour on the minor-street approach may be multiplied by the adjustment factor shown in Table 4C-3 for the appropriate percentage of high-occupancy buses.

Because the curves are based on tractor-trailer trucks comprising 10% of the vehicles crossing the track, the vehicles per hour on the minor-street approach may be multiplied by the adjustment factor shown in Table 4C-4 for the appropriate distance and percentage of tractor-trailer trucks.

**Standard:**

If this warrant is met and a traffic control signal at the intersection is justified by an engineering study, then:

A. The traffic control signal shall have actuation on the minor street;

B. Preemption control shall be provided in accordance with Sections 4D.27, 8C.09, and 8C.10; and

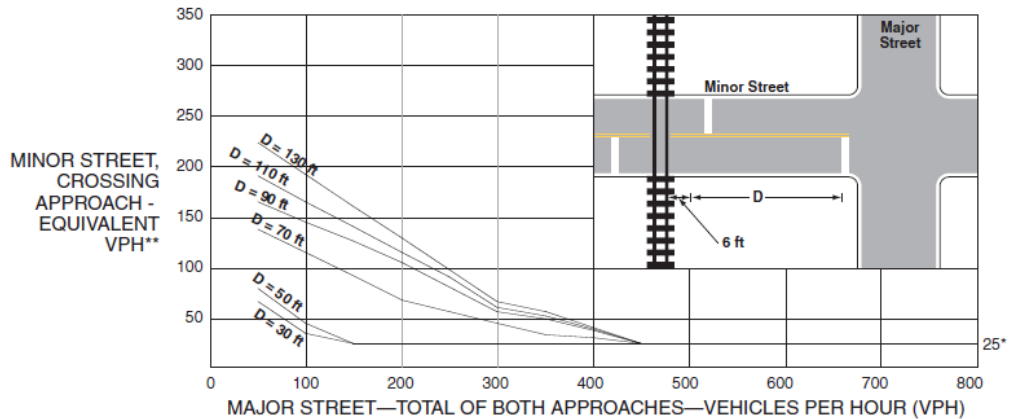


C. The grade crossing shall have flashing-light signals (see Chapter 8C).

**Guidance:**

If this warrant is met and a traffic control signal at the intersection is justified by an engineering study, the grade crossing should have automatic gates (see Chapter 8C).

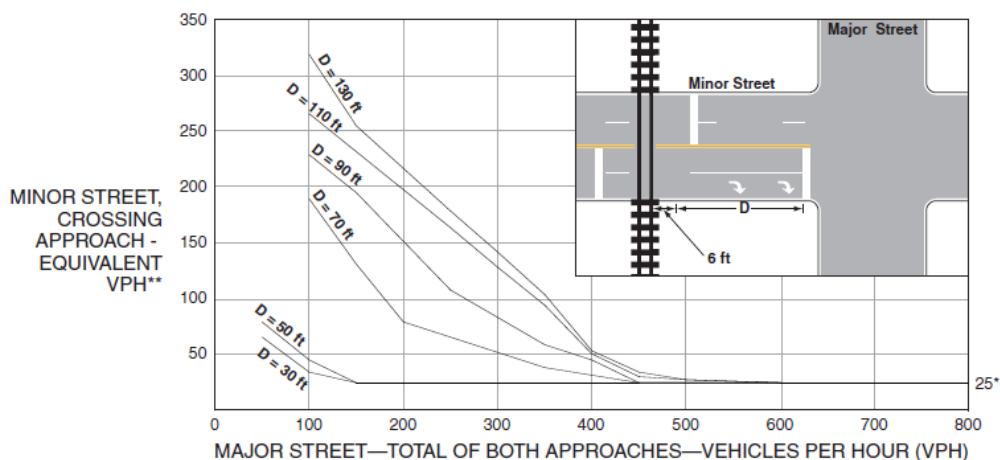
**Figure 4C-9. Warrant 9, Intersection Near a Grade Crossing  
(One Approach Lane at the Track Crossing)**



\* 25 vph applies as the lower threshold volume

\*\* VPH after applying the adjustment factors in Tables 4C-2, 4C-3, and/or 4C-4, if appropriate

**Figure 4C-10. Warrant 9, Intersection Near a Grade Crossing  
(Two or More Approach Lanes at the Track Crossing)**



\* 25 vph applies as the lower threshold volume

\*\* VPH after applying the adjustment factors in Tables 4C-2, 4C-3, and/or 4C-4, if appropriate

**Table 4C-2. Warrant 9, Adjustment Factor for Daily Frequency of Rail Traffic**

Rail Traffic per Day	Adjustment Factor
1	0.67
2	0.91
3 to 5	1.00
6 to 8	1.18
9 to 11	1.25
12 or more	1.33

**Table 4C-3. Warrant 9, Adjustment Factor for Percentage of High-Occupancy Buses**

% of High-Occupancy Buses* on Minor-Street Approach	Adjustment Factor
0%	1.00
2%	1.09
4%	1.19
6% or more	1.32

\* A high-occupancy bus is defined as a bus occupied by at least 20 people.

**Table 4C-4. Warrant 9, Adjustment Factor  
for Percentage of Tractor-Trailer Trucks**

% of Tractor-Trailer Trucks on Minor-Street Approach	Adjustment Factor	
	D less than 70 feet	D of 70 feet or more
0% to 2.5%	0.50	0.50
2.6% to 7.5%	0.75	0.75
7.6% to 12.5%	1.00	1.00
12.6% to 17.5%	2.30	1.15
17.6% to 22.5%	2.70	1.35
22.6% to 27.5%	3.28	1.64
More than 27.5%	4.18	2.09

# All-Way Stop Control (AWSC) Warrant

Figure 23 illustrates the AWSC data tab.

13 - Main Street & 1st Street

All-Way Stop Control Warrant: Multiway Stop Applications Federal 2009 Warrant MET

---

**Warrant Status** **Present Intersection**

Condition A: Traffic Signal Warrants - MET 0 Crashes Correctable by AWSC Intersection Within 12-Month Period

Condition B: 5 crashes in 12 months - NOT MET

Condition C: 8 (actual 0) hours NOT MET @ 100%

Condition D: Condition D was not used

---

**Approach Information**

	EB			WB			NB			SB		
Include in Analyses	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		
Name	1st Street			1st Street			Pellet Street			Pellet Street		
Major	<input type="checkbox"/>			<input type="checkbox"/>			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		
Speed Limit (mph)	30			30			40			40		
85th Percentile Speed	0.00			0.00			0.00			0.00		
Include in Analyses	L	T	R	L	T	R	L	T	R	L	T	R
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Lanes & Sharing	↕			↕			↕			↕		

---

**Vehicle Volumes**

☒ Raw Volumes ☐ Hourly Volumes (non-editable)

Time Period		EB			WB			NB			SB		
Begin	End	L	T	R	L	T	R	L	T	R	L	T	R
7:00	7:15	7	0	37	0	0	0	4	113	0	1	240	3
7:15	7:30	9	0	25	1	0	0	4	162	1	0	342	1
7:30	7:45	11	0	39	0	0	0	3	193	3	0	440	2
7:45	8:00	10	0	38	2	0	0	5	218	4	3	469	2
8:00	8:15	7	0	30	0	0	0	7	205	2	2	370	7
8:15	8:30	8	1	23	0	0	0	6	214	3	4	229	3
8:30	8:45	2	0	24	0	0	0	4	167	5	3	218	1
8:45	9:00	8	1	18	0	0	0	4	167	9	3	190	6
9:00	9:15	5	0	17	3	0	1	7	153	12	9	205	4
9:15	9:30	3	0	13	3	0	0	7	147	12	3	172	3
9:30	9:45	2	0	12	1	1	1	4	138	8	0	156	2
9:45	10:00	4	0	9	4	0	0	6	165	4	0	127	2
10:00	10:15	3	1	11	3	0	2	5	172	2	3	163	2
10:15	10:30	6	0	3	0	0	5	8	175	12	2	146	2
10:30	10:45	1	1	9	7	0	2	12	169	12	10	151	2
10:45	11:00	2	1	13	19	1	7	6	161	12	2	157	1

---

**Delays**

☒ Raw Delays (minutes per vehicle) ☐ Hourly Delays (non-editable)

Summary Warrant 1 Warrant 2 Warrant 3 Warrant 4 Warrant 6 Warrant 9 **AWSC Warrant** Warrant 5 Warrant 7 Warrant 8

Figure 23 AWSC Tab

This is the All-Way Stop Control (AWSC) warrant.

## **AWSC Information from MUTCD**

### **Support:**

Multiway stop control can be useful as a safety measure at intersections if certain traffic conditions exist. Safety concerns associated with multiway stops include pedestrians, bicyclists, and all road users expecting other road users to stop. Multiway stop control is used where the volume of traffic on the intersecting roads is approximately equal.

The restrictions on the use of STOP signs described in Section 2B.05 also apply to multiway stop applications.

### **Guidance:**

The decision to install multiway stop control should be based on an engineering study.

The following criteria should be considered in the engineering study for a multiway STOP sign installation:

- A. Where traffic control signals are justified, the multiway stop is an interim measure that can be installed quickly to control traffic while arrangements are being made for the installation of the traffic control signal.
- B. A crash problem, as indicated by 5 or more reported crashes in a 12-month period that are susceptible to correction by a multiway stop installation. Such crashes include right- and left-turn collisions as well as right-angle collisions.
- C. Minimum volumes:
  - 1. The vehicular volume entering the intersection from the major street approaches (total of both approaches) averages at least 300 vehicles per hour for any 8 hours of an average day, and
  - 2. The combined vehicular, pedestrian, and bicycle volume entering the intersection from the minor street approaches (total of both approaches) averages at least 200 units per hour for the same 8 hours, with an average delay to minor-street vehicular traffic of at least 30 seconds per vehicle during the highest hour, but
  - 3. If the 85th-percentile approach speed of the major-street traffic exceeds 65 km/h or exceeds 40 mph, the minimum vehicular volume warrants are 70 percent of the above values.

- D. Where no single criterion is satisfied, but where Criteria B, C.1, and C.2 are all satisfied to 80 percent of the minimum values. Criterion C.3 is excluded from this condition.

**Option:**

Other criteria that may be considered in an engineering study include:

- A. The need to control left-turn conflicts;
- B. The need to control vehicle/pedestrian conflicts near locations that generate high pedestrian volumes;
- C. Locations where a road user, after stopping, cannot see conflicting traffic and is not able to reasonably safely negotiate the intersection unless conflicting cross traffic is also required to stop; and
- D. An intersection of two residential neighborhood collector (through) streets of similar design and operating characteristics where multiway stop control would improve traffic operational characteristics of the intersection.

# Bicycle Warrant

Figure 24 illustrates the Bicycle data tab. This tab is only available when you select the California 2012 Option from the toolbar.

13 - Main Street & 1st Street

Bicycle Warrant

California 2012 Warrant NOT MET

Warrant Status

Bicycle Volumes: 0 hours met (1 required)

Present Intersection

Collision
Path Intersects

Approach Information

	EB			WB			NB			SB		
Include in Analyses	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		
Name	1st Street			1st Street			Pellet Street			Pellet Street		
Major	<input type="checkbox"/>			<input type="checkbox"/>			<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>		
Speed Limit (mph)	30			30			40			40		
85th Percentile Speed	0.00			0.00			0.00			0.00		
Include in Analyses	L	T	R	L	T	R	L	T	R	L	T	R
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Lanes & Sharing	+			+			1			1		

Vehicle Volumes

☒ Raw Volumes
☐ Hourly Volumes (non-editable)

Time Period		EB			WB			NB			SB		
Begin	End	L	T	R	L	T	R	L	T	R	L	T	R
7:00	7:15	7	0	37	0	0	0	4	113	0	1	240	3
7:15	7:30	9	0	25	1	0	0	4	162	1	0	342	1
7:30	7:45	11	0	39	0	0	0	3	193	3	0	440	2
7:45	8:00	10	0	38	2	0	0	5	218	4	3	469	2
8:00	8:15	7	0	30	0	0	0	7	205	2	2	370	7
8:15	8:30	8	1	23	0	0	0	6	214	3	4	229	3
8:30	8:45	2	0	24	0	0	0	4	167	5	3	218	1
8:45	9:00	8	1	18	0	0	0	4	167	9	3	190	6
9:00	9:15	5	0	17	3	0	1	7	153	12	9	205	4
9:15	9:30	3	0	13	3	0	0	7	147	12	3	172	3
9:30	9:45	2	0	12	1	1	1	4	138	8	0	156	2
9:45	10:00	4	0	9	4	0	0	6	165	4	0	127	2
10:00	10:15	3	1	11	3	0	2	5	172	2	3	163	2
10:15	10:30	6	0	3	0	0	5	8	175	12	2	146	2
10:30	10:45	1	1	9	7	0	2	12	169	12	10	151	2
10:45	11:00	2	1	13	19	1	7	6	161	12	2	157	1

Bicycle Volumes

☒ Raw Volumes
☐ Hourly Volumes (non-editable)

Time Period		EB	WB	NB	SB
Begin	End				

Summary
Warrant 1
Warrant 2
Warrant 3
Warrant 7
Warrant 9
Bicycle Warrant
AWSC Warrant

Figure 24 Bicycle Tab

The following data items are included on the Bicycle tab:

## **Bicycle Warrant Information from California MUTCD**

### **Section 4C.102(CA) Bicycle Signal Warrant**

#### **Guidance:**

A bicycle signal should be considered for use only when the volume and collision or volume and geometric warrants have been met:

1. Volume; When  $W = B \times V$  and  $W > 50,000$  and  $B > 50$ .

Where: W is the volume warrant. B is the number of bicycles at the peak hour entering the intersection. V is the number of vehicles at the peak hour entering the intersection. B and V shall use the same peak hour.

2. Collision; When 2 or more bicycle/vehicle collisions of types susceptible to correction by a bicycle signal have occurred over a 12-month period and the responsible public works official determines that a bicycle signal will reduce the number of collisions.
3. Geometric; (a) Where a separate bicycle/ multi use path intersects a roadway. (b) At other locations to facilitate a bicycle movement that is not permitted for a motor vehicle.



# Chapter 6 – Reports and Printing

## Single Intersection Reports

To create a report of the active window for the selected intersection, select the **File→Print** command, select the Printer icon in the toolbar, or choose [Ctrl]+[P]. A preview of the report for the given tab will be shown. The selected report will show for all intersections in the Intersection List. See .

## Warrant 1: Eight-hour Vehicular Volume

### 2: Main Street & Warrant Way

#### Intersection Information

Major Street Name: Pellet Street  
Major Street Direction: NB/SB  
Minor Street Direction: EB/WB

WARRANT 1 MET? **No**

#### Details:

Condition A Met? **No** 5 Hours met (8 required)  
Condition B Met? **No** 4 Hours met (8 required)

Hour	Major Street Vehicles (Total of Both Approaches)	High Volume Minor Approach Vehicles	100% Standard Met? Cond. A OR Cond. B		80% Standard Met? Cond. A AND Cond. B	
			Condition A 100% Column	Condition B 100% Column	Condition A 80% Column	Condition B 80% Column
07:00 to 08:00	2,344	410	Yes*	Yes*	Yes*	Yes*
Condition A	Volume >= 100% column (600)?	Volume >= 100% column (900)?	Yes	Yes		
	Volume >= 80% column (480)?	Volume >= 80% column (720)?	Yes	Yes		
Condition B	Volume >= 100% column (900)?	Volume >= 100% column (100)?	Yes	Yes		
	Volume >= 80% column (720)?	Volume >= 80% column (80)?	Yes	Yes		
07:15 to 08:15	2,470	371	Yes	Yes	Yes	Yes
Condition A	Volume >= 100% column (600)?	Volume >= 100% column (900)?	Yes	Yes		
	Volume >= 80% column (480)?	Volume >= 80% column (720)?	Yes	Yes		
Condition B	Volume >= 100% column (900)?	Volume >= 100% column (100)?	Yes	Yes		
	Volume >= 80% column (720)?	Volume >= 80% column (80)?	Yes	Yes		
07:30 to 08:30	2,197	266	Yes	Yes	Yes	Yes
Condition A	Volume >= 100% column (600)?	Volume >= 100% column (900)?	Yes	Yes		
	Volume >= 80% column (480)?	Volume >= 80% column (720)?	Yes	Yes		
Condition B	Volume >= 100% column (900)?	Volume >= 100% column (100)?	Yes	Yes		
	Volume >= 80% column (720)?	Volume >= 80% column (80)?	Yes	Yes		

Figure 25 Single Intersection Report

To create all active reports for the selected intersection, select the **File→Print-All-Reports** command or choose [Ctrl]+[R]. A preview of the report for the given tab will be shown.

To change pages use the buttons [|<], [<], [>], and [>|]. You can also change pages using the page number of X box.

To resize the preview, use the dropdown size. You can also choose to fit width or show the whole page.

To print the report, select the Printer icon button from the Report Preview toolbar.

## Multiple Intersection Reports

To create a report that includes multiple intersections, select the **View→Multiple Intersection Reports** menu item. To choose intersections for a report, hold down the [CTRL] key and click on each desired intersection. Next, select the report to generate using the **Select Report** listbox, then click **Run Report**.

The screenshot shows a dialog box titled "Multiple Intersection Report". It has a close button (X) in the top right corner. The dialog is divided into several sections:

- Select Intersections:** A list box containing four items: "2: Main Street & Warrant Way", "7: Main Street & Ped Way", "10: Main Street & Broken Road", and "13: Main Street & 1st Street".
- Select Report:** A dropdown menu currently showing "Summary Matrix".
- Buttons:** "Run Report" and "Cancel" buttons are located to the right of the list box.
- Report options:** A section with two text input fields: "Header" and "Footer".
- Checkboxes:** A checkbox labeled "Print page number" is checked.
- Save Button:** A "Save" button is located at the bottom right of the "Report options" section.

## Summary Matrix Report

The summary matrix report shows the status of the eight warrants for the selected intersections. The result can show Met for a signal that meets the warrants; Not Met when the warrant is analyzed but not met; or N/A for a warrant that has not been analyzed.

Warrants Summary Matrix Report												
		Warrant Status										
INTID	Intersection Name	1	2	3	4	5	6	7	8	9	Bicycle	AWSC
2	Main Street & Warrant Way	Not Met	Met	Met	Not Met	N/A	Met	N/A	N/A			
7	Main Street & Ped Way	Not Met	Met	Met	Met	Not Met	N/A	N/A	N/A			
10	Main Street & Broken Road	Not Met	Met	Met	N/A	N/A	Met	N/A	N/A			
13	Main Street & 1st Street	Not Met	Not Met	Not Met	N/A	N/A	N/A	N/A	N/A			

## Summary Report

The summary report shows a summary of the warrant status for the intersections selected. The top portion list the Street Name, Directions, Number of Lanes and Approach Speed. The lower portion shows the status of the warrant (No or Yes).

## Warrants Summary Report

### 2: Main Street & Warrant Way

#### Intersection Information:

	Major Street	Minor Street
Street Name	Pellet Street	Warrant Way
Direction	NB/SB	EB/WB
Number of Lanes	2	2
Approach Speed	40	30

Warrant	Met?	Notes
---------	------	-------

#### Warrant 1, Eight-Hour Vehicular Volume

No

Condition A or B Met?

No

5 Hours met (8 required)

Condition A and B Met?

No

4 Hours met (8 required)

#### Warrant 2, Four-Hour Vehicular Volume

Yes

5 Hours met (4 required)

#### Warrant 3, Peak Hour

Yes

Condition A Met?

No

0 Hours met (1 required)

Condition B Met?

Yes

3 Hours met (1 required)

#### Warrant 4, Pedestrian Volume

No

Condition A Met?

No

0 Hours met (4 required)

Condition B Met?

No

0 Hours met (1 required)

## Raw Volumes and Weekend Volumes Report

This report illustrates the raw volumes and weekend volumes entered on the Summary, Vehicle Volumes sub-tab. Refer to page 4-9 for full details.

Raw Volumes 2: Main Street & Warrant Way												
Time	NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
07:00	13	114	5	4	194	64	35	9	12	4	10	3
07:15	17	130	7	17	229	215	69	36	19	8	34	5
07:30	16	213	12	8	302	120	96	60	25	7	34	4
07:45	1	273	15	27	335	13	28	14	7	5	2	8
08:00	1	276	9	15	214	5	11	4	2	4	1	9
08:15	2	110	3	8	208	11	16	1	2	6	4	4
08:30	1	66	4	4	152	5	4	2	1	14	1	7
08:45	3	115	7	10	201	13	11	0	4	8	0	8
09:00	2	75	2	7	132	5	10	4	2	2	2	1
09:15	3	33	3	1	89	5	2	0	0	2	0	1
09:30	1	55	1	3	109	6	6	1	1	4	0	1
09:45	4	60	1	6	104	10	6	3	0	3	0	1
10:00	0	87	2	3	36	5	4	0	0	3	0	5
10:15	2	103	3	6	142	6	4	1	4	11	0	5
10:30	2	124	6	5	151	5	8	3	3	4	0	0
10:45	2	124	1	6	145	1	5	0	3	7	2	2
14:00	3	132	5	3	139	9	59	10	19	5	2	9
14:15	1	114	4	2	169	12	8	1	3	6	1	3
14:30	8	116	6	2	110	27	2	1	2	10	7	13
14:45	23	178	7	4	194	48	50	16	17	9	11	4
15:00	9	185	4	6	133	62	112	38	29	9	10	7
15:15	3	175	5	4	174	23	44	5	6	3	2	6
15:30	10	66	3	6	176	16	20	4	11	2	2	1
15:45	5	187	9	6	179	21	34	2	7	10	3	9
16:00	6	198	3	5	260	14	10	0	3	20	1	14
16:15	2	234	6	7	213	12	18	1	6	8	0	7
16:30	1	207	7	9	285	9	8	3	1	15	4	13
16:45	0	258	6	14	262	15	15	0	1	13	10	14
17:00	2	198	4	7	294	15	17	0	6	33	10	20
17:15	5	308	3	8	283	12	17	3	3	54	10	19
17:30	9	176	8	10	263	24	21	0	6	29	2	7
17:45	17	236	3	18	227	45	23	3	4	15	7	5

## Pedestrian Volumes Report

Select this report to print the Pedestrian Volumes entered on the Summary, Pedestrian Volumes sub-tab. Refer to page 4-11 for details on this report.

## Gaps Report

This report shows the gap values for pedestrians used for pedestrian warrants. Refer to page 4-12 for details.

## Delays Report

Select this report to show the delay value inputs used for the warrant analysis. Refer to page 4-14 for full delays.

## Site Information Report

Select this report to detail the information input on the Summary, Site Information sub-tab. Refer to page 4-4 for details.

Site Information

10: Main Street & Broken Road

Present Intersection		Projected Intersection	
Community Population < 10,000?	No	Total Entering Volume Growth Percentage (per year)	0.00
Pedestrian Crossing Speed	3.5	Projected Time Period (in years)	0.00
Crashes Correctable by Signal Within 12-Month Period	0		
Alternatives Failed to Reduce Crash Frequency?	No		
New Signal will Restrict Flow of Traffic?	No		
Student Crossing Time Interval (minutes)	0		
Measures to Reduce Student Ped Danger Considered	No		

Approach Information

	NEB	SB	WB	SWB	NWB	SEB	NB
Include in Analyses	No	Yes	Yes	No	No	No	Yes
Name		Pellet Street	Broken Road				Pellet Street
Major	No	Yes	No	No	No	No	Yes
Acceptable Platooning	No	No	No	No	No	No	No
Adj. Coord. Signal	No	Yes	No	No	No	No	Yes
Adj. Intersection Dist.	0.00	1145.00	1015.00	0.00	0.00	0.00	1290.00
Median Refuge	No	No	No	No	No	No	No
Speed Limit	30	40	30	30	30	30	40
85th Percentile Speed	0.00	0.00	0.00	0.00	0.00	0.00	0.00

## Warrant 1 – Eight-hour Vehicular Volume Report

This report shows the status and details for Warrant 1. The report illustrates the status of the warrant for each 15-minute increment. Refer to page 5-3 for details on this warrant.

Warrant 1: Eight-hour Vehicular Volume							
2: Main Street & Warrant Way							
Intersection Information							
Major Street Name:		Pellet Street					
Major Street Direction:		NB/SB					
Minor Street Direction:		EB/WB					
WARRANT 1 MET? <b>No</b>							
Details:							
Condition A Met?		<b>No</b> 5 Hours met (8 required)					
Condition B Met?		<b>No</b> 4 Hours met (8 required)					
Hour	Major Street Vehicles (Total of Both Approaches)	High Volume Minor Approach Vehicles	100% Standard Met? Cond. A OR Cond. B		80% Standard Met? Cond. A AND Cond. B		
			Condition A 100% Column	Condition B 100% Column	Condition A 80% Column	Condition B 80% Column	
07:00 to 08:00	2,344	410	Yes*	Yes*	Yes*	Yes*	
Condition A	Volume >= 100% column (600)? <b>Yes</b>	Volume >= 100% column (900)? <b>Yes</b>					
	Volume >= 80% column (480)? <b>Yes</b>	Volume >= 80% column (720)? <b>Yes</b>					
Condition B	Volume >= 100% column (900)? <b>Yes</b>	Volume >= 100% column (100)? <b>Yes</b>					
	Volume >= 80% column (720)? <b>Yes</b>	Volume >= 80% column (80)? <b>Yes</b>					
07:15 to 08:15	2,470	371	Yes	Yes	Yes	Yes	
Condition A	Volume >= 100% column (600)? <b>Yes</b>	Volume >= 100% column (900)? <b>Yes</b>					
	Volume >= 80% column (480)? <b>Yes</b>	Volume >= 80% column (720)? <b>Yes</b>					
Condition B	Volume >= 100% column (900)? <b>Yes</b>	Volume >= 100% column (100)? <b>Yes</b>					
	Volume >= 80% column (720)? <b>Yes</b>	Volume >= 80% column (80)? <b>Yes</b>					
07:30 to 08:30	2,197	266	Yes	Yes	Yes	Yes	
Condition A	Volume >= 100% column (600)? <b>Yes</b>	Volume >= 100% column (900)? <b>Yes</b>					
	Volume >= 80% column (480)? <b>Yes</b>	Volume >= 80% column (720)? <b>Yes</b>					
Condition B	Volume >= 100% column (900)? <b>Yes</b>	Volume >= 100% column (100)? <b>Yes</b>					
	Volume >= 80% column (720)? <b>Yes</b>	Volume >= 80% column (80)? <b>Yes</b>					
Federal 2009		1	12/21/2016				



## Warrant 2 – Four-hour Vehicular Volume Report

This report shows the status and details for Warrant 2. The report illustrates the status of the warrant on the MUTCD warrant graph. Refer to page 5-7 for details on this warrant.

### Warrant 2: Four-hour Vehicular Volume

#### 2: Main Street & Warrant Way

##### Intersection Information

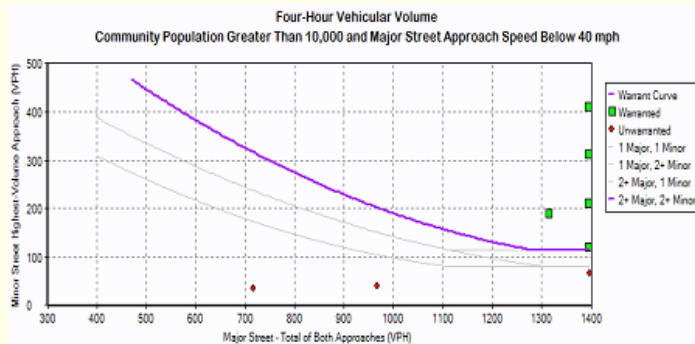
	Major Street	Minor Street
Street Name	Pellet Street	Warrant Way
Direction	NB/SB	EB/WB
Number of Lanes	2	2
Approach Speed	40	30

Warrant 2 Met? Yes

##### Details:

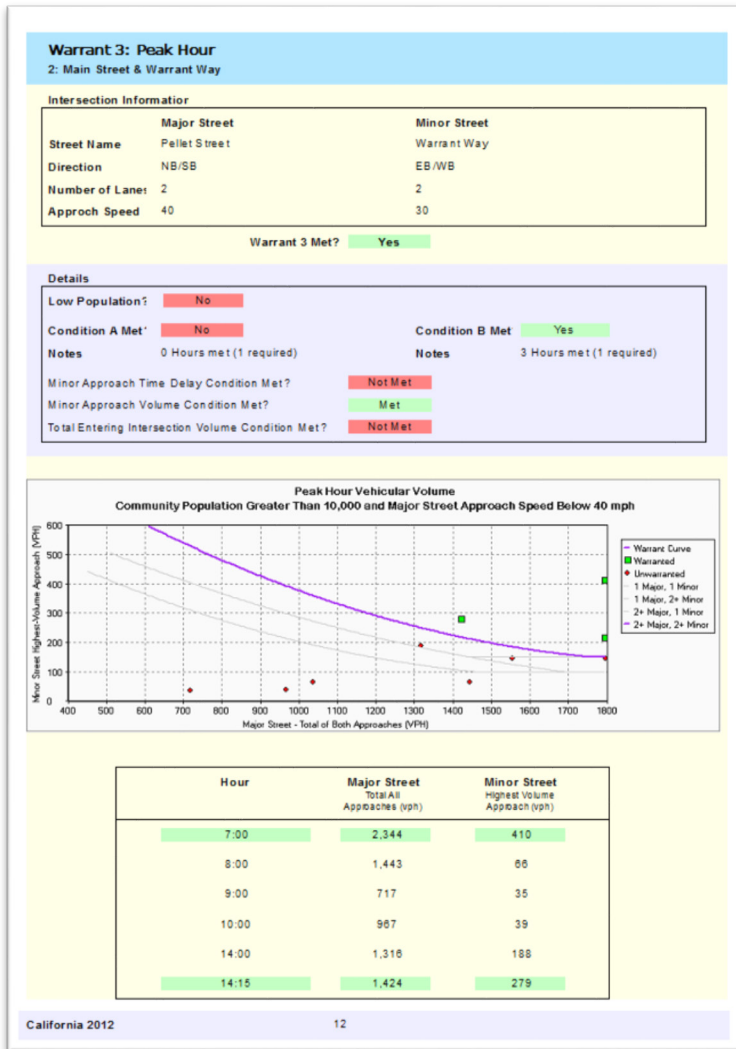
Notes: 5 Hours met (4 required)

Low Population? No



## Warrant 3 – Peak Hour Report

This report shows the status and details for Warrant 3. The report illustrates the status of the warrant on the MUTCD warrant graph. Refer to page 5-11 for details on this warrant.



Warrant 4 – Pedestrian Volume Report (2003 MUTCD)

This report shows the status and details for Warrant 4 using the 2003 MUTCD methods. The report illustrates the status of the warrant for each 15-minute increment. Refer to page 5-15 for details on this warrant.

Warrant 4: Pedestrian Volume

2: Main Street & Warrant Way

Intersestion Information:

Major Street Name	Pellet Street
Major Direction	NB/SB
Median Refuge	No
Pedestrian Speed	3.50

Warrant 4 Met? No

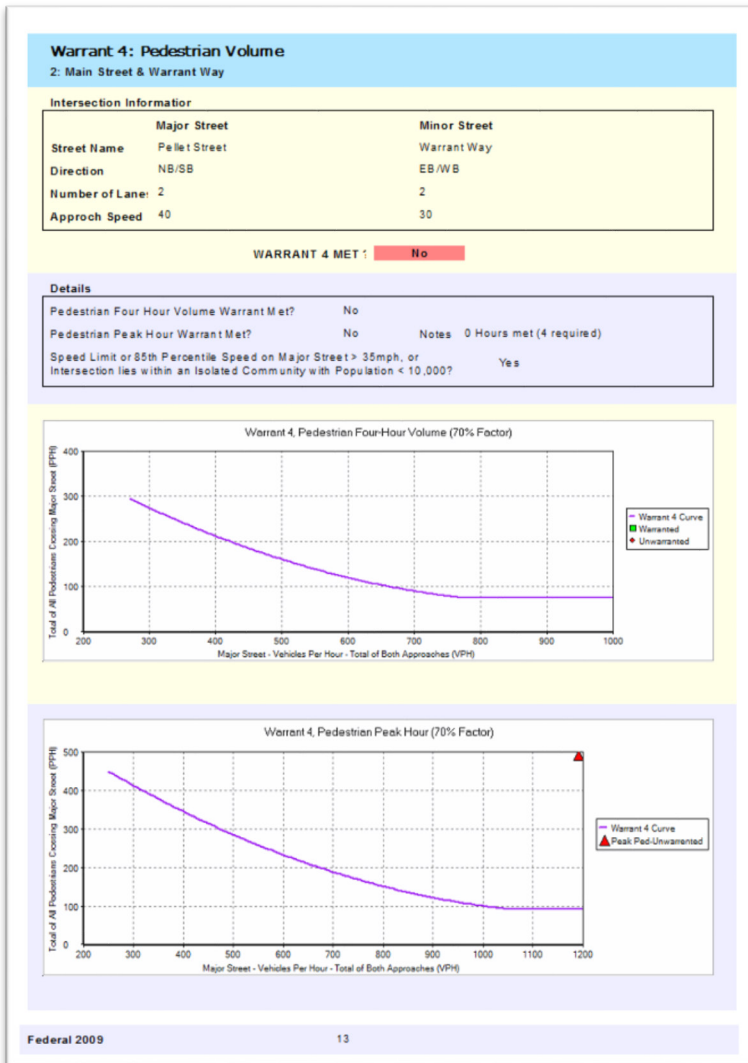
Details:

Low Ped Volume Hours Met: 0 (4 Required)  
High Ped Volume Hours Met: 0 (1 Required)

Hour	Eastbound Ped Volume						Westbound Ped Volume					
	Peds	Gaps	Gaps < 60?	Peds >= 100?	Peds >= 190?		Peds	Gaps	Gaps < 60?	Peds >= 100?	Peds >= 190?	

## Warrant 4 – Pedestrian Volume Report (2009 MUTCD)

This report shows the status of the details for Warrant 4 using the 2009 MUTCD methods. Refer to page 5-17 for details on this warrant.



## Warrant 5 – School Crossing

This report shows the status and details for Warrant 5. Refer to page 5-22 for details on this warrant.

### Warrant 5: School Crossing

#### 7: Main Street & Ped Way

##### Intersection Information:

Major Street Name	Pellet Street
Major Direction	NB/SB

Warrant 5 Met?

No

##### Details:

Time Period Interval for Students Crossing (min)	0
Number of Students Crossing in Time Period	50
Number of Adequate Gaps in Time Period	0
Other Remedial Measures Attempted?	No
Adjacent Signal on NB approach?	Yes
Distance to signal on NB Approach (ft)	1953
Adjacent Signal on SB approach?	Yes
Distance to signal on SB Approach (ft)	1290
Will New Signal Restrict Progressive Traffic?	No

## Warrant 6 – Coordinated Signal System

This report shows the status and details for Warrant 6. Refer to page 5-24 for details on this warrant.

**Warrant 6: Coordinated Signal System**  
2: Main Street & Warrant Way

**Intersection Information**  
Major Street Name Pellet Street  
Major Street Direction NB/SB

WARRANT 6 MET? Yes

**Details:**

Approach Direction & Name	Acceptable Platooning?	Adjacent Coordinating Signal?	Adjacent Intersection Distance
WB Approach (Warrant Way)	No	No	N/A
EB Approach (Warrant Way)	No	No	N/A
SB Approach (Pellet Street)	No	Yes	1,953.00
NB Approach (Pellet Street)	Yes	No	N/A

Unacceptable Platooning?  
(At least one approach)  
Yes

Distance to Closest Signal  
(Must be N/A or > 1000)  
1,953.00

## Warrant 7 – Crash Experience Report

This report shows the status and details for Warrant 7. Refer to page 5-26 for details on this warrant.

**Warrant 7: Crash Experience**  
**2: Main Street & Warrant Way**

**Intersection Information**  
Major Street Name    Pellet Street  
Major Street Direction    NB/SB  
Minor Street Direction    EB/WB

**WARRANT 7 MET?**    **No**

**Details:**  

Low Population?    **No**  
Major Street Speed Limit    40  
Major Street 85th-ile Speed    0.00

Traffic Volume Condition Met?    **No**  
5 Hours Met (\$ Required)  
Ped Volume Condition Met?    **No**  
0 Hours Met (\$ Required)

Qualifying Crashes    0  
Adequate Alternative Trials?    **No**

Hour	Traffic Volumes				Pedestrian Volumes			
	Major Street Vehicles	Minor Street Vehicles	80% Standard Met? A or B		Eastbound Ped Volumes		Westbound Ped Volumes	
			Condition A	Condition B	Peds	> 80?	Peds	> 80?
07:00 to 08:00	2,344	0	No	No	0	<b>No</b>	0	No
07:15 to 08:15	2,470	0	No	No	0	<b>No</b>	0	No
07:30 to 08:30	2,197	0	No	No	0	<b>No</b>	0	No
07:45 to 08:45	1,758	0	No	No	0	<b>No</b>	0	No
08:00 to 09:00	1,443	0	No	No	0	<b>No</b>	0	No
08:15 to 09:15	1,146	0	No	No	0	<b>No</b>	0	No
08:30 to 09:30	938	0	No	No	0	<b>No</b>	0	No
08:45 to 09:45	881	0	No	No	0	<b>No</b>	0	No

Federal 2009    18

This report shows the status and details for Warrant 8. Refer to page 5-29 for details on this warrant.

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## Warrant 9 – Intersection Near a Grade Crossing

This report shows the status and details for Warrant 9 (Federal 2009 report only). Refer to page 5-31 for details on this warrant.

### Warrant 9: Intersection Near a Grade Crossing 13: Main Street & 1st Street

#### Intersection Information:

	Major Street	Minor Street
Street Name	-	1st Street
Direction		NB/SB/EB/WB
Number of Lanes	1	2
Approach Speed	0	40

Warrant 9 Met? **No**

#### Details:

Note: No rail traffic	
Minor-street approach having a grade crossing	EB
Distance from the center of the track to the stop or yield line	130 Interpolated
Number of occurrences of rail traffic per day	0 Adjustment factor 0.67
Percentage of high-occupancy buses crossing the track	2.00% Adjustment factor 1.09
Percentage of tractor-trailer trucks crossing the track	10.00% Adjustment factor 1.00
The rail traffic arrival times are unknown, the highest traffic volume hour of the day is used	
No	

## AWSC Warrant Report

This report shows the status and details for the AWSC Warrant. Refer to page 5-38 for details on this warrant.

### All-Way Stop Control Warrant: Multiway Stop Applications

#### 2: Main Street & Warrant Way

##### Intersection Information

Major Street Name: Pellet Street  
Major Street Direction: NB/SB  
Minor Street Direction: EB/WB

AWSC WARRANT MET: **Yes**

##### Details:

Condition A Met?	Yes	Qualifying Crashes	0
Condition B Met?	No	Major Street 85th %-tile Speed	0.00
Condition C Met?	No	Major Street Speed Limit	40

Notes: 5 Hours Met (8 Required)

Hour	Traffic Volumes		Bicycle Volumes		Ped Volumes		Condition C		
	Major Street	Minor Street	North Bound Bicycle Volumes	East Bound Bicycle Volumes	North Bound Ped Volumes	East Bound Ped Volumes	Major Street Veh Volume > 300	Minor Street Avg (Veh + Ped + Bicycle) > 200	Delay > 30
07:00 to 08:00	2,344	534	0	0	0	0	False	No	No
14:00 to 15:00	1,316	268	0	0	0	0	False	No	No
15:00 to 16:00	1,467	376	0	0	0	0	False	No	No
16:15 to 17:15	2,067	223	0	0	0	0	False	No	No
17:15 to 18:15	1,655	228	0	0	0	0	False	No	No

## Bicycle Warrant Report

This report shows the status and details for the Bicycle Warrant. Refer to page 5-41 for details on this warrant.

Bicycle Warrant				
7: Main Street & Ped Way				
<b>Intersection Information</b>				
Major Street Name: Pellet Street				
Major Street Direction: NB/SB				
Minor Street Direction: EB/WB				
BICYCLE WARRANT MET? <b>No</b>				
<b>Details:</b>				
Collision (2 or more counts) 0				
Geometric Path <b>No</b>				
Volume Condition Met? <b>No</b>				
Notes: No hour met				
Hour	Traffic Volumes Vehicles entering the intersection (V)	Bicycle Volumes Bicycles entering the intersection (B)	Condition	
			$B \cdot V \geq 50,000?$	$B \geq 50?$
07:00 to 08:00	2,344	0	No	No
07:15 to 08:15	2,802	0	No	No
07:30 to 08:30	2,921	0	No	No
07:45 to 08:45	2,769	0	No	No
08:00 to 09:00	2,486	0	No	No
08:15 to 09:15	2,167	0	No	No
08:30 to 09:30	2,029	0	No	No
08:45 to 09:45	2,037	0	No	No
09:00 to 10:00	2,040	0	No	No
09:15 to 10:15	2,032	0	No	No
09:30 to 10:30	2,071	0	No	No
09:45 to 10:45	2,096	0	No	No
10:00 to 11:00	2,150	0	No	No
10:15 to 11:15	1,632	0	No	No
10:30 to 11:30	1,104	0	No	No
10:45 to 11:45	588	0	No	No
14:00 to 15:00	2,499	0	No	No
14:15 to 15:15	2,523	0	No	No
14:30 to 15:30	2,541	0	No	No
14:45 to 15:45	2,523	0	No	No
15:00 to 16:00	2,649	0	No	No
California 2012			22	



# Chapter 7 – Database Access

Universal Traffic Data Format (UTDF) is a standard specification for transferring data between various software packages. UTDF is useful for transferring data to and from Synchro and for reading volume data into Warrants.

## Import UTDF Data

Warrants 10 can import a Synchro UTDF Layout, Volume and combined data files. To Import data, use the command Transfer→Import command. TMC style Volume files (TMC#.vol) files can also be imported.

### Import Layout Data

The Layout UTDF file stores information about the location of intersections and how they connect to each other. This file includes coordinates for intersections and the node numbers of adjoining intersections. Warrants 10 will import the ID number, intersection names and intersection type. The Intersection type includes Signalized, Unsignalized, Roundabout, External and Bend.

To create a Layout file from Synchro, refer to the Synchro User Guide.

To **import** Layout data, do the following:

- Create a new Warrants 10 file (**File→New**).
- Select the menu command **Transfer→Import→UTDF→Layout**.
- Choose **Comma Delimited** from the '**File of Type**' dropdown
- Select the file and press [**Open**].
- The data from this UTDF Layout file will now be in your Warrants file.

### Import Volume Data

The VOLUME file(s) stores turning movement counts. The volume file(s) stores the intersection number along with the date, and time of the volume data. Warrants 10 will import volume by ID number.

The Volume file should be in the Volume.csv format. The data must be in 15-minute format (not hourly volumes). To create a Volume file, refer to the Synchro User Guide.

To **import** Volume data, do the following:

- Open an existing Warrants file with the Intersection list and ID.
- Select the menu command **Transfer→Import→UTDF→Volume**.
- Choose **Comma Delimited** from the '**File of Type**' dropdown
- Select the file and press **[Open]**.
- The volume data for matching ID numbers will be imported into you Warrants file.

## Import/Export Combined Data Format

Synchro 10 can create a combined data file format. This file contains the complete set of Synchro data including sections on Layout, Lanes, Volumes, Timings, Phasing, etc. Warrants can import data from the Layout and Lanes section. Volumes cannot be imported. Synchro stores volumes in hourly format, Warrants requires data in 15 minute increments. The Timing and Phasing data is not used by Warrants. To create a Combined data file, refer to the Synchro User Guide.

To **import** a Combined Synchro data file, do the following:

- Create a new Warrants 10 file (**File→New**).
- Select the menu command **Transfer→Import→UTDF→Combined File**.
- Choose **Comma Delimited** from the '**File of Type**' dropdown
- Select the file and press **[Open]**.
- The layout and applicable lanes data will be imported into your Warrants file.

To **export** a Combined Synchro data file, do the following:

- Open an existing Warrants file.
- Select the menu command **Transfer→Export →UTDF Combined File**.
- Choose **Comma Delimited** from the '**File of Type**' dropdown
- Select the file and press **[Open]**.
- Choose the Time Range for which to export volumes

- The layout and applicable lanes data will be exported to a combined data file format.

### **Import TMC (\*.VOL) Format**

TMC files are text files that store timing data from a single intersection from multiple time periods. The data is stored in a fixed length format with each line representing a single time period. Refer to the Synchro User Guide for full details on the TMC (\*.vol) format.

To **import** a TMC (\*.vol) data file, do the following:

- Open an existing Warrants file with the Intersection list and ID.
- Select the menu command **Transfer→Import→Vol Files**.
- Choose **Vol Files** from the 'File of Type' dropdown
- Select the file and press **[Open]**.
- The volume data for matching ID numbers will be imported into your Warrants file.

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