APPENDIX 11E – SOFTWARE GUIDANCE

This appendix provides software guidance to illustrate the software-specific data entry procedures to input Oregon specific-default values for freeway and multilane highway analysis using Highway Capacity Manual analysis procedures.

The following guidance is not intended to be an all-encompassing software tutorial. The guidance assumes the user has a working knowledge of the software and provides a visual reference on how to update the Oregon-specific default values within the existing software tools. The software tools covered in this document include McTrans HCS7, SwashWare HCM-Calc, and FREEVAL.

ODOT Default Values

Many of the Oregon-specific default values such as Peak Hour Factor (PHF) or Truck Percentage are direct inputs in all three software tools. An excerpt of Appendix C listing the Oregon-specific default values are provided in Table 1.

However, ODOT's methodology for default capacity values uses the unit of total passenger cars per hour per lane (pc/h/ln) while both software tools use a capacity adjustment factor (CAF) and a speed adjustment factor (SAF), which result in the ODOT suggested default bottleneck capacity. As a result, the user will be required to convert the desired bottleneck capacity values, from Table 1 below, into CAF and SAF. An ODOT-specific capacity calculator spreadsheet is provided to assist with this.

A companion Microsoft Excel spreadsheet was developed with this software guidance to aid the user in computing the appropriate CAF and SAF based on free flow speed, weather, and driver population factor. The companion spreadsheet is designed to work with HCS7, HCM-Calc, or FREEVAL – although most computations are automated within FREEVAL already.

Table 1. Oregon Default Values from Appendix C.

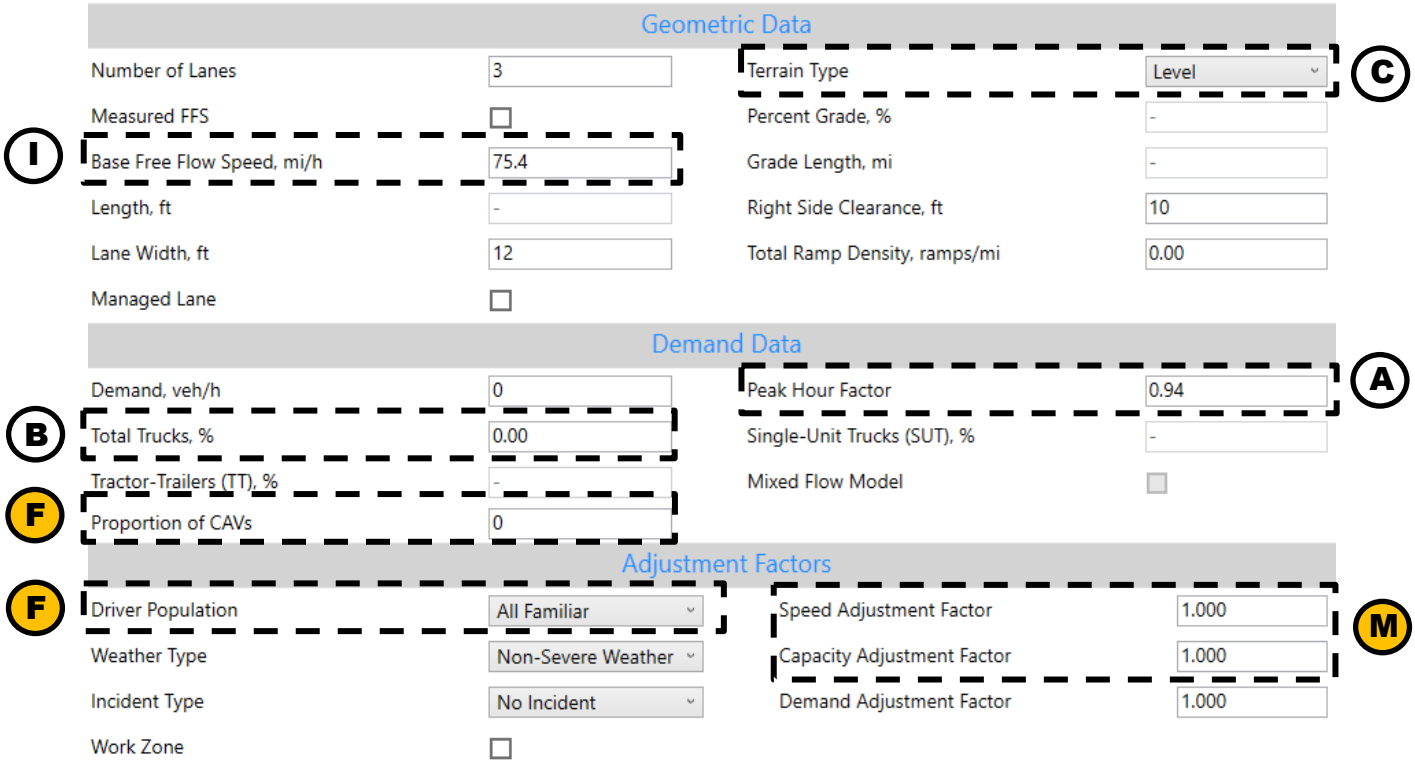
Required Data and Units		Source	Suggested Default Value		
A	Peak Hour Factor (PHF)	HCM 6th Edition	Rural:	0.94	
			Urban:	0.88	
B	Truck Percentage (%)	HCM 7th Edition	Rural:	26%	
			Small Urban:	19%	
			Medium Urban:	10%	
			Large Urban:	7%	
C	Terrain Type	HPMS and ODOT Vertical Grade Information	Generally level with few exceptions in the Cascade Range and Blue Mountains (see Exhibit 11-28)		
D	Area Type	GIS Database	No default, use urban or rural based on GIS		
E	Weave Volumes	Traffic Counts	(Ramp to ramp flow) = (on-ramp flow)/(mainline flow) * (off-ramp flow)		
F	CAV Proportion and Driver Population Factor	Exhibit 11-15	CAV proportion	0%	
			Rural:	0.939	
			Urban:	0.968	
G	Acceleration Lanes (ft)	ODOT 2012 HDM	750 ft		
H	Deceleration Lanes (ft)	ODOT 2012 HDM	500 ft		
I	Free Flow Speed (mph)	ODOT TransGIS	Speed Limit + 5 mph		
J	Ramp Free Flow Speed (mph)	HCM 7th Edition, and ODOT 2012 HDM	35 mph for loops ramps, 45 mph for diamond ramps		
K	Jam Density (pc/mi/ln)	HCM 7th Edition	190 pc/mi/ln		
L	Queue Discharge Capacity Drop (%)	HCM 7th Edition	7%		
M	Default Bottleneck Capacities (pc/h/ln)	Florida DOT Defaults for Freeway Segments	Urban merge and diverge freeway segments	3 lanes	2,100
				2: 3> lanes	2,000
			Urban weaving freeway segments	3 lanes	2,200
				2: 3> lanes	2,100
			Rural merge and diverge segments	3 lanes	1,900
				2: 3> lanes	1,800

HCS2023 Software Guidance

The guidance below highlights the location of HCS2023 (HCS Freeways Version 8.2) input fields and notes the corresponding Oregon-specific default values in Table 1. This section is organized based on the freeway analysis options available in HCS2023: Basic, Merge, Diverge, Weaving, and Facility analysis. Oregon default values are noted using letters (A) through (M) in the screen captures and correspond to the first column of Table 1. Inputs noted with a yellow circle (e.g. (M)) will require conversion to an adjustment factor, which can be performed using the adjustment factors spreadsheet provided. The user should refer to the Highway Capacity Manual for inputs not noted in Figures 1 – 4.

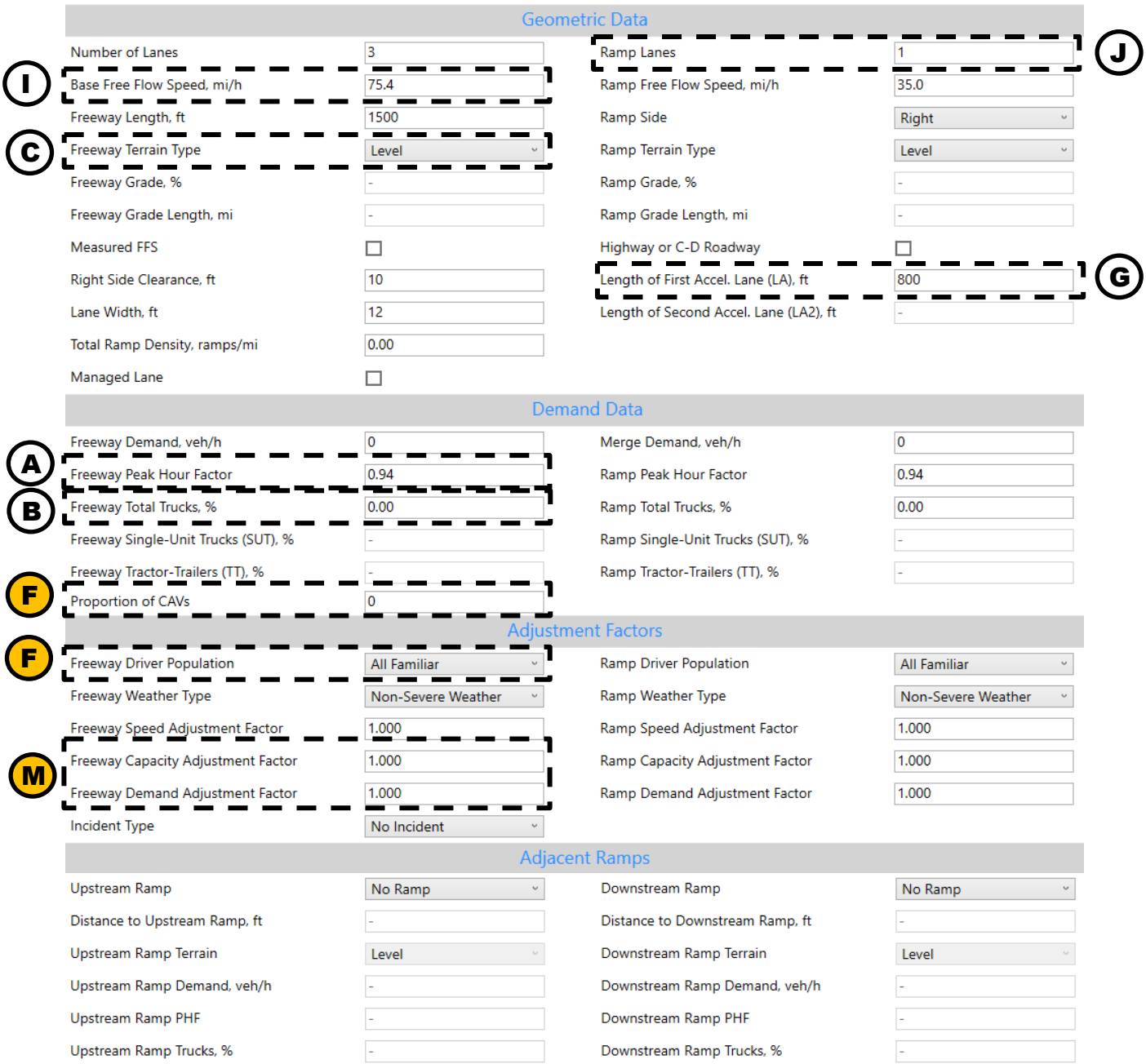
Basic Freeway Segment Analysis

Figure 1. Basic Freeway Segment Analysis Window in HCS2023



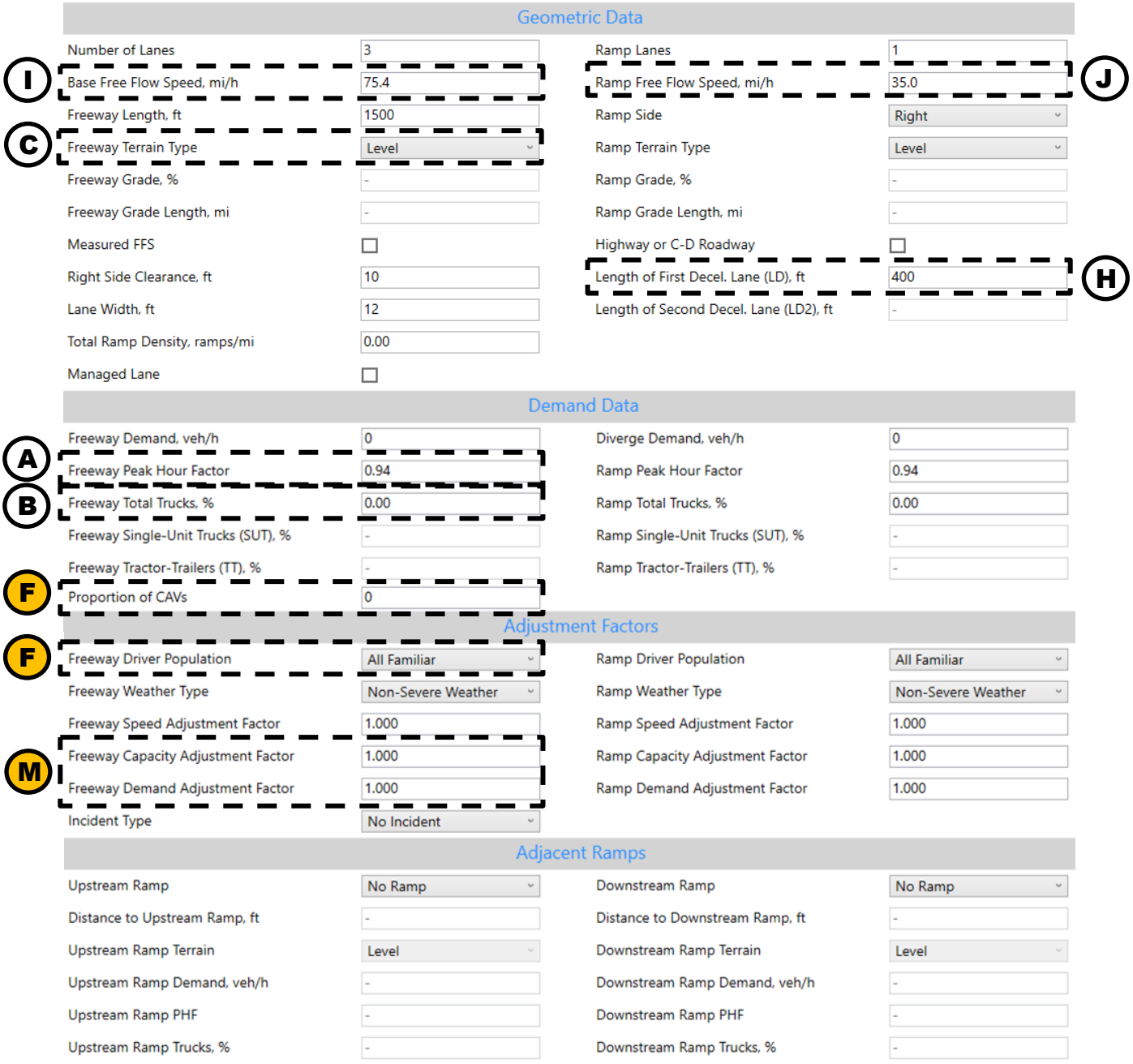
Merge Segment Analysis

Figure 2. Merge Segment Analysis Window in HCS2023



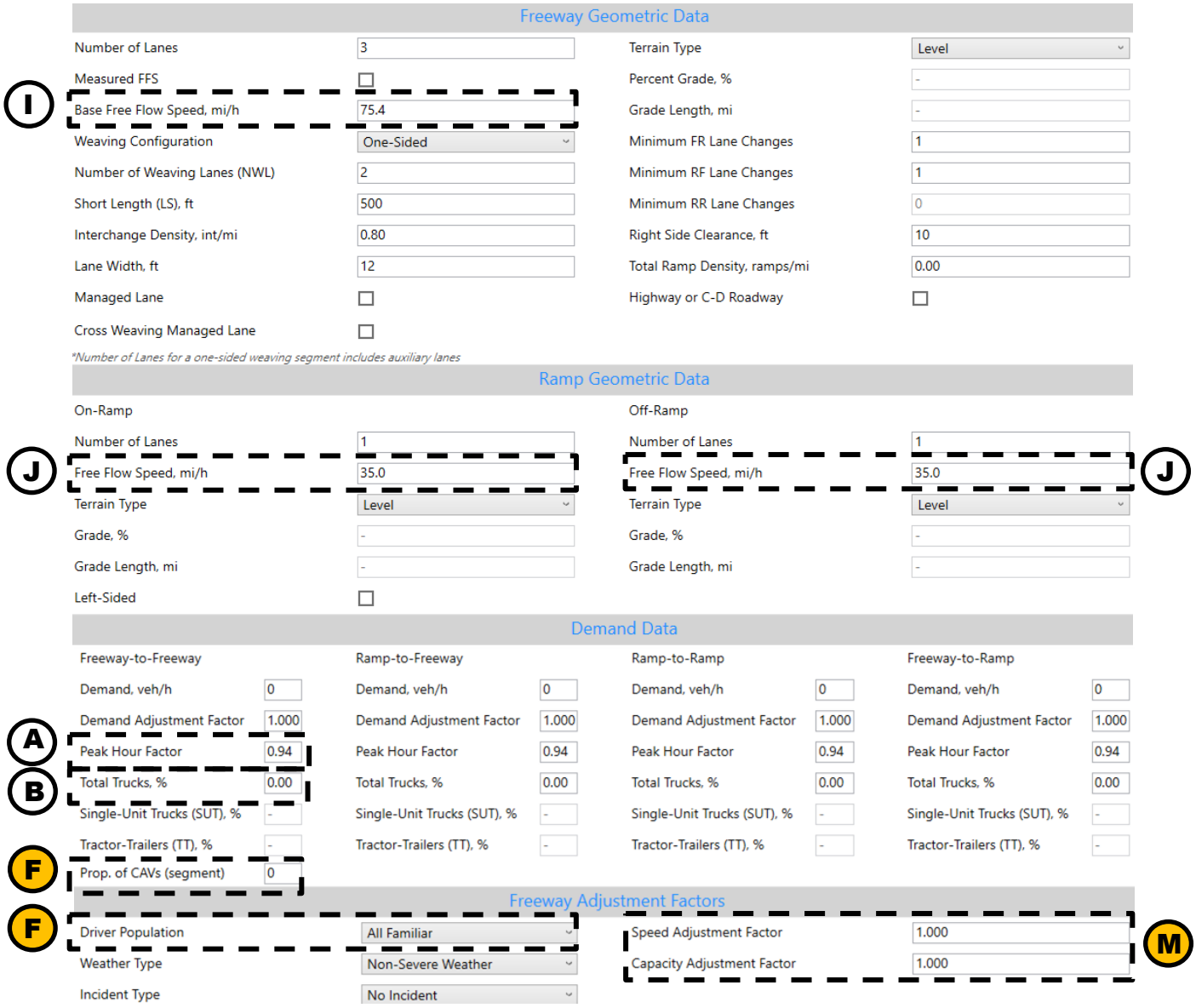
Diverge Segment Analysis

Figure 3. Diverge Segment Analysis Window in HCS2023



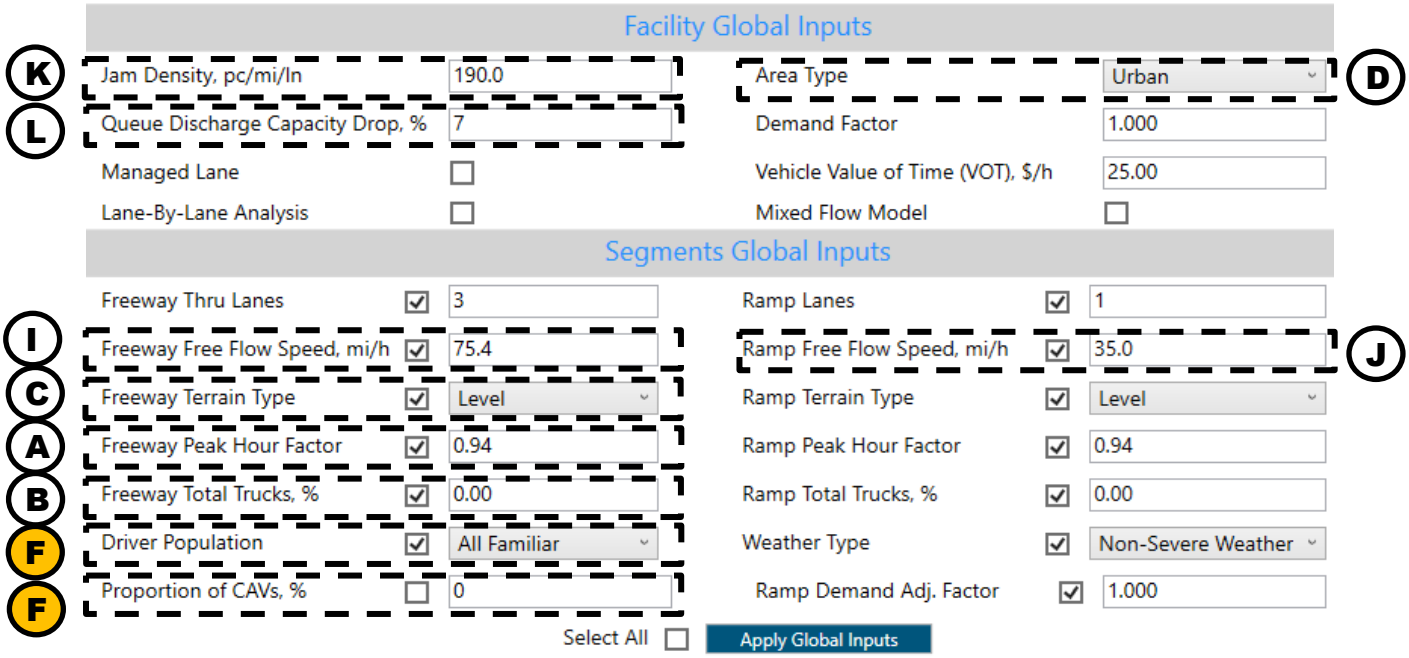
Weaving Segment Analysis

Figure 4. Weaving Segment Analysis Window in HCS2023



Facility Analysis

Figure 5. Facility Analysis Window in HCS2023



HCM-Calc software guidance

The guidance below highlights the location of HCM-Calc input fields and notes the corresponding Oregon-specific default values. This section is organized based on the analysis options available in HCM-Calc: Basic, Merge, Diverge, Weaving, Facility, and Multilane Highway analysis. Oregon default values are noted using letters (A) through (M) in the screen captures and correspond to the first column of Table 1. Inputs noted with a yellow circle (e.g. (M)) will require conversion to an adjustment factor, which can be performed using the adjustment factors spreadsheet provided. The user should refer to the Highway Capacity Manual for inputs not noted in Figures 6 - 16.

Basic Segment Analysis

Figure 6. Basic Segment Analysis Window in HCM-Calc

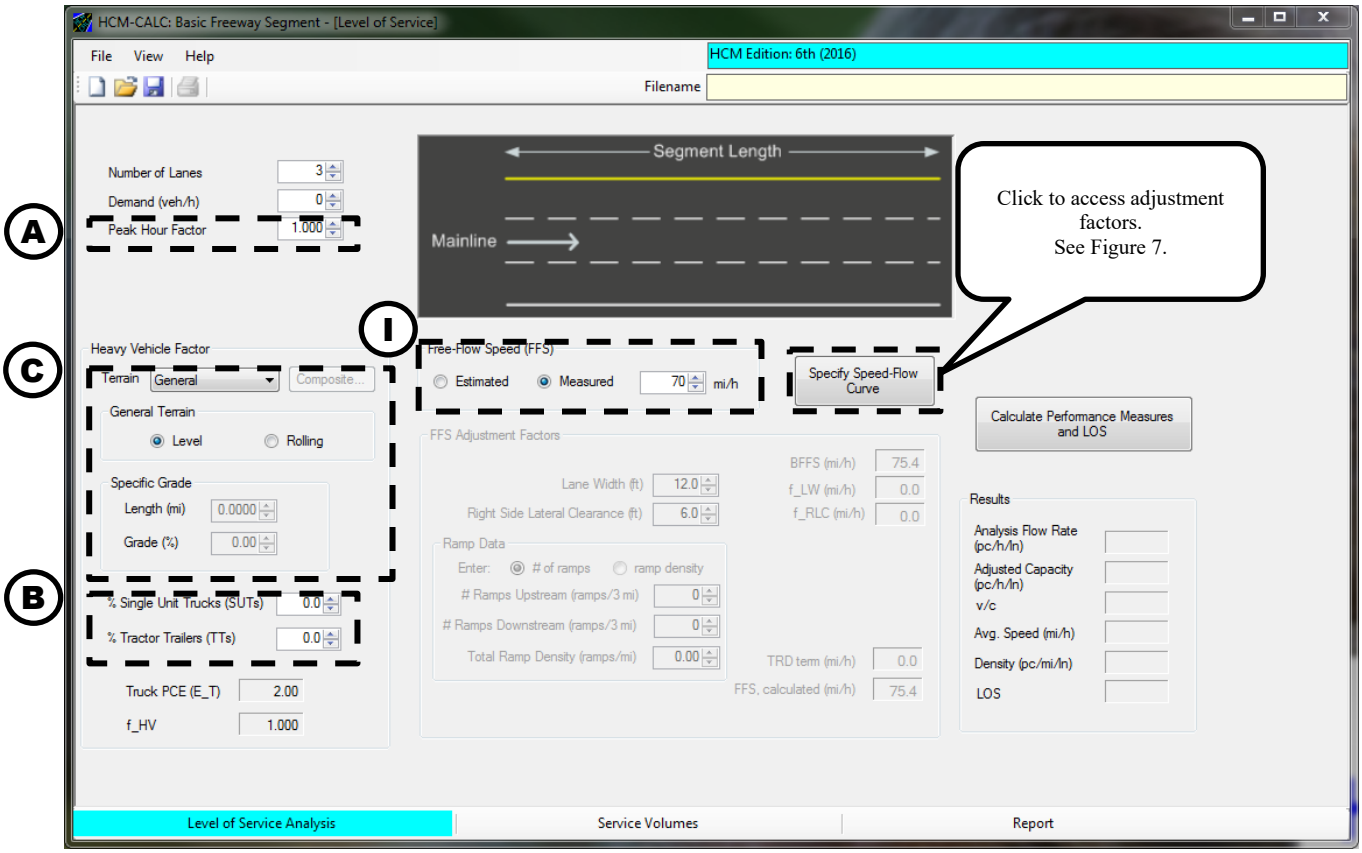
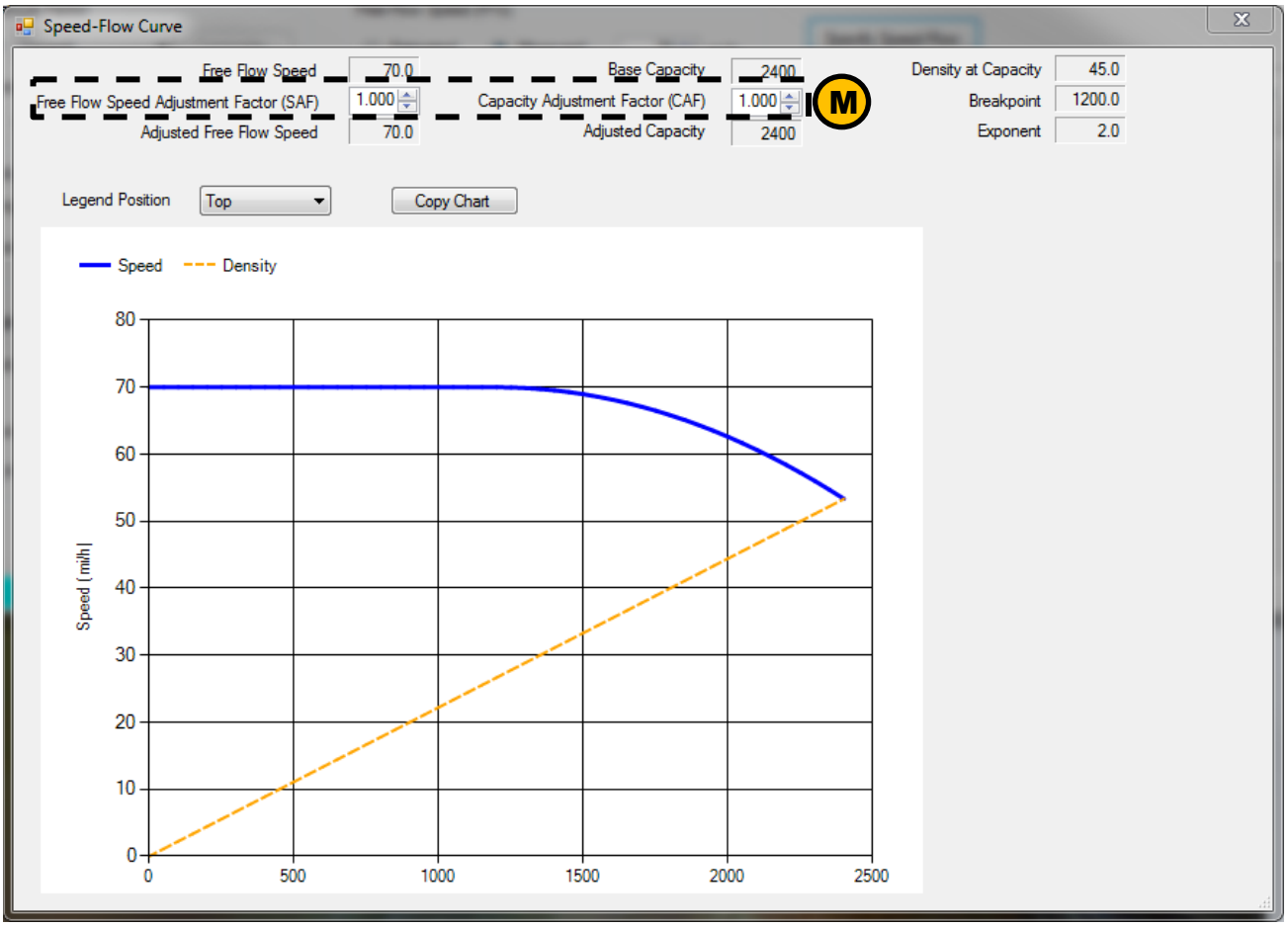
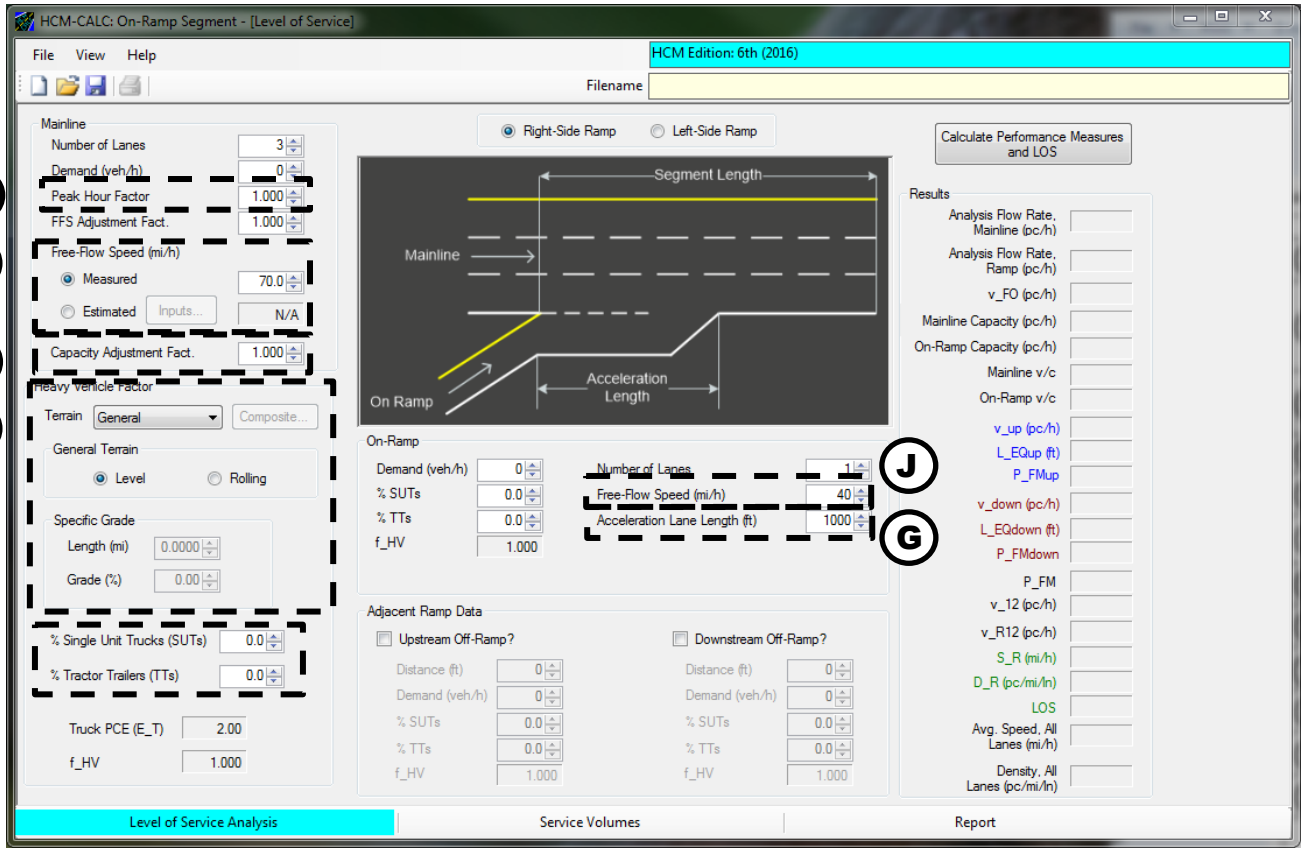


Figure 7. Speed-Flow Curve Accessible Through the Basic Segment and Multilane Highway Window in HCM-Calc



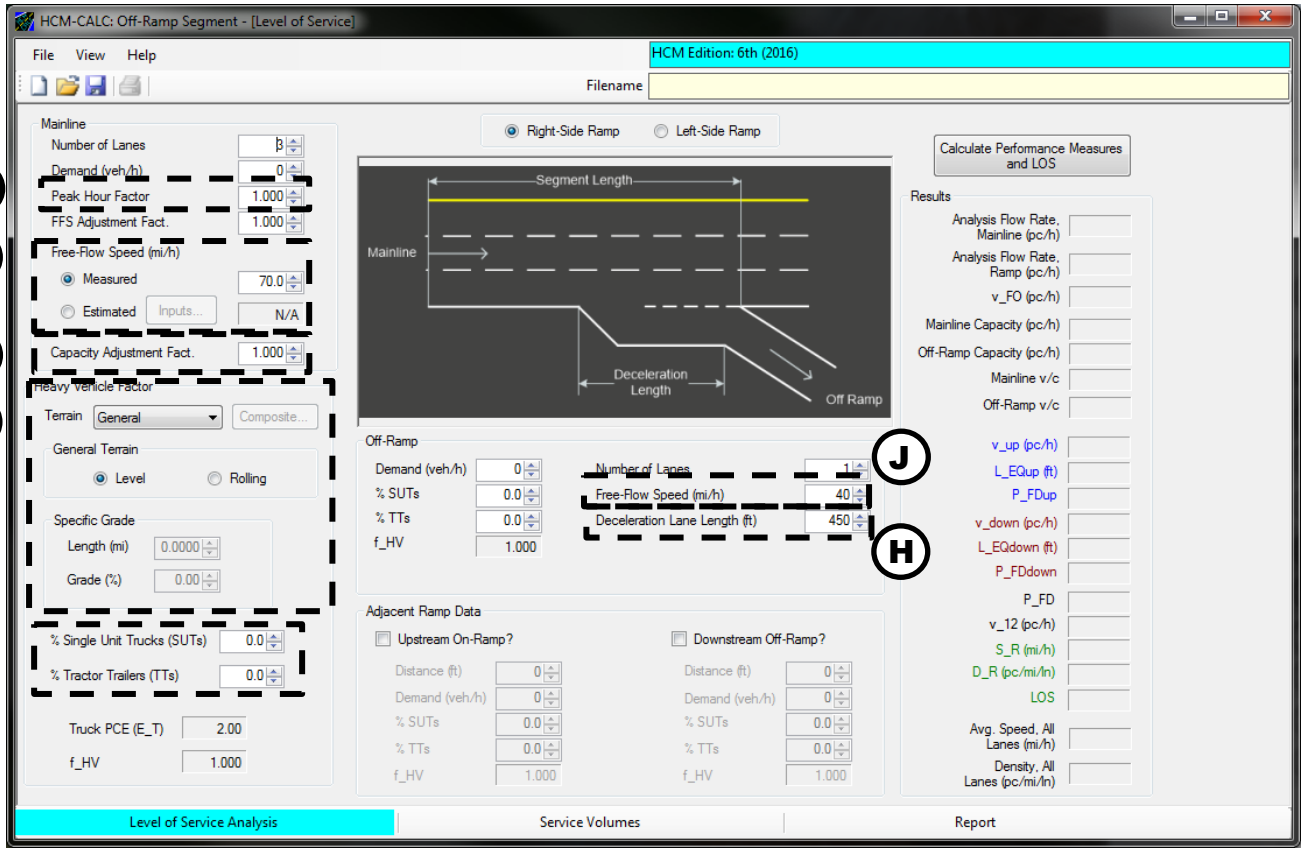
Merge Segment Analysis

Figure 8. Merge Segment Analysis Window in HCM-Calc



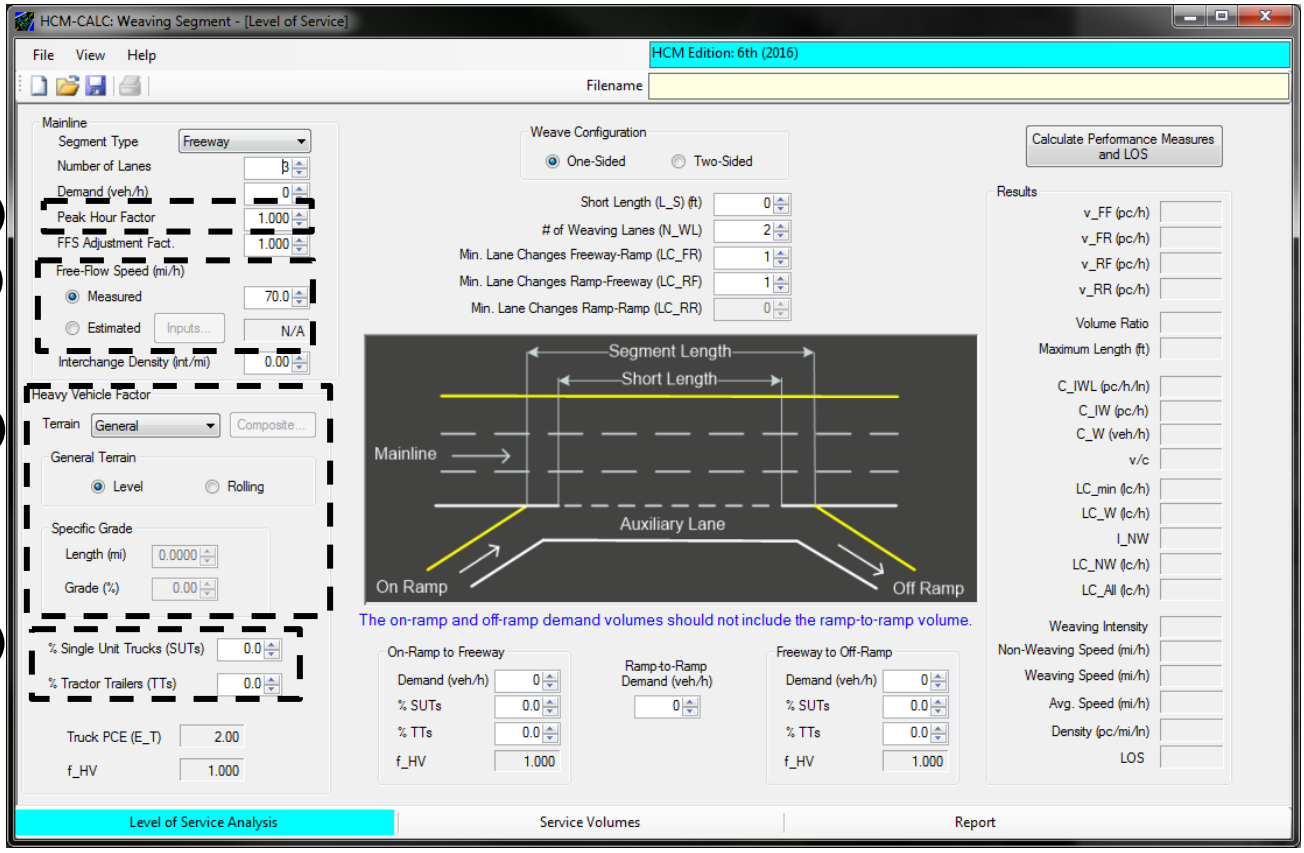
Diverge Segment Analysis

Figure 9. Diverge Segment Analysis Window in HCM-Calc



Weaving Segment Analysis

Figure 10. Weaving Segment Analysis Window in HCM-Calc



Facility Analysis

Input parameters for the facility analysis are included the facility analysis main window, and within the nested windows for each freeway segment defined in the facility. This guidance illustrates the location of the HCM-Calc input fields in the main window (Figure 11) and for the individual segment types (Figures 12 through 15).

Figure 11. Facility Analysis Main Window in HCM-Calc

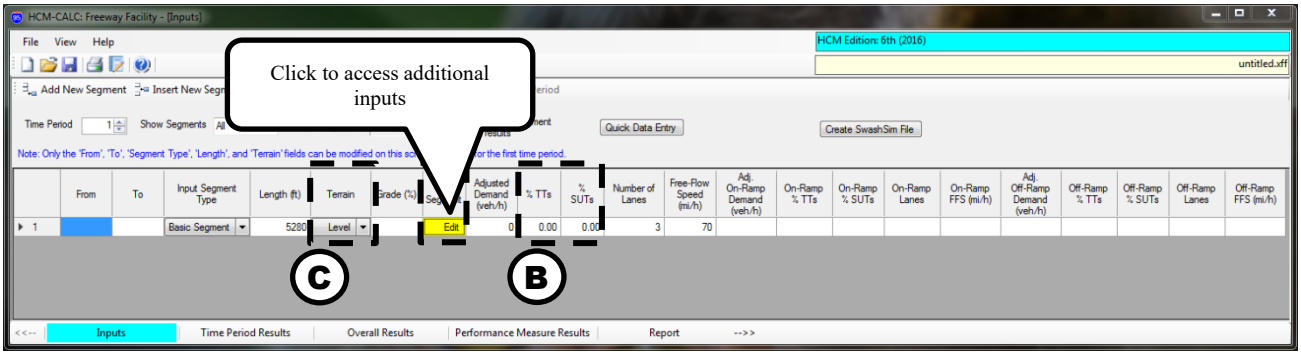


Figure 12. Basic Segment Window within the Facility Analysis in HCM-Calc

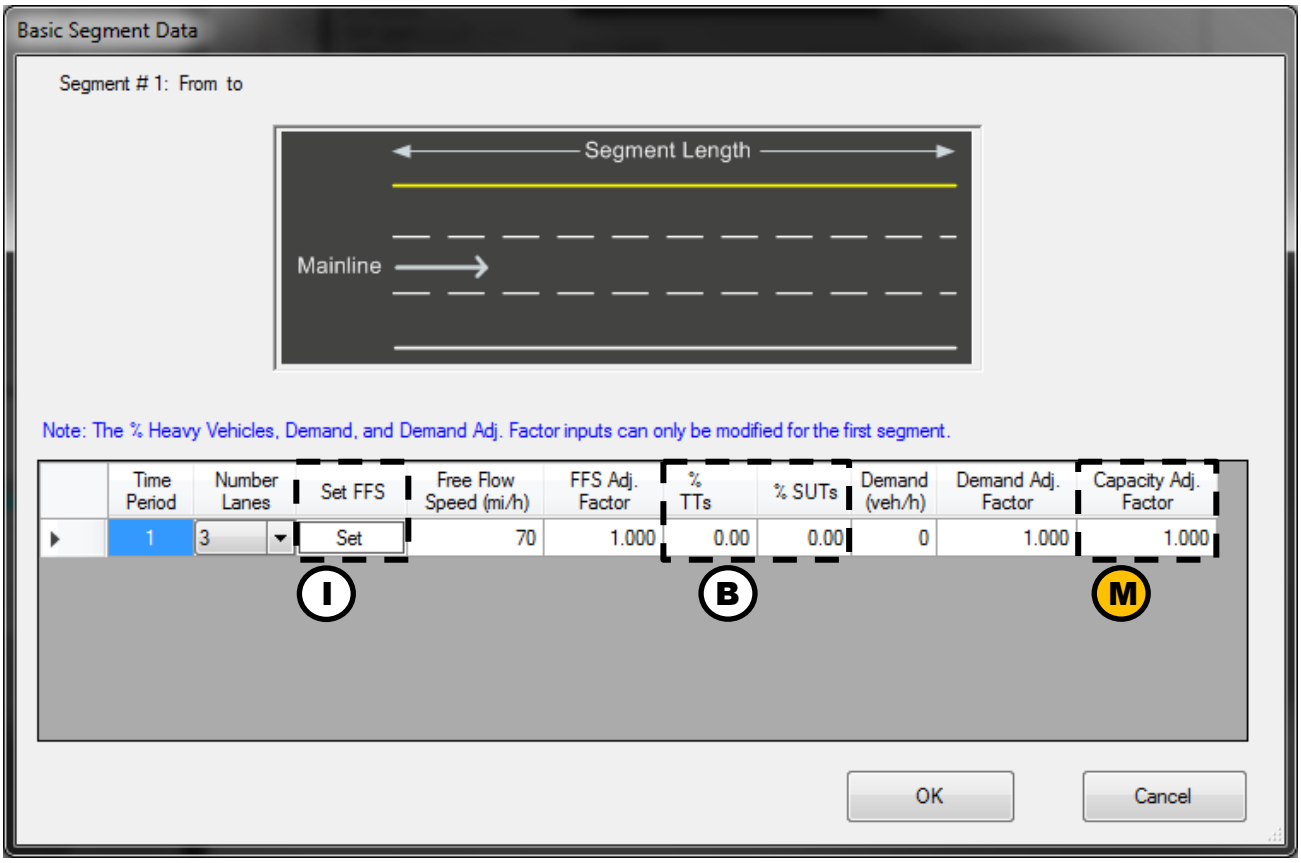


Figure 13. Merging Segment Window within the Facility Analysis in HCM-Calc

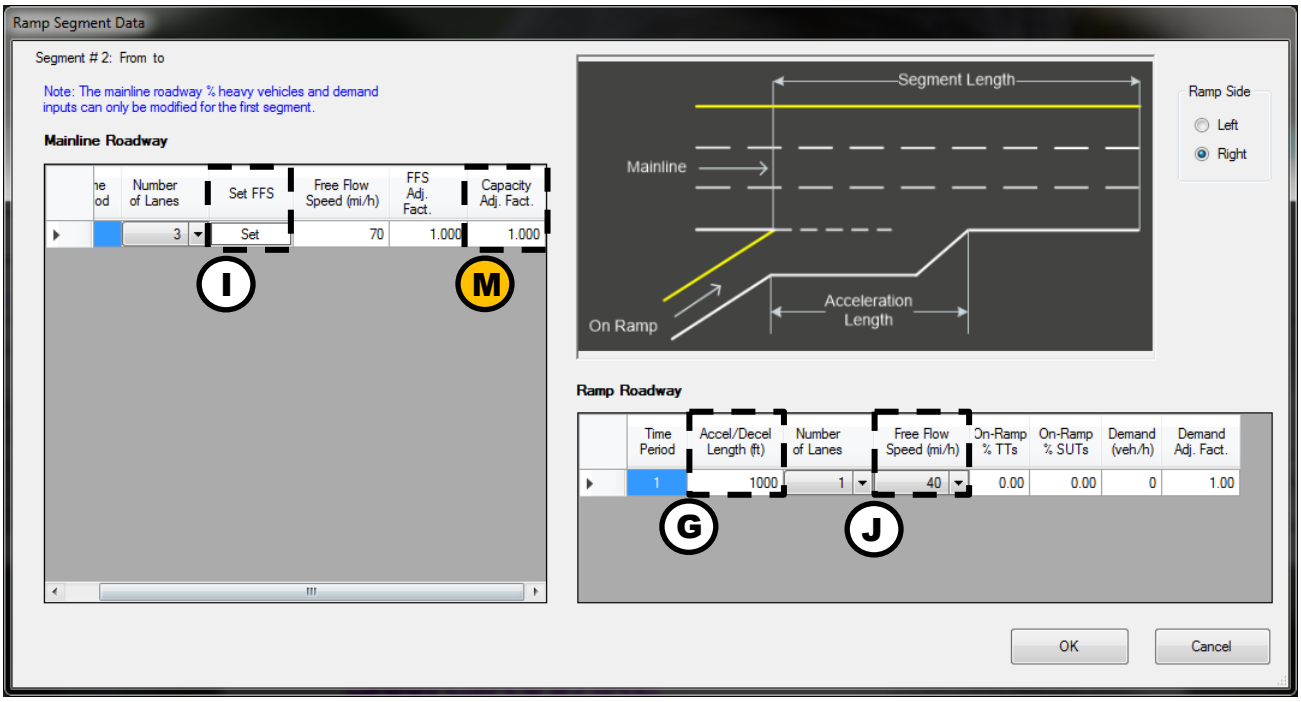


Figure 14. Diverging Segment Window within the Facility Analysis in HCM-Calc

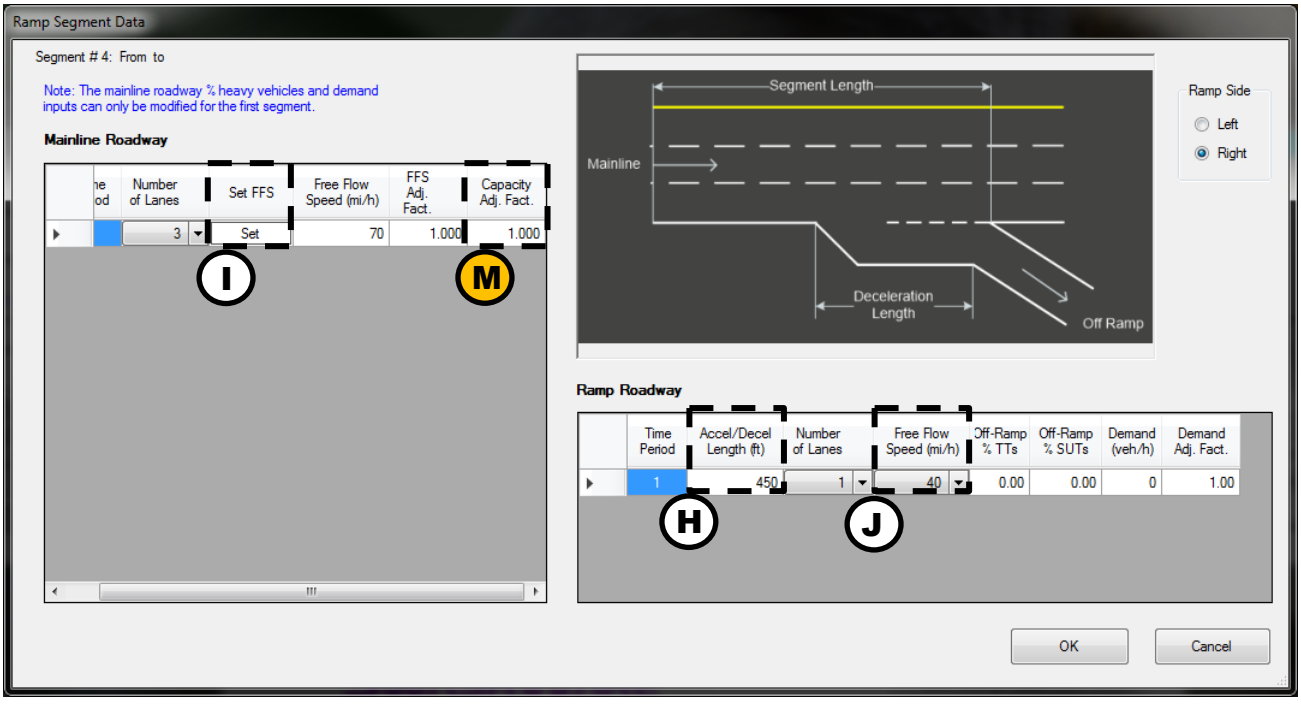
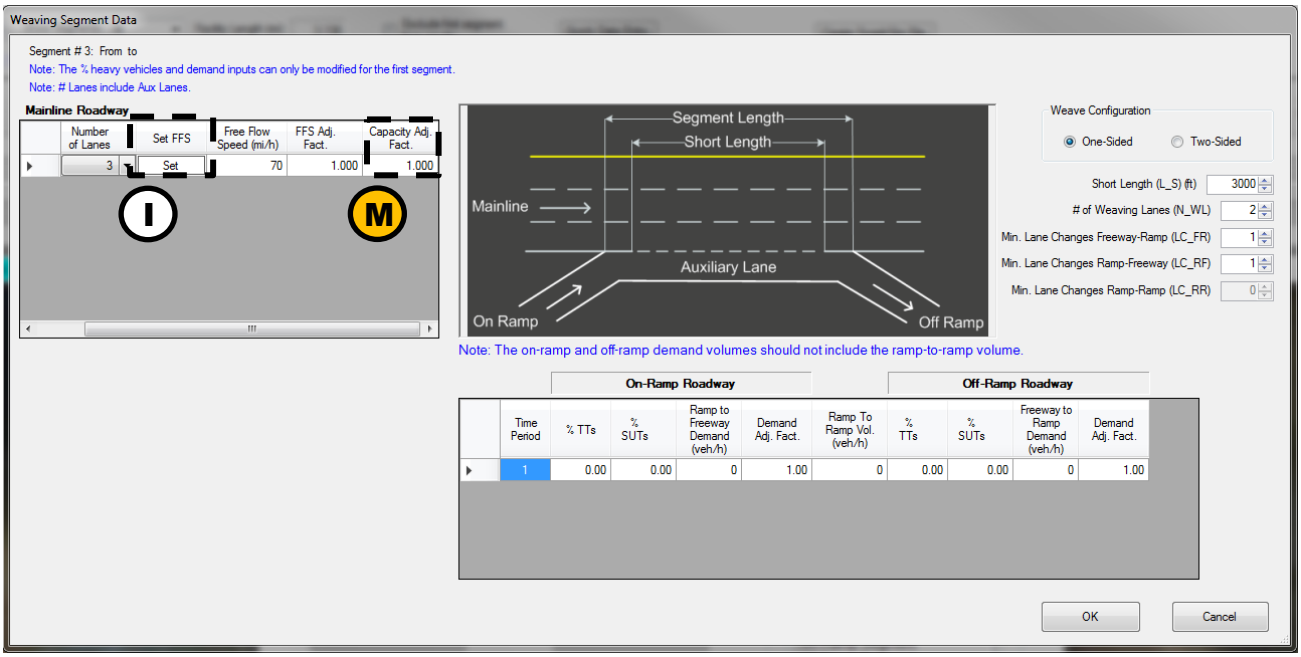
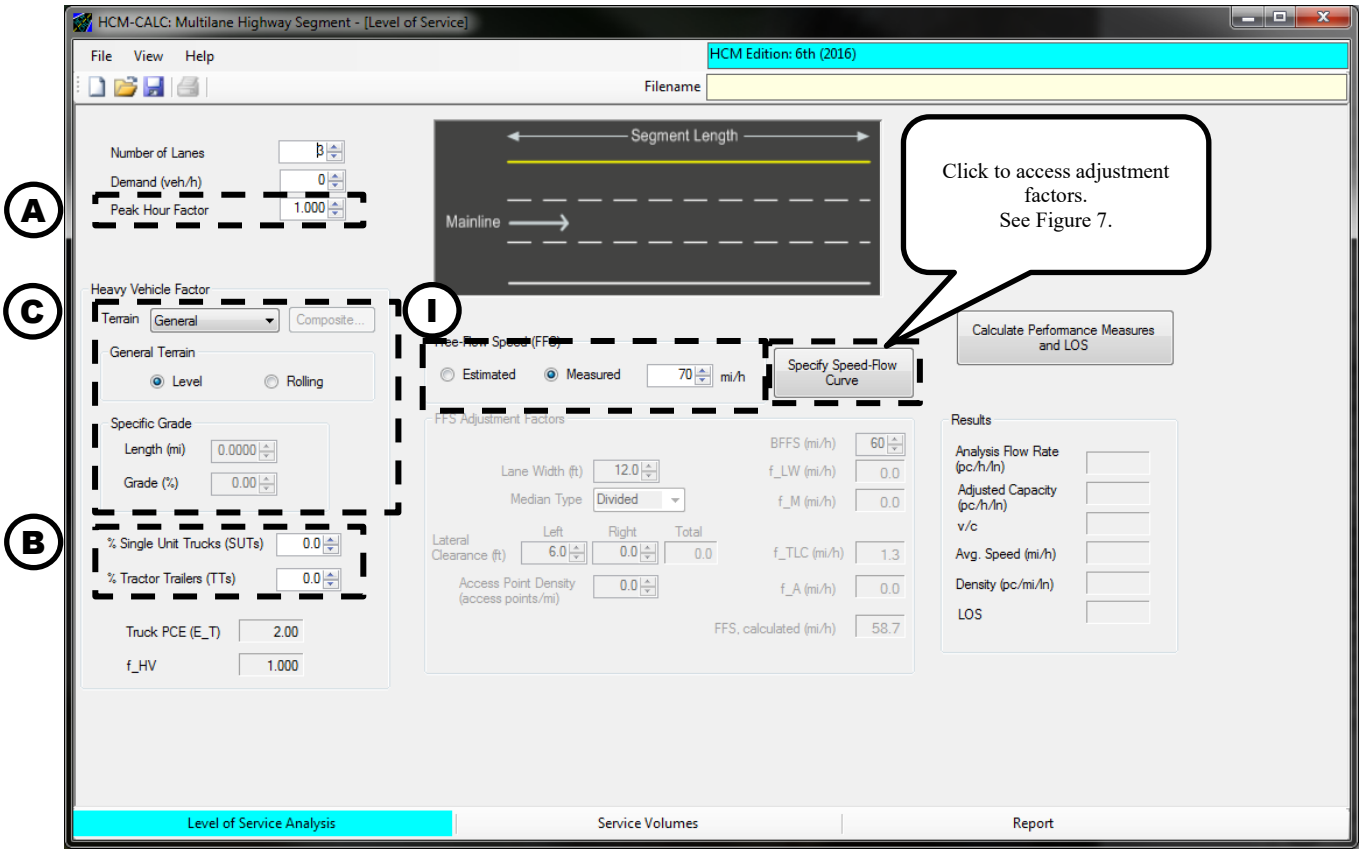


Figure 15. Weaving Segment Window within the Facility Analysis in HCM-Calc



Multilane Highway Segment Analysis

Figure 16. Multilane Highway Segment Window within the Facility Analysis in HCM-Calc



FREEVAL Software Guidance

The FREEVAL-OR software tool has been customized to incorporate all the Oregon-specific default values identified in the APM. A drop down menu (Figure 17) is available to apply the ODOT default values for a new facility, which are then translated into the global settings screen (Figure 18). The following guidance is based on FREEVAL+ OR version REL 20180627.

The guidance below highlights the location of FREEVAL input fields and notes the corresponding Oregon-specific default values. This section is organized based on freeway facilities analysis available in FREEVAL. While FREEVAL can support segment analysis, it is done in the context of a facility. Oregon default values are noted using letters (A) through (M) in the screen captures and correspond to the first column of Table 1. The user should refer to the Highway Capacity Manual for inputs not noted in Figures 17-20.

Since FREEVAL implements the freeway facilities analysis, the ODOT default for peak hour factor ((A)) is not used (all entries are in 15 minute intervals for the facility method).

Truck percentage ((B)) is divided into Single Unit Truck (SUT) and Tractor Trailer (TT) values. These can be specifically entered, but are also automatically populated based on the Area Type ((D)) from Table 1. The Driver Population speed and capacity adjustment factors ((F)) are also automatically updated based on the Area Type selection.

A tool for computing proportional ramp to ramp demands for weaving segments (Figure 19) can be accessed using the *Analyze->Demand Editor/Visualizer* option in the top menu bar.

The default bottleneck capacities for Oregon can be viewed and applied using the capacity tool (Figure 20) accessed using the *Analyze->Apply/Edit Default Parameters* option in the top menu bar.

Figure 17. Initial Prompt to Pre-select ODOT Defaults Over the HCM Defaults in FREEVAL

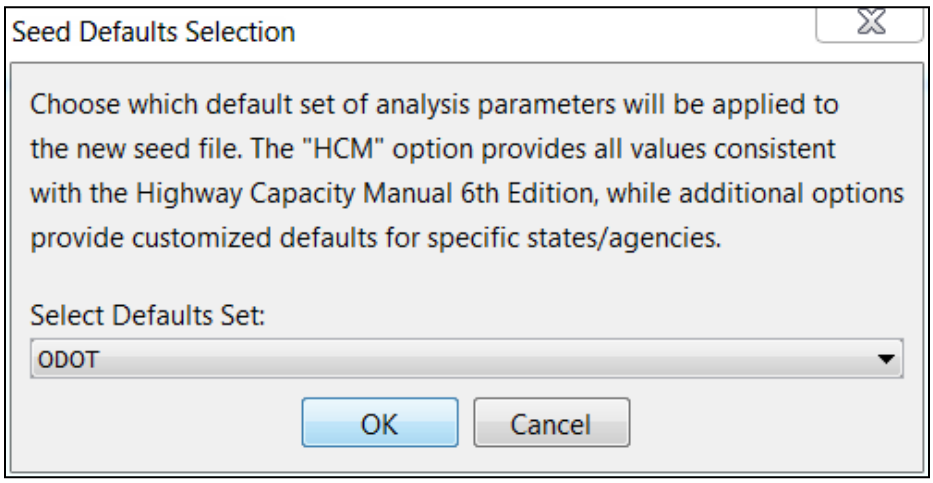


Figure 18. Project Seed Global Defaults in FREEVAL

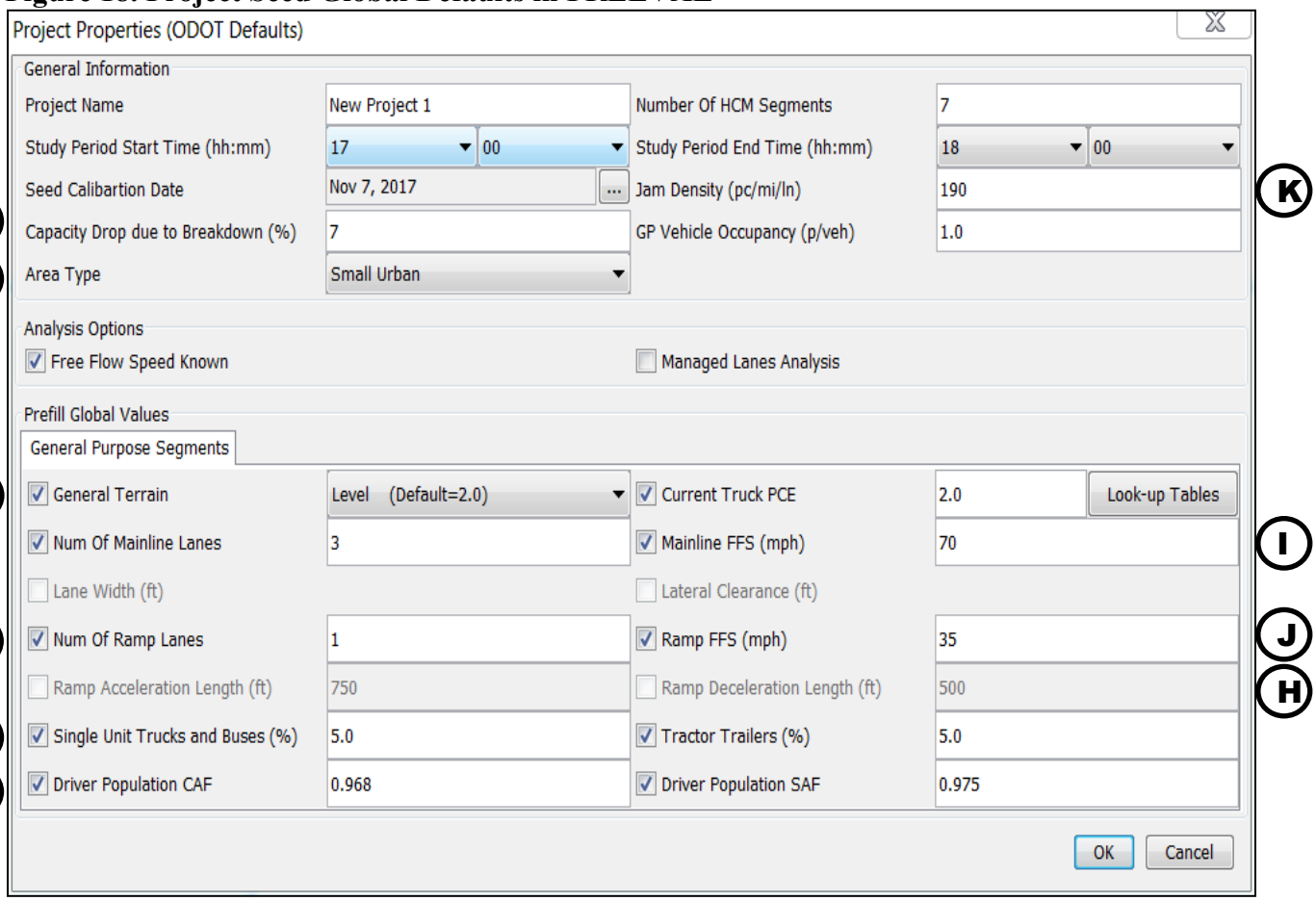


Figure 19. FREEVAL Weave Ramp to Ramp Demand Tool

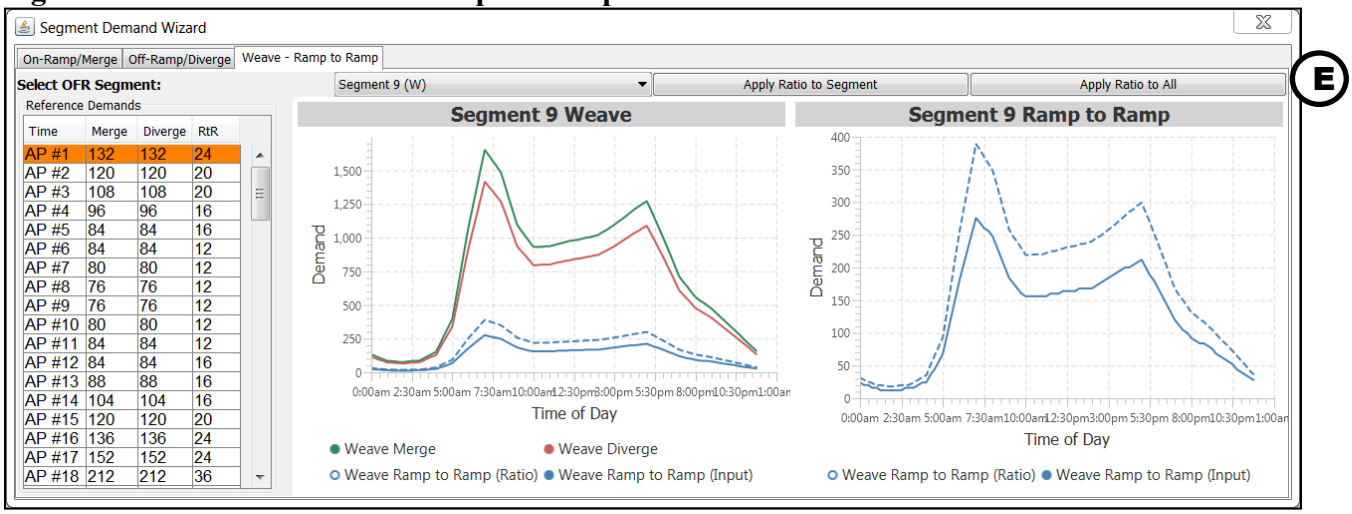
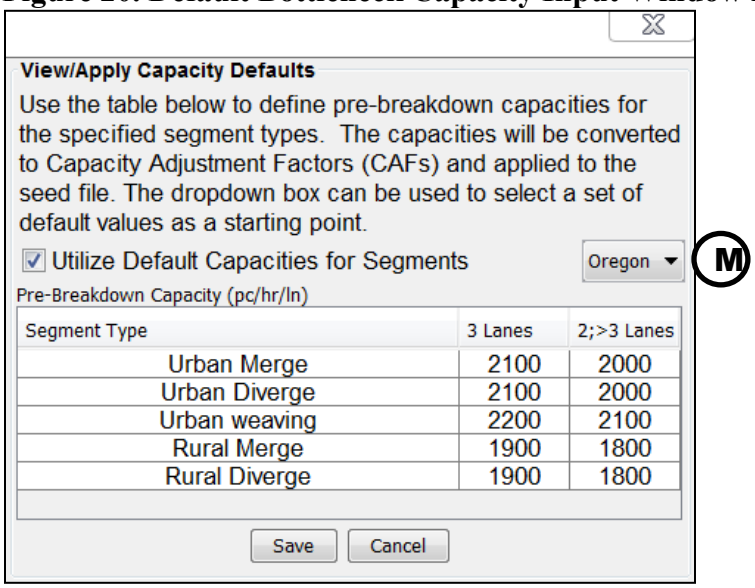


Figure 20. Default Bottleneck Capacity Input Window in FREEVAL

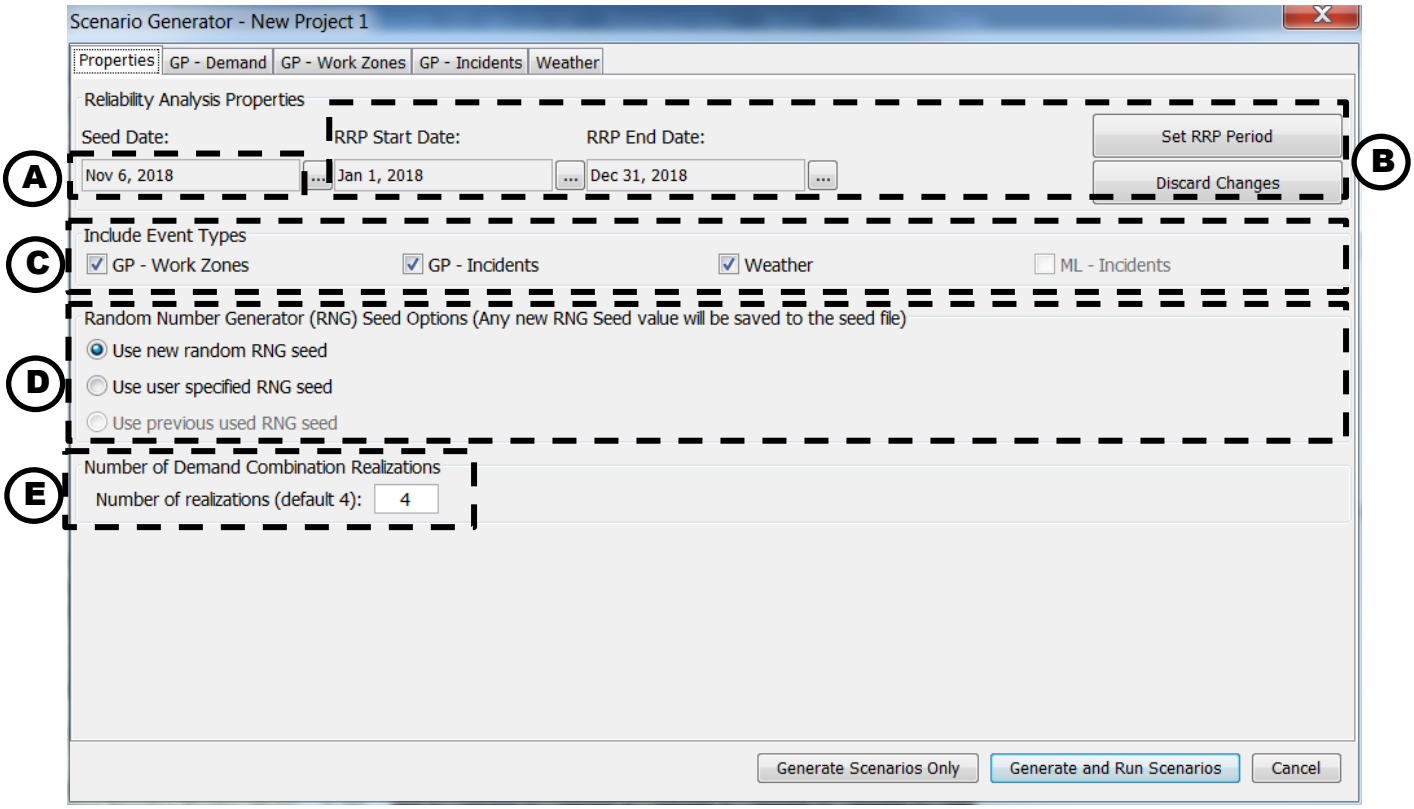


ODOT Default Values for Reliability

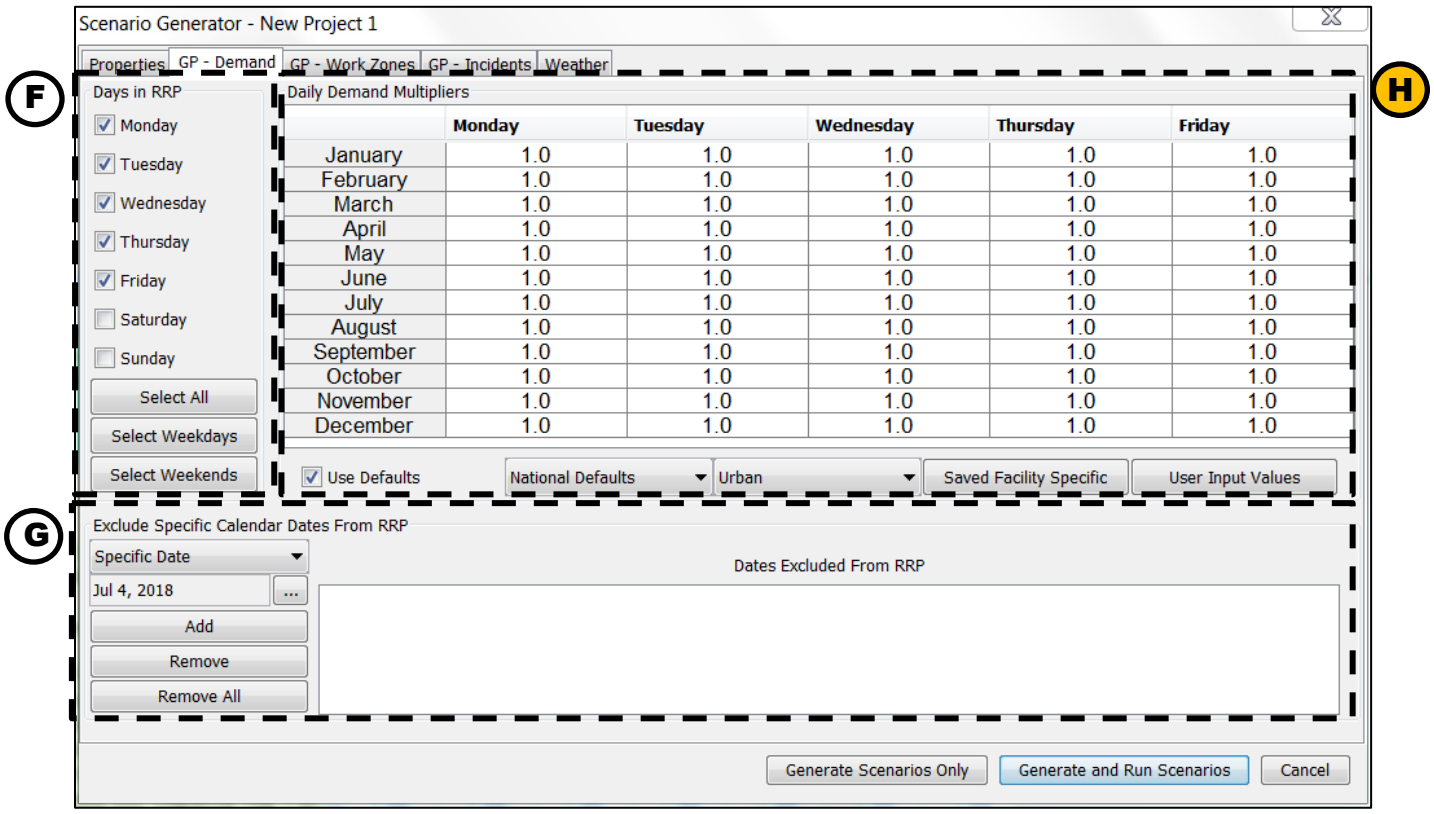
The following sections highlight updates to FREEVAL-OR for the inclusion of Oregon-specific default values for the Highway Capacity Manual's (HCM) reliability analysis approach for the freeway facilities methodology.

Required Data and Units		Source	Suggested Default Value
A	Seed Date	N/A	Date the seed analysis represents (Seasonal average day if not calibrated to specific date)
B	Reliability Reporting Period (RRP) Dates	N/A	Jan. 1st 20XX – Dec. 31st 20XX
C	Event Types	N/A	General Purpose Incidents, Weather, and Work Zones (as applicable)
D	Random Number Generator Seed	N/A	
E	Realizations per Demand-Combination	HCM 6th	4 – Approximates number of weekdays per month
F	Days of Week Included	HCM 6th	Monday – Friday (All Weekdays)
G	Days to Exclude	N/A	None
H	Daily Demand Multipliers	ODOT	Regional-specific value (see ODOT APM Chapter 11 Appendix C)
I	Dates Active	N/A	Analysis-specific values
J	Segments Active	N/A	Analysis-specific values
K	Daily Time Active	N/A	Analysis-specific values
L	Work Zone Configuration	N/A	Analysis-specific values
M	Incident Frequencies	N/A	Analysis-specific values
N	Incident Severity Distribution	N/A	Analysis-specific values
O	Incident Severity Durations	HCM 6th	Location-specific values (see ODOT APM Chapter 11 Appendix C)
P	Incident Adjustment Factors	HCM 6th	Highway Capacity Manual defaults
Q	Monthly Weather Severity Distribution	HCM/ NOAA Data	Location-specific values (see ODOT APM Chapter 11 Appendix C)
R	Weather Severity Durations	HCM/ NOAA Data	Location-specific values (see ODOT APM Chapter 11 Appendix C)
S	Weather Severity Adjustments	HCM 6th	Highway Capacity Manual defaults

General Project Properties



Demand



ODOT Default Demand Multipliers

The HCM provides two defaults sets of daily and season demand multipliers for urban and rural freeways. To supplement these, 11 new distinct sets of demand multipliers have been developed to represent the national and state highway system of Oregon. The new demand multiplier types are designated by thematic trend and guidance on which type applies to which section of roadway can be found in Chapter 11 Appendix C. The Oregon specific types are as follows:

- Agricultural.
- Coastal Destination.
- Coastal Destination Route.
- Commuter.
- Interstate—Nonurbanized.
- Interstate—Urbanized.
- Recreational—Summer.
- Recreational—Summer and Winter.
- Recreational—Winter.
- Summer.
- Summer < 2,500 AADT.

These have been incorporated directly into FREEVAL's reliability scenario generation functionality. A new option to choose between the national and Oregon-specific defaults is presented to the user as seen in Figure 21.

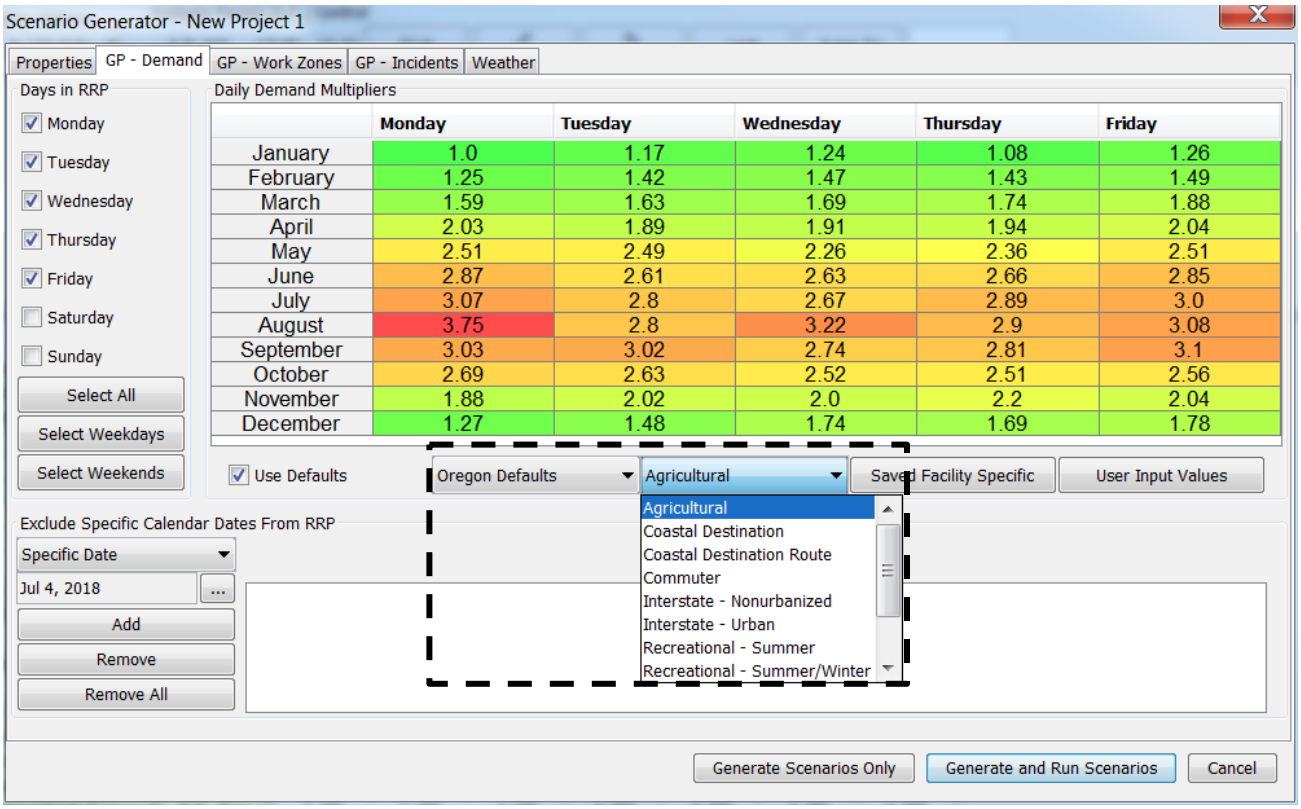
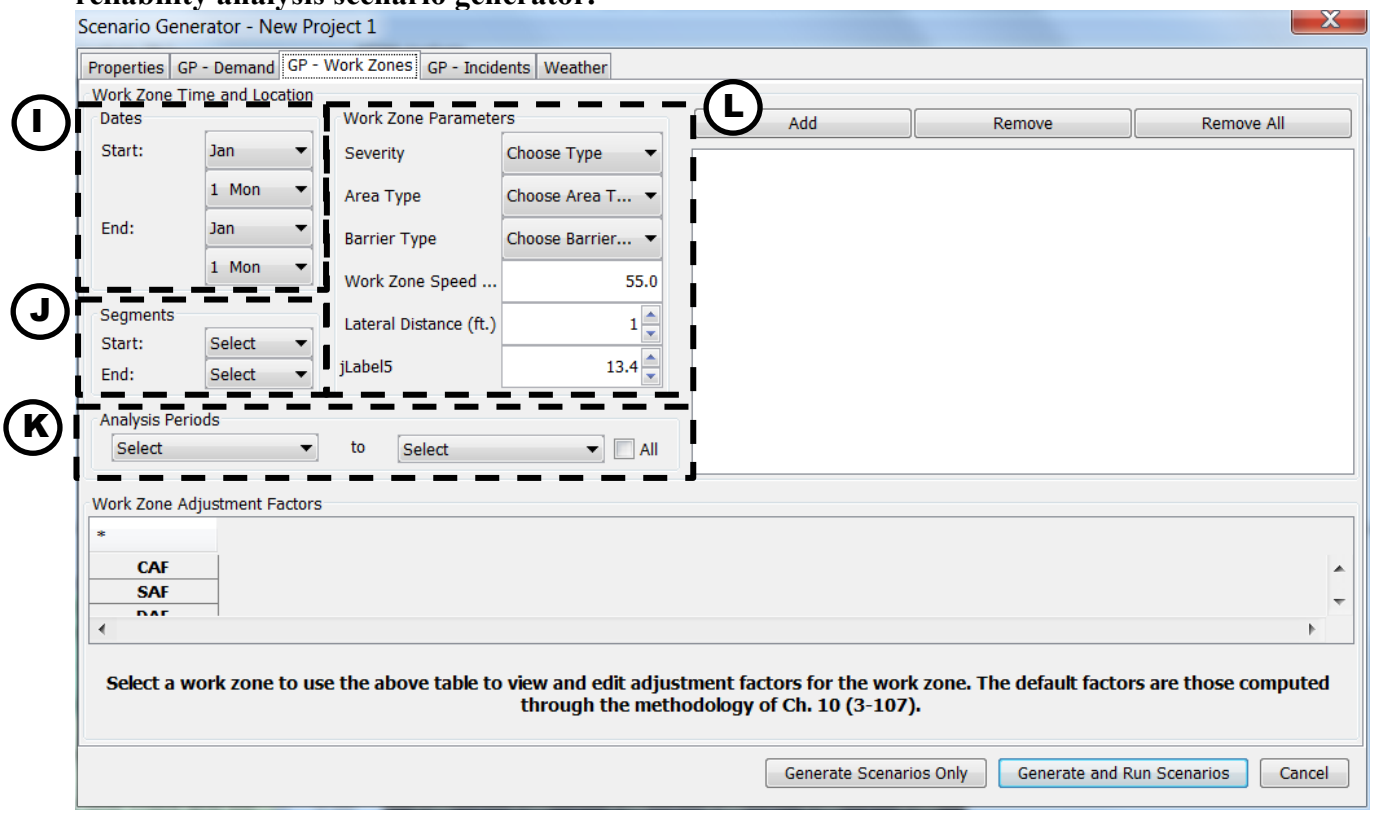
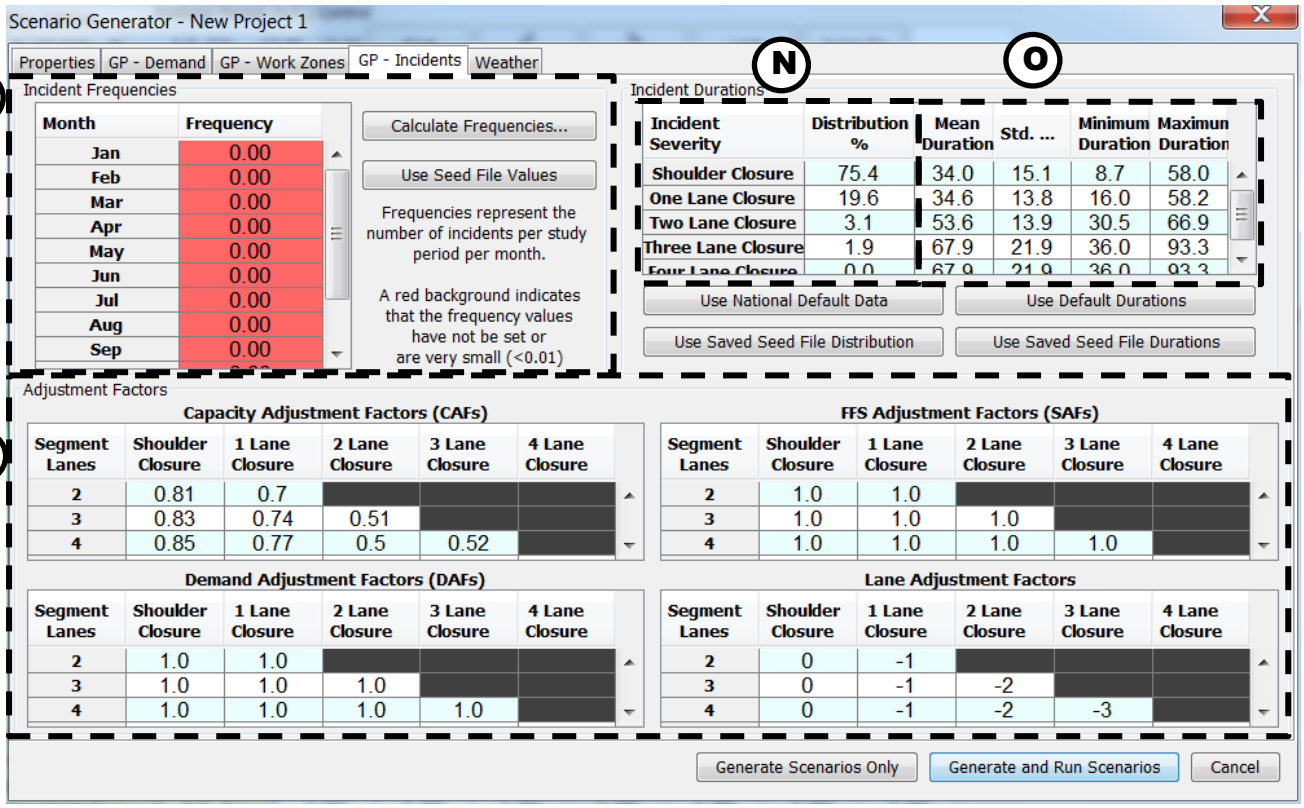


Figure 21 Screenshot of FREEVAL's demand options configuration window for the reliability analysis scenario generator.

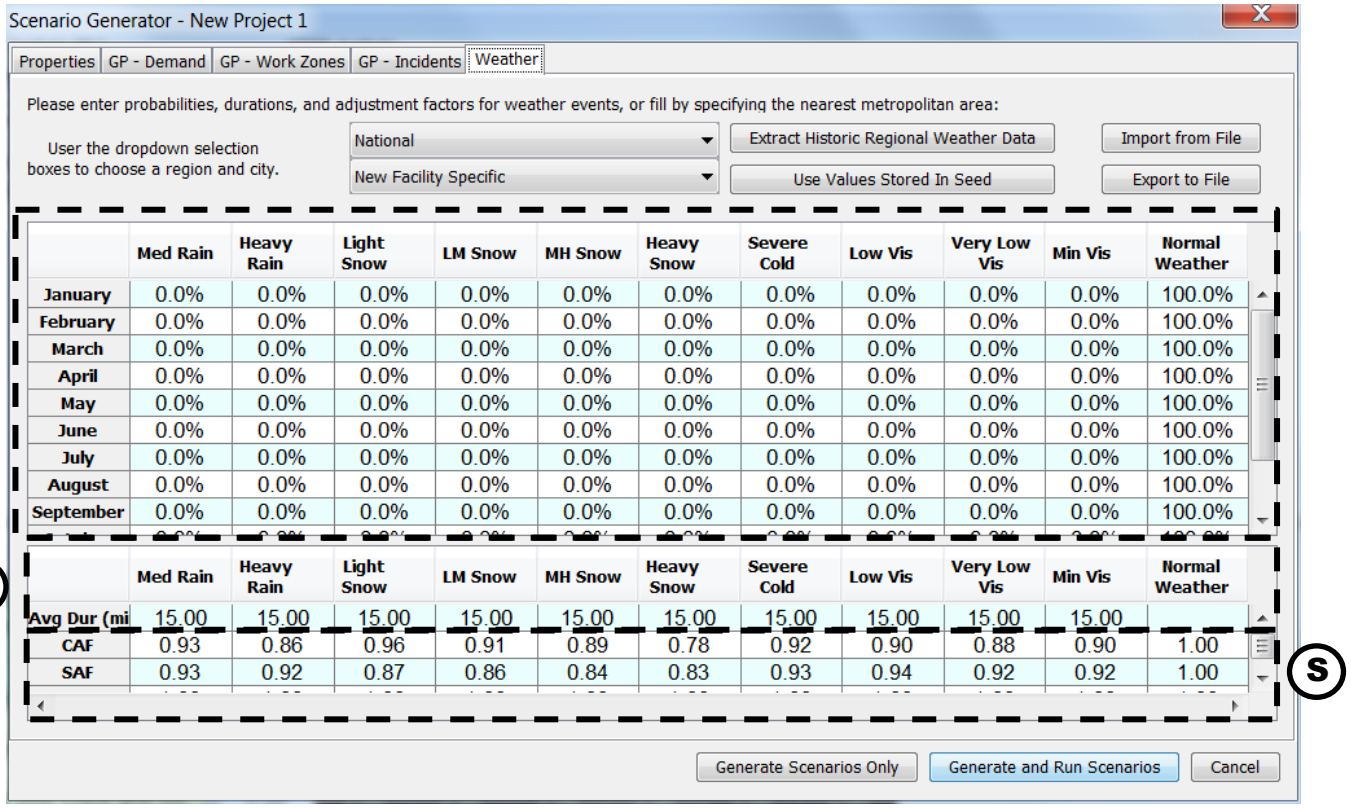


Incidents

There are no available Oregon-specific defaults for the incident rates, durations, and operational adjustments of the reliability analysis method. These values are highly dependent on geometric aspects of a given facility, and as such should be developed on an individual basis. There are three methods to compute incident rates within FREEVAL, and guidance on which approach to use is available in Chapter 11. Further, while a default severity type distribution is provided, it is highly recommended that these values be set for each specific analysis. One example to demonstrate the importance of this, is that the default distribution includes a percentage for three-lane closure incidents, which are only possible on four-lane freeway segments (the HCM method requires that at least one lane is always open). If no segment of a facility has at least 4-lanes, then this percentage of incidents cannot be assigned. In order for the full number of incidents to be assigned, it is critical that a user update this distribution to appropriately reflect a realistic incident severity distribution.


Scenario Generator - New Project 1
Properties
GP - Demand
GP - Work Zones
GP - Incidents
Weather
M
N
O
Incident Frequencies
Month
Frequency
Jan 0.00
Feb 0.00
Mar 0.00
Apr 0.00
May 0.00
Jun 0.00
Jul 0.00
Aug 0.00
Sep 0.00
Calculate Frequencies...
Use Seed File Values
Frequencies represent the number of incidents per study period per month.
A red background indicates that the frequency values have not be set or are very small (<0.01)
Incident Durations
Incident Severity
Distribution %
Mean Duration
Std. ...
Minimum Duration
Maximun Duration
Shoulder Closure 75.4 34.0 15.1 8.7 58.0
One Lane Closure 19.6 34.6 13.8 16.0 58.2
Two Lane Closure 3.1 53.6 13.9 30.5 66.9
Three Lane Closure 1.9 67.9 21.9 36.0 93.3
Use National Default Data
Use Default Durations
Use Saved Seed File Distribution
Use Saved Seed File Durations
Adjustment Factors
P
Capacity Adjustment Factors (CAFs)
Segment Lanes
Shoulder Closure
1 Lane Closure
2 Lane Closure
3 Lane Closure
4 Lane Closure
2 0.81 0.7
3 0.83 0.74 0.51
4 0.85 0.77 0.5 0.52
FFS Adjustment Factors (SAFs)
2 1.0 1.0
3 1.0 1.0 1.0
4 1.0 1.0 1.0 1.0
Demand Adjustment Factors (DAFs)
2 1.0 1.0
3 1.0 1.0 1.0
4 1.0 1.0 1.0 1.0
Lane Adjustment Factors
2 0 -1
3 0 -1 -2
4 0 -1 -2 -3
Generate Scenarios Only
Generate and Run Scenarios
Cancel

Weather


Scenario Generator - New Project 1
Properties
GP - Demand
GP - Work Zones
GP - Incidents
Weather
Please enter probabilities, durations, and adjustment factors for weather events, or fill by specifying the nearest metropolitan area:
User the dropdown selection boxes to choose a region and city.
National
New Facility Specific
Extract Historic Regional Weather Data
Use Values Stored In Seed
Import from File
Export to File
Q
Med Rain
Heavy Rain
Light Snow
LM Snow
MH Snow
Heavy Snow
Severe Cold
Low Vis
Very Low Vis
Min Vis
Normal Weather
January 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 100.0%
February 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 100.0%
March 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 100.0%
April 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 100.0%
May 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 100.0%
June 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 100.0%
July 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 100.0%
August 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 100.0%
September 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 0.0% 100.0%
R
Avg Dur (mi 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00 15.00
CAF 0.93 0.86 0.96 0.91 0.89 0.78 0.92 0.90 0.88 0.90 1.00
SAF 0.93 0.92 0.87 0.86 0.84 0.83 0.93 0.94 0.92 0.92 1.00
S
Generate Scenarios Only
Generate and Run Scenarios
Cancel

ODOT Specific Weather Data

In addition to the 98 default weather locations provided by the HCM, new Oregon-specific weather defaults were developed for 12 additional locations. As with the demand multipliers, these have been incorporated directly into FREEVAL's reliability scenario generation interface. A user can toggle between the national and Oregon-specific options, which then allows for additional selection of the specific location as a secondary option. Figure 22 shows the location of these new options within the software.

Figure 22 Example selection of the Oregon specific default weather station locations.