

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 HCS, 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 HCS, 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 7 th Edition	Rural:	0.88	
			Urban:	0.94	
(B)	Truck Percentage (%)	HCM 7 th 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 7 th Edition, and ODOT HDM	35 mph for loops ramps, 45 mph for diamond ramps		
(K)	Jam Density (pc/mi/ln)	HCM 7 th Edition	190 pc/mi/ln		
(L)	Queue Discharge Capacity Drop (%)	HCM 7 th 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(or later HCS20XX versions) 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

Geometric Data

Number of Lanes	3	Terrain Type	Level (C)
Measured FFS	<input type="checkbox"/>	Percent Grade, %	-
(I) Base Free Flow Speed, mi/h	75.4	Grade Length, mi	-
Length, ft	-	Right Side Clearance, ft	10
Lane Width, ft	12	Total Ramp Density, ramps/mi	0.00
Managed Lane	<input type="checkbox"/>		

Demand Data

Demand, veh/h	0	Peak Hour Factor	0.94 (A)
(B) Total Trucks, %	0.00	Single-Unit Trucks (SUT), %	-
Tractor-Trailers (TT), %	-	Mixed Flow Model	<input type="checkbox"/>
(F) Proportion of CAVs	0		

Adjustment Factors

(F) Driver Population	All Familiar	Speed Adjustment Factor	1.000 (M)
Weather Type	Non-Severe Weather	Capacity Adjustment Factor	1.000
Incident Type	No Incident	Demand Adjustment Factor	1.000
Work Zone	<input type="checkbox"/>		

Merge Segment Analysis

Figure 2. Merge Segment Analysis Window in HCS2023

Geometric Data			
<div> <div>I</div> <div>C</div> </div>	Number of Lanes	3	<div> <div>J</div> <div>G</div> </div>
	Base Free Flow Speed, mi/h	75.4	
	Freeway Length, ft	1500	
	Freeway Terrain Type	Level	
	Freeway Grade, %	-	
	Freeway Grade Length, mi	-	
	Measured FFS	<input type="checkbox"/>	
	Right Side Clearance, ft	10	
	Lane Width, ft	12	
	Total Ramp Density, ramps/mi	0.00	
Managed Lane	<input type="checkbox"/>		
Demand Data			
<div> <div>A</div> <div>B</div> <div>F</div> <div>F</div> <div>M</div> </div>	Freeway Demand, veh/h	0	
	Freeway Peak Hour Factor	0.94	
	Freeway Total Trucks, %	0.00	
	Freeway Single-Unit Trucks (SUT), %	-	
	Freeway Tractor-Trailers (TT), %	-	
	Proportion of CAVs	0	
	Freeway Driver Population	All Familiar	
	Freeway Weather Type	Non-Severe Weather	
	Freeway Speed Adjustment Factor	1.000	
	Freeway Capacity Adjustment Factor	1.000	
Freeway Demand Adjustment Factor	1.000		
Incident Type	No Incident		
Adjustment Factors			
	Ramp Lanes	1	
	Ramp Free Flow Speed, mi/h	35.0	
	Ramp Side	Right	
	Ramp Terrain Type	Level	
	Ramp Grade, %	-	
	Ramp Grade Length, mi	-	
	Highway or C-D Roadway	<input type="checkbox"/>	
	Length of First Accel. Lane (LA), ft	800	
	Length of Second Accel. Lane (LA2), ft	-	
Adjacent Ramps			
	Upstream Ramp	No Ramp	
	Distance to Upstream Ramp, ft	-	
	Upstream Ramp Terrain	Level	
	Upstream Ramp Demand, veh/h	-	
	Upstream Ramp PHF	-	
	Upstream Ramp Trucks, %	-	
	Downstream Ramp	No Ramp	
	Distance to Downstream Ramp, ft	-	
	Downstream Ramp Terrain	Level	
	Downstream Ramp Demand, veh/h	-	
	Downstream Ramp PHF	-	
	Downstream Ramp Trucks, %	-	

Diverge Segment Analysis

Figure 3. Diverge Segment Analysis Window in HCS2023

Geometric Data			
I	Number of Lanes	3	J
	Base Free Flow Speed, mi/h	75.4	
C	Freeway Length, ft	1500	H
	Freeway Terrain Type	Level	
	Freeway Grade, %	-	
	Freeway Grade Length, mi	-	
	Measured FFS	<input type="checkbox"/>	
	Right Side Clearance, ft	10	
	Lane Width, ft	12	
	Total Ramp Density, ramps/mi	0.00	
	Managed Lane	<input type="checkbox"/>	
	Ramp Lanes	1	
	Ramp Free Flow Speed, mi/h	35.0	
	Ramp Side	Right	
	Ramp Terrain Type	Level	
	Ramp Grade, %	-	
	Ramp Grade Length, mi	-	
	Highway or C-D Roadway	<input type="checkbox"/>	
	Length of First Decel. Lane (LD), ft	400	
	Length of Second Decel. Lane (LD2), ft	-	
Demand Data			
A	Freeway Demand, veh/h	0	
B	Freeway Peak Hour Factor	0.94	
	Freeway Total Trucks, %	0.00	
	Freeway Single-Unit Trucks (SUT), %	-	
	Freeway Tractor-Trailers (TT), %	-	
F	Proportion of CAVs	0	
	Diverge Demand, veh/h	0	
	Ramp Peak Hour Factor	0.94	
	Ramp Total Trucks, %	0.00	
	Ramp Single-Unit Trucks (SUT), %	-	
	Ramp Tractor-Trailers (TT), %	-	
Adjustment Factors			
F	Freeway Driver Population	All Familiar	
	Freeway Weather Type	Non-Severe Weather	
	Freeway Speed Adjustment Factor	1.000	
M	Freeway Capacity Adjustment Factor	1.000	
	Freeway Demand Adjustment Factor	1.000	
	Incident Type	No Incident	
	Ramp Driver Population	All Familiar	
	Ramp Weather Type	Non-Severe Weather	
	Ramp Speed Adjustment Factor	1.000	
	Ramp Capacity Adjustment Factor	1.000	
	Ramp Demand Adjustment Factor	1.000	
Adjacent Ramps			
	Upstream Ramp	No Ramp	
	Distance to Upstream Ramp, ft	-	
	Upstream Ramp Terrain	Level	
	Upstream Ramp Demand, veh/h	-	
	Upstream Ramp PHF	-	
	Upstream Ramp Trucks, %	-	
	Downstream Ramp	No Ramp	
	Distance to Downstream Ramp, ft	-	
	Downstream Ramp Terrain	Level	
	Downstream Ramp Demand, veh/h	-	
	Downstream Ramp PHF	-	
	Downstream Ramp Trucks, %	-	

Weaving Segment Analysis

Figure 4. Weaving Segment Analysis Window in HCS2023

Freeway Geometric Data			
Number of Lanes	3	Terrain Type	Level
Measured FFS	<input type="checkbox"/>	Percent Grade, %	-
Base Free Flow Speed, mi/h	75.4	Grade Length, mi	-
Weaving Configuration	One-Sided	Minimum FR Lane Changes	1
Number of Weaving Lanes (NWL)	2	Minimum RF Lane Changes	1
Short Length (LS), ft	500	Minimum RR Lane Changes	0
Interchange Density, int/mi	0.80	Right Side Clearance, ft	10
Lane Width, ft	12	Total Ramp Density, ramps/mi	0.00
Managed Lane	<input type="checkbox"/>	Highway or C-D Roadway	<input type="checkbox"/>
Cross Weaving Managed Lane	<input type="checkbox"/>		

**Number of Lanes for a one-sided weaving segment includes auxiliary lanes*

Ramp Geometric Data			
On-Ramp		Off-Ramp	
Number of Lanes	1	Number of Lanes	1
Free Flow Speed, mi/h	35.0	Free Flow Speed, mi/h	35.0
Terrain Type	Level	Terrain Type	Level
Grade, %	-	Grade, %	-
Grade Length, mi	-	Grade Length, mi	-
Left-Sided	<input type="checkbox"/>		

Demand Data							
Freeway-to-Freeway		Ramp-to-Freeway		Ramp-to-Ramp		Freeway-to-Ramp	
Demand, veh/h	0	Demand, veh/h	0	Demand, veh/h	0	Demand, veh/h	0
Demand Adjustment Factor	1.000	Demand Adjustment Factor	1.000	Demand Adjustment Factor	1.000	Demand Adjustment Factor	1.000
Peak Hour Factor	0.94	Peak Hour Factor	0.94	Peak Hour Factor	0.94	Peak Hour Factor	0.94
Total Trucks, %	0.00	Total Trucks, %	0.00	Total Trucks, %	0.00	Total Trucks, %	0.00
Single-Unit Trucks (SUT), %	-	Single-Unit Trucks (SUT), %	-	Single-Unit Trucks (SUT), %	-	Single-Unit Trucks (SUT), %	-
Tractor-Trailers (TT), %	-	Tractor-Trailers (TT), %	-	Tractor-Trailers (TT), %	-	Tractor-Trailers (TT), %	-
Prop. of CAVs (segment)	0						

Freeway Adjustment Factors	
Driver Population	All Familiar
Weather Type	Non-Severe Weather
Incident Type	No Incident
Speed Adjustment Factor	1.000
Capacity Adjustment Factor	1.000

Facility Analysis

Figure 5. Facility Analysis Window in HCS2023

Facility Global Inputs

K	Jam Density, pc/mi/ln	190.0		Area Type	Urban	D
L	Queue Discharge Capacity Drop, %	7		Demand Factor	1.000	
	Managed Lane	<input type="checkbox"/>		Vehicle Value of Time (VOT), \$/h	25.00	
	Lane-By-Lane Analysis	<input type="checkbox"/>		Mixed Flow Model	<input type="checkbox"/>	

Segments Global Inputs

I	Freeway Thru Lanes	3		Ramp Lanes	1	
C	Freeway Free Flow Speed, mi/h	75.4		Ramp Free Flow Speed, mi/h	35.0	J
A	Freeway Terrain Type	Level		Ramp Terrain Type	Level	
B	Freeway Peak Hour Factor	0.94		Ramp Peak Hour Factor	0.94	
F	Freeway Total Trucks, %	0.00		Ramp Total Trucks, %	0.00	
F	Driver Population	All Familiar		Weather Type	Non-Severe Weather	
	Proportion of CAVs, %	0		Ramp Demand Adj. Factor	1.000	

Select All ☐
Apply Global Inputs

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

The screenshot displays the HCM-Calc software interface for a Basic Freeway Segment analysis. The window title is "HCM-CALC: Basic Freeway Segment - [Level of Service]". The top menu bar includes File, View, and Help. The top status bar shows "HCM Edition: 6th (2016)" and a File name field.

Key input fields and annotations:

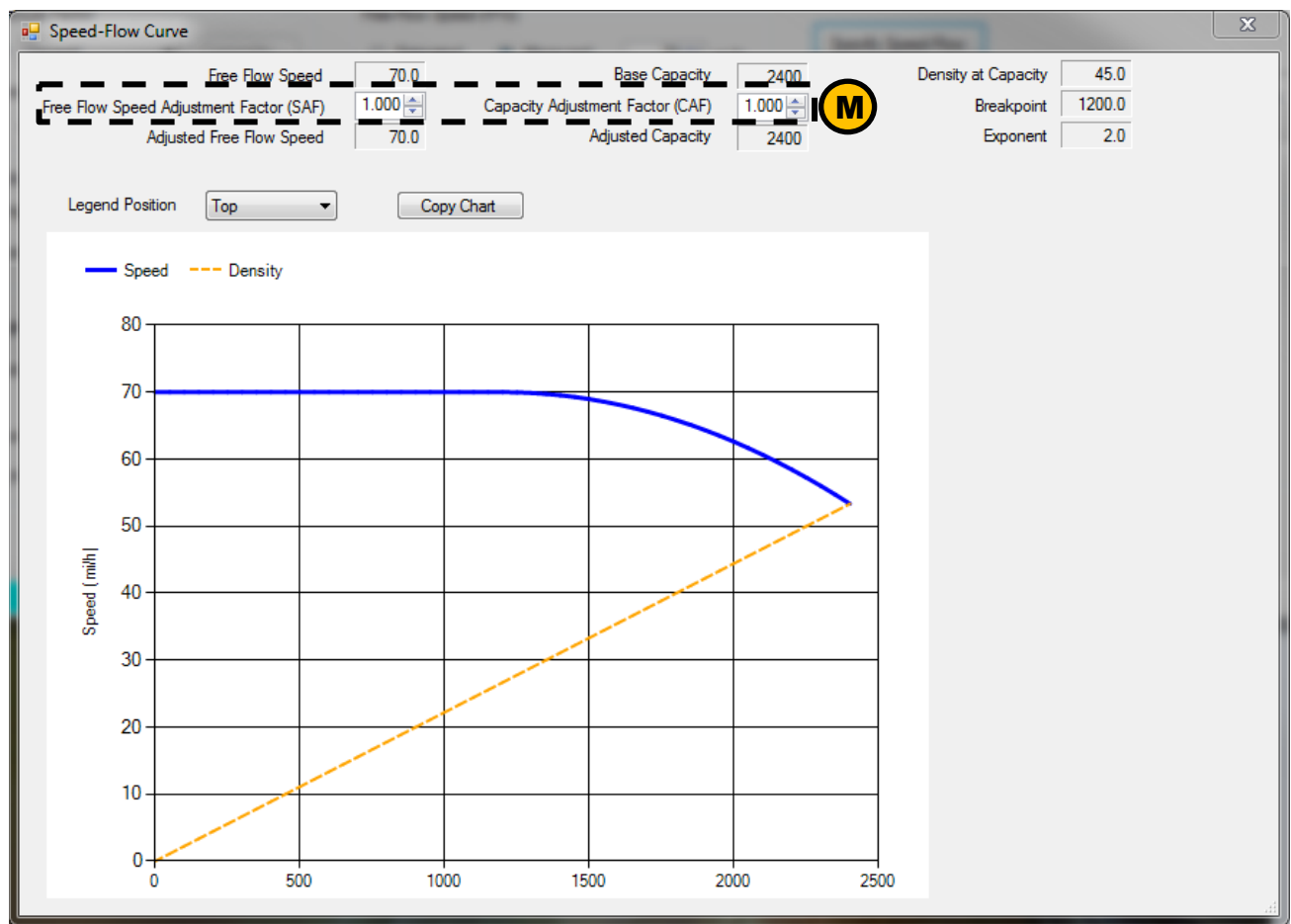
- A**: Number of Lanes (3), Demand (veh/h) (0), Peak Hour Factor (1.000).
- B**: % Single Unit Trucks (SUTs) (0.0), % Tractor Trailers (TTs) (0.0), Truck PCE (E_T) (2.00), f_{HV} (1.000).
- C**: Heavy Vehicle Factor (General Terrain, Level).
- I**: Free-Flow Speed (FFS) (Measured, 70 mi/h).

Other fields include:

- Segment Length (Mainline)
- FFS Adjustment Factors: Lane Width (ft) (12.0), Right Side Lateral Clearance (ft) (6.0), BFFS (mi/h) (75.4), f_{LW} (mi/h) (0.0), f_{RLC} (mi/h) (0.0).
- Ramp Data: Enter: # of ramps (0), # Ramps Upstream (ramps/3 mi) (0), # Ramps Downstream (ramps/3 mi) (0), Total Ramp Density (ramps/mi) (0.00), TRD term (mi/h) (0.0), FFS, calculated (mi/h) (75.4).
- Specify Speed-Flow Curve button (Callout: Click to access adjustment factors. See Figure 7).
- Calculate Performance Measures and LOS button.
- Results section: Analysis Flow Rate (pc/h/lane), Adjusted Capacity (pc/h/lane), v/c, Avg. Speed (mi/h), Density (pc/mi/lane), LOS.

The bottom status bar shows "Level of Service Analysis", "Service Volumes", and "Report".

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

HCm-CALC: On-Ramp Segment - [Level of Service]
HCM Edition: 6th (2016)

File View Help

Filename

Mainline

Number of Lanes: 3

Demand (veh/h): 0

Peak Hour Factor: 1.000

FFS Adjustment Fact.: 1.000

Free-Flow Speed (mi/h): 70.0

☒ Measured ☐ Estimated Inputs... N/A

Capacity Adjustment Fact.: 1.000

Heavy Vehicle Factor

Terrain: General Composite...

General Terrain: ☒ Level ☐ Rolling

Specific Grade: Length (mi): 0.0000 Grade (%): 0.00

% Single Unit Trucks (SUTs): 0.0

% Tractor Trailers (TTs): 0.0

Truck PCE (E_T): 2.00

f_{HV}: 1.000

On-Ramp

Demand (veh/h): 0

% SUTs: 0.0

% TTs: 0.0

f_{HV}: 1.000

Number of Lanes: 1

Free-Flow Speed (mi/h): 40

Acceleration Lane Length (ft): 1000

Adjacent Ramp Data

☐ Upstream Off-Ramp? ☐ Downstream Off-Ramp?

Distance (ft): 0

Demand (veh/h): 0

% SUTs: 0.0

% TTs: 0.0

f_{HV}: 1.000

Diagram

Segment Length

Mainline

On Ramp

Acceleration Length

Calculate Performance Measures and LOS

Results

Analysis Flow Rate, Mainline (pc/h)

Analysis Flow Rate, Ramp (pc/h)

v_{FO} (pc/h)

Mainline Capacity (pc/h)

On-Ramp Capacity (pc/h)

Mainline v/c

On-Ramp v/c

v_{up} (pc/h)

L_{EQup} (ft)

P_{FMup}

v_{down} (pc/h)

L_{EQdown} (ft)

P_{FMdown}

P_{FM}

v₁₂ (pc/h)

v_{R12} (pc/h)

S_R (mi/h)

D_R (pc/mi/h)

LOS

Avg. Speed, All Lanes (mi/h)

Density, All Lanes (pc/mi/h)

Level of Service Analysis Service Volumes Report

Diverge Segment Analysis

Figure 9. Diverge Segment Analysis Window in HCM-Calc

Mainline

Number of Lanes: 8
 Demand (veh/h): 0
 Peak Hour Factor: 1.000
 FFS Adjustment Fact.: 1.000
 Free-Flow Speed (mi/h): 70.0
 Capacity Adjustment Fact.: 1.000
 Heavy Vehicle Factor: 1.000

Off-Ramp

Demand (veh/h): 0
 % SUTs: 0.0
 % TTs: 0.0
 f_HV: 1.000
 Number of Lanes: 1
 Free-Flow Speed (mi/h): 40
 Deceleration Lane Length (ft): 450

Adjacent Ramp Data

Upstream On-Ramp? ☐ Distance (ft): 0
 Demand (veh/h): 0
 % SUTs: 0.0
 % TTs: 0.0
 f_HV: 1.000
 Downstream Off-Ramp? ☐ Distance (ft): 0
 Demand (veh/h): 0
 % SUTs: 0.0
 % TTs: 0.0
 f_HV: 1.000

Results

Analysis Flow Rate, Mainline (pc/h)
 Analysis Flow Rate, Ramp (pc/h)
 v_FO (pc/h)
 Mainline Capacity (pc/h)
 Off-Ramp Capacity (pc/h)
 Mainline v/c
 Off-Ramp v/c
 v_up (pc/h)
 L_EQup (ft)
 P_FDup
 v_down (pc/h)
 L_EQdown (ft)
 P_FDdown
 P_FD
 v_12 (pc/h)
 S_R (mi/h)
 D_R (pc/mi/h)
 LOS
 Avg. Speed, All Lanes (mi/h)
 Density, All Lanes (pc/mi/h)

Level of Service Analysis | **Service Volumes** | **Report**

Weaving Segment Analysis

Figure 10. Weaving Segment Analysis Window in HCM-Calc

HCM-CALC: Weaving Segment - [Level of Service]

File View Help HCM Edition: 6th (2016)

Filename

Mainline

Segment Type: Freeway

Number of Lanes: 3

Demand (veh/h): 0

Peak Hour Factor: 1.000

FFS Adjustment Fact.: 1.000

Free-Flow Speed (mi/h): 70.0

☒ Measured ☐ Estimated

Interchange Density (int/mi): 0.00

Heavy Vehicle Factor

Terrain: General

General Terrain: ☒ Level ☐ Rolling

Specific Grade: Length (mi): 0.0000, Grade (%): 0.00

% Single Unit Trucks (SUTs): 0.0

% Tractor Trailers (TTs): 0.0

Truck PCE (E_T): 2.00

f_{HV}: 1.000

Weave Configuration

☒ One-Sided ☐ Two-Sided

Short Length (L_S) (ft): 0

of Weaving Lanes (N_{WL}): 2

Min. Lane Changes Freeway-Ramp (LC_{FR}): 1

Min. Lane Changes Ramp-Freeway (LC_{RF}): 1

Min. Lane Changes Ramp-Ramp (LC_{RR}): 0

Diagram: Mainline, Short Length, Segment Length, Auxiliary Lane, On Ramp, Off Ramp

The on-ramp and off-ramp demand volumes should not include the ramp-to-ramp volume.

On-Ramp to Freeway

Demand (veh/h): 0

% SUTs: 0.0

% TTs: 0.0

f_{HV}: 1.000

Ramp-to-Ramp

Demand (veh/h): 0

Freeway to Off-Ramp

Demand (veh/h): 0

% SUTs: 0.0

% TTs: 0.0

f_{HV}: 1.000

Calculate Performance Measures and LOS

Results

v_{FF} (pc/h)

v_{FR} (pc/h)

v_{RF} (pc/h)

v_{RR} (pc/h)

Volume Ratio

Maximum Length (ft)

C_{IWL} (pc/h/ln)

C_{IW} (pc/h)

C_W (veh/h)

v/c

LC_{min} (c/h)

LC_W (c/h)

I_{NW}

LC_{NW} (c/h)

LC_{All} (c/h)

Weaving Intensity

Non-Weaving Speed (mi/h)

Weaving Speed (mi/h)

Avg. Speed (mi/h)

Density (pc/mi/ln)

LOS

Level of Service Analysis Service Volumes Report

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

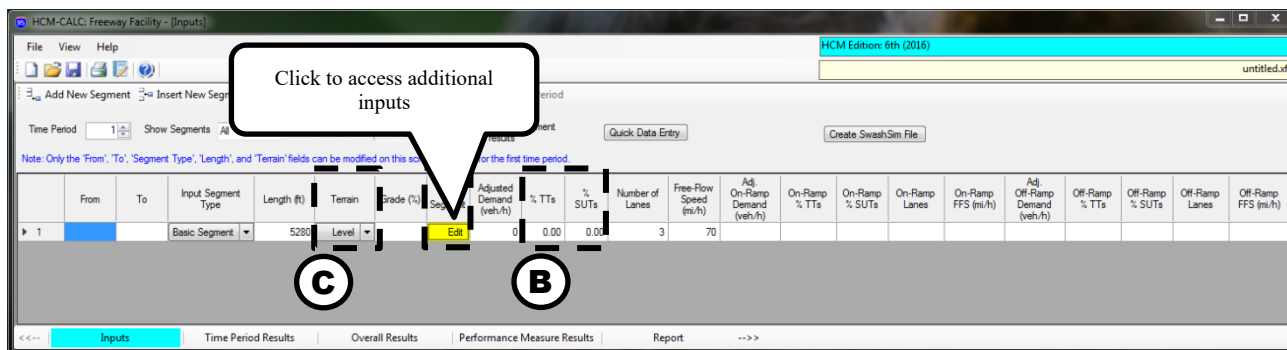


Figure 12. Basic Segment Window within the Facility Analysis in HCM-Calc

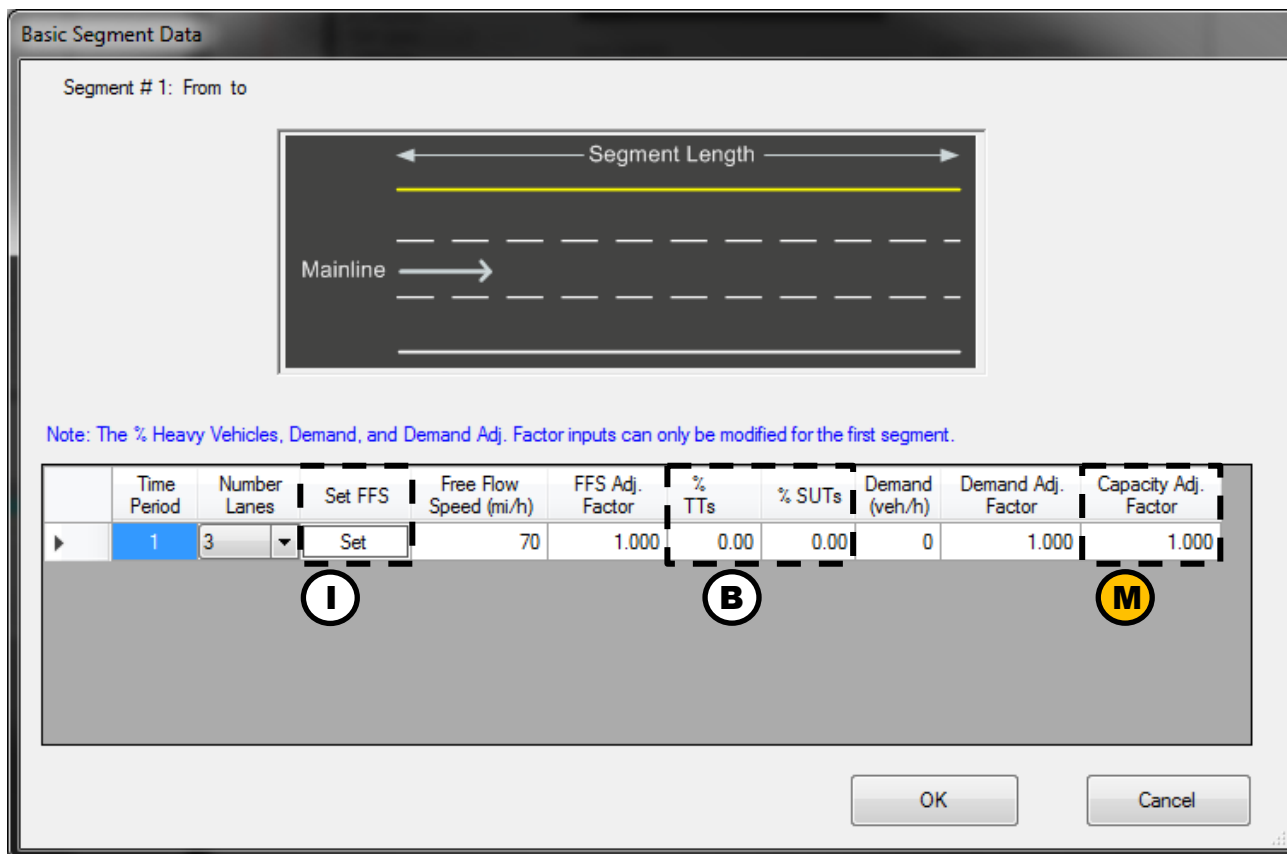


Figure 13. Merging Segment Window within the Facility Analysis in HCM-Calc

Ramp Segment Data

Segment # 2: From to

Note: The mainline roadway % heavy vehicles and demand inputs can only be modified for the first segment.

Mainline Roadway

Segment	Number of Lanes	Set FFS	Free Flow Speed (mi/h)	FFS Adj. Fact.	Capacity Adj. Fact.
1	3	Set	70	1.000	1.000

Ramp Roadway

Time Period	Accel/Decel Length (ft)	Number of Lanes	Free Flow Speed (mi/h)	On-Ramp % TTs	On-Ramp % SUTs	Demand (veh/h)	Demand Adj. Fact.
1	1000	1	40	0.00	0.00	0	1.00

Diagram: A schematic of a merging segment. A yellow line represents the 'On Ramp' entering from the bottom left and merging into a multi-lane 'Mainline' road. The 'Segment Length' is indicated for the mainline section. The 'Acceleration Length' is indicated for the ramp section. The 'Ramp Side' is set to 'Right'.

OK Cancel

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

Ramp Segment Data

Segment # 4: From to

Note: The mainline roadway % heavy vehicles and demand inputs can only be modified for the first segment.

Mainline Roadway

Segment	Number of Lanes	Set FFS	Free Flow Speed (mi/h)	FFS Adj. Fact.	Capacity Adj. Fact.
1	3	Set	70	1.000	1.000

Ramp Roadway

Time Period	Accel/Decel Length (ft)	Number of Lanes	Free Flow Speed (mi/h)	Off-Ramp % TTs	Off-Ramp % SUTs	Demand (veh/h)	Demand Adj. Fact.
1	450	1	40	0.00	0.00	0	1.00

Diagram: A schematic of a diverging segment. A yellow line represents the 'Off Ramp' exiting from a multi-lane 'Mainline' road. The 'Segment Length' is indicated for the mainline section. The 'Deceleration Length' is indicated for the ramp section. The 'Ramp Side' is set to 'Right'.

OK Cancel

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

Weaving Segment Data

Segment # 3: From to
 Note: The % heavy vehicles and demand inputs can only be modified for the first segment.
 Note: # Lanes include Aux Lanes.

Mainline Roadway

	Number of Lanes	Set FFS	Free Flow Speed (mi/h)	FFS Adj. Fact.	Capacity Adj. Fact.
	3	Set	70	1.000	1.000

Weave Configuration

☒ One-Sided ☐ Two-Sided

Short Length (L_S) (ft) 3000

of Weaving Lanes (N_{WL}) 2

Min. Lane Changes Freeway-Ramp (LC_{FR}) 1

Min. Lane Changes Ramp-Freeway (LC_{RF}) 1

Min. Lane Changes Ramp-Ramp (LC_{RR}) 0

Note: The on-ramp and off-ramp demand volumes should not include the ramp-to-ramp volume.

On-Ramp Roadway					Off-Ramp Roadway				
Time Period	% TTs	% SUTs	Ramp to Freeway Demand (veh/h)	Demand Adj. Fact.	Ramp To Ramp Vol. (veh/h)	% TTs	% SUTs	Freeway to Ramp Demand (veh/h)	Demand Adj. Fact.
1	0.00	0.00	0	1.00	0	0.00	0.00	0	1.00

OK Cancel

Multilane Highway Segment Analysis

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

HCM-CALC: Multilane Highway Segment - [Level of Service]

File View Help HCM Edition: 6th (2016)

Filename

Number of Lanes 8

Demand (veh/h) 0

Peak Hour Factor 1.000

Heavy Vehicle Factor

Terrain General Composite...

General Terrain

☒ Level ☐ Rolling

Specific Grade

Length (mi) 0.0000

Grade (%) 0.00

% Single Unit Trucks (SUTs) 0.0

% Tractor Trailers (TTs) 0.0

Truck PCE (E_T) 2.00

f_{HV} 1.000

Free-Flow Speed (FFS)

☐ Estimated ☒ Measured 70 mi/h

Specify Speed-Flow Curve

FFS Adjustment factors

Lane Width (ft) 12.0

Median Type Divided

Lateral Clearance (ft) Left 6.0 Right 0.0 Total 0.0

Access Point Density (access points/mi) 0.0

BFFS (mi/h) 60

f_{LW} (mi/h) 0.0

f_M (mi/h) 0.0

f_{TLC} (mi/h) 1.3

f_A (mi/h) 0.0

FFS, calculated (mi/h) 58.7

Calculate Performance Measures and LOS

Results

Analysis Flow Rate (pc/h/ln)

Adjusted Capacity (pc/h/ln)

v/c

Avg. Speed (mi/h)

Density (pc/mi/ln)

LOS

Level of Service Analysis Service Volumes Report

Click to access adjustment factors. See Figure 7.

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

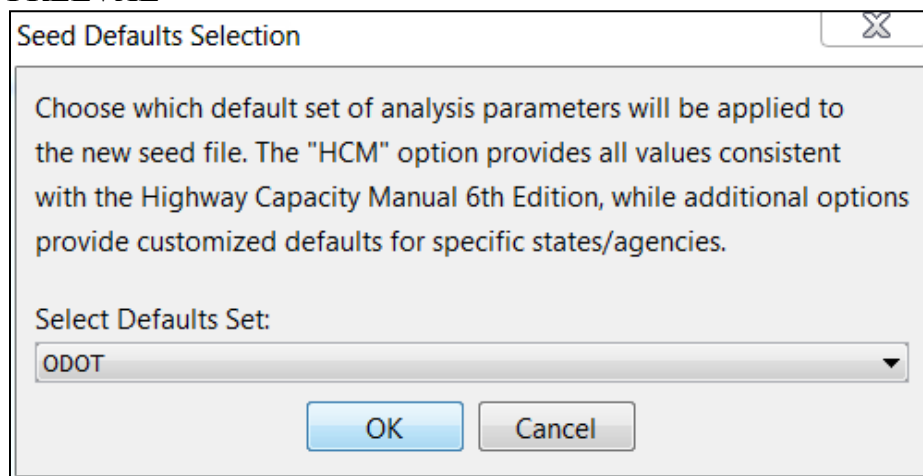


Figure 18. Project Seed Global Defaults in FREEVAL

Project Properties (ODOT Defaults)

General Information

Project Name: New Project 1 Number Of HCM Segments: 7

Study Period Start Time (hh:mm): 17:00 Study Period End Time (hh:mm): 18:00

Seed Calibration Date: Nov 7, 2017 Jam Density (pc/mi/ln): 190

Capacity Drop due to Breakdown (%): 7 GP Vehicle Occupancy (p/veh): 1.0

Area Type: Small Urban

Analysis Options

☒ Free Flow Speed Known ☐ Managed Lanes Analysis

Prefill Global Values

General Purpose Segments

☒ General Terrain: Level (Default=2.0) ☒ Current Truck PCE: 2.0 Look-up Tables

☒ Num Of Mainline Lanes: 3 ☒ Mainline FFS (mph): 70

☐ Lane Width (ft)

☐ Lateral Clearance (ft)

☒ Num Of Ramp Lanes: 1 ☒ Ramp FFS (mph): 35

☐ Ramp Acceleration Length (ft): 750 ☐ Ramp Deceleration Length (ft): 500

☒ Single Unit Trucks and Buses (%): 5.0 ☒ Tractor Trailers (%): 5.0

☒ Driver Population CAF: 0.968 ☒ Driver Population SAF: 0.975

OK Cancel

Figure 19. FREEVAL Weave Ramp to Ramp Demand Tool

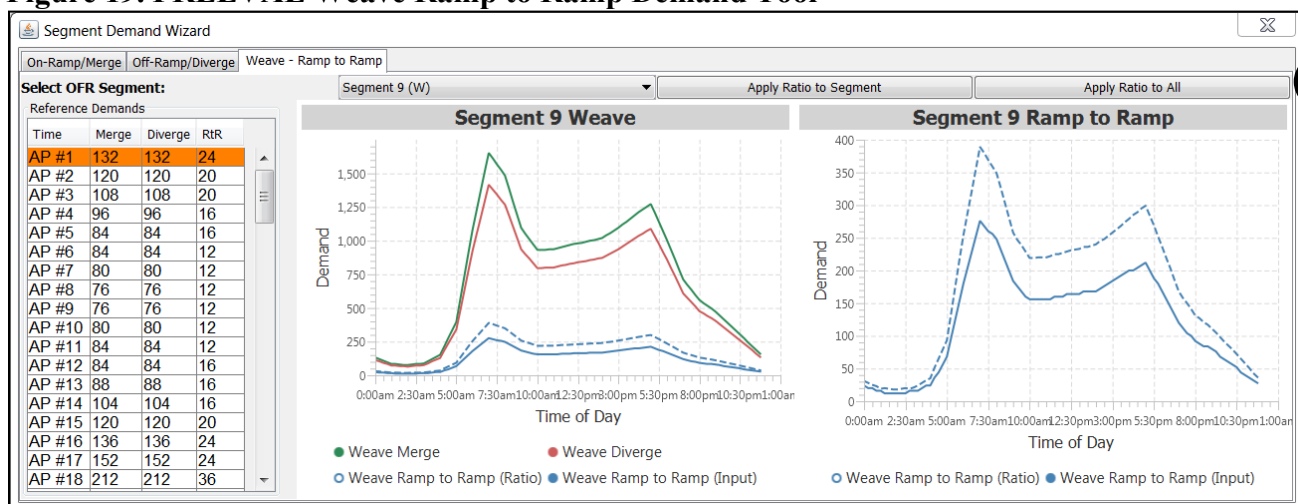
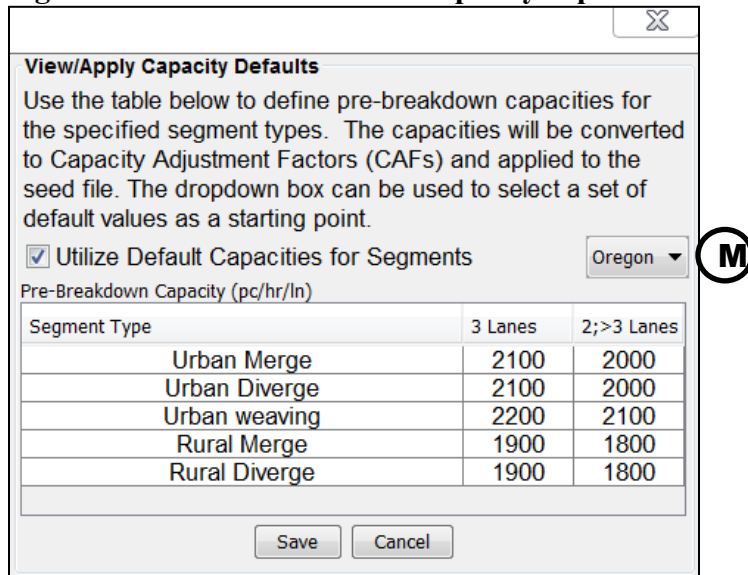


Figure 20. Default Bottleneck Capacity Input Window in FREEVAL



View/Apply Capacity Defaults

Use the table below to define pre-breakdown capacities for the specified segment types. The capacities will be converted to Capacity Adjustment Factors (CAFs) and applied to the seed file. The dropdown box can be used to select a set of default values as a starting point.

☒ Utilize Default Capacities for Segments Oregon ▼ **M**

Pre-Breakdown Capacity (pc/hr/ln)

Segment Type	3 Lanes	2;>3 Lanes
Urban Merge	2100	2000
Urban Diverge	2100	2000
Urban weaving	2200	2100
Rural Merge	1900	1800
Rural Diverge	1900	1800

Save Cancel

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. 1 st 20XX – Dec. 31 st 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 6 th	4 – Approximates number of weekdays per month
(F)	Days of Week Included	HCM 6 th	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 6 th	Location-specific values (see ODOT APM Chapter 11 Appendix C)
(P)	Incident Adjustment Factors	HCM 6 th	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 6 th	Highway Capacity Manual defaults

General Project Properties

The screenshot shows the 'Scenario Generator - New Project 1' dialog box. It has a tabbed interface with 'Properties', 'GP - Demand', 'GP - Work Zones', 'GP - Incidents', and 'Weather'. The 'Properties' tab is active, showing 'Reliability Analysis Properties'. Callout A points to the 'Seed Date' field (Nov 6, 2018). Callout B points to the 'RRP End Date' field (Dec 31, 2018) and the 'Set RRP Period' and 'Discard Changes' buttons. Callout C points to the 'Include Event Types' section, which has checkboxes for 'GP - Work Zones', 'GP - Incidents', 'Weather', and 'ML - Incidents'. Callout D points to the 'Random Number Generator (RNG) Seed Options' section, which has radio buttons for 'Use new random RNG seed', 'Use user specified RNG seed', and 'Use previous used RNG seed'. Callout E points to the 'Number of Demand Combination Realizations' section, which has a text box for 'Number of realizations (default 4):' with the value '4'.

Scenario Generator - New Project 1

Properties | GP - Demand | GP - Work Zones | GP - Incidents | Weather

Reliability Analysis Properties

Seed Date: Nov 6, 2018 ... RRP Start Date: Jan 1, 2018 ... RRP End Date: Dec 31, 2018 ...

Set RRP Period

Discard Changes

Include Event Types

☒ GP - Work Zones ☒ GP - Incidents ☒ Weather ☐ ML - Incidents

Random Number Generator (RNG) Seed Options (Any new RNG Seed value will be saved to the seed file)

☒ Use new random RNG seed

☐ Use user specified RNG seed

☐ Use previous used RNG seed

Number of Demand Combination Realizations

Number of realizations (default 4): 4

Generate Scenarios Only Generate and Run Scenarios Cancel

Demand

Scenario Generator - New Project 1

Tabs: Properties | **GP - Demand** | GP - Work Zones | GP - Incidents | Weather

Days in RRP

- ☒ Monday
- ☒ Tuesday
- ☒ Wednesday
- ☒ Thursday
- ☒ Friday
- ☐ Saturday
- ☐ Sunday

Buttons: Select All, Select Weekdays, Select Weekends

Daily Demand Multipliers

	Monday	Tuesday	Wednesday	Thursday	Friday
January	1.0	1.0	1.0	1.0	1.0
February	1.0	1.0	1.0	1.0	1.0
March	1.0	1.0	1.0	1.0	1.0
April	1.0	1.0	1.0	1.0	1.0
May	1.0	1.0	1.0	1.0	1.0
June	1.0	1.0	1.0	1.0	1.0
July	1.0	1.0	1.0	1.0	1.0
August	1.0	1.0	1.0	1.0	1.0
September	1.0	1.0	1.0	1.0	1.0
October	1.0	1.0	1.0	1.0	1.0
November	1.0	1.0	1.0	1.0	1.0
December	1.0	1.0	1.0	1.0	1.0

Options: ☒ Use Defaults | National Defaults | Urban | Saved Facility Specific | User Input Values

Exclude Specific Calendar Dates From RRP

Specific Date: Jul 4, 2018

Buttons: Add, Remove, Remove All

Dates Excluded From RRP: [Empty List]

Buttons: Generate Scenarios Only, Generate and Run Scenarios, Cancel

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.

Scenario Generator - New Project 1

Properties | GP - Demand | GP - Work Zones | GP - Incidents | Weather

Days in RRP

- ☒ Monday
- ☒ Tuesday
- ☒ Wednesday
- ☒ Thursday
- ☒ Friday
- ☐ Saturday
- ☐ Sunday

Select All

Select Weekdays

Select Weekends

Daily Demand Multipliers

	Monday	Tuesday	Wednesday	Thursday	Friday
January	1.0	1.17	1.24	1.08	1.26
February	1.25	1.42	1.47	1.43	1.49
March	1.59	1.63	1.69	1.74	1.88
April	2.03	1.89	1.91	1.94	2.04
May	2.51	2.49	2.26	2.36	2.51
June	2.87	2.61	2.63	2.66	2.85
July	3.07	2.8	2.67	2.89	3.0
August	3.75	2.8	3.22	2.9	3.08
September	3.03	3.02	2.74	2.81	3.1
October	2.69	2.63	2.52	2.51	2.56
November	1.88	2.02	2.0	2.2	2.04
December	1.27	1.48	1.74	1.69	1.78

☒ Use Defaults

Oregon Defaults

Agricultural

Save Facility Specific

User Input Values

Exclude Specific Calendar Dates From RRP

Specific Date

Jul 4, 2018

Add

Remove

Remove All

Generate Scenarios Only

Generate and Run Scenarios

Cancel

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

Scenario Generator - New Project 1

Properties | GP - Demand | **GP - Work Zones** | GP - Incidents | Weather

Work Zone Time and Location

Dates
Start: Jan 1 Mon
End: Jan 1 Mon

Segments
Start: Select
End: Select

Analysis Periods
Select to Select ☐ All

Work Zone Parameters

Severity: Choose Type
Area Type: Choose Area T...
Barrier Type: Choose Barrier...
Work Zone Speed ...: 55.0
Lateral Distance (ft.): 1
jLabel5: 13.4

Work Zone Adjustment Factors

	CAF	SAF	DAF

Select a work zone to use the above table to view and edit adjustment factors for the work zone. The default factors are those computed through the methodology of Ch. 10 (3-107).

Generate Scenarios Only | Generate and Run Scenarios | Cancel

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

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 been set or are very small (<0.01)

Incident Durations

Incident Severity	Distribution %	Mean Duration	Std. ...	Minimum Duration	Maximum 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
Four Lane Closure	0.0	67.0	21.0	36.0	93.3

Use National Default Data
Use Default Durations
Use Saved Seed File Distribution
Use Saved Seed File Durations

Adjustment Factors

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)

Segment Lanes	Shoulder Closure	1 Lane Closure	2 Lane Closure	3 Lane Closure	4 Lane Closure
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)

Segment Lanes	Shoulder Closure	1 Lane Closure	2 Lane Closure	3 Lane Closure	4 Lane Closure
2	1.0	1.0			
3	1.0	1.0	1.0		
4	1.0	1.0	1.0	1.0	

Lane Adjustment Factors

Segment Lanes	Shoulder Closure	1 Lane Closure	2 Lane Closure	3 Lane Closure	4 Lane Closure
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:

Use the dropdown selection boxes to choose a region and city.

National
New Facility Specific

Extract Historic Regional Weather Data
Import from File
Use Values Stored In Seed
Export to File

Weather Probabilities

	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%

Weather Durations and Adjustment Factors

	Med Rain	Heavy Rain	Light Snow	LM Snow	MH Snow	Heavy Snow	Severe Cold	Low Vis	Very Low Vis	Min Vis	Normal Weather
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

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.

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:

Use the dropdown selection boxes to choose a region and city.

Oregon

New Facility Specific

New Facility Specific

Troutdale,OR

Eugene,OR

Salem,OR

Medford,OR

Roseburg,OR

Sexton Summit,OR

Hermiston,OR

Extract Historic Regional Weather Data

Import from File

Use Values Stored In Seed

Export to File

	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%
Avg Dur (mi)	15.00	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

Generate Scenarios Only | Generate and Run Scenarios | Cancel