

LILL HILL PRIME

USER GUIDE

UF Transportation Institute UNIVERSITY of FLORIDA

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Introduction

License Agreement

HIGHWAY CAPACITY SOFTWARE™ (HCS™) END-USER LICENSE AGREEMENT (EULA)

Effective Date: 10/15/2024

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Acknowledgements

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Getting Started

System Requirements

HCS is designed for standard Windows installations. For optimal performance, the system should be Windows 10 or newer. While HCS may be compatible with older versions of Windows, any installation and operational issues arising from using these older versions will be the sole responsibility of the end user.

Getting Started

To begin, click on File then New (or the "New File..." button on the Start page).

Normal Windows keyboard and mouse functions are available. Tabbing, clicking to a new field, or pressing the Enter key will trigger a recalculation and update the report.

Multilane Highway Analysis

Multilane Highway analyses will estimate Capacity and Level of Service (LOS) for a given set of traffic and geometric conditions. This type of analysis is oriented toward the evaluation of an existing or planned segment or facility. The methodology and procedures of application use the HCM Chapter 12 procedures.

Two-Lane Highway Analysis

Two-lane Highway analyses will estimate Capacity and Level of Service (LOS) for a given set of traffic and geometric conditions. This type of analysis is oriented toward the evaluation of an existing or planned segment or facility. The methodology and procedure of application use the HCM Chapter 15 procedures.

General Controls

Menu Items

New - Creates a new Multilane or TwoLane file (*.xuf) and starts a new analysis project; shortcut is Ctrl+N

Multilane Segment – Creates a new Multilane file (*.xuf) and starts a new Multilane Segment analysis project

Two-Lane Segment – Creates a new TwoLane file (*.xuf) and starts a new TwoLane Segment analysis project

Two-Lane Facility - Creates a new TwoLane file (*.xuf) and starts a new TwoLane Facility analysis project

Open - Opens an existing Multilane or TwoLane file (*xuf, *.xhm, or *.xh2); shortcut is Ctrl+O

Example Folder - Opens folder with all HCS examples in File Explorer

Save - Saves an open Multilane or TwoLane file (*.xuf) using the current file name; shortcut is Ctrl+S

Save As... – Saves an open Multilane or TwoLane file (*.xuf) using a specified file name; shortcut is F12

Close - Closes an existing Multilane or TwoLane file (*.xuf); shortcut is Ctrl+W

Units

USC Units - Changes the units of the current file to U.S. Customary

Metric Units - Changes the units of the current file to Metric

Print – Brings up printer selection and prints a Multilane or TwoLane report to the printer or specified file type; shortcut is Ctrl+P

Print Preview – Displays preview of current report before printing; shortcut is Ctrl+F2

View

Page View – Changes the view to display inputs and report by pages; shortcut is F9

Full View

Report -> Right – Changes the view to display both the input screen and report simultaneously; the report is displayed on the right portion of the screen; shortcut is F10

Report -> Bottom – Changes the view to display both the input screen report simultaneously; the report is displayed on the bottom portion of the screen; shortcut is F11

Report

Formatted Report – Displays formatted report including the most important values; shortcut is F4

Text Report – Displays text report with input, intermediary, and final results; shortcut is F6

Import From CSV – Imports the analysis inputs of both directions from a CSV file into the *.xuf file for a Multilane file; imports the analysis inputs of the segment(s) from a CSV file into the *.xuf file for a TwoLane file

Export To CSV – Exports the analysis inputs of both directions from the *.xuf file into a CSV file for a Multilane file; exports the analysis inputs of the segment(s) from the *.xuf file into a CSV file for a TwoLane file

Default Settings – Opens a dialog box for the user to input defaults for Analyst, Agency, and Jurisdiction, which will be applied to all new files; also allows selection of USC or SI units, which will be applied to all new files; also provides option to include Safety Analysis results, which will be applied to all newly opened files; shortcut is Alt+F

Help

Contents – Provides access to glossary, acknowledgements, copyrights, and information on the HCM procedures; shortcut is Ctrl+F1

Index – Allows user to search keywords within the glossary

Search – Allows user to search for any word within the glossary

User Guide – Opens a comprehensive user guide in PDF format; shortcut is Ctrl+G

HCM Reference Guide – Opens a reference guide for the HCM in PDF format

HCS Updates – Sends the HCS version number anonymously without any personally identifiable information to McTrans to check for a newer version

HCM/HCS Training – Opens the McTrans Training Page in the default web browser to view the latest training opportunities

HCQS Web Page – Opens the TRB Highway Capacity and Quality of Service Committee page in the default web browser

Support

Frequently Asked Questions – Opens the McTrans support page for HCS in the default web browser

HCS Overview – Opens the McTrans HCS Overview page in the default web browser

McTrans Website - Opens the McTrans home page in the default web browser

E-mail McTrans – Composes a new e-mail addressed to McTrans in the default e-mail client with registration number, serial key, module, and version number already populated in the Subject field

About HCS – Opens an about window with software version information, EULA, general acknowledgements, contact information, and other relevant links

Exit - Exits the HCS Highways module; shortcut is Alt+F4

Multilane Highway Segments

HCM Chapter 12

The Highway Capacity Software (*HCS*) faithfully implements the methodology prescribed in the Highway Capacity Manual (HCM) for analyzing Basic Freeway and Multilane Highway Segments. These segments are outside the influence of merging, diverging, and weaving maneuvers. In the case of multilane highways, they are also outside the influence of signalized intersections. Because of the similar operational characteristics of basic freeway and multilane highway segments, they are analyzed with the same methodology.

Chapter 12 focuses on *uninterrupted flow*, which refers to access-controlled facilities, with access and egress being controlled through grade-separated cross streets and ramp movements to access the facility. For multilane highways, uninterrupted flow also exists when there are no traffic control devices that interrupt traffic and where no platoons are formed by upstream traffic signals.

The methodologies in this chapter are limited to *uncongested flow* conditions. Uncongested flow conditions require that the demand-to-capacity ratio for the segment is less than or equal to 1.0. Uncongested flow on freeways and multilane highways further means that there are no queuing impacts on the segment from downstream bottlenecks. The HCM does not currently provide a method for evaluating oversaturated multilane highways, other than to identify them as LOS F.

The bicycle methodology is identical for two-lane highways and multilane highways. Details are provided in Chapter 15, Two-Lane Highways. Bicycle levels of service for multilane highway segments are based on a bicycle LOS score, which is in turn based on a traveler perception model.

Operational Data

Geometric Data

For multilane highway segments, there are inputs for each direction. The number of lanes for both directions is entered. The user chooses the type of Terrain (Level, Rolling, or Specific Grade). If Specific Grade is chosen, fields for Percent Grade and Grade Length will enable for the user to change. Lane Width, Base Free Flow Speed, and Right Side Clearance are also available as inputs. Access-Point Density, Median (left) Side Clearance, and Median Type are also included for each direction. However, if a Median Type is selected for one direction, the other direction will automatically update to reflect the same Median Type.

Checkboxes are provided for Measured FFS to indicate if it is necessary for the current analysis. When Measured FFS is checked, the following fields are disabled: Lane Width, Right Side Clearance, Median (Left) Side Clearance, and Access-Point Density. The input for Base Free Flow Speed is then taken as the measured Free Flow Speed.

Demand Data

Demand, Peak Hour Factor, Percent Total Trucks, Percent Single-Unit Trucks, and Percent Tractor-Trailers are included as inputs for multilane highway segments.

If 'Mixed Flow Model' is checked, the mixed-flow model will be used to assess capacity, speed, and density in addition to the traditional passenger-car-equivalent (PCE) method. Results of both methods will be provided in the

reports.

Adjustment Factors

Driver Population is taken into account. This affects the Speed and Capacity Adjustment Factors. However, if the user chooses to override the default values based on driver population, they can change the adjustment factors.

Bicycle LOS

Outside Lane Width, Shoulder Width, Speed Limit, Pavement Condition Rating, and Percent Occupied Parking are included as inputs for the evaluation of bicycle level of service.

Results

A multilane highway segment can be characterized by three performance measures: density in passenger cars per mile per lane (pc/mi/ln), space mean speed in miles per hour (mi/h), and the ratio of demand flow rate to capacity (v/c). Since speed is constant through a broad range of flows and the v/c ratio is not directly discernible to road users (except at capacity), the service measure for multilane segments is density.

Level of Service (LOS) Criteria for Basic Freeway and Multilane Highway Segments:

	Density (pc/mi/ln) [USC]	Density (pc/km/ln) [SI]
LOS A	≤11	≤7
LOS B	>11 - 18	>7 – 11
LOS C	>18 - 26	>11 – 16
LOS D	>26 - 35	>16 – 22
LOS E	>35 - 45	>22 - 28
LOS F	>45 or v/c>1.0	>28 or v/c>1.0

Bicycle levels of service for multilane highway segments are based on a bicycle LOS score, which is in turn based on a traveler perception model.

Bicycle Level of Service (LOS) Criteria for Multilane Highway Segments:

Score

	Bicycle LOS
LOS A	≤1.5
LOS B	>1.5 - 2.5
LOS C	>2.5 - 3.5
LOS D	>3.5 - 4.5
LOS E	>4.5 - 5.5
LOS F	>5.5

Safety Results

When 'Show Safety Analysis Results in Reports' is checked in the *Default Settings*, predicted crashes will be computed based on the Highway Safety Manual (HSM) methods for the corresponding road type.

Due to the structural differences between the HCM and HSM methods, certain transformations are required to convert HCM inputs into HSM inputs. Additionally, not all HSM-required data is available from HCM. Therefore, certain assumptions are included in the calculations.

The next section lists the conversion process of internal parameters, default values, and assumptions used to compute safety results in the *Highways* module for Multilane.

The following HCS Multilane inputs are internally converted to HSS as shown:

- Directional Volume (veh/h): The sum of demand volumes from both directions in *Multilane* are added together, then the bidirectional peak hour volume is converted to 'AADT (veh/day)' by applying the 'K-Factor'. This factor can be defined by the user in the *Default Settings*.
- Lane Width: If 'Lane Width' is entered in *Multilane*, no conversion is needed. Otherwise, a base condition value of 12 ft is applied.

- Model Type: If the 'Median Type' in *Multilane* is entered as 'TWLTL' or 'Undivided', the 'Model Type' in HSS will be 'Undivided'. Otherwise, the 'Model Type' used will be 'Divided'.
- Paved Right Shoulder Width (Divided): If 'Right-Side Clearance' is entered in *Multilane*, the average of both directions is used in HSS. Otherwise, a default value of 6 ft is applied.
- Shoulder Width (Undivided): If 'Right-Side Clearance' is entered in *Multilane*, the average of both directions is used in HSS. Otherwise, a default value of 6 ft is applied.

The following inputs required in *HSS* are not used in *HCS Multilane*. Therefore, the base conditions are assumed in the calculation of safety results, represented by the following values:

- Segment Length: 1 mile
- Driveway Density (DD): 5 driveways per mile
- Horizontal Curvature: None
- Roadside Hazard Rating: 3
- Median Barriers (Divided): None
- Shoulder Type (Undivided): Paved
- Sideslope (Undivided): 1:7
- Centerline Rumble Strips: None
- Two-Way Left Turn Lanes: None
- Lighting: None
- Automated Speed Enforcement: None

Multilane Highway Report

The report page shows a formatted version of the analysis in a dynamic form, reacting to changes in the Multilane page. All or a portion can be copied to the Windows clipboard for insertion into other files by right-clicking into the report and selecting Copy.

Both formatted and text reports are available for viewing and printing. The formatted report provides data and results that are most important to the user, and are displayed in a clean and more presentable fashion. The text report provides more details to the user, rather than a summary.

The user can switch between reports by clicking on the button found at the bottom of the Report page.

Two-Lane Highways

HCM Chapter 15

This Highway Capacity Software (*HCS*) faithfully implements the methodology prescribed in the Highway Capacity Manual (HCM) for analyzing Two-Lane Highways. Two-lane highways have one lane for use of traffic in each direction. The principal characteristic that distinguishes two-lane highway operation from that of other uninterrupted-flow facilities is that passing maneuvers take place in the opposing lane of traffic. Passing maneuvers are limited by the availability of gaps in the opposing traffic stream and by the availability of sufficient sight distance for a driver to discern the approach of an opposing vehicle safely. As demand flows and geometric restrictions increase, opportunities to pass decrease. This creates platoons within the traffic stream, with trailing vehicles subject to additional delay because of the inability to pass the lead vehicles.

Chapter 15 presents methodologies for analyzing two-lane highway operations under uninterrupted-flow conditions. Uninterrupted flow exists when there are no traffic control devices that interrupt traffic and where no platoons are formed by upstream signals or roundabouts. In general, any segment that is more than 2.0 mi from the nearest signalized intersection fits into this category. When traffic signals are less than 2.0 mi apart, the facility should be classified as an urban street and analyzed with the methodologies of Chapter 16, Urban Street Facilities, and Chapter 18, Urban Street Segments.

The methodology is most directly used to determine the LOS on a uniform directional segment of two-lane highway by estimating the service measure of Follower Density that defines LOS. Such an analysis can also be used to determine the capacity of the directional segment or the service flow rate that can be accommodated at any given LOS.

Operational Data

Geometric Data

On the Input page for a Segment analysis or the Details page for a Facility analysis, the user can choose the Coded Type, which includes the following options: Passing Constrained, Passing Zone, and Passing Lanes. Other inputs include, Measured FFS, Analyze Bicycle Results, Free-Flow Speed, Speed Limit, Lane Width, Shoulder Width, Percent Grade, Access Point Density, Pavement Condition Rating, and Percent Occupied Parking.

Checkboxes are provided for Measured FFS and Analyze Bicycle Result to indicate if they are necessary for the current analysis. When Measured FFS is checked, the Access-Point Density field is disabled, and the Free-Flow Speed field is enabled. The input for Free Flow Speed is then taken as the measured Free Flow Speed. When Analyze Bicycle Results is checked, the Pavement Condition Rating and Percent Occupied Parking fields are enabled for the user to edit. Bicycle results will also be added to both the formatted and text reports.

Demand Data

On the input page for a Segment analysis, Directional Demand, Opposing Demand, Peak Hour Factor, and Total Trucks are included as inputs for two-lane highway segments. Opposing Demand is only enabled when the Segment Coded Type selected is Passing Zone.

Segments Input

On the Segments page for a Facility analysis, the geometric and demand data can be found under the Segments Input section. In this section, the user can add, insert, or delete segments within the facility using the buttons Add Segment, Insert Segment, and Delete Segment, respectively. The Type of segment can be specified as Passing Constrained, Passing Zone, or Passing Lanes. For each segment, the corresponding segment Name, Length, Speed Limit, Directional Volume, Opposing Volume, Peak Hour Factor, and Heavy Vehicle Percentage can be entered. Opposing Volume is only enabled when the segment type selected is Passing Zone. For each segment, a Details link is also provided. Clicking the Details link for a segment will bring the user to the Details page for that specific segment.

On the Segments page for a Facility analysis, there is also a 'Map-Based Segmentation' button that will bring up a separate 'Segmentation' window for editing. Please see *Map-Based Segmentation* for details.

Subsegments

On the Input page for a Segment analysis or the Details page for a Facility analysis, the user can add, insert, or delete subsegments within the current segment using the buttons Add Subsegment, Insert Subsegment, and Delete Subsegment, respectively. The Type of each subsegment can be specified as Tangent or Horizontal Curve and the corresponding Length can also be entered. If the subsegment type selected is Horizontal Curve, the user can specify the corresponding Radius and Superelevation.

Bicycle LOS

On the Input page for a Segment analysis or the Details page for a Facility analysis, Lane Width, Shoulder Width, Speed Limit, Pavement Condition Rating, and Percent Occupied Parking are included as inputs for the evaluation of bicycle level of service.

Facility Graphic

On the Segments page for a Facility analysis, a facility graphic is provided under the Segment Input section to help better visualize the facility being analyzed. It provides information on the Segment Type, Segment Length in feet, and Segment ID. This same graphic can be found on the Details page for a Facility analysis, with the currently viewed segment being highlighted. The user can switch between segment inputs by selecting the desired segment in the graphic itself. The user also has the option of changing the color of the graphic based on difference performance measures, which include Speed and Follower Density. Selecting 'None' will leave the graphic the color of a road. A legend for different colors appears to the side of the graphic when any of the other options are selected.

Results

If the volume-to-capacity ratio is less than or equal to 1.0, follower density is used as the service measure for all two-lane highways. However, two sets of LOS thresholds are used to account for differences in driver perception between driving on higher-speed versus lower-speed highways.

On higher-speed two-lane highways (\geq 50 mi/h, \geq 80 km/h in metric), absolute speed and delay due to passing restrictions are generally both important to motorists. Higher-speed two-lane highways are most commonly encountered as inter-city connecting routes. Lower-speed two-lane highways (<50 mi/h, or <80 km/h in metric) are typically encountered as intra-city routes and in scenic and rural-developed areas. These highways generally have posted speed limits of 35-45 mi/h (or 56.3-72.4 km/h in metric) and have limited passing opportunities. Thus, for two-lane highways in these areas, high speeds are usually not expected and higher percentages of followers are generally tolerated. Consequently, the follower density thresholds for a given LOS are higher for lower-speed highways than higher-speed highways.

Level of Service (LOS) Criteria for Two-Lane Highways:					
	Follower Density (followers/mi)	Follower Density (followers/mi)			
	Higher-Speed Highways	Lower-Speed Highways			
	Posted Speed Limit ≥ 50 mi/h	Posted Speed Limit < 50 mi/h			
LOS A	≤2.0	≤2.5			
LOS B	>2.0 - 4.0	>2.5 - 5.0			
LOS C	>4.0 - 8.0	>5.0 - 10.0			
LOS D	>8.0 - 12.0	>10.0 - 15.0			
LOS E	>12.0	>15.0			

Note: LOS F exists when demand exceeds capacity.

Level of Service (LOS) Criteria for Two-Lane Highways in Metric units:

	Follower Density (followers/km)	Follower Density (followers/km)
	Higher-Speed Highways	Lower-Speed Highways
	Posted Speed Limit ≥ 80 km/h	Posted Speed Limit < 80 km/h
LOS A	≤1.2	≤1.6
LOS B	>1.2 - 2.5	>1.6 - 3.1
LOS C	>2.5 - 5.0	>3.1 - 6.2
LOS D	>5.0 - 7.5	>6.2 - 9.3
LOS E	>7.5	>9.3

Note: LOS F exists when demand exceeds capacity.

Bicycle levels of service for two-lane highway segments are based on a bicycle LOS score, which is in turn based on a traveler perception model.

Bicycle Level of Service (LOS) Criteria for Two-Lane Highway Segments:

	Bicycle LOS Score
LOS A	≤1.5
LOS B	>1.5 - 2.5
LOS C	>2.5 - 3.5
LOS D	>3.5 - 4.5
LOS E	>4.5 - 5.5
LOS F	>5.5

Safety Results

When 'Show Safety Analysis Results in Reports' is checked in the *Default Settings*, predicted crashes will be computed based on the Highway Safety Manual (HSM) methods for the corresponding road type.

Due to the structural differences between the HCM and HSM methods, certain transformations are required to convert HCM inputs into HSM inputs. Additionally, not all HSM-required data is available from HCM. Therefore, certain assumptions are included in the calculations.

The next section lists the conversion process of internal parameters, default values, and assumptions used to compute safety results in the *Highways* module for Two-Lane.

The following HCS Two-Lane inputs are internally converted to HSS as shown:

- Demand Volume (veh/h): The 'Demand Volume' is converted to 'AADT (veh/day)' by applying 'K-Factor' and 'D-Factor'. These factors can be defined by the user in the *Default Settings*. The 'Opposing Demand', applicable for Passing Zone segments, is not used internally in the safety calculations.
- Lane Width: If 'Lane Width' is entered in *Two-Lane*, no conversion is needed. An average lane width considering both directions is used. Otherwise, a base condition value of 12 ft is applied.
- Segment Length (ft): Lengths in feet are internally converted to miles.
- Grade: No conversion is needed.

• Shoulder Width: No conversion is needed.

The following inputs required in *HSS* are not used in *HCS Two-Lane*. Therefore, the base conditions are assumed in the calculation of safety results, represented by the following values:

- Horizontal Curvature: None
- Roadside Hazard Rating: 3
- Shoulder Configuration: Paved Shoulder
- Lighting: None
- Automated Speed Enforcement: None

Two-Lane Highway Report

The report page shows a formatted version of the analysis in a dynamic form, reacting to changes in the Input page for a Segment analysis or the Segments and Details pages for a Facility analysis. All or a portion can be copied to the Windows clipboard for insertion into other files by right-clicking into the report and selecting Copy.

Both formatted and text reports are available for viewing and printing. The formatted report provides data and results that are most important to the user, and are displayed in a clean and more presentable fashion. The text report provides more details to the user, rather than a summary.

The user can switch between reports by clicking on the button found at the bottom of the Report page.

How To

Create a New File

1. From the Start screen, there are three options for creating a new file:



Note: A new file can be created if an existing file is already open; you do not need to start from the Start screen.

a. Selecting *File > New* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen, hovering over "New", and then selecting one of the analysis types.

New	Ctrl+N 🔸	Multilane Segment	
Open Example Folder	Ctrl+O	Two-Lane Segment Two-Lane Facility	
Save Save As	Ctrl+S F12		Help
Close	Ctrl+W		Topics
Units	•	HIGHWAYS	HCS Updates
Print Print Preview	Ctrl+P Ctrl+F2	THOMWARD .	HCS Overview
View	+		McTrans Website
Report Import From CSV	•		<u>HCM/HCS Training</u> <u>E-mail McTrans</u>
Export To CSV			About HCS
Default Settings	Alt+F	MCS2025	Aboutries
Help	•		
Exit	Alt+F4	UF Transportation Institute UNIVERSITY of FLORIDA MCTrans	

b. Selecting "New File..." from the Start screen; this can be found below in the red box. A Select New File Type dialog box will pop up after selecting "New File..." which allows you to choose the desired analysis type.

HCS Highways		- O X
3		
Start		Help
New File	HIGHWAYS	<u>Topics</u>
Open File	HIGHWAYS	HCS Updates
Example Folder		HCS Overview
Recent		McTrans Website
		HCM/HCS Training
		E-mail McTrans
	MCS2025	About HCS
	URI Transportation Institute MCTRANS	
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c. Using the keyboard shortcut "Ctrl+N", selecting one of the analysis types from the Select New File Type dialog box, and clicking "OK"

Select New File Type	-		×	
Multilane Segment				
O Two-Lane Segment				
O Two-Lane Facility				
ОК				

- 2. Once a new file is created, you will be brought to the input page of the selected analysis type if in Page View or the input screen split with the report either on the right or the bottom of the screen if in Full View.
 - a. Page View

Tigh	vays1.xuf - HCS Highways				- 0 X			
	START INPUT REPORT				0			
			Project Properties		A			
	Analyst		Jurisdiction					
	Agency		Time Analyzed					
	Analysis Year	2024	Date	10/2/2024				
	Project Description		Units	U.S. Customary				
	Geometric Data							
	Direction 1		Direction 2					
	Number of Lanes	3	Number of Lanes	3				
	Measured FFS		Measured FFS					
	Free Flow Speed, mi/h	60.0	Free Flow Speed, mi/h	60.0				
	Median Type	Divided	Median Type	Divided				
	Lane Width, ft		Lane Width, ft					
	Right Side Clearance, ft		Right Side Clearance, ft					
	Median (Left) Side Clearance, ft		Median (Left) Side Clearance, ft					
(\leftarrow)	Access Point Density, points/mi		Access Point Density, points/mi		→ Next			
Back	Terrain Type	Level ~	Terrain Type	Level *	Next			
	Percent Grade, %		Percent Grade, %					
	Grade Length, mi		Grade Length, mi					
	Demand Data							
	Demand, veh/h	0	Demand, veh/h	0				
	Peak Hour Factor	0.94	Peak Hour Factor	0.94				
	Total Trucks, %	0.00	Total Trucks, %	0.00				
	Single-Unit Trucks (SUT), %		Single-Unit Trucks (SUT), %					
	Tractor-Trailers (TT), %		Tractor-Trailers (TT), %					
	Mixed Flow Model		Mixed Flow Model					
	Analyze Bicycle Results	V	Analyze Bicycle Results					
	Adjustment Factors							
	Driver Population	All Familiar 🗸	Driver Population	All Familiar ~				
	Capacity Adjustment Factor	1.000	Capacity Adjustment Factor	1.000				
	Creed Adjustment Easter	1.000	Speed Adjustment Easter	1.000	V North Martine 2001 and Co			
Соруп	ght © 2024 University of Florida. All Rights Reserved.				HCS [™] Highways Version 2025 (USC)			

- i. If Multilane Segment or Two-Lane Segment was selected, you will be brought to the Input page.
- ii. If Two-Lane Facility was selected, you will be brought to the Segments page.

b. Full View

	Pro	ject Properties			HCS Multil	ane Highway Report	
Analyst		Jurisdiction		Project Information			
				Analyst		Date	10/2/2024
Agency		Time Analyzed		Agency		Analysis Year	2024
Analysis Year	2024	Date	10/2/2024	Jurisdiction		Time Analyzed	
Project Description		Units	U.S. Customary	Project Description		Units	U.S. Customary
	Ger	ometric Data		Direction 1 Geometric Data			
Direction 1		Direction 2		Direction 1			1
				Number of Lanes (N), in	3 Measured	Terrain Type	Level
Number of Lanes	3	Number of Lanes	3	Measured or Base Free-Flow Speed Base Free-Flow Speed (BFFS), mi/h	Measured	Percent Grade, % Grade Length, mi	~
Measured FFS	4	Measured FFS	v	Lane Width, ft	-	Access Point Density, pts/mi	
Free Flow Speed, mi/h	60.0	Free Flow Speed, mi/h	60.0	Median Type		Left-Side Lateral Clearance (LCR), ft	
Median Type	Divided ~	Median Type	Divided ~	Free-Flow Speed (FFS), mi/h	60.0	Total Lateral Clearance (TLC), ft	
Lane Width, ft		Lane Width. ft		Direction 1 Adjustment Factors			
				Driver Population	All Familiar	Final Speed Adjustment Factor (SAF)	1.000
Right Side Clearance, ft		Right Side Clearance, ft		Driver Population SAF	1.000	Final Capacity Adjustment Factor (CAF)	1.000
Median (Left) Side Clearance, ft		Median (Left) Side Clearance, ft		Driver Population CAF	1.000		
Access Point Density, points/mi		Access Point Density, points/mi		Direction 1 Demand and Capacity			
Terrain Type	Level ~	Terrain Type	Level ~	Volume (V) veh/h	0	Heavy Vehicle Adjustment Factor (fHV)	1.000
Percent Grade. %		Percent Grade. %		Peak Hour Factor	0.94	Flow Rate (Vp), pc/h/ln	0
				Total Trucks, %	0.00	Capacity (c), pc/h/ln	2200
Grade Length, mi		Grade Length, mi		Single-Unit Trucks (SUT), % Tractor-Trailers (TT), %		Adjusted Capacity (cad), pc/h/ln Volume-to-Capacity Ratio (v/c)	0.00
	De	emand Data		Direction 1 Speed and Density	P	Volume-to-Capacity Natio (V/C)	0.00
Demand, veh/h	0	Demand, veh/h	0	Lane Width Adjustment (fiW)	-	Average Speed (S), mi/h	60.0
Peak Hour Factor	0.94	Peak Hour Factor	0.94	Total Lateral Clearance Adj. (fLLC)		Density (D), pc/mi/ln	0.0
Total Trucks. %	0.00	Total Trucks. %	0.00	Median Type Adjustment (fM)	-	Level of Service (LOS)	A
				Access Point Density Adjustment (fA)	-		
Single-Unit Trucks (SUT), %		Single-Unit Trucks (SUT), %		Direction 1 Bicycle LOS			
Tractor-Trailers (TT), %		Tractor-Trailers (TT), %		Flow Rate in Outside Lane (vOL), veh/h	0	Effective Speed Factor (St)	4.62
Mixed Flow Model		Mixed Flow Model		Effective Width of Volume (Wv), ft	36	Bicyle LOS Score (BLOS)	0.00
Analyze Bicycle Results	v	Analyze Bicycle Results	1	Average Effective Width (We), ft	42	Bicycle Level of Service (LOS)	A
		stment Factors		Direction 2 Geometric Data	I		
			AN 8	<			
Driver Population	All Familiar ~	Driver Population	All Familiar 🗸	P	Switch to Text Repo	et.	B = -8

Open an Existing File

1. From the Start screen, there are six options for opening an existing file:

HCS Highways		- 🗆 X
=		
Start		Help
New File		Topics
Open File	Highways	HCS Updates
Example Folder		HCS Overview
Recent		McTrans Website
		HCM/HCS Training
		E-mail McTrans
	MCS2025	About HCS
	UF Transportation Institute McTrans	SLEP
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Note: A file can be opened even if another file is currently open; you do not need to start from the Start screen.

a. Selecting *File > Open* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen and then selecting "Open"

HCS Highways			- 0
New	Ctrl+N 🔸		
Open	Ctrl+O		
Example Folder			
Save	Ctrl+S		
Save As	F12		Help
Close	Ctrl+W		Topics
Units	×	HIGHWAYS	HCS Updates
Print	Ctrl+P	THOMAIS	HCS Overview
Print Preview	Ctrl+F2		McTrans Website
View	•		
Report	÷.		HCM/HCS Training
Import From CSV			E-mail McTrans
Export To CSV			About HCS
Default Settings	Alt+F	🌌 HCS2025	
Help	•	Transportation Institute	A 10
Exit	Alt+F4	UF Transportation Institute McTrans	
oyright © 2024 Universit	ty of Florida. All R	ight	HCS™ Highways Version 2

b. Selecting "Open File..." from the Start screen; this can be found below in the red box

HCS Highways		- 0 X
=		
	13	
Start		Help
New File		Topics
Open File	Highways	HCS Updates
Example Folder		HCS Overview
Recent		McTrans Website
		HCM/HCS Training
		E-mail McTrans
	E uccanas	About HCS
	MCS2025	1.01
	UF Transportation Institute McTrans	
	UNIVERSITY OF FLORIDA	
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c. Using the keyboard shortcut "Ctrl+O"

d. Selecting a file under the Recent files list from the Start screen; this can be found below in the red box

HCS Highways		- 0 X
	110	
Start New File Open File Example Folder Recent Multifunct-Evetaneti		Help Topics HCS Updates HCS Downiew McTana: Wabsite HCM/HCS Training
Twolane1-LevelStraig Twolane2-EasingCon Twolane3-EaclityAnal Twolane4-EaclityAnal	Highways	E-mail McTrans About HCS
	ACS2025	100
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e. Selecting *File > Example Folder* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen and then selecting "Example Folder". Opening the example folder will open the path of the HCS example files in File Explorer. The desired example file can be double-clicked or right-clicked and selecting 'Open', which will open the example file in the Highways program.

New	Ctrl+N		
Open	Ctrl+O		
Example Folder			
Save	Ctrl+S		
Save As	F12		Help
Close	Ctrl+W	Highways	Topics
Units	•	HIGHWAYS	HCS Updates
Print	Ctrl+P	Indiwars	HCS Overview
Print Preview	Ctrl+F2	-	McTrans Website
View		-	
Report	•		HCM/HCS Training
Import From CSV			E-mail McTrans
Export To CSV			About HCS
Default Settings	Alt+F	MCS2025	
Help	•	Transportation Institute	
Exit	Alt+F4	UF Transportation Institute UNIVERSITY of FLORIDA	

f. Selecting "Example Folder..." from the Start screen; this can be found below in the red box. Opening the example folder will open the path of the HCS example files in File Explorer. The desired example file can be double-clicked or right-clicked and selecting 'Open', which will open the example file in the Highways program.

HCS Highways		- O X
	AN AN	
Start		Help
New File		Topics
Open File	HIGHWAYS	HCS Updates
Example Folder		HCS Overview
Recent		McTrans Website
		HCM/HCS Training
		E-mail McTrans
	-	About HCS
	MCS2025	
	UF Transportation Institute McTrans	1.50
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- 2. Once an existing file is opened, you will be brought to the corresponding input page if in Page View or the input screen split with the report either on the right or the bottom of the screen if in Full View
 - a. Page View

	tr					7.00						
					Project Prop							
Analyst					Juri	sdiction						
Agency					Tim	e Analyzed						
Analysis Year	2024				Dat	e			9/9/2024			
Project Description	Chapter 26:	Example Problem			Uni	ts			U.S. Customary			
Analyze Bicycle Results					2+1	Highway (Super 2)						
					Segments Glob	al Inputs						
Free Flow Speed, mi/h	60.0					ed Limit, mi/h			50			
Peak Hour Factor	0.94					leavy Vehicles			0.00			
Directional Demand, veh/n	0					oosing Demand, veh/h			0			
Lane Width, ft	12					ulder Width (Paved), ft			6			
Access Point Density, points/mi	0.0				Gra	de, %			0.00			
A	dd Segment.				Segments I Map-Based Segments Insert Segme	intation				Delet	e Segment	
	Type	Name	Length, ft	Speed Limit, mi/h	Directional Demand, veh/h	Opposing Demand, weh/h	PHF	Grade,%	Heavy Vehicles (%)	Segment Details		
	1 Passing Constrained		3960	55	850	-	0.94	0.00	8.00	Details	1	
			7920	55	825		0.95	0.00	8.00	Details		
	2 Passing Lanes								0.00		-	
			5280 2640	55	820 800	500	0.95	0.00	8.00	Details Details	-	
	2 Passing Lanes 3 Passing Constrained		5280	55	820	- 500	0.95	0.00		Details	-	
	2 Passing Lanes 3 Passing Constrained 4 Passing Zone	Faci	5280 2640 9240 ity	55 55 55 PC	820 800	- PZ	0.95	0.00	7.50	Details Details	-	
	2 Passing Lanes 3 Passing Constrained 4 Passing Zone	Facil	5280 2640 9240 ity	55 55 55 PC 3960	820 800 795 PL PC	- PZ	0.95	0.00 0.00 0.00 PC	7.50	Details Details		
	2 Passing Lanes 3 Passing Constrained 4 Passing Zone	Facil	5280 2640 9240 ity	55 55 55 PC 3960	820 800 795 PL PC 7920 52	PZ 2640	0.95	0.00 0.00 0.00 PC 9240	7.50	Details Details		
	2 Passing Lanes 3 Passing Constrained 4 Passing Zone	Facil	5280 2640 9240 ity	55 55 55 PC 3960	820 800 795 PL PC 7920 52	PZ 2640	0.95	0.00 0.00 0.00 PC 9240	7.50	Details Details		
	2 Passing Lanes 3 Passing Constrained 4 Passing Zone	Facil	5280 2640 9240 ity 	55 55 55 PC 3960	820 800 795 PL PC 7920 52	PZ 2640	0.95	0.00 0.00 0.00 PC 9240	7.50	Details Details		

b. Full View

				_	Project Prog	and the second se							14	CS Two	Lane High	way Eac	ility D	aport		
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nalyst						isdiction				Anah		mation				Date			9/9/2024	
gency					Tin	ne Analyzed				Ager			+			Analysis Year	-		2024	
nalysis Year		2	024		Da	te	9,	/9/2024			diction		-			Time Analyze	ed			
roject Description		C	hapter 26: Exa	ample Problem 3	Un	its	U.	S. Customary		Facili	ty Name					Units			U.S. Custor	imary
nalyze Bicycle Resu	ilts		7		2+	1 Highway (Super 2)		1		Proje	ct Descripti	ion	Ch	apter 26: Exar	mple Problem 3					
nanyze orcycle nesu	21(3		-					1		Faci	lity Segm	ent Data								
					Segments Glob					No.	Nam	е Туре		Length	Lane Width		ler Width	Speed	Limit Acco	cess Point Densi pts/mi
ree Flow Speed, mi/	i/h	6	0.0		Sp	eed Limit, mi/h	5	0		1		Passin		3960	12		6	5		0.0
eak Hour Factor	1		.94		%	Heavy Vehicles	0	00			<u> </u>	Constrai			_			_		
irectional Demand,	, veh/h				Op	posing Demand, veh/h	0			2		Passing L	_	7920 5280	12	_	6	5	-	0.0
ane Width, ft			2		Shi	oulder Width (Paved), ft	6			3		Passin Constrai		5280	12		0	,		0.0
ccess Point Density		_			64	ade. %				-4		Passing 2	lone	2640	12		6	5		0.0
			.0		Gia	sue, 70		00		5		Passin Constrai		9240	12		6	5		0.0
ccess Point Density,																				
ccess Point Density,												Constant	inco	Sean	nent 1. Pass	ing Const	trained			
ccess Point Density,					Select All 🔲 Apply	Global Inputs					emand		PHF		nent 1: Pass	D/C S	Speed	*	Follower De	ensity LO
ccess Point Density,					Select All 🔲 Apple Segments						veh/h	Opp. Demand veh/h	PHF	%HV	Capacity veh/h	D/C S	Speed mi/h	Followers	followers/r	mi/In
ccess Point Density,						Input						Opp. Demand		%HV 8.00	Capacity veh/h 1700	D/C 5	Speed mi/h 58.8	% Followers 69.7	Follower De followers/r 10.7	mi/In
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Save a File

- 1. There are five options for saving an open file:
 - a. Selecting *File* > *Save* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen and then selecting "Save"

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iopyright © 2024 University of Florida. All Rights Reserved.	Соруг	Search Adjustment Pastor ight © 2024 University of Florida. All Rights Reserved.	1.000	Sneed Adjustment Easter		HCS** Highways Version 2025	(USC)

b. Selecting *File > Save As...* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen and then selecting "Save As..."

START INPUT REPORT					
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- c. Using the keyboard shortcut "Ctrl+S" for Save
- d. Using the keyboard shortcut "F12" for Save As
- e. Exiting the program or closing the file without saving changes beforehand; this will prompt you to save changes to the file before anything is closed



- i. Selecting "Yes" will save the file if it is an existing file. If the file has not been previously saved, the Save As dialog box will pop up allowing you to change the file name and save it.
- ii. Selecting "No" will exit the program or close the file without saving the file
- iii. Selecting "Cancel" will prevent the file from closing

Note: Using Save with an existing file will save a file without prompting you to specify a file name. Using Save with a new file will bring up the Save As dialog box for you to specify a file name for saving. Using Save As will always bring up the Save As dialog box for you to specify a file name for saving.

Close a File

1. There are three options for closing an open file:

a. Selecting *File > Close* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen and then selecting "Close"

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Single-Unit Trucks (SUT), %		Single-Unit Truck			
Tractor-Trailers (TT), %		Tractor-Trailers (T	T), % -		
Mixed Flow Model		Mixed Flow Mode	H 🔲		
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		Adjustment Factors			
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- b. Using the keyboard shortcut "Ctrl+W"
- c. Exiting the program itself; please see How To: Exit the Program

Exit the Program

1. From the Start screen, there are three options for exiting the program:



Note: The program can be exited even if a file is still open; you do not need to start from the Start screen.

a. Selecting *File* > *Exit* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen and then selecting "Exit"

New	Ctrl+N		
Open Example Folder	Ctrl+O		
Save	Ctrl+S		
Save As	F12		Help
Close	Ctrl+W		Topics
Units	•	Highways	HCS Updates
Print	Ctrl+P	THOMMAIS	HCS Overview
Print Preview	Ctrl+F2		McTrans Website
View	•		HCM/HCS Training
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Import From CSV Export To CSV			E-mail McTrans
	Alt+F	HCS 2025	About HCS
Default Settings		A HCS2025	
Help	,	UF Transportation Institute McTrans	
Exit	Alt+F4	UNIVERSITY of FLORIDA	

- b. Using the keyboard shortcut "Alt+F4"
- c. Selecting "X" in the top right-hand corner of the screen; this can be found below in the red box

HCS Highways		- 🗆 🗙
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Start		Help
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	MCS2025	About HCS
	UF Transportation Institute McTrans	S. S
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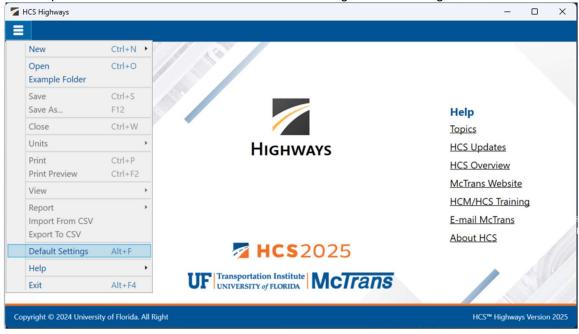
Edit the Default Settings

1. From the Start screen, there are two options for editing the Default Settings:



Note: The Default Settings can be changed even if an existing file is already open; you do not need to start from the Start screen.

a. Selecting *File > Default Settings* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen and then selecting "Default Settings"



b. Using the keyboard shortcut "Alt+F"

2. Opening the Default Settings will cause a Default Settings window to pop up:

Analyst	
Agency	
Jurisdiction	
New File Default Units	
USC O Metric	
Safety Analysis	
Show Safety Analysis Results in F	Reports
K-Factor: 0.10	
D-Factor: 0.55	

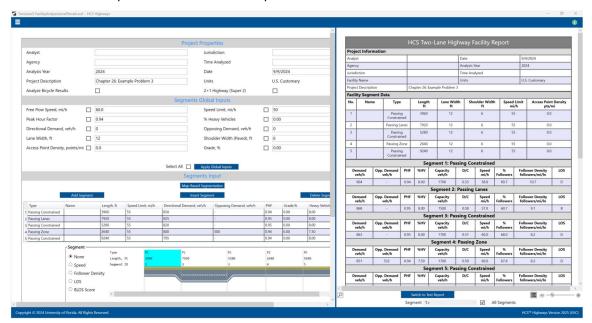
- 3. Settings
 - a. You can specify Analyst, Agency, and Jurisdiction by clicking in the corresponding text boxes and typing the desired text.
 - b. Under 'Units', you are given the option of running the analysis in either U.S. Customary (USC) or *SI (Metric)* units.
 - c. Under 'Safety Analysis', you are given the option of displaying safety analysis results in reports.
 - i. Show Safety Analysis Results in Reports: If this is checked, a section for safety analysis results will be displayed in the text report.
 - ii. K-Factor: The value indicated in this textbox will apply to the safety calculations if results are shown
 - iii. D-Factor: The value indicated in this textbox will apply to the safety calculations if results are shown
- 4. Clicking "OK" will save the changes made and close the Default Settings window; clicking "Cancel" will close the Default Settings window without saving any changes.
 - a. When a new file is created, the Analyst, Agency, and Jurisdiction fields will automatically be populated with the text specified in the Default Settings.
 - b. When starting a new file, the inputs and results will display according to the units specified in the Default Settings.
 - c. When viewing the text report, safety results will be displayed or hidden depending on what is checked in the Default Settings.
 - i. If the desired selection indicates to show safety results, it is important to note that they will only update after saving the file.
 - 1. If a new file is created, the safety results section will at first be hidden.
 - 2. If inputs are changed in an existing file, it will be necessary to save the file first before the safety results will update.

Change the View

- 1. When a file is open, there are three main options for the view of the program:
 - a. Page View: the input and results reports are separated into pages as seen below. You can navigate between pages using the "Back" and "Next" buttons or by clicking the page names found at the top of the screen.

START SEGMENTS DETAILS REPORT												_	0
START SEGMENTS DETAILS REPORT													
					Project Prop								
Analyst					Jurisdiction								
Agency					Tin	Time Analyzed							
Analysis Year	2024				Da	Date 9/9/			9/9/2024	9/2024			
Project Description	Chapter 26: Example Problem 3		3		Units			U.S. Customary					
Analyze Bicycle Results					2+1 Highway (Super 2)								
					Segments Glob	oal Inputs							
Free Flow Speed, mi/h	, mi/h 🔲 60.0				Speed Limit, mi/h				50				
Peak Hour Factor	0.94				% 1	Heavy Vehicles				.00			
Directional Demand, veh/h	0				Op	posing Demand, veh/h			0				
Lane Width, ft	12				Shi	oulder Width (Paved), ft			6				
Access Point Density, points/mi	0.0				Gra	ade, %			0.00				
Add	Segment				Map-Based Segm Insert Segm					Delete	Segment		
	Type	Name	Length, ft Speer	ed Limit, mi/h	Directional Demand, weh/h	Opposing Demand, weh/h	PHF	Grade,%	Heavy Vehicles (%)	Segment Details			
	1 Passing Constrained	1	3960 55		850	-	0.94	0.00	8.00	Details			
	2 Passing Lanes	4	7920 55 5280 55		825 820	*	0.95	0.00	8.00	Details			
	3 Passing Constrained 4 Passing Zone					-	0.95	0.00	8.00	Details			
	3 Passing Constrained 4 Passing Zone 5 Passing Constrained		2640 55 9240 55		800 795	- 500 -	0.95 0.94 0.94	0.00 0.00 0.00	8.00 7.50 8.00				
	4 Passing Zone	Fac	2640 55 9240 55 ility		800 795	-	0.94	0.00	7.50	Details Details			
	4 Passing Zone	Fac Type	2640 55 9240 55 ility e PC		800 795 PL P	С РД	0.94	0.00 0.00 PC	7.50	Details Details			
	4 Passing Zone	Fac Type Leng	2640 55 9240 55 ility		800 795 PL P	C PZ 280 2540	0.94	0.00	7.50	Details Details			
	4 Passing Zone	Fac Type Leng	2640 55 9240 55 ility e PC gth, ft 3960		800 795 PL P 7928 S	C P2 280 2640	0.94	0.00 0.00 PC 9240	7.50	Details Details			
	4 Passing Zone	Fac Type Leng	2640 55 9240 55 ility e PC gth, ft 3960		800 795 PL P 7928 S	C P2 280 2640	0.94	0.00 0.00 PC 9240	7.50	Details Details			
	4 Passing Zone	Fac Type Leng Segr	2640 55 9240 55 illity eth, ft 3960 sent ID 1		800 795 PL P 7928 S	C P2 280 2640	0.94	0.00 0.00 PC 9240	7.50	Details Details			
	4 Passing Zone	Fac Type Leng	2640 55 9240 55 illity eth, ft 3960 sent ID 1		800 795 PL P 7928 S	C P2 280 2640	0.94	0.00 0.00 PC 9240	7.50	Details Details			

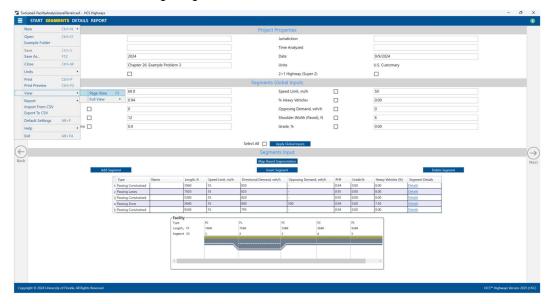
b. Full View with the report on the right of the screen: the screen is split with all inputs on the left side and the results reports on the right side. You can access all inputs and view all of the current report by using the corresponding scroll bars. There is also a screen splitter that can be moved to adjust the views of the input screen and results report.



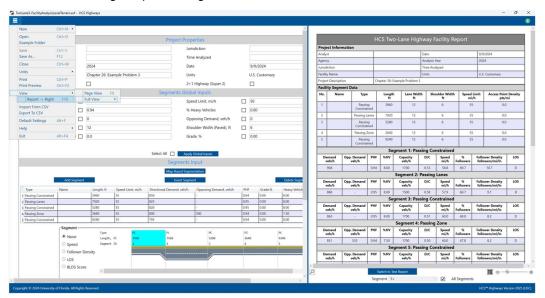
c. Full View with the report on the bottom of the screen: the screen is split with all inputs on the top of the screen and the results reports on the bottom of the screen. You can access all inputs and view all of the current report by using the corresponding scroll bars. There is also a screen splitter that can be moved to adjust the views of the input screen and results report.

				Project Properties					
Analyst				Jurisdiction					
Agency				Time Analyzed					
Analysis Year	ysis Year 2024			Date	9/9/2024				
Project Description Chapter 26: Example Problem 4				Units	U.S. Customary				
				Geometric Data					
Direction 1	EB			Direction 2	WB				
Number of Lanes		2		Number of Lanes	2				
Measured FFS				Measured FFS					
		52.0							
Base Free Flow Speed, mi/h				Base Free Flow Speed, mi/h	52.0				
Median Type		TWLTL		Median Type	TWLTL ~				
inalyst		Date Analysis Year	9/9/2024 2024						
igency urisdiction		Analysis Year Time Analyzed	2024						
Project Description	Chapter 26: Example	Units	U.S. Customary						
roject beschption	Problem 4	UTINS	o.s. customary						
Direction 1 Geometric Data	-								
	EB	1							
Direction 1	2	Terrain Type Percent Grade, %	Specific Grade -3.50						
Number of Lanes (N), In	Base 52.0	Grade Length, mi	-3.50						
Number of Lanes (N). In Measured or Base Free-Flow Speed		Access Point Density, pts/mi	10.0						
Number of Lanes (N), In Measured or Base Free-Flow Speed Base Free-Flow Speed (BFFS), mi/h									
Number of Lanes (N). In Measured or Base Free-Flow Speed	12.0 TWLTL	Left-Side Lateral Clearance (LCR), ft	6						
Number of Lanes (N), In Measured or Base Free-Flow Speed Base Free-Flow Speed (BFFS), mi/h ,ane Width, ft	12.0	Left-Side Lateral Clearance (LCR), ft Total Lateral Clearance (TLC), ft	6 12						
Number of Lanes (N). In Measured or Base Free-Flow Speed Base Free-Flow Speed (BFFS), mi/h ane Width, ft Median Type	12.0 TWLTL 49.5								
Number of Lanes (N), In Measured or Base Free-Flow Speed Base Free-Flow Speed (BFFS), mi/h ane Width, ft Median Type ree-Flow Speed (FFS), mi/h	12.0 TWLTL 49.5 All Familiar								
Number of Lanes (N), In Measured or Base Free-Flow Speed Base Free-Flow Speed (BFFS), mi/h .ane Width, fit Median Type ree-Flow Speed (FFS), mi/h Direction 1 Adjustment Factors	12.0 TWLTL 49.5	Total Lateral Clearance (TLC), ft	12						

- 2. Views can be changed by using the main menu items or the keyboard shortcuts.
 - a. Main Menu Items
 - i. To switch to Page View, select *File > View > Page View* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen, hovering over "View", and then selecting "Page View".



ii. To switch to Full View with the report on the right of the screen, select *File > View > Full View > Report -> Right* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen, hovering over "View", hovering over "Full View", and then selecting "Report -> Right".



iii. To switch to Full View with the report on the bottom of the screen, select *File > View > Full View > Report -> Bottom* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen, hovering over "View", hovering over "Full View", and then selecting "Report -> Bottom".

New Ctrl+N										
Open Ctrl+O	-									
Example Folder				Project Properties						
Save Ctrl+S				Jurisdiction						
Save As F12				Time Analyzed						
Close Ctrl+W		2024		Date	9/9/2024					
Units		Chapter 26: Example Problem 4		Units	U.S. Customary					
Print Ctrl+P		Chapter 26. Example Problem 4			0.5. Customary					
Print Preview Ctrl+F2				Geometric Data						
	Page View F9	EB		Direction 2	WB					
Report -> Right F10	Full View	2		Number of Lanes	2					
Report -> Bottom F11 Export To CSV				Measured FFS						
Default Settings Alt+F		52.0		Base Free Flow Speed, mi/h	52.0					
		TWLTL		 Median Type 	TWLTL					
Help Exit Alt+F4		TWEIL		wedian type	TWUL V					
Analyst		Date	9/9/2024							
Agency		Analysis Year	2024							
Jurisdiction		Time Analyzed								
	Chapter 26: Example Problem 4		2024 U.S. Customary	-						
Jurisdiction	Chapter 26: Example Problem 4	Time Analyzed								
Jurisdiction Project Description	Problem 4 EB	Time Analyzed	U.S. Customary							
Jurisdiction Project Description Direction 1 Geometric Data Direction 1 Number of Lanes (N), In	E8 2	Time Analyzed Units Terrain Type	U.S. Customary Specific Grade							
Jurisdiction Project Description Direction 1 Geometric Data Direction 1 Number of Lanes (N), In Measured or Base Free-Flow Speed	Problem 4 E8 2 Base	Time Analyzed Units Terrain Type Percent Grade, %	U.S. Customary Specific Grade -3.50							
Jurisdiction Project Description Direction 1 Geometric Data Direction 1 Number of Lanes (N), In Measured or Base Free-Flow Speed Base Free-Flow Speed (BFFS), mi/h	Problem 4 E8 2 Base 52.0	Time Analyzed Urits Terrain Type Percent Grade, % Grade Length; mi	U.S. Customary Specific Grade -3.50 1.25							
Jurisdiction Project Description Direction 1 Geometric Data Direction 1 Number of Lanes (N), In Measured or Base Free-Flow Speed Base Free-Flow Speed (BFFS), mi/h Lane Width, ft	Problem 4 EB 2 Base 52.0 12.0	Time Analyzed Urits Ternin Type Percent Grade, % Grade Length, mi Access Foint Density, pts/mi	U.S. Customary Specific Grade -3.50 1.25 10.0							
Jurisdiction Project Description Direction 1 Geometric Data Direction 1 Number of Lanes (N), In Measured or Base Free-Flow Speed Base Free-Flow Speed (BFFS), mU/h Lane Width, fit Median Type	Problem 4 EB 2 2 Base 52.0 12.0 TWUTL	Time Analyzed Units Percent Grade, % Grade Length, mi Access Pairc Dennity, ptt/mi Left: Side Lateral Charance (LCR), ft	U.S. Customary Specific Grade -3.50 1.25 10.0 6							
Jurisdiction Project Description Direction 1 Geometric Data Direction 1 Number of Lanes (M), In Measured or Base Free-Flow Speed Base Free-Flow Speed (BFS), mi/h Lane Width, ft Median Type Free-Flow Speed (FFS), mi/h	Problem 4	Time Analyzed Urits Ternin Type Percent Grade, % Grade Length, mi Access Foint Density, pts/mi	U.S. Customary Specific Grade -3.50 1.25 10.0							
Jurisdiction Project Description Direction 1 Geometric Data Direction 1 Number of Lanes (N), In Measured or Base Free-Flow Speed Base Free-Flow Speed (BFFS), mU/h Lane Width, fit Median Type	Problem 4	Ime Analyzed Units Terram Type Percent Gasla, % Grade Length, mi Access Siriel Density, pt/mi Left: Side Lateral Clearance (EOL), ft Sold Lateral Clearance (EOL), ft	U.S. Customary Specific Grade -3.50 1.25 10.0 6							
Juridiction Project Discription Direction 1 Geometric Data Direction 1 Number of Lanes (N), In Maaured of Base Free-Tion Speed Base Free-Tion Speed (IFS), mich Direction 1 Speed (IFS), mich Direction 1 Adjustment Fact	Problem 4 E8 2 Base 52.0 12.0 TWTL 49.5	Time Analyzed Units Percent Grade, % Grade Length, mi Access Pairc Dennity, ptt/mi Left: Side Lateral Charance (LCR), ft	U.S. Customary Specific Grade -3.50 1.25 10.0 6 12							
Juridiction Project Description Direction 1 Geometric Data Direction 1 Number of Lanes (PL), In Manared or Base Free Flow Speed Ease Free Flow Speed (BFS), mich Lane Wohl, R Madian Type Tree-Teo Speed (FS), mich Direction 1 Adjustment Fact Direction 1 Adjustment Fact	Problem 4 EB 2 Base 32.0 12.0 70/11 49.5 39.5 OF Jeansity	Time Analyzed Uolts Percent Grade, % Grade Longth, mi Access Foice Density, pty/mi Left: Sde Lateral Clearance (EC), It Total Lateral Clearance (EC), It Final Speed Adjustment Factor (SAI)	U.S. Customary Specific Grade -2.50 1.25 10.0 6 12. 1.000							

b. Keyboard Shortcuts

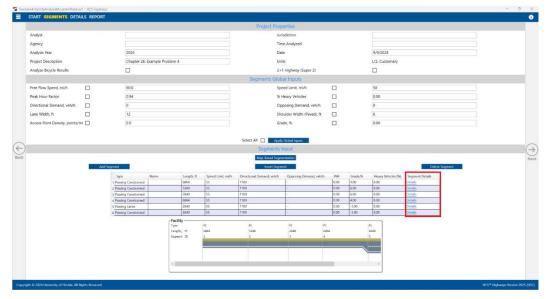
- i. Page View: keyboard shortcut is "F9"
- ii. Full View with report on the right of the screen: keyboard shortcut is "F10"
- iii. Full View with report on the bottom of the screen: keyboard shortcut is "F11"

Create a Horizontal Curve

- 1. There are two options for creating a horizontal curve in a Two-Lane Facility analysis.
 - a. Add a curve through the segment input table
 - i. In the current Two-Lane Facility analysis, there is a Segments Input section on the Segments page.

					Project Prop	erties						
Analyst					Juri							
Agency				Time Analyzed								
Analysis Year	2024								9/9/2024			
Project Description		Example Problem 4								Customary		
Analyze Bicycle Results				2+1 Highway (Super 2)								
Pringle outer results					Segments Glob							
Free Flow Speed, mi/h	60.0				CONTRACTOR CONTRACTOR	ed Limit, mi/h			50			
Peak Hour Factor	60.0					ed Limit, myn Ieavy Vehicles			0.00			
	0.94											
Directional Demand, veh/h						oosing Demand, veh/h			0			
Lane Width, ft	12					ulder Width (Paved), ft			6			
Access Point Density, points/mi	0.0				Gra	de, %			0.00			
	Segment				Inset Segm							
Add	Security				man sogn	with a second				Delete 1	egnent	
Add	Type	Name		eed Limit, migh	Directional Demand, velv/h	Opposing Demand, which	PHF	Grade,%	Heavy Vohiclas (%)	Sogmont Details	egnent	
Add	Type 1 Passing Constrained	Name	6864 55		Directional Demand, velv/h 1100		0.90	4.00	8.00	Segment Details	egment	
Add	Type	Name			Directional Demand, velv/h					Sogmont Details	egment	
Add	Type 1 Passing Constrained 2 Passing Constrained 3 Passing Constrained 4 Passing Constrained	Name	6864 55 5280 55 2640 55 6864 55		Directorial Demand, whyfit 1100 1100 1100 1100		0.90	4.00 6.00 6.00 4.00	8.00 8.00 8.00 8.00 8.00	Segment Details Ortails Ortails Ortails Details Details	egment	
	Type 1 Passing Constrained 2 Passing Constrained 3 Passing Constrained 4 Passing Constrained 5 Passing Lanes	Name	6864 55 5280 55 2640 55 6864 55 6864 55 2640 55		Directional Demand, weight 1100 1100 1100 1100 1100		0.90 0.90 0.90 0.90 0.90	4.00 6.00 6.00 4.00 -3.00	8.00 8.00 8.00 8.00 8.00 8.00	Segment Details Cortails Cortails Cortails Octails Details	icgment	
Add	Type 1 Passing Constrained 2 Passing Constrained 3 Passing Constrained 4 Passing Constrained		6864 55 5280 55 2640 55 6864 55 2640 55 2640 55 2640 55 2640 55		Directorial Demand, whyfit 1100 1100 1100 1100		0.90	4.00 6.00 6.00 4.00	8.00 8.00 8.00 8.00 8.00	Segment Details Ortails Ortails Ortails Details Details	kigment -	
	Type 1 Passing Constrained 2 Passing Constrained 3 Passing Constrained 4 Passing Constrained 5 Passing Lanes	Facil Type Long	6864 55 5280 55 2640 55 6864 55 2640 55 2640 55 ity		Directional Demand, weight 1100 1100 1100 1100 1100		0.90 0.90 0.90 0.90 0.90 0.90	4.00 6.00 4.00 -3.00 -3.00	8.00 8.00 8.00 8.00 8.00 8.00	Segment Details Cortails Cortails Cortails Octails Details	igmité	
68	Type 1 Passing Constrained 2 Passing Constrained 3 Passing Constrained 4 Passing Constrained 5 Passing Lanes	Facil Type Long	6864 55 5280 55 2640 55 6864 55 2860 55 2860 55 ity Pc chr, eft case		Directional Demand, whyth 1100 1100 1100 1100 1100 1100 1100 PC	Copioning Demand, which	0.90 0.90 0.90 0.90 0.90 0.90	4.00 6.00 4.00 -3.00 -3.00	8.00 8.00 8.00 8.00 8.00 8.00 8.00 8.00	Segment Details Cortails Cortails Cortails Octails Details	rgmont -	

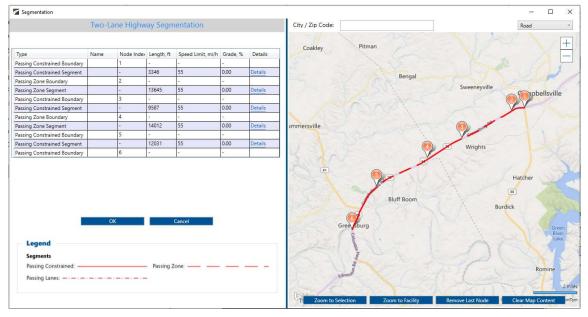
ii. In the data grid, select the "Details" link of the desired segment. This will cause the Details page of the selected segment to open.



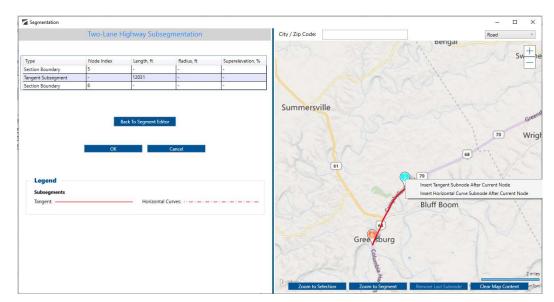
- 1. The Details page can also be accessed by selecting the Details page at the top bar. The desired segment can then be selected by clicking on the segment in the facility graphic at the top of the page.
- iii. Under the Subsegments section, add a subsegment to the segment by clicking the "Add Subsegment" button.

START SEGMENTS DETAILS REPO	RT								
		iegment Speed Follower Density LOS BLDS Score	Type Length, ft Segment ID	PC 0854 1	PC 5280 2	PC 2649 3	РС сеос 4		
	Ļ			G	eometric Data				
Coded Type	Passing Constrain	d			Length Used in Cal	lculation, mi	1.30		
Measured FFS					Analyze Bicycle Re	sults			
Free Flow Speed, mi/h					Speed Limit, mi/h		55		
Lane Width, ft	12			Shoulder Width (Pa	aved), ft	6			
Grade, %	4.00				Access Point Densi	ty, points/mi	0.0		
Pavement Condition Rating					Percent Occupied I	Parking, %	·		
					Subsegments				
	ld Subsegment				Insert Subsegment			Delete Subsegnient	
	Type 1 Tangent	1	angth, ft 864		Radius fr		Superelevation, %	-	
	2 Horizontal Curve	3864 3000			850 2.0				

- iv. In the data grid, select "Horizontal Curve" for the Type. Edit the Length, Radius, and Superelevation as necessary.
- b. Map-Based Segmentation



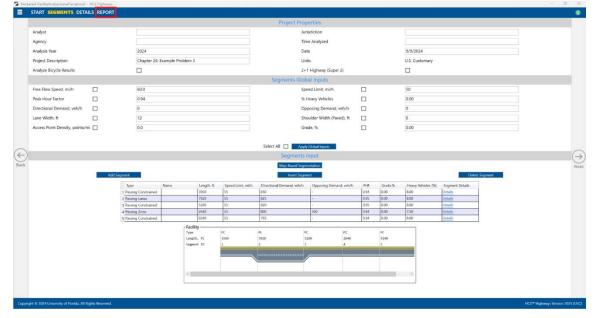
- i. Create the entire facility using the Map-Based Segmentation functionality. This function can be accessed in the Two-Lane Facility analysis by selecting the 'Map-Based Segmentation' button found under the Segments Input section on the Segments page.
- ii. After creating the facility using the map, access the Subsegment Editor by clicking on the "Details" link of the desired segment.
- iii. In the Subsegment Editor, right-click on the beginning boundary node of the segment and select "Insert Horizontal Curve Subnode After Current Node".



- iv. Drag the subnode to the correct location and edit Radius and Superelevation in the data grid.
- v. Please see *Map-Based Segmentation* in the glossary for more details.

View Results of the Analysis

- 1. After editing all the necessary inputs, results of the analysis can be found in the form of reports. Reports can be found on the Report page if using Page View or on the results portion of the split screen if using Full View.
 - a. Page View with Report page displayed



b. Full View with the report on the right of the screen

								~											
				Project Prop	oerties							н	CS Two	o-Lane Hig	hway	Facility F	leport		
Analyst				Jur	isdiction			1	Proje	ct Inform	nation								
gency				Tin	te Analyzed				Analys	t)					Date			9/9/2024	
		202.1							Agency						Analysis		_	2024	
nalysis Year		2024		Dat			9/2024		Jurísdir			_			Time An	alyzed			
roject Description		Chapter 26: E	xample Problem 3	Uni	its	0.9	5. Customary	6		Name		-		xample Problem	Units			U.S. Customary	
nalyze Bicycle Resul	lts			2+	1 Highway (Super 2)		1				ent Data	Chi	apter 26: E	ample Problem					_
				Segments Glob	al Inputs				No.	Name		. 1	Length	Lane Wid	ath Sł	houlder Widtl	h Speed L	imit Access Poin	nt De
ree Flow Speed, mi/	h 🗆	60.0		Spr	eed Limit, mi/h	50)					_	ft	ft	_	ft	mi/i		_
Peak Hour Factor		0.94		96.0	Heavy Vehicles		00		1		Passir Constrai	ined	3960	12		6	55	0.0	0.
Directional Demand.		0			posing Demand, veh/h				2		Passing L	anes	7920	12		6	55	0.0	0
									3		Passir Constra		5280	12		6	55	0.0	0
Lane Width, ft		12			oulder Width (Paved), ft	6			4		Passing		2640	12	-	6	55	0.0	0
Access Point Density,	, points/mi	0.0		Gra	ide, %	0.	00	_	5		Passir Constrai	g	9240	12	+	6	55	0.0	0
											Constra	100	Sar	gment 1: Pa	ssing Cr	onstrainer			-
				Select All Apply	r Global Inputs				Der	nand	Opp. Demand	PHF	%HV	Capacity	D/C	Speed	5	Follower Density	
				Segments I	Input					nh/h	veh/h	10000		veh/h		mi/h	Followers	followers/mi/In	
				Map-Based Segm	entation					04		0.94	1.12.2.2.2.2.2	1700 Segment 2:	0.53	58.8	69.7	10.7	
	Add Segme	4		Insert Segm	ent			Delete Segm		nand	Opp. Demand	PHF	%HV	Capacity	D/C	Speed	5	Follower Density	T
Туре	Name	Length, ft	Speed Limit, mi/h	Directional Demand. veh/h	Opposing Demand, veh/h	PHF	Grade,%	Heavy Vehick		eh/h 168	veh/h	0.95	8.00	veh/h 1500	0.58	mi/h 57.9	Followers 60.7	followers/mi/In 9.1	-
Passing Constrained		3960	55	850	-	0.94	0.00	8.00	-	65		0.95		ment 3: Par				9.1	-
Passing Lanes		7920	55	825	8	0.95	0.00	8.00	Der	nand	Opp. Demand	PHF	%HV	Capacity	D/C	Speed	N	Follower Density	T
Passing Constrained Passing Zone		5280 2640	55	820	500	0.95	0.00	8.00	v	nh/h	veh/h	1635655	1.000	veh/h	1000	mi/h	Followers	followers/mi/In	
Passing Constrained		9240	55	795		0.94	0.00	8.00	8	63		0.95	8.00	1700	0.51	60.0	68.0	8.2	
	-Segment -					1						PHF	L avenue L	Segment 4:		-			
	None	Type	PC	PL	PC.	PZ		PC	Der	nand nb/h	Opp. Demand weh/h	PHD	SHV	Capacity veh/h	D/C	Speed mi/b	% Followers	Follower Density followers/mi/In	1.1
	O Speed	Length		7920	5280	2640		9240	8	IS1	532	0.94	7.50	1700	0.50	60.0	67.8	8.2	
	 Speed Follower 							1						gment 5: Par	sing Co		1		_
	O LOS	Density							Der	mand sh/h	Opp. Demand veh/h	PHF	SHV	Capacity veh/h	D/C	Speed mi/h	% Followers	Follower Density followers/mi/In	1
	O BLOS Sco	ire							3	1		_				1		B = -	1
														at Report					

c. Full View with the report on the bottom of the screen

				Project Properties			
Analyst				Jurisdiction			
Agency				Time Analyzed			
Analysis Year		2024		Date		9/9/2024	
Project Description		Chapter 26: Example Problem 4		Units		U.S. Customary	
				Geometric Data			
Direction 1		EB		Direction 2		WB	
Number of Lanes		2		Number of Lanes		2	
Measured FFS				Measured FFS			
Base Free Flow Speed, mi/h		52.0		Base Free Flow Speed, m	ii/h	52.0	
Median Type		TWLTL		 Median Type 		TWLTL	
roject Information	HCS Multilane	Highway Report	Innan				
nalyst	HCS Multilane	Date	9/9/2024				
nalyst gency	HCS Multilane	Date Analysis Year	9/9/2024 2024				
salyst gency risdiction		Date Analysis Year Time Analyzed	2024				
allys: gency risdiction oject Description	HCS Multilane	Date Analysis Year					
allyst gency risdiction oject Description irection 1 Geometric Data	Chapter 26: Example Problem 4	Date Analysis Year Time Analyzed	2024				
nalyst: gency visdiction oject Description irection 1 Geometric Data irection 1	Chapter 26: Example Problem 4 EB	Date Analysis Year Time Analyzed Units	2024 U.S. Customary				
nalyst: gency arisdiction roject Description Virection 1 Geometric Data inection 1 umber of Lanes (N), In	Chapter 26: Example Problem 4 EB 2:	Date Analysis Year Time Analysed Units Temain Type	2024 U.S. Customary Specific Grade				
salyst gency nissischen ogiert Description irection 1 Geometric Data irection 1 mother of Lanes (R), In leasured or Base Free-Flow Speed	Chapter 26: Example Problem 4 EB	Date Analysis Year Time Analyzed Units	2024 U.S. Customary				
nalyst gency visid-toion genct Description inection 1 Geometric Data lection 1 umber of Lanes (R), In: lecured an Base Free-Flow Speed ase Free-Flow Speed (BFS), mith	Chapter 26: Szample Problem 4 EB 2. Base	Date Analysis Year Time Analysed Units Ternain Type Percent Grade. %	2024 U.S. Customary Specific Grade -3.50				
subjet: gency orgent Description institution 1 Geometric Data fraction 1 Geometric Data mother of Lanes (98, In institution of Data Free-Tiow Speed size Free-Tiow Speed (BEFS), mith new Wolth, R	Chapter 26: Example Problem 4 EB 2. Sase 52.0	Data Data Analysis War Time Analysed Units Ternain Type Perset Gonde, % Gonde Length, mi	2024 - U.S. Guitomary Specific Grade -2.50 1.25				
walyst percy orget Description instruction 1 Geometric Data excision 1 uniter of Lanes (N), In exection 1 Base Frace Took Speed (BTS), mich exidem Type exiting Speed (BTS), mich	Chapter 26: Stample Problem 4 EB 2: Rate 52:0 12:0 TW/TL 49:5	Data Andryist Year Tama Analyzed Urinn Servain Type Persent Grade, % Cande Length, mi Access Front Density, pric/mi	2024 U.S. Customary Specific Grade -2:50 1:25 10.0				
white very spect Description instiction 1 description insteadion 1 whiter of Lanes (N), In assound or Disa Free-Tow Speed dFSS, mich net Webh, It exidem Type exidem Type exidem Type exidem Speed (PSS), mich	Chapter 26: Stample Problem 4 EB 2: Rate 52:0 12:0 TW/TL 49:5	Oran Analyse Yaar Tena Analyse J United Analyse J Bensin Type Parent Garde, % Coalle Length, mi Access Four Density project Left Sale Lateral Characce (EO), 9.	2024 U.S. Customary Specific Grade -3.50 1.25 10.0 6				
wayst gency gency bencherine indiction i	Base Study Technologies Base Study Technologies Study Technologies Stu	Data Analysis Year Time Analysed Utan Analysed Utana Pareatic Goade & S Analog Sector (Social Sector) Analog Sector (Social Sector) Left-Safe Lateral Charance (Soci), R Data Lateral Charance (Soci), R Data Lateral Charance (Social Sector) Trad Speed Adjustment Factor (SAV)	2024 U.S. Guttomary Specific Grade -3:50 1:25 10:0 6 12 10:0 10:0				
nalyst: gency urisdiction roject Description Hirection 1 Geometric Data Irection 1	Chapter 26 (sample Problem 4 1 2 8 0 0 0 20 120 120 170/11 49.5	Date Analysis Year Time Analysed Using Persent Grade, % Goade Length, mi Access Young Denity pri/Uni Lieft-Side Latent Charance (EC), II Ibid Latent Charance (EC), II	2024 U.S. Customary Specific Grade -3.50 12.5 10.0 6 12				

2. There are two options for reports: Formatted and Text

a. Formatted reports show the most important results in a presentable format

				HCS	s Two-L	ane Hig	hway Fa	icility R	eport		
Projec	t Infor	mation									
Analyst							Date			9/9/2024	
Agency	e -						Analysis Ye	sar		2024	
Jurisdic	tion						Time Analy	/zed			
Facility	Name						Units			U.S. Customary	
Project	Descripti	ion		Chapt	ter 26: Exam	ple Problem 3					
Facilit	y Segm	ent Data									
No.	Nam	e Type	•		Length ft	Lane Wid ft	th Shou	ilder Widtl ft	Speed L		oint Density ts/mi
1		Passin Constrai			3960	12		6	55		0.0
2		Passing L	anes		7920	12		6	55		0.0
3		Passin			5280	12		6	55		0.0
		Constrai									
4		Passing 2			2640	12	_	6	55		0.0
5		Passin Constrai	ined		9240	12		6	55		0.0
_				-	Seam	ent 1: Pas	sing Con	strained	1		
Den	nand	Opp. Demand	PH	4F		Capacity	D/C	Speed	%	Follower Density	LOS
	h/h	veh/h			1000	veh/h	1345	mi/h	Followers	followers/mi/ln	
9	04	-	0.5	34	8.00	1700	0.53	58.8	69.7	10.7	D
					Se	gment 2:	Passing I	anes			
	nand h/h	Opp. Demand veh/h	PH	łF	%HV (Capacity veh/h	D/C	Speed mi/h	% Followers	Follower Density followers/mi/In	
8	68	-	0.5	95	8.00	1500	0.58	57.9	60.7	9.1	В
					Segm	ent 3: Pas	sing Con	strained			
	nand h/h	Opp. Demand veh/h	PH	łF	%ну (Capacity veh/h	D/C	Speed mi/h	% Followers	Follower Density followers/mi/In	
8	63	-	0.9	95	8.00	1700	0.51	60.0	68.0	8.2	D
					Se	gment 4:	Passing 2	Zone			
	nand h/h	Opp. Demand veh/h	PH	IF	%HV (Capacity veh/h	D/C	Speed mi/h	% Followers	Follower Density followers/mi/In	
8	51	532	0.9	94	7.50	1700	0.50	60.0	67.8	8.2	D
					Segm	ent 5: Pas	sing Con	strained			
	nand h/h	Opp. Demand veh/h	PH	łF	%ну (Capacity veh/h	D/C	Speed mi/h	% Followers	Follower Density followers/mi/ln	
8	50	-	0.5	34	8.00	1700	0.50	58.9	67.7	8.8	D
Facilit	y Resul	ts	-								10
	VMT veh-mi/			VHD eh-h//			r Density ars/mi/In		Travel Time min	1	LOS

b. Text reports show a more detailed analysis in plain text

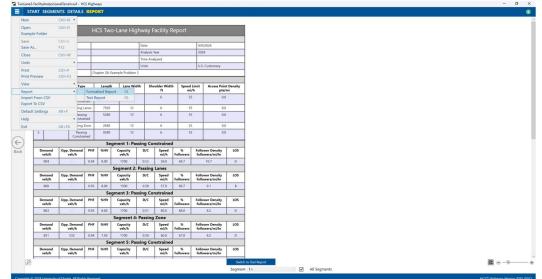
5.60

1.08

	HCS Multilane Highway Segment Text B	laport	
	MULTILANE HIGHWAY SEGMENT ANALYSIS	5	
ane:	Multilane4-FiveLaneHighwayTWLTL.xuf		
alyst:			
pency: prisdiction:			
urisdiction: ate:	9/1/2822		
nalysis Year:	2022		
ine Analyzed:			
Project Description:	Chapter 25: Example Problem 4		
inits:	U.S. Customary		
	105 and Performance Measures:		
Direction	1	2	
Direction Description	68	NB	
Flow rate, v.	835	983	pi/h/ln
Capacity, C	1998	2040	pt/h/ln
Speed, S Density, O	49.5	52.8 18.9	m1/h pc/m1/ln
analty, 0 anal of Service, 105	18.1 C	18.9	beluet eu
and of section, cos			
Direction	Step 1: Input Data		
Direction Direction Description	1 68	2	
Number of Lates, N	2	2	10
Lane Width	12	17	ft
Terrain Type	Specific Grade	Specific Grade	
Percent Grade	-3.58	3.98	1
Grade Length	1.25	1.25	mi
Right-Side Lateral Clearance, LCR	6	6	ft
Left-Side Lateral Clearance, LCL	6	6	ft
Median Type	TMLTL	TWLTL	Contractory and a second
Access Point Density	10.0	8.0	access points/ml
		2	
Direction Direction Description	1	WB	
Direction Description Demand Volume, V	1580	1500	web/h
Peak Hour Factor, PHF	0,98	0.90	- managed
Percent Total Trucks	6.00	5.00	1
Percent Single-Unit Trucks, SUT	342	36	ĩ
Percent Tractor-Trailers, TT	78	70	8
	Step 2: Estimate and Adjust FFS.		
stimating FFS			
rection	1	2	
Direction Description	ES.	ND	
Measured on Base FFS	Base	Base	
Base Free-Flow Speed, BFFS	52.0	52.0	m1/h
Lane Width Adjustment, fill	12	12	ft m1/h
Lane width Adjustment, fiw Right-Side Lateral Clearance, LCR	6.0	e.e 5	m1/h ft
Left-Side Lateral Clearance, LCL	2		et ft
Total Lateral Clearance, TLC	12	17	ft ft
Total Lateral Clearance Adjustm	et. filt 0.0	8.0	m1/h
Median Type	TMLTL	TWLTL	
Median Type Adjustment, 4M	0.0	0.0	m1/h
Access Point Density	10.0	8.0	access points/ml
	FA 2.5	0.0	m1/h
Access Point Density Adjustment,	49.5	52.0	m1/h
Access Point Density Adjustment,			
Access Point Density Adjustment, ree-Flow Speed, FF5			
Access Point Density Adjustment, nee-flow Speed, FF5 peed Adjustments			
Access Point Density Adjustment, ree-Flow Speed, FFS opend Adjustments irection	1	2	
Access Point Density Adjustment, nee-flow Speed, FF5 peed Adjustments	1 FH All Familiar	2 MS All familiar	

3. The type of report displayed can be changed by using the main menu items, keyboard shortcuts, or toggle buttons found under the report

- a. Main Menu Items
 - i. To switch to the Formatted Report, select *File > Report > Formatted Report* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen, hovering over "Report", and then selecting "Formatted Report".

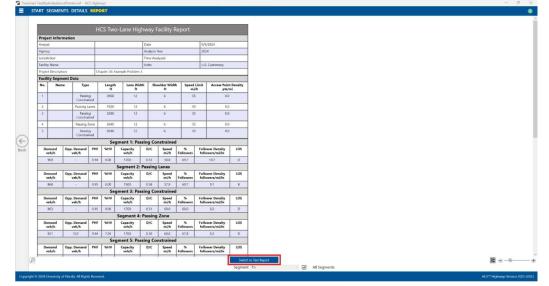


ii. To switch to the Text Report, select *File > Report > Text Report* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen, hovering over "Report", and then selecting "Text Report".

	dysisLevelTerrain.xuf -					- 0	0
START SEC	SMENTS DETAIL	S REPORT					
Vew	Ctrl+N +	HCS Two-Lane Highway Segment Text Res					
Open	Ctrl+O	HCS TWO-Lane Highway segment Text Rej	ort				
Example Folder							
Save	Ctrl+S	TWO-LANE HIGHWAY SEGMENT ANALYSIS TwoLane3-FacilityAnalysisLevelTerrain					
Save As	F12						
Close	Ctrl+W						
	CONTRACT	9/9/2024 2024					
Units	•	Chapter 26: Example Problem 3					
Print	Ctrl+P	U.S. Customary					
Print Preview	Ctrl+F2						
View		Facility LOS and Performance Measure					
Report	,	Formatted Report F4	5.50 1122	mi veh-mi/AP			
Import From CS	v	Text Report F6	1.08	veh-h/p			
Export To CSV	31		7.3 55	followers/mi/ln mi/h			
Default Settings	Alt+F	05	c				
Help							
Exit	Alt+F4	Segment 1					
Exit	Alt+F4	LOS and Performance Measures					
 Segment Le Demand Flo Demand Flo Capacity, Free-Flow Speed, S Percent Fo Follower D 	Speed, FFS llowers, PF	Direction, vd	3960 0.75 904 1500 1200 62.4 58.8 69.7 10.7 D	ft mi veh/h veh/h mi/h mi/h % followers/mi/ln			
	Step 1	: Identify Facility Study Boundaries and Corres	ponding Segmen	tation			
Segment Ty Vertical C	pe		Passing Cont	trained			
Minimum Se	gment Length gment Length		0.25	mi mi			
PLOCINUM SE	gment Length		3.00	81			
		Step 2: Determine Demand Flow Rates, Capacity,					
Demand Vol	ume in Analysis Di	rection, Vd	850	vet/h			
Demand Vol Peak Hour	ume in Opposing Di Factor, PHF	rection, Vo	0.94	veh/h			
Demand Flo	w Rate in Analysis	Direction, vd	984 1500	veh/h veh/h			
d/c Ratio	w Rate in Opposing	Direction, vo	0.53	vefi/h			
		Step 3: Determine the Vertical Alignment Clar	sification				
Segment Le	ngth, L		3960	ft	ted Report		
P				Switch to F Segment	ed Report III - V All Segments		

- b. Keyboard Shortcuts
 - i. Formatted Report: keyboard shortcut is "F4"
 - ii. Text Report: keyboard shortcut is "F6"

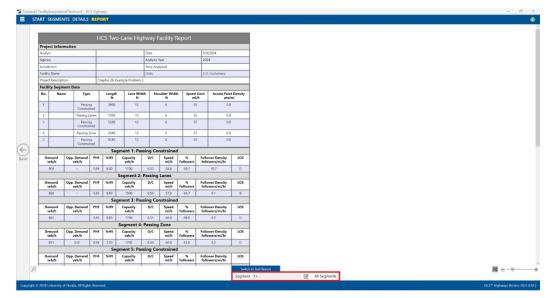
- c. Report Toggle Buttons
 - i. Toggle buttons are available at the bottom of the screen underneath the report.
 - ii. If the formatted report is currently being displayed, the toggle button will say "Switch to Text Report" which will allow you to display the text report if clicked.



iii. If the text report is currently being displayed, the first toggle button will say "Switch to Formatted Report" which will allow you to display the formatted report if clicked.

Tivol	anel FacilityAnalysisLevelTerrain.scd - HCS Highw	18/5							-	0 ×
=	START SEGMENTS DETAILS REPO	DRT								0
		HIS Two-Lane Highway Segment Text Re	port							ĺ
	File Name: Analyst: Agenty: Jurisdiction: Dute: Analysis Year: Time Analysed:	THO-LANE HISONAW SECRET ANALYSIS ThoLane3-FacilityAnalysisLevelTerrai 9/9/2024 2024	n. xuf							
	Project Description: Units:	(hapter 26: Example Problem) U.S. Customary								
	Facility Length Facility WH Facility WH Facility Average Follower Density, F0 Facility Average Speed Limit Facility Level of Service, LOS	_Facility LOS and Performance Heasure	5 5-50 1122 1.08 7.3 55 0	mi voh-mi/AP voh-h/p followers/mi/ln mi/h						
		Segment 1			_					
		LOS and Performance Heasures								
Back	Coded Segment Type Analyzed Segment Type Artual Segment Length, L Segment Length Used in Calculation Demand flow Rate in Analysis Directio Demand flow Rate in Opposing Directio	e, vá n, vo	Passing Constra Passing Constra 3968 0,75 904 1508 1208	ined ft wth/h wth/h						
	Capacity, cap Free-Flow Speed, FFS Speed, S Percent followers, PF Follower Density, FD Level of Service, LOS		1708 62.4 58.8 69.7 10.7 D	veh/h mi/h mi/h % followers/mi/ln						
	Step 1: Identif	y Facility Study Boundaries and Corres	ponding Segmentat:	len						
	Segment Type Wertical Class MinImum Segment Length Maximum Segment Longth		Passing Constra 1 0.25 3.00	ni ni						
	star to r	wtermine Demand Flow Mates, capacity.	and die matte							
	Demand Volume in Analysis Direction, Demand Volume in Oppoing Direction, Peak Noor Factor, PH Demand Flow Rate in Analysis Directio Demand Flow Rate in Opposing Directio d/c Ratio	vd Vo	850 904 1509 0.53	veh/h veh/h veh/h						
	1200									
	Segment Length, 1	: Determine the Vertical Alignment Cla	3960	Ft. Switch	h to Formatted Report					
	Server S			Segm	nent 1>	All Segments				
Copyri	ght © 2024 University of Florida: All Rights Reserv							HCS** High	neays Versio	

iv. For a two-lane facility analysis, there are two options for displaying the reports: single segment report or facility report. A dropdown menu along with a checkbox is provided to indicate which type of report to display.



1. The dropdown menu allows the selection of which single segment report to display. This is only enabled if the 'All Segments' checkbox is unchecked.

in	elow is an e a facility be	•	•	le segn	nent formatted report for Segment 1	
	START SEGMENTS DETAILS REPORT				•	
		HCS Two-Lane	Highway Report			
	Project Information					
	Analyst		Date	9/9/2024		
	Agency		Analysis Year	2024		
	Jurisdiction		Time Analyzed			

		ane Highway Re			
Project Information					
Analyst		Date		9/9/2024	
Agency		Analysis Year		2024	
lurisdiction		Time Analyzed			
Project Description	Chapter 26: Example Problem 3	Units		U.S. Customary	
	:	Segment 1			
Vehicle Inputs					
iegment Type	Passing Constrained	Length, ft			
ane Width, ft	12	Shoulder Width,	Shoulder Width, ft		
Speed Limit, mi/h	55	Access Point Den	Access Point Density, pts/mi		
Demand and Capacity					
Directional Demand Flow Rate, veh/h	904	Opposing Deman	Opposing Demand Flow Rate, veh/h		
Peak Hour Factor	0.94	Total Trucks, %			
Segment Capacity, velvh	1700	Demand/Capacit	Demand/Capacity (D/C)		
intermediate Results					
Segment Vertical Class	1	Free-Flow Speed,	Free-Flow Speed, mi/h		
Speed Slope Coefficient (m)	3.93029	Speed Power Cor	efficient (p)	0.41674	
PF Slope Coefficient (m)	-1.28948	PF Power Coeffic	PF Power Coefficient (p)		
n Passing Lane Effective Length?	No	Follower Density,	Follower Density, followers/mi/In		
Emprovement to Percent Followers	0.0	%Improvement 8	o Speed	0.0	
Subsegment Data					
Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h	
I Tangent	3960		-	58.8	
Vehicle Results					
Average Speed, mi/h	58.8	Percent Followers	i, %	69.7	
Segment Travel Time, minutes	0.76	Adj. Follower Der	nsity, followers/mi/In	10.7	
/ehicle LOS	D				

- 2. The 'All Segments' checkbox indicates whether or not to display the single segment report or facility report.
 - a. Formatted Report

а

- i. Checking 'All Segments' will display the facility formatted report.
- ii. Unchecking 'All Segments' will display the results for a single selected segment.
- b. Text Report
 - i. Checking 'All Segments' will include the results for all segments and display them one after the other.
 - ii. Unchecking 'All Segments' for the text report will display the results for a single selected segment.

c. Below is an example of a facility formatted report being displayed.



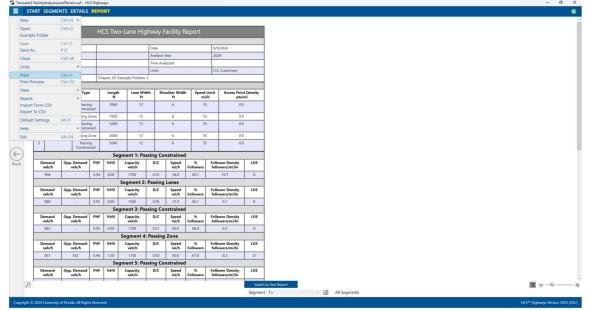
4. The magnification of the report currently being displayed can be changed using the zoom slider found at the bottom right-hand corner of the screen.

I				CS Two-	Lane High	iway Fa	acility R	eport		
l	Project Info	rmation								
[Analyst					Date			9/9/2024	
[Agency					Analysis Ye	iar -		2024	
	lurisdiction					Time Analy	yzed			
	Facility Name		_			Units			U.S. Customary	
	Project Descrip		Ch	apter 26: Exa	mple Problem 3					
ł	Facility Segr						ulder Width		imit Access Poin	
	No. Na	ne Type		Length ft	Lane Widt ft	h Shou	ft	Speed L mi/		
ĺ	1	Passir Constrai		3960	12		6	55	2.0	ň¢.
[2	Passing L	anes	7920	12		6	55	0.0	2
	3	Passir Constrai	ig ned	5280	12		6	55	0.0	
[4	Passing 2	lone	2640	12		6	55		8
	5	Passir Constrai	ined	9240	12		6	55	0.0	
I				Segi	ment 1: Pass	ing Con	strained	(
[Demand veh/h	Opp. Demand veh/h	PHF	%HV	Capacity veh/h	D/C	Speed mi/h	% Followers	Follower Density followers/mi/In	LOS
	904	2	0.94	8.00	1700	0.53	58.8	69.7	10.7	D
		-			egment 2: F					1
	Demand veh/h	Opp. Demand veh/h	PHF	%HV	Capacity veh/h	D/C		% Followers	Follower Density followers/mi/In	LOS
ļ	868		0.95	8.00	1500	0.58	\$7.9	60.7	9.1	B
ł		1			ment 3: Pass					
	Demand veh/h	Opp. Demand veh/h	PHF	%HV	Capacity veh/h	D/C		% Followers	Follower Density followers/mi/In	LOS
ł	863		0.95	8.00	1700	0.51	60.0	68.0	8.2	D
ł					segment 4: I					105
	Demand veh/h	Opp. Demand veh/h	PHF	%HV	Capacity veh/h	D/C		% Followers	Follower Density followers/mi/In	LOS
	851	532	0.94	7.50	1700	0.50	60.0	67.8	8.2	D
-		10.0.1			ment 5: Pass					105
	Demand veh/h	Opp. Demand veh/h	PHF	%HV	Capacity veh/h	D/C	Speed mi/h	% Followers	Follower Density followers/mi/In	LOS

- a. To zoom in, drag the slider to the right; to zoom out, drag the slider to the left
- b. Clicking the plus (+) button will zoom in; clicking the minus (-) button will zoom out
- c. Holding down "ctrl" on the keyboard and scrolling up on the mouse wheel will zoom in; holding down "ctrl" on the keyboard and scrolling down on the mouse wheel will zoom out

Print a Report

- 1. There are four options for printing a report:
 - a. Selecting *File > Print* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen and then selecting "Print"



b. Selecting *File > Print Preview* from the main menu; this can be found by selecting the three lines in the top left-hand corner of the screen and then selecting "Print Preview"

TART SEC										
lew	GMENTS	DETAIL	S REPO	RT						
	Ctrl	i+N +								
Dpen xample Folder		1+0	Н	CS Two	-Lane Hig	hway l	Facility F	Report		
ave	Ctrl	1+S					_			
ave As	F12	2 an	ingco,Sa	mantha	A (staningco				9/9/2024	
lose	Ctrl	I+W				Analysis Time An	10000 C		2024	
Inits		•				Units	aryzed		U.S. Customar	
rint	Ctrl		Ch	oter 26: Ex	ample Problem	2.000				
rint Preview	Ctrl	1+F2								
liew		, I)	pe	Length	Lane Wid	lth Sh	oulder Widt	h Speed	Limit Access	Point Density
eport mport From CS	~	•	sing	10 3960	ft 12	-	ft 6			0.0
xport From CSV	50		rained	3900	12		0			
efault Settings	is Alt-	+F	g Lanes	7920	12		6	55		0.0
lelp		las	sing rained	5280	12		6	55	6	0.0
xit	Alt	+F4 sin	g Zone	2640	12		6	55		0.0
5		Pas	sing	9240	12		6	55	5	0.0
		Const	rained		ment 1: Pa	1				
Dema	and 0	pp. Deman	d PHF	Seg %HV	Capacity	D/C	Speed	3	Follower Densi	y LOS
veh/	h/h	veh/h			veh/h	byc	mi/h	Followers	followers/mi/l	1 105
904	14		0.94	8.00	1700	0.53	58.8	69.7	10.7	D
					Segment 2:					-
Dema	h/h Oj	pp. Deman veh/h	d PHF	%HV	Capacity veh/h	D/C	Speed mi/h	% Followers	Follower Densi followers/mi/l	
868	58		0.95	8.00	1500	0.58	57.9	60.7	9.1	В
000										100
				Seg	ment 3: Pas	ssing Co	nstrainec			
Dema		pp. Deman veh/h	d PHF	Seg %HV	Capacity	D/C	Speed	*	Follower Densi	y LOS
	h/h	pp. Deman veh/h	d PHF 0.95				-		Follower Densi followers/mi/l 8.2	y LOS D
Dema veh/	h/h	veh/h		%HV 8.00	Capacity veh/h	D/C 0.51	Speed mi/h 60.0	% Followers	followers/mi/l	
Dema veh/	h/h 53 hand Op	veh/h	0.95	%HV 8.00	Capacity veh/h 1700	D/C 0.51	Speed mi/h 60.0	% Followers	followers/mi/l	y LOS
Dema veh/ 863 Dema	h/h 53 hand Oj h/h	veh/h	0.95	%HV 8.00	Capacity veh/h 1700 Segment 4: Capacity	D/C 0.51 Passing	Speed mi/h 60.0 Zone Speed	% Followers 68.0	followers/mi/l 8.2 Follower Densi	y LOS
Dema veh/ 863 Dema veh/	h/h 53 hand Oj h/h	pp. Deman veh/h	0.95 d PHF	%HV 8.00 %HV 7.50	Capacity veh/h 1700 Segment 4: Capacity veh/h	D/C 0.51 Passing D/C 0.50	Speed mi/h 60.0 Zone Speed mi/h 60.0	% Followers 68.0 % Followers 67.8	followers/mi/l 8.2 Follower Densi followers/mi/l	y LOS
Dema veh/ 863 Dema veh/	h/h 53 0 53 0 h/h 0 51 51 51	pp. Deman veh/h	0.95 d PHF 0.94	%HV 8.00 %HV 7.50	Capacity veh/h 1700 Segment 4: Capacity veh/h 1700	D/C 0.51 Passing D/C 0.50	Speed mi/h 60.0 Zone Speed mi/h 60.0	% Followers 68.0 % Followers 67.8	followers/mi/l 8.2 Follower Densi followers/mi/l	y LOS
Dema vehy 863 Dema vehy 851	h/h 53 0 53 0 h/h 0 51 51 51	veh/h pp. Deman veh/h 532 pp. Deman	0.95 d PHF 0.94	%HV 8.00 %HV 7.50 Seg	Capacity veh/h 1700 Segment 4: Capacity veh/h 1700 ment 5: Pa: Capacity	D/C 0.51 Passing D/C 0.50 ssing Co	Speed mi/h 60.0 Zone Speed mi/h 60.0 mstrained Speed	% Followers 68.0 Followers 67.8 5	followers/mi/l 8.2 Follower Densi followers/mi/l 8.2 Follower Densi	y LOS
Dema vehy 863 Dema vehy 851 Dema vehy	h/h 53 0 53 0 h/h 0 51 51 51	veh/h pp. Deman veh/h 532 pp. Deman	0.95 d PHF 0.94	%HV 8.00 %HV 7.50 Seg	Capacity veh/h 1700 Segment 4: Capacity veh/h 1700 ment 5: Pa: Capacity	D/C 0.51 Passing D/C 0.50 ssing Co	Speed mi/h 60.0 Zone Speed mi/h 60.0 mstrained Speed	% Followers 68.0 Followers 67.8 5	followers/mi/l 8.2 Follower Densi followers/mi/l 8.2 Follower Densi	y Los y Los

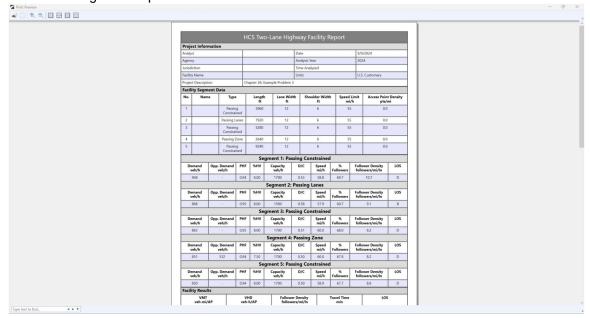
- c. Using keyboard shortcut "Ctrl+P" for Print
- d. Using keyboard shortcut "Ctrl+F2" for Print Preview

- 2. Print
 - a. Using Print will bring up a Print dialog box where you can select which printer to print to

Select Printer	
A Microsoft XPS Document Writer ConeNote for Windows 10	
<	>
Status: Ready Location: Comment:	P <u>r</u> eferences Fin <u>d</u> Printer
Page Range	
C Selection C Current Page	Number of <u>c</u> opies: 1
C Pages:	Collate 11 22 33

3. Print Preview

a. Using Print Preview will bring up a window where you can view how the report will look on paper before sending it to the printer



b. The print icon in the toolbar found in the top left-hand corner can then be selected



c. A print dialog box will pop up where you can select which printer to print to

Select Printer		
	ft Print to PDF	
	ft XPS Document Writer e for Windows 10	
<		>
Status:	Ready	Preferences
Location: Comment:		Fin <u>d</u> Printer
Page Range -		1
		Number of copies: 1
C Selection	C Current Page	
C Pages:		

Glossary of Terms

Access Point Density

Access Point Density, or APD, is the measure of access points per mile (or access points per kilometer in metric).

In Multilane, the number of access points per mile is determined by dividing the total number of access points (i.e., driveways and unsignalized intersections) on the right side of the highway in the direction of travel by the length of the segment in miles (or kilometers in metric). An intersection or driveway should only be included in the count if it influences traffic flow. Access points that go unnoticed by drivers, or with little activity, should not be used to determine access-point density.

In TwoLane, access points are major driveways and side roads where significant traffic enters and/or leaves the two-lane highway within the analysis segment. Access points lower the free-flow speed for the segment. By lowering the free-flow speed, access points will also indirectly affect the average speed and the follower density.

The total number of access points on an analysis segment is the sum of the number of active major driveways and road or street approaches (on both sides of the highway) where traffic enters and/or leaves the two-lane highway within the segment. Residential driveways and other low-volume driveways and side roads (generally with ADT below 20 vehicles per day) should not be counted as access points. If the two-lane highway has a physical median barrier, or barrier striping, that prevents access to driveways on the opposite side of the barrier, then the access points on the opposite side of the median should not be included in the total for the segment.

Note that the methodology for estimating segment speeds does not provide for the computation of the effects of intersection delays *within* a two-lane highway analysis segment. Therefore, segments cannot include all-way stop, roundabout, or signal-controlled intersections between their endpoints. The segment must be split into smaller segments so that these intersections fall at the segments' start- or endpoints. Intersections at the beginning or end point of a segment do not count as access points.

Access-Point Density Adjustment

The exhibit below presents the adjustment to FFS for various levels of access-point density. Studies indicate that for each access point per mile, the estimated FFS decreases by approximately 0.25 mi/h, regardless of the type of median.

Access-Point Density (access points/mi)	Reduction in FFS, f ₄ (mi/h)	
0	0.0	
10	2.5	
20	5.0	
30	7.5	
≥40	10.0	

Note: Interpolation to the nearest 0.1 is recommended.

Access Point Density is measured in access points per mile (or access points per kilometer in metric), and the corresponding Access Point Density Adjustment is measured in miles per hour (or kilometers per hour in metric).

Add Segment

Clicking on the button 'Add Segment' will add a row of inputs with the default Segment Type of 'Passing Constrained' along with the default values for the Passing Constrained segment type. The user can add an unlimited number of segments and can manually change the inputs to the desired values.

Add Subsegment

Clicking on the button 'Add Subsegment' will add a row of inputs with the default Subsegment Type of 'Tangent' along with the default values for the Tangent subsegment type. The user can add an unlimited number of subsegments and can manually change the inputs to the desired values.

Agency

This field is provided to document the agency or company associated with the analysis or project.

Analysis Year

This field is provided to document the year for which the analysis is being performed. For example, a current or past operational year or a future design or planning year might be coded here.

Analyst

This field is provided to document the name of the analyst.

Analyze Bicycle Results

A checkbox is provided for the user to indicate whether or not to analyze bicycle results. Checking this box will enable inputs relevant to the bicycle LOS procedure and display bicycle results on the formatted and text reports. Likewise, leaving this box unchecked will disable inputs relevant to the bicycle LOS procedure and will remove the bicycle results from the formatted and text reports.

Back to Segment Editor

A 'Back to Segment Editor' is provided when viewing subsegment details in the map-based segmentation window. Clicking this button will bring back the segment editor to edit details with the segments in the map-based segmentation window.

Base Free-Flow Speed

The methodology covers multilane highway segments with a FFS in the range of 45 to 70 mi/h. There is not a great deal of information available to help establish a base value. In one sense, it is like the design speed—it represents the potential FFS based only on the highway's horizontal and vertical alignment, not including impacts of lane widths, lateral clearances, median type, and access points. The design speed may be used for BFFS if it is available.

Although speed limits are not always uniformly set, BFFS for multilane highways may be estimated, if necessary, as the posted or statutory speed limit plus 5 mi/h for speed limits 50 mi/h and higher and as the speed limit plus 7 mi/h for speed limits less than 50 mi/h.

For metric units, Base Free-Flow Speed is measured in kilometers per hour, with a range of 72.4 to 112.7 km/h.

Bicycle LOS

Bicycle levels of service for multilane highway segments are based on a bicycle LOS score, which is in turn based on a traveler perception model. The bicycle LOS score is based, in order of importance, on give variables:

- Average effective width of the outside through lane,
- Motorized vehicle volumes and speeds,
- Heavy vehicle (truck) volumes, and
- Pavement condition.

The LOS ranges for bicycles on multilane highways are given in the following table:

LOS	Bicycle LOS Score
А	≤1.5
В	>1.5-2.5
С	>2.5-3.5
D	>3.5-4.5
E	>4.5-5.5
F	>5.5

The data required for evaluating bicycle LOS on a multilane highway and used in the development of the LOS model are as follows:

- Width of the outside through lane: 10 to 16 ft (or 3.0 to 4.9 m in metric),
- Shoulder width: 0 to 6 ft (or 0 to 1.8 m in metric),
- Motorized vehicle volumes: up to 36,000 annual daily traffic (AADT),
- Number of directional through lanes,
- Posted speed,
- Heavy vehicle percentage, and
- Pavement condition: 2 to 5 on the FHWA 5-point pavement rating scale.

Bicycle LOS Score

LOS score is a numerical output from a traveler perception model that typically indicates the average rating that travelers would give a transportation facility or service under a given set of condition.

The bicycle LOS model for multilane highways uses a traveler perception index calibrated by using a linear regression model. The model fits independent variables associated with roadway characteristics to the results of a user survey that rates the comfort of various bicycle facilities. The resulting bicycle LOS index computes a numerical LOS score, generally ranging from 0.5 to 6.5, which is stratified to produce a LOS A to F result.

The bicycle LOS score can be calculated from the following equation:

 $BLOS = 0.507 \ln(v_{OL}) + 0.1999 S_t (1 + 10.38 HV)^2 + 7.066 (1/P)^2 - 0.005 (W_e)^2 + 0.760$

where

- BLOS = bicycle level of service score;
 - v_{OL} = directional demand flow rate in the outside lane (veh/h);
 - S_t = effective speed factor;
 - *HV* = percentage of heavy vehicles (decimal); if *V* <200 veh/h, then *HV* should be limited to a maximum of 50%;
 - P = FHWA's 5-point pavement surface condition rating; and
 - W_e = average effective width of the outside through lane (ft).

For metric units, the width listed in the calculations above are measured in meters. However, it is converted to feet for calculations and then converted to meters for end results.

Capacity Adjustment Factor

The Capacity Adjustment Factor (CAF) is the factor used to allow the user to adjust the capacity for reducedcapacity situations or to match field measurements. The capacity in any cell of the time-space domain can be reduced to represent incident situations such as construction and maintenance activities, adverse weather, traffic accidents, and vehicle breakdowns. Similarly, capacity can be increased to match field measurements.

Central Angle

Central Angle is a horizontal curve specific input. The central angle, along with the radius, of the curve will automatically adjust the segment length and control points accordingly.

Coded Type

There are three coded types: Passing Constrained, Passing Zone, and Passing Lane.

In the analysis methodology, these segment types are defined as follows:

- <u>Passing Constrained</u>: Length of two-lane highway in which passing in the oncoming lane is either prohibited or effectively negligible due to lack of utilization of passing zone(s). The latter might be due to insufficient sight distance and indicates an area where passing should be formally prohibited.
- **Passing Zone**: Length of two-lane highway for which passing in the oncoming lane is permitted, and the length and location of such passing zone provides reasonable accommodation of passing maneuvers under certain traffic conditions.
- **Passing Lane**: This segment type consists of an added lane in the same direction as the analysis direction, with the intent to break up platoons that have formed upstream by allowing faster vehicles to pass slower vehicles.

D-factor

D is the proportion of traffic moving in the peak direction of travel on a given roadway during the peak hour. It is used, along with AADT (annual average daily traffic) and the *K*-factor (proportion of AADT occurring during the peak hour), in the following equation to determine the demand volume (*V*) or directional peak-hour volume (*DDHV*) in a planning and preliminary engineering analysis:

$V = DDHV = AADT \times K \times D$

While the consideration of directional distribution is not mandated in the analysis of multilane facilities, the distribution has a dramatic effect on both design and LOS.

Date

This field is provided to document the date when the analysis is performed.

Delete Segment

After the user selects a segment to delete, clicking on the button 'Delete Segment' will delete the row of inputs corresponding to the selected segment. Multiple segments can be selected and deleted at the same time.

Delete Subsegment

After the user selects a subsegment to delete, clicking on the button 'Delete Subsegment' will delete the row of inputs corresponding to the selected subsegment. Multiple subsegments can be selected and deleted at the same time.

Demand

The number of vehicles or other roadway users desiring to use a given system element during a specific analysis period, typically 1 h or 15 min.

Demand volume is the number of vehicles that arrive to use the facility. Under noncongested conditions, demand volume is equal to the observed volume.

Direction Description

This field is provided to document the description of the direction being analyzed (e.g., EB, WB, NB, SB).

Directional Demand

The demand volume for the analysis direction (V_d), in vehicles per hour, at the entrance of the segment being analyzed. This is then adjusted to account for the peak 15-min volume within the analysis hour.

Directional Flow Rate in the Outside Lane

The directional demand flow rate of motorized traffic in the outside lane is calculated on the basis of the hourly directional volume, the peak hour factor, and the number of directional lanes (two or more for passing lanes or multilane highways):

$$v_{OL} = \frac{V}{PHF \times N}$$

where

 v_{OL} = directional demand flow rate in the outside lane (veh/h),

V = hourly directional volume (veh/h),

PHF = peak hour factor, and

N = number of directional lanes.

Driver Population

Driver population describes the level of driver familiarity in the traffic stream and is used in adjustments for speed and capacity. The base traffic stream characteristics for basic freeway and multilane highway segments are representative of traffic streams composed primarily of commuters or drivers who are familiar with the facility.

The driver population adjustment factor f_p had previously been used in the HCM to reflect the effects of unfamiliar drivers in the traffic stream and was applied as an increase in demand volume. With the addition of a unified speed flow equation in Chapter 12 of the HCM and the ability to adjust both the base FFS and capacity in all freeway segment chapters (12-14) to account for incidents and weather events, the driver population factor is no longer used. Instead, FFS and capacity adjustment factors SAF_{pop} and CAF_{pop} are applied in combination with other applicable SAFs and CAFs.

Analyst judgment is still required when applying recommended adjustments. However, should there be expectations of significant presence of unfamiliar drivers, the values shown in the exhibit below can serve as a guide for the analysis.

Level of Driver Familiarity	CAFpop	SAFpop
All familiar drivers, regular commuters	1.000	1.000
Mostly familiar drivers	0.968	0.975
Balanced mix of familiar and unfamiliar drivers	0.939	0.950
Mostly unfamiliar drivers	0.898	0.913
All or overwhelmingly unfamiliar drivers	0.852	0.863

Effective Speed Factor

The effect of motor vehicle speed on bicycle quality of service is primarily related to the differential between motor vehicle and bicycle travel speeds. For example, a typical cyclist may travel in the range of 15 mi/h. An increase in motor vehicle speeds from 20 to 25 mi/h is more readily perceived than a speed increase from 60 to 65 mi/h, since the speed differential increased by 100% in the first instance compared with only 11% in the latter.

The following equation shows the calculation of the effective speed factor that accounts for this diminishing effect.

 $S_t = 1.1199 \ln(S_p - 20) + 0.8103$

where

- S_t = effective speed factor, and
- S_p = posted speed limit (mi/h).

For metric units, the posted speed limit is measured in kilometers per hour. However, this is converted to miles per hour for the calculation of the effective speed factor.

Effective Width

The effective width of the outside through lane depends on both the actual width of the outside through lane and the shoulder width, since cyclists will be able to travel in the shoulder where one is provided. Moreover, striped shoulders of 4 ft or greater provide more security to cyclists by giving cyclists a dedicated place to ride outside of the motorized vehicle travelway. Thus, an 11-ft lane and adjacent 5-ft paved shoulder results in a larger effective width for cyclists than a 16-ft lane with no adjacent shoulder.

Parking occasionally exists. On-highway parking reduces the effective width because parked vehicles take up shoulder space and bicyclists leave some shy distance between themselves and parked cars.

The following equations are used to calculate the effective width W_e on the basis of the paved shoulder width W_s and the hourly directional volume *V*:

If W_s is greater than or equal to 8 ft:

 $W_e = W_v + W_s - (\% OHP \times 10 \text{ ft})$

If W_s is greater than or equal to 4 ft and less than 8 ft:

 $W_e = W_v + W_s - 2 \times [\% OHP(2 \text{ ft} + W_s)]$

If W_s is less than 4 ft:

 $W_e = W_v + [\% OHP(2 \text{ ft} + W_s)]$

with, if V is greater than 160 veh/h:

 $W_v = W_{OL} + W_s$

Otherwise,

 $W_v = (W_{OL} + W_s) \times (2 - 0.005V)$

where

 W_v = effective width as a function of traffic volume (ft),

 W_{OL} = outside lane width (ft),

- W_s = paved shoulder width (ft),
- V = hourly directional volume per lane (veh/h),
- W_e = average effective width of the outside through lane (ft), and

%OHP = percentage of segment with occupied on-highway parking (decimal).

For metric units, Effective Width is measured in meters. All widths listed in the calculations above are measured in meters. However, they are converted to feet for calculations and then converted to meters for end results.

Free Flow Speed

- 1. The average speed of vehicles on a given segment, measured under low-volume conditions, when drivers are free to drive at their desired speed and are not constrained by the presence of other vehicles or downstream traffic devices.
- 2. The theoretical speed when both density and flow rate are zero.

The free-flow speed (FFS) can be determined either through direct field measurement (preferred) or by estimation.

For multilane highway segments, the adjusted free-flow speed is determined by subtracting each speed adjustment from the base free-flow speed according to HCM Equation 12-3 for Multilane Highway Segments, which can be found below.

 $FFS = BFFS - f_{LW} - f_{TLC} - f_M - f_A$

where

FFS = free-flow speed of the multilane highway segment (mi/h);

BFFS = base FFS for the multilane highway segment (mi/h);

 f_{LW} = adjustment for lane width (mi/h);

 f_{TLC} = adjustment for total lateral clearance (mi/h);

- f_M = adjustment for median type (mi/h); and
- f_A = adjustment for access-point density (mi/h).

If a field measured free-flow speed is entered, no subsequent adjustments are made, and the adjusted free-flow speed will simply be the field-measured free-flow speed.

For metric units, free-flow speed, along with all the corresponding adjustments, are measured in kilometers per hour.

For two-lane highways, the operating conditions of the facility in terms of a base free-flow speed (BFFS) that reflects the facility's geometric characteristics must be characterized to estimate the FFS. As part of this estimation process, it is recognized that the posted speed limit is intended to inform motorist of appropriate operating speed for the given geometric conditions. The FFS is calculated with HCM Equations 15-3 through 15-6, which can be found below:

$$FFS = BFFS - a(HV\%) - f_{LS} - f_A$$

with

 $a = \max[0.0333, a_0 + a_1 \times BFFS + a_2 \times L + \max(0, a_3 + a_4 \times BFFS + a_5 \times L) \times v_0/1000]$

where

FFS = free-flow speed in the analysis direction (mi/h);

BFFS = base free-flow speed (mi/h);

HV% = percentage of heavy vehicles in the analysis direction (%) (e.g., 5% is expressed as 5);

 f_{LS} = adjustment for lane and shoulder width (mi/h), from Equation 15-5;

 f_A = adjustment for access-point density (mi/h), from Equation 15-6;

 a_0 - a_5 = coefficient values from Exhibit 15-12

- L = segment length (mi), subject to minima and maxima given in Step 1; and
- v_o = demand flow rate in opposing direction (veh/h); v_o = 1,500 in Passing Constrained segments and v_o = 0 in Passing Lane segments.

For metric units, free-flow speed, along with all the corresponding adjustments, are measured in kilometers per hour. Segment length is measured in kilometers.

Grade Length

The length of the segment, in miles (or kilometers in metric), representing the percent grade

Heavy Vehicles

The percentage of heavy vehicles in the traffic stream. Heavy vehicles are engaged primarily in the transportation of goods and materials or in the delivery of services other than public transportation. Heavy vehicles generally consist of large trucks, buses, and recreational vehicles (RVs).

Horizontal Curve

This is a geometric design that provides a transition between two tangent sections of roadway, allowing a vehicle to complete a turn at a gradual rate than a sharp cut.

Insert Segment

Clicking on the button 'Insert Segment' will add a row of inputs with the default Segment Type 'Passing Constrained' along with the default values for the Passing Constrained segment type above the selected segment. The user can insert an unlimited number of segments and can manually change the inputs to the desired values.

Insert Subsegment

Clicking on the button 'Insert Subsegment' will add a row of inputs with the default Subsegment Type 'Tangent' along with the default values for the Tangent subsegment type above the selected subsegment. The user can insert an unlimited number of subsegments and can manually change the inputs to the desired values.

Jurisdiction

This field is provided to document any jurisdiction convention or project related information.

K-factor

K is the proportion of AADT (annual average daily traffic) that occurs during the peak hour. It is used, along with AADT and the *D*-factor (the proportion of peak-hour volume traveling in the peak direction), in the following equation to determine the demand volume (V) or directional peak-hour demand volume (*DDHV*) in a planning and preliminary engineering analysis:

$V = DDHV = AADT \times K \times D$

For many rural and urban highways, this factor falls between 0.09 and 0.10. For highway sections with high peak periods and relatively low off-peak flows, the *K*-factor may exceed 0.10. Conversely, for highways that demonstrate consistent and heavy flows for many hours of the day, the *K*-factor is likely to be lower than 0.09. In general,

- The K-factor decreases as the AADT on a highway increases;
- The K-factor decreases as development density increases; and
- The highest *K*-factors occur on recreational facilities, followed by rural, suburban, and urban facilities, in descending order.

The *K*-factor should be determined, if possible, from local data for similar facilities with similar demand characteristics.

Lane Width

The lateral distance between stripes for a given lane; measured in feet (or meters in metric)

For the two-lane highways bicycle methodology, the lane width input also specifies the outside lane width, or WoL.

Lane Width Adjustment

This is an adjustment to Base Free-Flow Speed based on the average lane width. The base condition for lane width is 12 ft or greater. When the average lane width across all lanes is less than 12 ft, the FFS is negatively affected. Adjustments to reflect the effect of narrower average lane width are shown below:

Average Lane Width (ft)	Reduction in FFS, f_{LW} (mi/h)	
≥12	0.0	
≥11-12	1.9	
≥10-11	6.6	

For metric units, Average Lane Width is measured in meters, and the corresponding Lane Width Adjustment is measured in kilometers per hour.

Level of Service

Level of Service (LOS) is a quantitative stratification of a performance measure or measures that represent quality of service, measured on an A-F scale, with LOS A representing the best operating conditions from the traveler's perspective and LOS F the worst.

LOS on multilane highway segments is defined by density, which is measured in passenger cars per mile per lane. Although speed is a major concern of drivers related to service quality, it would be difficult to describe LOS by using speed, as it remains constant up to high flow rates (i.e., 1,400 pc/h/ln for multilane highway segments). Density describes a motorist's proximity to other vehicles and is related to a motorist's freedom to maneuver within the traffic stream. Unlike speed, however, density is sensitive to flow rates throughout the range of flows.

The criteria for LOS is shown in the exhibit below:

LOS	Density (pc/mi/ln)	
А	≤11	
В	>11-18	
С	>18-26	
D	>26-35	
E	>35-45	
F	Demand exceeds capacity	
	OR density >45	

For metric, density is measured in passenger cars per kilometer per lane. The criteria for LOS is shown in metric below:

LOS	Density (pc/km/ln)	
А	≤7	
В	>7–11	
С	>11–16	
D	>16–22	
E	>22–28	
F	Demand exceeds capacity OR density >28	

If the demand-to-capacity ratio is less than or equal to 1.0, follower density is used as the service measure for all two-lane highways. However, two sets of LOS thresholds are used to account for differences in driver perception between driving on higher-speed versus lower-speed highways.

The criteria for LOS is shown in the exhibit below:

	Follower Density (followers/mi/ln)		
LOS	Higher-Speed Highways Posted Speed Limit ≥ 50 mi/h	Lower-Speed Highways Posted Speed Limit < 50 mi/h	
A	≤ 2.0	≤ 2.5	
В	> 2.0 - 4.0	> 2.5 - 5.0	
С	> 4.0 - 8.0	> 5.0 - 10.0	
D	> 8.0 - 12.0	> 10.0 - 15.0	
E	> 12.0	> 15.0	
F	Demand exceeds capacity		

In the case of facilities with mixed speed limits (e.g., some above 50 mi/h and others below 50 mi/h), an average speed limit is computed for the facility, and that is used to determine the facility LOS.

For metric, follower density is measured in followers per kilometer per lane. The criteria for LOS is shown in metric below:

	Follower Density (followers/km/in)			
LOS	Higher-Speed Highways Posted Speed Limit ≥ 80 km/h	Lower-Speed Highways Posted Speed Limit < 80 km/h		
А	≤ 1.2	≤ 1.6		
В	> 1.2 – 2.5	> 1.6 – 3.1		
С	> 2.5 – 5.0	> 3.1 – 6.2		
D	> 5.0 – 7.5	> 6.2 – 9.3		
E	> 7.5	> 9.3		
F	Demand exceeds capacity			

Level Terrain

Any combination of grades and horizontal or vertical alignment that permits heavy vehicles to maintain the same speed as passenger cars. This type of terrain typically contains short grades of no more than 2%.

Map-Based Segmentation

Clicking on the 'Map-Based Segmentation' button will bring up the Segmentation window, where the user can create sections through a map. Clicking 'OK' after finalizing sections will bring the user back to the Segments page in Highways and will automatically generate the appropriate segments and subsegments for the facility. Clicking 'Cancel' will close the Segmentation window without applying any of the changes made.

Specific locations can be searched using the 'City / Zip Code' textbox. When a city or zip code is entered, the map will adjust to find that location. The user may also zoom in/out or drag the map to find a location. At the top right corner of the map, there are '+' and '-' buttons that allow zooming in and out, respectively. Above that is a drop-down menu that allows changing of the map view. Options include the following: Road and Aerial With Labels.

Segment Editor:

When ready to add a node, the user can right-click on the map which will bring up a menu with the following: Add Passing Constrained Node, Add Passing Zone Node, and Add Passing Lanes Node. Adding a node will place a pin on the map with a number. As more nodes are added, the pins will be connected by lines representing segments of the roadway. Nodes can be dragged on the map to change their location and the length of the segments. If there is already a node on the map, the user can right-click that node which will bring up a menu with the following: Delete Current Node, Insert Passing Constrained Node After Current Node, Insert Passing Zone Node After Current Node, and Insert Passing Lanes Node After Current Node.

At the bottom of the map, there are also buttons provided to make editing the facility easier. They include the following: Zoom to Selection, Zoom to Facility, Remove Last Node, and Clear Map Content. For 'Zoom to Selection', the user can highlight rows within the data grid or select nodes/segments on the map. Once selected, clicking on 'Zoom to Selection' will zoom in to the selected nodes/segments on the map. Clicking on 'Zoom to Facility' will zoom

in/out to show the entire facility on the map. Clicking on 'Undo Last Node' will remove the last node added to the map. Clicking on 'Clear Map Content' will remove everything that was added to the map.

Subsegment Editor:

To access the subsegment editor, the 'Details' link of the desired segment must be clicked. This will cause the map to show just the segment selected, along with its boundary nodes. The data grid will also only show the nodes/sections pertaining to this selected segment. The segment and its boundary nodes cannot be adjusted while in the subsegment editor. Only subnodes/subsegments can be edited in the subsegment editor.

When ready to add a subnode, the user can right-click the beginning segment boundary node on the map. This will bring up a menu with the following: Insert Tangent Subnode After Current Node and Insert Horizontal Curve Subnode After Current Node. Inserting a subnode will place a pin on the map with a number. Numbering is based on the beginning boundary node. For example, if the beginning boundary node is 3, the first subnode inserted will be 3.1. As more subnodes are added, the pins will be connected by lines representing subsegments of the segment. If there is already a subnode on the map, the user can right-click that subnode which will bring up a menu with the following: Insert Tangent Subnode After Current Node, Insert Horizontal Curve Subnode After Current Node, and Delete Current Node.

At the bottom of the map, there are also buttons provided to make editing the facility easier. They include the following: Zoom to Selection, Zoom to Segment, Remove Last Subnode, and Clear Map Content. For 'Zoom to Selection', the user can highlight rows within the data grid or select subnodes/subsegments on the map. Once selected, clicking on 'Zoom to Selection' will zoom in to the selected subnodes/subsegments on the map. Clicking on 'Zoom to Segment' will zoom in/out to show the entire segment on the map. Clicking on 'Undo Last Subnode' will remove the last subnode added to the map. Clicking on 'Clear Map Content' will remove all subnodes/subsegments that were added to the map.

Clicking on the 'Back to Segment Editor' button will bring back the segment editor and change the map back to view the entire facility with just the nodes and segments.

Measured Free-Flow Speed

The measured free-flow speed is the FFS measured in the field and provided by the user. If the FFS is measured directly, no adjustments are applied to the measured value.

Median (Left) Side Clearance

Left-side lateral clearance is measured from the edge of the travel lanes to the nearest periodic or continuous obstruction in the median. If such obstructions are farther than 6 ft (or 1.8 m in metric) from the edge of the pavement, a value of 6 ft (or 1.8 m in metric) is used.

Left-side lateral clearances are subject to some judgement. Many types of common median barriers do not affect driver behavior if they are no closer than 2 ft (or 0.6 m in metric) from the edge of the travel lane, including concrete and W-beam barriers. A value of 6 ft (or 1.8 m in metric) would be used in such cases. Also, when the multilane highway segment is undivided or has a TWLTL, no left-side lateral clearance restriction is assumed, and a value of 6 ft (or 1.8 m in metric) is applied.

Median Type

Multilane highways have three median types:

- Undivided (with only a centerline separating the directions of flow)
- Divided (with a physical median separating the directions of flow)
- TWLTL (two-way left-turn lane)

Median type is used in determining the adjustment for median type f_M , which is used in the calculation of free-flow speed.

Median Type Adjustment

Median Type	Reduction in FFS, f _M (mi/h)
Undivided	1.6
TWLTL	0.0
Divided	0.0

The adjustment for type of median is given in the following exhibit:

For metric units, Median Type Adjustment is measured in kilometers per hour.

Mixed-Flow Model

The mixed-flow model is one of two distinct methodologies offered to assess the effect of heavy vehicles on capacity and LOS. The model directly assesses the capacity, speed, and density of traffic streams that include a significant percentage of heavy vehicles operating on a single or composite grade. When using the mixed-flow models, no PCEs are needed, as the passenger car, SUT, and TT volumes are used directly in the estimation of mixed-flow speed and density.

Number of Lanes

This specifies the number of lanes on the roadway in the specified direction.

Opposing Demand

The demand volume for the opposing direction (V_0), in vehicles per hour, at the entrance of the segment being analyzed. This is then adjusted to account for the peak 15-min volume within the analysis hour.

Outside Lane Width

The width of the outside through lane is measured in feet. This is denoted as W_{OL} and is used in the calculation of effective width.

If V is greater than 160 veh/h:

$$W_v = W_{OL} + W_s$$

Otherwise,

 $W_v = (W_{OL} + W_s) \times (2 - 0.005V)$

where

 W_v = effective width as a function of traffic volume (ft);

 W_{OL} = outside lane width (ft);

 W_s = paved shoulder width; and

V = hourly directional volume per lane (veh/h).

For metric units, the width of the outside through lane is measured in meters. All widths listed in the calculations above are measured in meters. However, they are converted to feet for calculations and then converted to meters for end results.

Pavement Condition Rating

A description of the road surface in terms of ride quality and surface defects. The pavement condition is rated from 2 to 5 based on the Federal Highway Administration (FHWA) 5-point rating scale.

Peak Hour Factor

Peak Hour Factor (PHF) is the hourly volume during the analysis hour divided by the peak 15-min flow rate within the analysis hour. It is a measure of traffic demand fluctuation within the analysis hour.

Percent Grade

The longitudinal slope of a roadway; provided by the user as a percentage.

Percent Occupied Parking

This refers to the percent of the segment with occupied on-highway parking. On-highway parking reduces effective width because parked vehicles take up shoulder space and bicycles leave some shy distance between themselves and the parked cars.

Project Description

This field is provided for the user to document the analysis with any information for identification purposes.

Radius

Curve radius is a horizontal curve specific input. The curve radius, along with the central angle, of the curve will automatically adjust the segment length and control points accordingly.

Right Side Clearance

Right-side lateral clearance is measured from the right edge of the travel lanes to the nearest periodic or continuous roadside obstruction. If such obstructions are farther than 6 ft (or 1.8 m in metric) from the edge of the pavement, a value of 6 ft (or 1.8 m in metric) is used.

Fixed obstructions with lateral clearance effects include light standards, signs, trees, abutments, bridge rails, traffic barriers, and retaining walls. Standard raised curbs are not considered to be obstructions.

Rolling Terrain

Any combination of grades and horizontal or vertical alignment that causes heavy vehicles to reduce their speed below those of passenger cars, but that does not cause heavy vehicles to operate at crawl speeds for any significant length of time or at frequent intervals.

Segment Length

This field is provided to document the length of the segment being analyzed; measured in feet (or meters in metric)

Segment Name

This field is provided for each segment to identify the segment or specify the start point and end point of the segment under analysis.

Select All

A 'Select All' checkbox is provided under the 'Segments Global Inputs' section of a Two-Lane Facility analysis to easily select and apply all inputs provided under that section to the entire facility.

Shoulder Width

This is the width of the shoulder, measured in feet (or meters in metric)

Single-Unit Trucks (SUT)

Single-Unit Trucks (SUT) are defined as one of two categories of heavy vehicles. Buses and RVs are treated as SUTs in the HCM. SUTs include the following:

- Other Two-Axle, Four-Tire Single-Unit Vehicles: Two-axle, four-tire vehicles, other than passenger cars. Generally pickup trucks, sports utility vehicles, and vans.
- Buses: All vehicles manufactured as traditional passenger-carrying buses with two axles and six tires or three or more axles. Excludes modified buses no longer capable of mass passenger transport.
- Two-Axle, Six-Tire, Single-Unit Trucks: All vehicles on a single frame with two axles and dual rear wheels. Includes some trucks, camping and recreational vehicles, and motor homes.
- Three-Axle Single-Unit Trucks: All vehicles on a single frame with three axles. Includes some trucks, camping and recreational vehicles, and motor homes.
- Four or More Axle Single-Unit Trucks. All trucks on a single frame with four or more axles.

Specific Grade

A single grade of roadway segment or extended roadway segment expressed as a percentage.

Speed Adjustment Factor

The Speed Adjustment Factor (SAF) is the factor used to allow the user to adjust speed based on a combination of different sources, including weather and work zone effect. The SAF may also be used to calibrate the estimated FFS for local conditions or other effects that contribute to a reduction in FFS. For example, poor pavement conditions or sun glare may result in drivers reducing their speed even under low-volume conditions.

Speed Limit

The speed limit, in miles per hour (or kilometers per hour in metric), posted on the highway segment in the analysis direction. In Multilane, the posted speed limit is used to calculate the effective speed factor.

Subsegment Length

This field is provided to document the length of the subsegment being analyzed. For tangent subsegments, the link length is entered. For curves, the link length will be based on the curve radius and central angle.

Subsegment Type

There are two subsegment types: Tangent and Horizontal Curve. Tangent sections are either straight or have horizontal curves with radii greater than 2,550 ft (or 777.24 m in metric).

Super 2

The 2+1, sometimes referred to as "Super 2", design typically extends for many miles, with several changes of direction for the passing lane provided within this distance.

Superelevation

Superelevation is a horizontal curve specific input. It is the banking of a roadway in a curve to counteract lateral acceleration.

Target LOS

Target LOS is used in a planning and preliminary engineering analysis. This is the Level of Service (LOS) the analyst wishes to achieve based on other parameters, such as Number of Lanes and FFS.

See also Level of Service.

Terrain Type

An extended length of highway containing a number of upgrades and downgrades where no single grade is long enough or steep enough to have a significant impact on the operation of the overall segment. There are three types of terrain: Level, Rolling, and Specific Grade.

See also Level Terrain, Rolling Terrain, and Specific Grade.

Time Analyzed

This field is provided to document the time frame of the analysis as morning peak, afternoon peak, existing conditions, future projections, etc.

Total Lateral Clearance Adjustment

The adjustment for total lateral clearance (TLC) on multilane highway segments is based on TLC at the roadside (right side) and at the median (left side). Fixed obstructions with lateral clearance effects include light standards, signs, trees, abutments, bridge rails, traffic barriers, and retaining walls. Standard raised curbs are not considered to be obstructions.

The following equation is used to determine TLC:

$$TLC = LC_R + LC_L$$

where

- *TLC* = total lateral clearance (ft) (maximum value 12 ft);
- LC_R = right-side lateral clearance (ft) (maximum value 6 ft); and
- LC_L = left-side lateral clearance (ft) (maximum value 6 ft).

Four-Lane Highways		Six-Lane Highways	
TLC (ft)	Reduction in FFS (mi/h)	TLC (ft)	Reduction in FFS (mi/h)
12	0.0	12	0.0
10	0.4	10	0.4
8	0.9	8	0.9
6	1.3	6	1.3
4	1.8	4	1.7
2	3.6	2	2.8
0	5.4	0	3.9

The following exhibit shows the reduction of FFS due to lateral obstructions on the multilane highway:

Note: Interpolation to the nearest 0.1 is recommended.

For metric units, Total Lateral Clearance, along with Right-Side Lateral Clearance and Left-Side Lateral Clearance, are measured in meters. The corresponding Total Lateral Clearance Adjustment is measured in kilometers per hour.

Total Trucks

The percentage of trucks in the traffic stream. Trucks are heavy vehicles engaged primarily in the transport of goods and materials or in the delivery of services other than public transportation. All heavy vehicles are classified as single-unit trucks (SUTs) or tractor-trailers (TTs).

Tractor-Trailers (TT)

Tractor-Trailers (TT) are defined as one of two categories of heavy vehicles. TTs include the following:

- Four or Fewer Axle Single-Trailer Trucks: All vehicles with four or fewer axles consisting of two units, one of which is a tractor or straight truck power unit.
- Five-Axle Single-Trailer Trucks: All five-axle vehicles consisting of two units, one of which is a tractor or straight truck power unit.
- Six or More Axle Single-Trailer Trucks: All vehicles with six or more axles consisting of two units, one of which is a tractor or straight truck power unit.
- Five or Fewer Axle Multi-Trailer Trucks: All vehicles with five or fewer axles consisting of three or more units, one of which is a tractor or straight truck power unit.
- Six-Axle Multi-Trailer Trucks: All six-axle vehicles consisting of three or more units, one of which is a tractor or straight truck power unit.
- Seven or More Axle Multi-Trailer Trucks: All vehicles with seven or more axles consisting of three or more units, one of which is a tractor or straight truck power unit. Includes triple-trailer combinations.

Units

This specifies the units of the analysis file (i.e., U.S. Customary or Metric).

Vehicle Hours of Delay (VHD)

VHD is the vehicle hours of delay during time period t. In TwoLane, the facility VHD is the sum of each segment VHD, which is calculated using the equation below:

$$VHD = \sum_{t} \left[\left(\left(V_i \times \frac{L_i}{S_i} \right) - \left(V_i \times \frac{L_i}{S_i} \right) \right) \times T \right]$$

where

VHD = Vehicle Hours of Delay (hours/time period)

V_i = Segment Volume (veh/h)

 L_i = Segment Length (mi)

 S_i = Segment Average Speed (mi/h)

FFS = Free-Flow Speed (mi/h)

T = Length of time period (h)

For metric units, Segment Length is measured in km, while Segment Average Speed and Free-Flow Speed are measured in km/h.

Vehicle Miles Traveled (VMT)

VMT is the vehicle miles traveled during time period *t*. In TwoLane, the facility VMT is the sum of each segment VMT, which is calculated using the equation below:

$$VMT = \sum_{t} [V_i \times L_i \times T]$$

where

VMT = Vehicle Miles Traveled (veh-miles/time period)

V_i = Segment Volume (veh/h)

 L_i = Segment Length (mi)

T = Length of time period (h)

For metric units, Vehicle Miles Traveled (VMT) is converted to vehicle-kilometers per time period and is then denoted as VkmT, which stands for Vehicle Kilometers Traveled.

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