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USER GUIDE

UF Transportation Institute UNIVERSITY of FLORIDA

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Introduction

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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

Two-Lane (2016) Segment – Opens the HCS7 TwoLane module which uses the HCM6E TwoLane methodology

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

Open TwoLane 2016 - Opens the HCS7 TwoLane module which uses the HCM6E TwoLane methodology

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. Length of the segment, 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 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. There is also the option to include a managed lane analysis. If 'Managed Lane' is checked under Geometric Data, managed lane sections will be added to the bottom of the input screen, which will allow coding of geometric data, demand data, and adjustment factor inputs related to the managed lane.

Adjustment Factors

Driver Population and Weather Conditions are 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 and weather conditions, 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

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

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:

HCS Highways		- 🗆 ×
=		
	1a	
Start		Help
New File		Topics
Open File	HIGHWAYS	HCS Updates
Example Folder		HCS Overview
Recent		McTrans Website
		HCM/HCS Training
		E-mail McTrans
	MCS2024	About HCS
τ	JF Transportation Institute McTrans	
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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	Ctri+N 🔸	Multilane Segment	
Open	Ctrl+O	Two-Lane Segment Two-Lane Facility	
Open Two Lane 2016 Example Folder		Two-Lane (2016) Segment	
Save Save As	Ctrl+S F12		
Close	Ctrl+W		Help
Jnits	•		Topics
Print Print Preview	Ctrl+P Ctrl+F2		<u>HCS Updates</u> <u>HCS Overview</u>
/iew	•	Highways	McTrans Website
Report mport From CSV Export To CSV	•		HCM/HCS Training E-mail McTrans
Default Settings	Alt+F		About HCS
Help	•		
Exit	Alt+F4		
		₩ HCS 2024	
		UNIVERSITY of FLORIDA	Suc Suc

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		– 🗆 X
	10	
	_	
Start		Help
New File		Topics
Open File	HIGHWAYS	HCS Updates
Example Folder		HCS Overview
Recent		McTrans Website
		HCM/HCS Training
		E-mail McTrans
	MCS2024	About HCS
	UF 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"



- 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

Highv	ways1.xuf - HCS Highways				-	٥	×
	START INPUT REPORT						
		Pr	roject Properties			^	
	Analyst		Jurisdiction]		
	Agency		Time Analyzed				
	Analysis Year	2023	Date	10/26/2023			
	Project Description		Units	U.S. Customary			
		Ge	eometric Data				
	Direction 1		Direction 2				
	Number of Lanes	3	Number of Lanes	3			
	Measured FFS	\checkmark	Measured FFS	\checkmark			
$\left(\leftarrow \right)$	Free Flow Speed, mi/h 60.0		Free Flow Speed, mi/h	60.0]		(\rightarrow)
Back	Median Type	Divided	Median Type	Divided			Next
	Lane Width, ft		Lane Width, ft	*			
	Right Side Clearance, ft	-	Right Side Clearance, ft	-			
	Median (Left) Side Clearance, ft	-	Median (Left) Side Clearance, ft	-			
	Access Point Density, points/mi	-	Access Point Density, points/mi	-			
	Terrain Type	Level	Terrain Type	Level			
	Percent Grade, %	-	Percent Grade, %	÷.			
	Grade Length, mi	-	Grade Length, mi	- ·			
	Demand Data						
	Demand, veh/h	0	Demand, veh/h	0		~	
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- 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.
- iii. If Two-Lane (2016) Segment was selected, the HCS7 TwoLane module will open.

b. Full View

			^			
	Dro	ject Properties			HCS Multil	lane Highway R
	FIU	ject rioperties		Project Information		
Analyst		Jurisdiction		Analyst		Date
		Time Arch and		Agency		Analysis Year
Agency		Time Analyzed		Jurisdiction		Time Analyzed
Analysis Year	2023	Date	10/26/2023	Project Description		Units
				Direction 1 Geometric Data		
Project Description		Units	U.S. Customary	Direction 1		
	Ger	ometric Data		Number of Lanes (N), In	3	Terrain Type
	UCC.	Since Data		Measured or Base Free-Flow Speed	Measured	Percent Grade,
Direction 1		Direction 2		Base Free-Flow Speed (BFFS), mi/h		Grade Length, r
Number of Lanes	3	Number of Lanes		Lane Width, ft		Access Point De
Number of Lanes	3	Number of Lanes	3	Median Type		Left-Side Latera
Measured FFS	\checkmark	Measured FFS	✓	Free-Flow Speed (FFS), mi/h	60.0	Total Lateral Cle
				Direction 1 Adjustment Factor		
Free Flow Speed, mi/h	60.0	Free Flow Speed, mi/h	60.0	Driver Population	All Familiar	Final Speed Adj
Median Type	Divided	Median Type	Divided	Driver Population SAF Driver Population CAF	1.000	Final Capacity A
incolution type	Divided	Median type	Divided	Direction 1 Demand and Capa		
Lane Width, ft	-	Lane Width, ft	-	Volume (V) veh/h	0	Heavy Vehicle A
Right Side Clearance, ft		Right Side Clearance, ft		Peak Hour Factor	0.94	Flow Rate (Vp).
Right Side Clearance, ft	-	Right Side Clearance, ft	-	Total Trucks. %	0.00	Capacity (c). pc
Median (Left) Side Clearance, ft	-	Median (Left) Side Clearance, ft	-	Single-Unit Trucks (SUT), %		Adjusted Capac
				Tractor-Trailers (TT), %		Volume-to-Cap
Access Point Density, points/mi	-	Access Point Density, points/mi	-	Direction 1 Speed and Density		
Terrain Type	Level ~	Terrain Type	Level ~	Lane Width Adjustment (fLW)	•	Average Speed
			10000	Total Lateral Clearance Adj. (fLLC)		Density (D). pc/
Percent Grade, %	-	Percent Grade, %	-	Median Type Adjustment (fM)		Level of Service
Grade Length, mi	-	Grade Length, mi	-	<		
		1 D 1	U U U U U U U	Switch to Text Report		8-

Open an Existing File

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

HCS Highways		– 🗆 X
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	19	
Start		Help
New File		Topics
Open File	HIGHWAYS	HCS Updates
Example Folder		HCS Overview
Recent		McTrans Website
		HCM/HCS Training
		E-mail McTrans
	MCS2024	About HCS
	UF Transportation Institute McTrans	
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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"



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

🚪 HCS Highways		- 0	×
Start New File		Help	
New File Open File	Highways	<u>Topics</u> <u>HCS Updates</u>	
Example Folder	TIGHWATS	HCS Overview	
Recent		McTrans Website	
		HCM/HCS Training	
		E-mail McTrans	
	🜌 HCS2024	About HCS	
	UNIVERSITY of FLORIDA	•	Ø
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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



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.

ICS Highways			- 0
New	Ctrl+N +		
Open Open Two Lane 201	Ctrl+O		
Example Folder			
Save Save As	Ctrl+S F12		
Close	Ctrl+W		elp
Units			pics
Print	Ctrl+P		<u>CS Updates</u>
Print Preview	Ctrl+F2	HIGHWAYS	CS Overview
View	•	MIGHWAYS M	cTrans Website
Report	•	HC	CM/HCS Training
Import From CSV		E	mail McTrans
Export To CSV		At	Dout HCS
Default Settings	Alt+F		
Help	•		
Exit	Alt+F4	HCS 2024	
		UF Transportation Institute UNIVERSITY of FLORIDA	· Sille
yright © 2023 Universit	ty of Florida. All Righ	ts Reserved.	HCS™ Highways Version 2

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		– 🗆 X
	15	
	_	
Start		Help
New File		Topics
Open File	HIGHWAYS	HCS Updates
Example Folder		HCS Overview
Recent		McTrans Website
		HCM/HCS Training
		E-mail McTrans
	MCS2024	About HCS
	UF Transportation Institute MCTrans	
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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

Project Properties Analyst	Analyst Jurisdiction Agency Time Analyzed Analysis Year 2022 Project Description Chapter 26: Example Problem 3 Units U.S. Customary Analyze Bicycle Results 2+1 Highway (Super 2) Segments Global Inputs Free Flow Speed, mi/h 60.0 Speed Limit, mi/h 9 50 Directional Demand, veh/h 0 Opposing Demand, veh/h 0 Shoulder Width (Paved), ft 6 12	(START SEGMENTS DETAI	LS R	EPORT										
Agency Image: Image	Agency Time Analyzed Analysis Year 2022 Date \$8/31/2022 Project Description Chapter 26: Example Problem 3 Units U.S. Customary Analyze Bicycle Results 2+1 Highway (Super 2) Segments Global Inputs Free Flow Speed, mi/h 60.0 Segments Global Speed Limit, mi/h 50 Directional Demand, veh/h 0 Directional Demand, veh/h 0 Directional Demand, veh/h 0 Select All Apply Global Inputs Select All Apply Global Inputs <th></th> <th></th> <th></th> <th></th> <th></th> <th>Proj</th> <th>ect Properties</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>^</th>						Proj	ect Properties							^
Analysis Year 2022 Date B(31/2022 Project Description Chapter 26: Example Problem 3 Units U.S. Customary Analyze Bicycle Results 2+1 Highway (Super 2)	Analysis Year 2022 Date 8/31/2022 Project Description Chapter 26: Example Problem 3 Units U.S. Customary Analyze Bicycle Results 2+1 Highway (Super 2)	1	Analyst					Jurisdiction							
Project Description Chapter 26: Example Problem 3 Units U.S. Customary Analyze Bicycle Results 2+1 Highway (Super 2)	Project Description Chapter 26: Example Problem 3 Units U.S. Customary Analyze Bicycle Results 2+1 Highway (Super 2)		Agency					Time Analyzed	1						
Project Description Chapter 26: Example Problem 3 Units U.S. Customary Analyze Bicycle Results 2+1 Highway (Super 2) Segments Global Inputs Free Flow Speed, mi/h 60.0 Peak Hour Factor 0.94 % Heavy Vehicles 0.00 Directional Demand, veh/h 0 Opposing Demand, veh/h 0 Lane Width, ft 12 Shoulder Width (Paved), ft 6	Project Description Chapter 26: Example Problem 3 Units U.S. Customary Analyze Bicycle Results 2+1 Highway (Super 2)		Analysis Year		2022			Date			8/31/2022				
Analyze Bicycle Results 2+1 Highway (Super 2) Segments Global Inputs Free Flow Speed, mi/h 60.0 Speed Limit, mi/h Peak Hour Factor 0.94 Directional Demand, veh/h 0 Qpposing Demand, veh/h 0 Lane Width, ft 12	Analyze Bicycle Results 2+1 Highway (Super 2) Segments Global Inputs Free Flow Speed, mi/h 60.0 9.94 Speed Limit, mi/h 9 0.00 Directional Demand, veh/h 0 0 Opposing Demand, veh/h 0 Opposing Demand, veh/h 0 0 Lane Width, ft 12 Access Point Density, points/mi 0.0 Grade, % 0.00 Select All Apply Global Inputs Select All Apply Global Inputs Segments Input Detets Segment 1/ Passing Constrained 3980 1/ Passing Constrained 3980 1/ Passing Lanes 750 1/ Passing Lanes 750		and the second se		Chapter 26: Evam	le Problem 3		Units			IIS Customan	,			
Segments Global Inputs Free Flow Speed, mi/h 60.0 Speed Limit, mi/h 50 Peak Hour Factor 0.94 % Heavy Vehicles 0.00 Directional Demand, veh/h 0 Opposing Demand, veh/h 0 Lane Width, ft 12 Shoulder Width (Paved), ft 6	Segments Global Inputs Free Flow Speed, mi/h 60.0 Speed Limit, mi/h 50 Peak Hour Factor 0.94 0.00 0.00 Directional Demand, veh/h 0 Opposing Demand, veh/h 0 Lane Width, ft 12 Shoulder Width (Paved), ft 6 Access Point Density, points/mi 0.0 Grade, % 0.00 Select All Apply Global Inputs Select AllApply Global Inputs Detet Segment Detet Segment Detet Segment Detet Segment Type 1 Passing Constrained 3960 55 850 - 0.04 0.00 8.00 Details 2 Passing Langes 7920 55 825 - 0.05 0.00 8.00 Details					ile i robieni b			(Super 2)		,				
Free Flow Speed, mi/h 60.0 Speed Limit, mi/h 50 Peak Hour Factor 0.94 % Heavy Vehicles 0.00 Directional Demand, veh/h 0 Opposing Demand, veh/h 0 Lane Width, ft 12 Shoulder Width (Paved), ft 6	Free Flow Speed, mi/h 60.0 Peak Hour Factor 0.94 Directional Demand, veh/h 0 Directional Demand, veh/h 0 Directional Demand, veh/h 0 Lane Width, ft 12 Access Point Density, points/mi 0.0 Grade, % 0.00 Select All Apply Global Inputs Delete Segment Delete Segment Delete Segment Delete Segment Type Name Length, ft Speed Limit, m Directional Demand, v Ppising Constrained 3960 55 850 - 0.04 0.00 8.00 Details 1 Passing Lanes 7920 55 825 - 0.04 0.00 8.00 Details	I,	Analyze bicycle Results												
Peak Hour Factor 0.94 % Heavy Vehicles 0.00 Directional Demand. veh/h 0 Opposing Demand, veh/h 0 Lane Width, ft 12 Shoulder Width (Paved), ft 6	Peak Hour Factor 0.94 0 0 Directional Demand, veh/h 0 0 0 Directional Demand, veh/h 0 0 0 Lane Width, ft 12 Shoulder Width (Paved), ft 6 Access Point Density, points/mi 0.0 Grade. % 0.00 Select All	J					Segmei	nts Global Inputs							
Directional Demand, veh/h 0 0 0 Lane Width, ft 12 Shoulder Width (Paved), ft 6	Directional Demand, veh/h		Free Flow Speed, mi/h		60.0			Speed Limit, n	ni/h		50				
Lane Width, ft	Lane Width, ft 12 2 Shoulder Width (Paved), ft 6 Access Point Density, points/mi 0.0 Grade, % 0.00 Select All Apply Global Inputs Select All Apply Global Inputs Segments Inputs Add Segment Details Delete Segment Delete Segment Delete Segment Details Segment PHF Grade, % Heavy Vehicles (%) Segment Details Segment Details Segment PHF Grade, % Heavy Vehicles (%) Segment Details Segment PHF Grade, % Heavy Vehicles (%) Segment Details Segment Segment		Peak Hour Factor		0.94			% Heavy Vehic	les		0.00				
Lane Width, ft	Lane Width, ft 12 Shoulder Width (Paved), ft 6 6 6 6 6 6 6 6 6)	Directional Demand, veh/h		0			Opposing Der	nand, veh/h		0				
	Access Point Density, points/mi 0.0 Grade, % 0.00 Select All Apply Global Inputs Segments Input Add Segment Add Segment Inser Segment Delete Segment Del	/	Lane Width, ft		12			Shoulder Widt	h (Paved), ft		6				
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	Map-Based Segmentation Add Segment Delete Segment Type Name Length, ft Speed Limit, m Directional Demand, v PHF Grade,% Heavy Vehicles (%) Segment Details 1 Passing Constrained 3960 55 850 - 0.94 0.00 8.00 Details 2 Passing Lanes 7920 55 825 - 0.95 0.00 8.00 Details						Sec	ments Input							
Seaments Input	Add Segment Insert Segment Delete Segment Type Name Length, ft Speed Limit, m Directional Demand, v PHF Grade,% Heavy Vehicle (%) Segment Details 1 Passing Constrained 3960 55 850 - 0.94 0.00 8.00 Details 2 Passing Lanes 7920 55 825 - 0.95 0.00 8.00 Details	Ľ												_	
	Type Name Length, ft Speed Limit, m Directional Demand, v Opposing Demand, v PHF Grade,% Heavy Vehicles (%) Segment Details 1 Passing Constrained 3960 55 850 - 0.94 0.00 8.00 Details 2 Passing Lanes 7920 55 825 - 0.95 0.00 8.00 Details														
Map-Based Segmentation	1 Passing Constrained 3960 55 850 - 0.94 0.00 8.00 Details 2 Passing Lanes 7920 55 825 - 0.95 0.00 8.00 Details		Add S	gmen	t			nsert Segment				Delete Segment			
Map-Based Segmentation	2 Passing Lanes 7920 55 825 - 0.95 0.00 8.00 Details		Type Name		Length, ft	Speed Limit, m	Directional Demand, v	Opposing Demand, ve	PHF	(Grade,%	Heavy Vehicles (%)	Segment Details		
Map-Based Segmentation Add Segment Insert Segment Delete Segment			1 Passing Constrained												
Map-Based Segmentation Add Segment Delete Segment Type Name Length, ft Speed Limit, m Directional Demand, v PHF Grade,% Heavy Vehicles (%) Segment Details 1/Passing Constrained 3960 55 850 - 0.94 0.00 8.00 Details			2 Passing Lanes		7920		825	-	0.95	0	0.00	8.00	Details		

b. Full View

						^					_
			Proi	ect Properties					HCS Two-La	ne Highwa	iy I
						_		Project Information			
Analyst				Jurisdiction				inalyst		Date	_
Agency	<u></u>			Time Analyzed				lgency		Analysis Ye	_
Agency				Time Palatyzed		-		urisdiction		Time Anal	yzec
Analysis Year	2022			Date		8/:	P	Project Description	Chapter 26: Example Problem 3	Units	
Project Description	Chapter 26: F	xample Problem 3		Units		U.S			Si	egment 1	
rojectocomption	chapter core	ample rioblem b		onto		0.0	V	/ehicle Inputs		-	_
Analyze Bicycle Results				2+1 Highway (Super 2)			s	iegment Type	Passing Constrained	Length, ft	
			Soamo	nts Global Inputs			L	ane Width, ft	12	Shoulder V	Midt
			Segmen	its clobal inputs			s	ipeed Limit, mi/h	55	Access Poi	int (
Free Flow Speed, mi/h	60.0			Speed Limit, mi/h		50		Demand and Capacity			
					_		D	Directional Demand Flow Rate, veh/h	904	Opposing	Der
Peak Hour Factor	0.94			% Heavy Vehicles		0.0		eak Hour Factor	0.94	Total Truck	_
Directional Demand, veh/h	0			Opposing Demand, veh/h		0		iegment Capacity, veh/h	1700	Demand/0	Гара
								ntermediate Results	1.		
Lane Width, ft	12			Shoulder Width (Paved), ft		6		egment Vertical Class	3,93029	Free-Flow Speed Pov	
Access Point Density, points/mi	0.0			Grade, %		0.0		ipeed Slope Coefficient (m) /F Slope Coefficient (m)	3.93029	PF Power 0	
								P Slope Coemcient (m) n Passing Lane Effective Length?	-1.28948 No	Follower D	_
								6 morovement to Percent Followers	0.0	96/mprove	_
			Select All	Apply Global Inputs				subsegment Data			
						- 1	L 18	Segment Type	Length, ft	Radius, ft	-
			Seg	iments Input			1	Tangent	3960		-
			Man	Based Segmentation			V	/ehicle Results			-
			тар-с	ased Segmentation			A	kverage Speed, mi/h	58.8	Percent Fo	Nolic
Add Segme	ent			nsert Segment			(anness Travel Time minutes	0.76	Arti Enllow	
						_		Switch to Text Report			
Type Name	Length, ft		Directional Demand, v	Opposing Demand, ve PHF		Grade v		Contraction (1998) - Contraction (1998)		All Seq	
						>		Segment	~	1 will sed	m

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"

ways1.xuf* - HCS Highways				- 0	1
START INPUT REPORT					
ew Ctrl+N +	Proje	ect Properties			^
pen Ctrl+O pen Two Lane 2016 ample Folder		Jurisdiction Time Analyzed			
ive Ctrl+S	2023	Date	10/26/2023		
ive As F12		Units	U.S. Customary		
ose Ctrl+W	Geor	netric Data			
nits •		Direction 2			
int Ctrl+P				= 1	
int Preview Ctrl+F2	3	Number of Lanes	3	_	
ew •	\checkmark	Measured FFS	V		
eport •	60.0	Free Flow Speed, mi/h	60.0		
port From CSV port To CSV	Divided	Median Type	Divided		
efault Settings Alt+F	-	Lane Width, ft	-		
elp 🕨	-	Right Side Clearance, ft	-		
it Alt+F4	-	Median (Left) Side Clearance, ft			
Access Point Density, points/mi	-	Access Point Density, points/mi	-		
Terrain Type	Level ~	Terrain Type	Level	~	
Percent Grade, %	-	Percent Grade, %			
Grade Length, mi	-	Grade Length, mi			
	Den	nand Data			
Demand, veh/h	0	Demand, veh/h	0		

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..."

Highways1.xuf* - HCS Highways		-		- 0	×
START INPUT REPORT					0
New Ctrl+N >	Pro	oject Properties			^
Open Ctrl+O Open Two Lane 2016 Example Folder		Jurisdiction Time Analyzed			
Save Ctrl+S	2023	Date	10/26/2023		
Save As F12		Units	U.S. Customary		
Close Ctrl+W	Ge	ometric Data			
Units Image: Print Ctrl+P Print Preview Ctrl+F2	3	Direction 2 Number of Lanes	3		
View +	2	Measured FFS	2		
Report Import From CSV Export To CSV	60.0 Divided	Free Flow Speed, mi/h Median Type	60.0 Divided		\supset
Default Settings Alt+F	-	Lane Width, ft	-		Next
Help	-	Right Side Clearance, ft	-		
Exit Alt+F4	-	Median (Left) Side Clearance, ft	-		
Access Point Density, points/mi	-	Access Point Density, points/mi	-		
Terrain Type	Level ~	Terrain Type	Level ~		
Percent Grade, %	-	Percent Grade, %	-		
Grade Length, mi	F	Grade Length, mi	-		
	D	emand Data			
Demand, veh/h	0	Demand, veh/h	0		
Copyright © 2023 University of Florida. All Rights Reserved	d.		HCS™ Highway	s Version 20	024 (USC)

- 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"

START SEGMENT	S DETAILS R	EPORT										
New	Ctrl+N +			Proje	ect Properties							^
Open Open Two Lane 2016 Example Folder	Ctrl+O				Jurisdiction Time Analyzed	i -						
ave	Ctrl+S	2022			Date			8/31/2022				
ave As	F12	Chapter 26: Examp	le Problem 3		Units			U.S. Customary				
lose	Ctrl+W				2+1 Highway	(Super 2)						
Jnits	•											
Print	Ctrl+P			Segmer	nts Global Inputs	5						
Print Preview	Ctrl+F2	60.0			Speed Limit, n	ni/h		50				
liew	• 🗆	0.94			% Heavy Vehic	cles		0.00				
leport	، ا	0			Opposing Der	nand, veh/h		0				
mport From CSV								6				
xport To CSV		12			Shoulder Widt	th (Paved), ft						
Default Settings	Alt+F	0.0			Grade, %			0.00				
lelp	•											
xit	Alt+F4			Select All	Apply Global Inpu	ts						
					ments Input						-	
				Map-B	lased Segmentation							
	Add Segmer	it		6	nsert Segment				Delete Segment			
Туре	Name	Length, ft	Speed Limit, m	Directional Demand, v	Opposing Demand, ve	PHF		Grade,%	Heavy Vehicles (%)	Segment Details		
1 Passing Constraine	d	3960	55	850	-	0.94	0	0.00	8.00	Details		
2 Passing Lanes		7920	55	825	-	0.95	0	0.00	8.00	Details		
3 Passing Constraine	d	5280	55	820	-	0.95	0	0.00	8.00	Details		4

- 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 Open Two Lane 2016 Example Folder	Ctrl+O		
Save	Ctrl+S		
Save As	F12		Help
Close	Ctrl+W		Topics
Units	+		
Print	Ctrl+P	69	HCS Updates
Print Preview	Ctrl+F2	HIGHWAYS	HCS Overview
View	*	riignwar5	McTrans Website
Report Import From CSV Export To CSV	٠		HCM/HCS Training E-mail McTrans
Default Settings	Alt+F		About HCS
Help			
Exit	Alt+F4		
		HCS 2024	
		UF Transportation Institute MCTRANS	S.C.
yright © 2023 University o			HCS™ Highways Version 20

- 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		- U X
=		
	1 ^a	
Start		Help
New File		Topics
	Highways	DERIC AND DECEMBER OF
Open File	HIGHWAYS	HCS Updates
Example Folder		HCS Overview
Recent		McTrans Website
		HCM/HCS Training
		E-mail McTrans
	HCS 2024	About HCS
	Transportation Institute	
	UF Transportation Institute UNIVERSITY of FLORIDA	
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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:

🖉 Default Setting	gs	×
Analyst		
Agency		
Jurisdiction		
New File De	fault Units	
	● USC ○ Metric	
Safety Analy	vsis	
Show Sa	afety Analysis Results in Reports	
K-Factor:	0.10	
D-Factor:	0.55	
D-Factor:		

- 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.

Analys Agenc		S REP	ORT								
Agenc											
Agenc		-			Proje	ect Properties					-
	01					Jurisdiction					
	~ 7					Time Analyzed					
Analys	vsis Year	20	022			Date		8/31/2022			
	ct Description		hapter 26: Example	e Problem 3		Units		U.S. Customar	N/		
		_		i i i obietiti b					· y		
Analyz	ze Bicycle Results		Ł			2+1 Highway (Super 2)					
					Segmer	nts Global Inputs					
Free Fl	Flow Speed, mi/h	60	0.0			Speed Limit, mi/h		50			1
Peak H	Hour Factor	0.	94			% Heavy Vehicles		0.00			
Directi	tional Demand, veh/h					Opposing Demand, veh	/h 🗌	0			
						Shoulder Width (Paved)	_	6			
-K		_					_				
Access	ss Point Density, points/mi	0.	0			Grade, %		0.00			

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.

					^					
			Proje	ect Properties				HCS Two-La	ne Highway	/ Re
			i i oje	the second s		Proje	ect Information			
Analyst				Jurisdiction		Analys	t		Date	_
Agency		[Time Analyzed		Agend			Analysis Yea	_
						Jurisdi	t Description	Chapter 26: Example	Time Analys Units	ed
Analysis Year		2022		Date	8/:	Projec	t Description	Problem 3	Units	
Project Description		Chapter 26: Example Problem 3		Units	U.S			S	egment 1	
						Vehic	le Inputs			
Analyze Bicycle Results				2+1 Highway (Super 2)		-	ent Type	Passing Constrained	Length, ft	_
			Seamer	ts Global Inputs		1000000	Width, ft	12	Shoulder W	
			Seginer				l Limit, mi/h	55	Access Poin	: De
Free Flow Speed, mi/h		60.0		Speed Limit, mi/h	50		and and Capacity	Inc		
Peak Hour Factor		0.94		% Heavy Vehicles	0.0		ional Demand Flow Rate, veh/h four Factor	904	Opposing D Total Trucks	
reak flour factor		0.54		76 Heavy vehicles	0.0		Hour Factor ent Capacity, veh/h	1700	Demand/Ca	
Directional Demand, veh/h		0		Opposing Demand, veh/h	0	-	mediate Results	1700	Demand/Ca	pac
Lane Width, ft	П	12		Shoulder Width (Paved), ft	6	10000000	ent Vertical Class	1	Free-Flow S	
Lane Width, it		12		Shoulder width (Paved), It	•		Slope Coefficient (m)	3.93029	Speed Powe	
Access Point Density, points/mi		0.0		Grade, %	0.0	PF SIO	pe Coefficient (m)	-1.28948	PF Power Co	seff
					_	In Pas	sing Lane Effective Length?	No	Follower De	insit
						96Imp	rovement to Percent Followers	0.0	%Improvem	ient
			Select All	Apply Global Inputs		Subs	egment Data			_
			Coo	mente lanut	- 11	-	Segment Type	Length, ft	Radius, ft	
			Seg	ments Input		1	Tangent	3960	-	
			Map-B	ased Segmentation		Vehic	le Results			
							ge Speed, mi/h	58.8	Percent Foll	24.5
Add Seg	ment		la la	isert Segment		<	nat Traval Time, anias tas	0.76	Adi Enllour	- 0
Type Name		Length, ft Speed Limit, m Direc	tional Demand y	Opposing Demand, ve PHF	Grad	P	Switch to Text Report			_
Type Tvame		lanco los	uonai Demano, v	opposing Demand, ve PHP			gment		All Segn	

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.

ultilane4-FiveLaneHighwayT	WLTL.xuf - HCS Highway	/5				-	٥	>
			Proj	ect Properties				
Analyst				Jurisdiction				
Agency				Time Analyzed				
Analysis Year		2022		Date	8/31/2022			
		Let a set a						
Project Description		Chapter 26: Examp		Units	U.S. Customary			
			Geo	metric Data				
Direction 1		EB		Direction 2	WB			
Number of Lanes		2		Number of Lanes	2			
Measured FFS				Measured FFS	Π			
Base Free Flow Speed	, mi/h	52.0		Base Free Flow Speed, mi/h	52.0			
	HCS Multilane	e Highway Report						
roject Information								
nalyst		Date	8/31/2022					
gency		Analysis Year	2022					
risdiction		Time Analyzed						
oject Description	Chapter 26: Example Problem 4	Units	U.S. Customary					
irection 1 Geometric Data								
rection 1	EB							
umber of Lanes (N), In	2	Terrain Type	Specific Grade					
	Dara	Barrant Grada Di	3 60					_
nariurad as Dasa Essa, Elaus Canad								_
aariirad ar Dara Eraa, Elaiii Caaad			Switch to Text Rep	ort				

- 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".

START SEGMEN	IS DETAILS	REPORT										
New	Ctrl+N +			Proje	ect Properties							^
Open Open Two Lane 2016 Example Folder	Ctrl+O				Jurisdiction Time Analyzed	()						
Save	Ctrl+S	2022			Date			8/31/2022				
Save As	F12	Chapter 26: Exampl	e Problem 3		Units			U.S. Customary				
Close	Ctrl+W				2+1 Highway	Super 2)						
Units	•			C	nts Global Inputs							
Print	Ctrl+P			segmen								
Print Preview	Ctrl+F2	60.0			Speed Limit, n	ni/h		50				
/iew	•	Page View F9			% Heavy Vehic	les		0.00				
Report	•L_	Full View			Opposing Der	nand, veh/h		0				
mport From CSV		1 12			Shoulder Widt			6				
Export To CSV		-				n (Paved), π						
Default Settings	Alt+F] 0.0			Grade, %			0.00				
Help	+											
Exit	Alt+F4			Select All	Apply Global Input	s						
				Sec	ments Input							
											_	
				Map-E	Based Segmentation							
	Add Segm	ent		1	nsert Segment				Delete Segment			
Туре	Name	Length, ft	Speed Limit, m	Directional Demand, v	Opposing Demand, ve	PHF	(Grade,%	Heavy Vehicles (%)	Segment Details		
1 Passing Constraine	ed	3960	55	850	-	0.94	0	0.00	8.00	Details		
2 Passing Lanes		7920	55	825	•	0.95		0.00	8.00	Details		
3 Passing Constraine	bd	5280	55	820		0.95	0	0.00	8.00	Details		v.

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".

Туре	Name	Length, ft	Speed Limit, m	Directional Demand, v	Opposing Demand, ve PHF	Gr		Switch to Text Report Seament		All Seam
	Add Segmer				nsert Segment					- Art. Settlement
	ALLC				and A statements .			Average Speed, mi/h	58.8	Percent Follo
				Map-B	ased Segmentation			Vehicle Results	-	
				Seg	ments mpar			1 Tangent	3960	•
				Son	ments Input			# Segment Type	Length, ft	Radius. ft
				Select All	Apply Global Inputs			Subsegment Data		
								Stimprovement to Percent Followers	0.0	96Improveme
İxit	Alt+F4							In Passing Lane Effective Length?	No	Follower Den
		0.0			Grade, %		0.0	PF Slope Coefficient (m)	-1.28948	PF Power Cos
Help								Speed Slope Coefficient (m)	3.93029	Speed Power
Default Settings	Alt+F	12			Shoulder Width (Paved), ft		6	Segment Vertical Class	1	Free-Flow Sp
Export To CSV		0			Opposing Demand, veh/h		0	Intermediate Results	1	
mport From CSV					(1000-0000) · (1000-0000)			Segment Capacity, veh/h	1700	Demand/Cap
Report	• [0.94	Kep	are rught 110	% Heavy Vehicles		0.0	Peak Hour Factor	0.94	Total Trucks
		Full View		ort -> Right F10	Speed Limit, mi/h		50	Directional Demand Flow Rate, veh/h	904	Opposing De
liew	,	Page View	F9		and the second second second			Speed Limit, mi/h Demand and Capacity	55	Access Point
Print Preview	Ctrl+F2			Segmen	its Global Inputs			Lane Width, ft Speed Limit, mi/h	12	Shoulder Wic Access Point
Print	Ctrl+P				2+1 Highway (Super 2)			Segment Type	Passing Constrained	Length, ft
Jnits	•	-			2 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			Vehicle Inputs		
		Chapter 26: Exan	nple Problem 3		Units		J.S		Se	egment 1
lose	Ctrl+W	2022			Date		8/.	- index entropy	Problem 3	
Save As	F12				1000 Control 1000			Project Description	Chapter 26: Example	Linits
Save	Ctrl+S				Time Analyzed		-	Agency	-	Analysis Year Time Analyze
Example Folder					Jurisdiction			Analyst		Date
Open Two Lane 2016				FIOJE	curroperues			Project Information		
Open	Ctrl+O			Denis	ect Properties		-		HCS Two-Lar	he Highway
Vew	Ctri+N 🔸									
				,			_			

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			Dec			
Open Two Lane 2016				Proj	ject Properties		
Example Folder					Jurisdiction		
Save	Ctrl+S				Time Analyzed		
Save As	F12		2022		Date	8/31/2022	
Close	Ctrl+W		2022		Date	6/31/2022	
Units			Chapter 26: Exa	mple Problem 4	Units	U.S. Customary	
Print	Ctrl+P	1		Geo	ometric Data		
Print Preview	Ctrl+F2		EB		Direction 2	WB	
View		-	Page View F9				
	_	î 🗖	Full View	Report -> Right F10	Number of Lanes	2	
Report Import From CSV				Report -> Bottom F11	Measured FFS		
Export To CSV			52.0		Base Free Flow Speed, mi/h	52.0	
Default Settings	Alt+F		Contractory.				
	CPANSO .						
Help		lulti	ilane Highway Report				
Exit	Alt+F4						
nalyst	_		Date	8/31/2022			
gency			Analysis Year	2022			
urisoliction	Chanter	26: Exampl	Time Analyzed ple Units	U.S. Customary			
	Problem 4	.4	xe Units	U.S. Customery			
irection 1 Geometric Data							
lirection 1	EB		1 10 10 10 10 10 10 10				
lumber of Lanes (N), In	2		Terrain Type	Specific Grade			
Instructed on Para Stee, Since Conned	I Dana		I Bourcat Grade 16	1.250			
				Switch to Text Rep	ort		

- 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.

ane4-FacilityAnalysisMou	untainRoad.xuf -	HCS Hig	hways								- č	3
START SEGMEN	TS DETAILS	REPO	RT									
Directional Demand	d, veh/h	0				Opposing D	emand, veh/h	0				^
Lane Width, ft		12				Shoulder W	dth (Paved), ft	6				
Access Point Densit	tv. points/mi	7 0.0				Grade, %		0.00				
					Colord All							
					Select All		outs					e l
					Seg	gments Input						
					Map	Based Segmentation						
	Add Segm	ent				Insert Segment			Delete Segment			
				12 20 8			ranel	1021 0121	-		-	
Type 1 Passing Constrain	Name		Length, ft 6864	Speed Limit, m 55	Directional Demand, v	Opposing Demand,	0.90	Grade,% 4.00	Heavy Vehicles (%) 8.00	Segment Details		
2 Passing Constrain			5280	55	1100		0.90	6.00	8.00	Details	-	
3 Passing Constrain			2640	55	1100	-	0.90	6.00	8.00	Details		
4 Passing Constrain			6864	55	1100	-	0.90	4.00	8.00	Details		
5 Passing Lanes			2640	55	1100	-	0.90	-3.00	8.00	Details		
6 Passing Constrain	ied		2640	55	1100	-	0.90	-3.00	8.00	Details		
	- Facility		8	8		\$			Š		_	
	Туре	PC	5	PC	PC	F	c	PL	PC			
	Length, ft	68	864	5280	26		864	2640	2640			
	Segment ID	1		2	3	4		5	6			
												Ě
nt © 2023 University of	Florida. All Rights	Reserve	d.							HCS [™] Highways	/ersion	2024

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.

	CSegment									
	None	Type Length, ft	PC 6864	PC 5280	PC 2640	PC 6864	PL 2640	PC 2640		
	O Speed	Segment ID	1	2	3	4	5	6		
	O Follower Density									
	O LOS									
	O BLOS Score	<			1	1			>	
				Geon	etric Data					
	Coded Type		Passing Constrained		Length Used in	Calculation, mi	1.30			
\frown	Measured FFS				Analyze Bicycle	e Results				\sim
\leftarrow	Free Flow Speed, mi/h		-		Speed Limit, m	ii/h	55			(\rightarrow)
Back	Lane Width, ft		12		Shoulder Widt	h (Paved), ft	6			Next
	Grade. %		4.00			ensity, points/mi	0.0			
	Pavement Condition Rating				Percent Occup	1.22.14	010			
	Pavement Condition Rating					ieu Farking, %	-		_	-
					osegments					
	Add Su	bsegment		Inse	rt Subsegment		D	elete Subsegment		
	Туре		Length, ft		Radius ft		Superelevatio	n, %		
	1 Tangent		3864		- 850		- 2.0			
	2 Horizontal Curve		3000		008		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.

STA	RT SEGMENTS DETA	LS REPORT							
		HCS Two-Lar	e Highway	Report		í			
0	roject Information				_				
	nalyst	Т	Date		8/31/2022	1			
	gency		Analysis Yea		2022				
	urisdiction		Time Analyz						
PI	roject Description	Chapter 26: Example Problem 3	Units		U.S. Customary				
		Se	gment 1			1			
v	ehicle Inputs					1			
	egment Type	Passing Constrained	Length, ft		3960	1			
L	ane Width, ft	12	Shoulder Wi	dth, ft	6				
S	peed Limit, mi/h	55	Access Point	: Density, pts/mi	0.0	1			
D	emand and Capacity	1.				1			
D	irectional Demand Flow Rate, veh/h	904	Opposing D	emand Flow Rate, veh/h	-	1			
P	eak Hour Factor	0.94	Total Trucks,	96	8.00	1			
S	egment Capacity, veh/h	1700	Demand/Ca	pacity (D/C)	0.53	1			
Ir	ntermediate Results					1			
s	egment Vertical Class	1	Free-Flow S	peed, mi/h	62.4	1			
S	peed Slope Coefficient (m)	3.93029	Speed Powe	r Coefficient (p)	0.41674				
P	F Slope Coefficient (m)	-1.28948	PF Power Co	efficient (p)	0.76718	1			
In	Passing Lane Effective Length?	No	Follower De	nsity, followers/mi/in	10.7	1			
96	improvement to Percent Followers	0.0	96/mprovem	ent to Speed	0.0	1			
s	ubsegment Data					1			
#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h]			
1	Tangent	3960	-	-	58.8				
V	ehicle Results								
A	verage Speed, mi/h	58.8	Percent Folk	owers, %	69.7				
	egment Travel Time, minutes	0.76	Adj. Followe	r Density, followers/mi/in	10.7				
p		1-		s	witch to Text Report				_
				Sea	ment	~ •	All Segments		

a. Page View with Report page displayed

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

				HCS Two-La	ne Highway Re	aport	
		Project Proper	Project Information	TICS TWO-Lai	ne mgilway iki	sport	
nalyst		Jurisdi	Analyst	1	Date		8/31/2022
layse			Agency	-	Analysis Year		2022
gency		Time /	Jurisdiction		Time Analyzed		
nalysis Year	2022	Date	Project Description	Chapter 26: Example Problem 3	Units		U.S. Customary
roject Description	Chapter 26: Example Problem 3	Units		Se	gment 1		
roject Description	chapter 20, example rioblem 5		Vehicle Inputs	10-40	-		
nalyze Bicycle Results		2+1 H	Segment Type	Passing Constrained	Length, ft		3960
		Segments Global	Lane Width, ft	12	Shoulder Width,	ft	6
		Segments Global	Speed Limit, mi/h	55	Access Point Den	sity, pts/mi	0.0
ree Flow Speed, mi/h	60.0	Speed	Demand and Capacity				
			Directional Demand Flow Rate, veh/h	904	Opposing Deman	nd Flow Rate, veh/h	•
eak Hour Factor	0.94	% Hea	Peak Hour Factor	0.94	Total Trucks, %		8.00
irectional Demand, veh/h	0	Oppos	Segment Capacity, veh/h	1700	Demand/Capacit	y (D/C)	0.53
_		opper	Intermediate Results				
ane Width, ft	12	Should	Segment Vertical Class	1	Free+Flow Speed		62.4
			Speed Slope Coefficient (m)	3.93029	Speed Power Cor		0.41674
ccess Point Density, points/mi	0.0	Grade	PF Slope Coefficient (m)	+1.28948	PF Power Coeffic		0.76718
			In Passing Lane Effective Length?	No	Follower Density,	followers/mi/In	10.7
			96improvement to Percent Followers	0.0	%improvement t	o Speed	0.0
	Se	lect All 📃 🛛 Apply Gl	Subsegment Data				
		Segments Inc	# Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/
		Segments mp	1 Tangent	3960	-	-	58.8
		Map-Based Segment	Vehicle Results	1			1
-			Average Speed, mi/h	58.8	Percent Followen	1997.10	69.7
Add Segme	at .	Insert Segment	Conment Travel Time minuter	0.76	Adi, Sollower Der	with a falloware (m) /la	110.7

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

			Project	Properties			
Analyst				Jurisdiction			
1999 199 4 1992				Time Analyzed			
Agency				Time Analyzed			
Analysis Year		2022		Date	8/31/2022		
Project Description		Chapter 26: Example Prob	lem 4	Units	U.S. Customary		
			Geome	tric Data			
Direction 1		EB		Direction 2	WB		
Number of Lanes	HCS Multilane	2 e Highway Report		Number of Lanes	2		_
	HCS Multilane	2 e Highway Report		Number of Lanes	2		
oject Information	HCS Multilane		8/31/2022	Number of Lanes	2		
oject Information	HCS Multilane	e Highway Report	Contraction (Number of Lanes	2		
oject Information alyst ency		e Highway Report	8/31/2022 2022	Number of Lanes	2		
oject Information alyst ency isdiction	HCS Multilane	e Highway Report Date Analysis Year	Contraction (Number of Lanes	2		
roject Information ubjet ency rediction oject Description	Chapter 26: Example	2 Highway Report Date Analysis Year Time Analyzed	2022	Number of Lanes	2		
roject Information wlyst gency sidiotion oject Description irrection 1 Geometric Data	Chapter 26: Example Problem 4	2 Highway Report Date Analysis Year Time Analyzed	2022	Number of Lanes	2		
roject Information abjit gency modicion genc Description irrection 1 Geometric Data ection 1	Chapter 20: Example Problem 4	2 Highway Report Date Analysis Year Time Analyzed	2022	Number of Lanes	2		
roject Information whyst: gency right Discription gent Discription irrection 1 Geometric Data rescion 1 umber of Lanes (N), In	Chapter 26: Example Problem 4 EB 2 Base	e Highway Report Date Analysis Yaar Tine Analyzed Unite	2022 U.S. Customary Specific Grade -3.50	Number of Lanes	2		
roject Information valys: gercy visidiction registr Description interction 1 Geometric Data vacion 1 under of Data (Feb Speed tessured o Bata (Feb Speed tes Gree-Row Speed (BFS), m/h	Chapter 26 Example Problem 4 EB 2 8ase 52.0	Highway Report Date Anaysis Year Time Analysed Units Terrain Type Percent Grade. % Grade Length mi	2022 U.S. Customary Specific Grade -3.50 1.25	Number of Lanes	2		
roject Information nalyst gency inject Description irrection 1 Geometric Data receiton 1 member of Lanes (PI), In leasured of Base Free-Row Speed see Free-Row Speed (BFS), m/h no Woth, ft	Chapter 26: Example Problem 4 EB 2 Base	Highway Report Date Analysis Year Time Analysed Units Terrain Type Percent Grade. % Grade Length. ml Access Pair Density. ptz/ml	2022 U.S. Customary Specific Grade -3-50 1.25 10.0	Number of Lanes	2		
roject Information valys: gercy visidiction registr Description interction 1 Geometric Data vacion 1 under of Data (Feb Speed tessured o Bata (Feb Speed tes Gree-Row Speed (BFS), m/h	Chapter 26 Example Problem 4 EB 2 8ase 52.0	Highway Report Date Anaysis Year Time Analysed Units Terrain Type Percent Grade. % Grade Length mi	2022 U.S. Customary Specific Grade -3.50 1.25	Number of Lanes	2	R =	

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

- onal Demand Flow Rate, veh/h 1222 Opposing Demand Flow Rate, veh/h Total Trucks, % & Project Information 0.72 Segment Capacity, veh/ 1700 Demand/Capacity (D/0 Intermediate Results 2022 gency Analysis Year Free-Flow Speed, mi/h Speed Power Coefficient (p) PF Power Coefficient (p) Chapter 26: Example Units 59.0 0.53956 5 14.16895 Speed Slope Coefficient (m) roject Description U.S. Customa PF Slope Coefficient (m) In Passing Lane Effective Length? 1,8963 PF Power Coefficient (p) Total Segment Density, veh/mi/In No 24.8 Segment 1 Vehicle Inputs Subsegment Data Segment Type
 Tangent
 Horizontal Curve Length, ft 1000 4280 Length, ft Shoulder Width, ft Radius, ft Supere ion, 16 Segment Type Lane Width, ft Pass 12 6864 Access Point Density, pt 500 Demand and Capacity Vehicle Results 1222 Opposing Demand Flow Rate, veh/h . 8.00 0.72 liverage Speed, mi/h Segment Travel Time, 44.0 1.36 Percent Followers, % Follower Density (FD), follo 89.3 24.8 Total Trucks, % eak Hour Facto 0.90 Segment Capacity, veh/h Demand/Capacity (D/C Intermediate Results Segment 3 Vehicle Inputs Speed Power Coefficient (p) PF Power Coefficient (p) 0.51862 peed Slope Coefficient (m) F Slope Coefficient (m) 10.15817 Segment Type Lane Width, ft Speed Limit, mi/f Length, ft Shoulder Width, ft Access Point Density, pts/mi Pas 12 Total Segment Density, vel 6 0.0 n Passing Lane Effect 22.1 Demand and Capacity Subsegment Data segment Type
 Tangent
 Horizontal Curv Averag 49.2 39.4 irectional Demand Flow Rat tak Hour Factor 1222 Opposing Demand Flow Rate, veh/h Total Trucks, % Length; # 5964 900 Radius, ft Super Segment Capacity, veh/1 Demand/Capacity (D/C) 350 1700 0.72 Vehicle Results Intermediate Res 48.0 86.9 Segment Vertical Class Speed Slope Coefficient (m) IF Slope Coefficient (m) In Passing Lane Effective Length? Free-Flow Spred, mi/h Speed Power Coefficient (p) PF Power Coefficient (p) Total Segment Density, veh/mi/ln erage Speed, mith gment Travel Time, minutes Percent Followers, % Follower Density (FD), followers 0.52318 hide LOS 20.2 No 0.0 Segment 2 ent to Sp Vehicle Inputs Length, ft Shoulder Width, ft Access Point Density, Length, ft 2640 Radius, ft Superelevation, % Average Sp Lane Width, ft 12 6 0.0 Vehicle Results Demand and Capacity Average Speed, mi/h 50.7 Percent Followers, % 83.8 PF Slope Coefficient (m In Passing Lane Effective Selmprovement to Perce PF Power Coefficient (p) Total Segment Density, w %Improvement to Speed Segment Travel Time, Vehicle LOS 0.59 Follower Density (FD), follo mi/In 20.2 Segment 4 /ehicle Inputs Length, ft Radius, ft Superelevation, % Average Speed, mi/h 6864 6 0.0 Passin 12 55 Length, ft ane Width, ft Length, ft Shoulder Width, ft Access Point Density, pts/mi Passing Lane Results timit mi/ Demand and Capacity How Rate, weh/h 568 13.53 58.7 56.8 55.9 655 3.20 Directional Demand Flow R Ioak Hour Factor Regment Capacity, veh/h 1222 Opposing Demand Flow Rate, vely/h Total Trucks, % Demand/Capacity (D/C) Percentage of Heavy Vehicles (HV%), % 3.20 Initial Average Speed (Sint), m/h 59.2 Average Speed at Midpoint (SPLmid), m/h 61.1 Percent Followers at Midpoint (CFPLmid), % 62.0 8.00 59.2 1700 Intermediate Results Vehicle Results gment Vertical Class reed Slope Coefficient (m) Slope Coefficient (m) Passing Lane Effective Len Free-Flow Speed, mi/h Speed Power Coefficient (p) PF Power Coefficient (p) Total Segment Density, veh/s %improvement to Speed 0.5186 10.15817 Average Speed, mi/h 56.0 Segment Travel Time, minutes 0.54 Follower Density Mid-Point, followers/ 6.2 mi/ln Follower Density (FD), foll Vehicle LOS 21.5 No Subsegment Data Segment 6 # Segment Type
 1 Tangent Length, R 3864 3000 Radius, ft Vehicle Inputs 49.2 Segment Type Lane Width, ft Passing Constrained Length, ft Shoulder Width, ft 2640 6 850 Vehicle Results Speed Limit, miv Access Point Density, pts/m Percent Followers, % Follower Density (FD), follo 86.9 21.6 werage Speed, m 49.2 1.58 Demand and Capacity 1222 0.90 1700 Vehicle LOS Opposing Dem Total Trucks, % Peak Hour Factor 8.00 Segment 5 ament Capacity, veh/ Demand/Capacity (D/C) Vehicle Inputs Intermediate Results Shoulder Width, It Access Point Density, Pree How speed, m(H Speed Power Coefficient (p) PF Power Coefficient (p) Total Segment Density, velv/ %Improvement to Speed ane Width, ft 6 Speed Slope Coefficient (m) 0.41674 12 3.91393 PF Slope Coefficient (m) n Passing Lane Effective Demand and Capacity Opposing Demand Flow Rate, velv/h -Total Trucks, % 8.00 rectional Demand Flow Rate, velv/h ak Hour Factor 1222 Subsegment Data Length, ft 2294 346 Radius, R Superelevation, % Average Speed, mi/h Demand/Capacity Segment Type
 Tangent
 Horzontal Curve Intermediate Results 62.4 0.78660 350 39,4 Free-Flow Speed, mi/h Speed Power Coefficient (p) Segment Vertical Class Speed Slope Coefficient (m) Vehicle Results 5.87205 Average Speed, mi/h Segment Travel Time, Vehicle LOS Percent Followers, % Follower Density (FD), fr 78.4 Facility Results VHD veh-h/p Follower Density, follo mi/In LOS VMT veh-mi/AP 1 19.9 F
- a. Formatted reports show the most important results in a presentable format





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

le Name: Multil Myst: Multil Holdition: 9/32/20 Mr Sal Yawa: 2022 Secto Description: Chapter Les U.S. G	- To: Dangle Problem 4 ustomery 5 and Performance Measures: _ 10 10 100 100 100 100 100 100	2 8 982 2048 18-9 5 5 2 8 9 2 8 9 2 8 9 2 8 9 2 8 9 2 8 9 2 8 9 2 8 9 2 8 9 2 9 2	pi/b/2s pi/b/2s ai/h sc/nt/2s	Idention	1 EH 40.5 10900 1 EH 1.0000 10900 Demand Volume EH	52.0 2 30 52.0 2040 52.0 2040 2040 2040 2040 2040 2040 2040 2040 2040 2040	mi/h mi/h pc/h/ln pc/h/ln
to tame: ADILI April Haddition: 97/282 Haddition: 97/282 Haddittoo: 97/282 Haddittoo: 97/282 Haddittoo	22 r 35: Drongle Problem 4 ustomary 5: and Performance Measures: 5: and Performance Measures:	2 80 900 9340 9340 9340 9340 9 840 0 2 840 840 840 840 840 840 840 840 840 840	pt/h/ln m1/h	Direction 1 Direction 1 Direction 2 Capacity, 6 Capacity, 4 Capacity, 4 Capac	1 EH 40.5 10900 1 EH 1.0000 10900 Demand Volume EH	2 w6 52.8 2040 2 w6 All Familiar 1.000 2040 2 2 w6	pc/h/la
algent: Market State St	22 Tr 26: Example Problem 4 St and Performance Nessures: 1 1 1 1 1 1 1 1 1 1 1 1 1	NB 982 2046 52.8 18.9 C	pt/h/ln m1/h	Direction 1 Direction 1 Direction 2 Capacity, 6 Capacity, 4 Capacity, 4 Capac	1 EH 40.5 10900 1 EH 1.0000 10900 Demand Volume EH	2 w6 52.8 2040 2 w6 All Familiar 1.000 2040 2 2 w6	pc/h/la
	- To: Dangle Problem 4 ustomery 5 and Performance Measures: _ 10 10 100 100 100 100 100 100	NB 982 2046 52.8 18.9 C	pt/h/ln m1/h	Birretin Breefstim Genetic, Newspee, Frantj Cenetic, Nejsments Birretin Breefstim Birretin Breefstim Cenetic, Melonest Attack Cenetic Melone	is 60.5 10900 All Familiar 1.0000 10990 Demand Volume 1 Em	46 52.8 2048 2 46 All Familiar 1.000 2040 2 45	pc/h/la
videntime: 97/28 Vigits wave: 982 W schjed: U.S. G. Tertime Constraints: U.S. G. Tertime Con	- To: Dangle Problem 4 ustomery 5 and Performance Measures: _ 10 10 100 100 100 100 100 100	NB 982 2046 52.8 18.9 C	pt/h/ln m1/h	Adjusted Free-Tak Speed, FFSadj 64 Gancity, c 13 Caucity Adjustemets Burtism 1 Diver ProJation 1 Caucity Adjustemet Factor, GAF 1 Adjusted Caucity, Gaf 1 1 Adjusted Caucity, Gaf 1	40.5 1990 18 18 Familiar 1.000 1990 Demand Volume 1 Ef	52.8 2040 2 WE All Familiar 1.000 2040 2 2 45	pc/h/la
dei di yerze: 97/2000 dei di yerze: 2022 gene Baserrettane: Charar (and Saserrettane: Charar vettano description ar rete, y. staty, g. et g'arctine, Los vettano description descr	- To: Dangle Problem 4 ustomery 5 and Performance Measures: _ 10 10 100 100 100 100 100 100	NB 982 2046 52.8 18.9 C	pt/h/ln m1/h	Capacity, c 23 Capacity Adjustments Distriction Bescription 1 Distriction Adjustment Factor, GAP 1 Capacity Adjustment Factor, GAP 1 Adjusted Capacity, Cadj 11	1990 1 1 1.000 1990 Demand Volume 1 1	2040 2 WB All Familiar 1.000 2040 2 2 45	pc/h/la
Vide Vern 2022 en Annouelle Contraction C	- To: Dangle Problem 4 ustomery 5 and Performance Measures: _ 10 10 100 100 100 100 100 100	NB 982 2046 52.8 18.9 C	pt/h/ln m1/h	Capacity Adjustments Direction 1 Direction Description II Decker Population Fractor, GAP 4 Adjusted Capacity, card 1 Adjusted Capacity, card 10	1 HB h11 Familiar 1000 1990 Demand Volume 1 EF	2 WB All Familiar 1.000 2040 2	pc/h/ln
to a service to a	United Performance Measures:	NB 982 2046 52.8 18.9 C	pt/h/ln m1/h	Direction 1 Direction Description 19 Driver Population Al 20 Adjusted Copecity, cadj 30 Adjusted Copecity, cadj 30	All Familiar 1.000 1990 Demand Volume 1 1	NE All Familiar 1.000 2040	
to description: Chapter U.S. C. Chapter U.S. C. Construction: Construction of Construction	United Performance Measures:	NB 982 2046 52.8 18.9 C	pt/h/ln m1/h	Direction 1 Direction Description 19 Driver Population Al 20 Adjusted Copecity, cadj 30 Adjusted Copecity, cadj 30	All Familiar 1.000 1990 Demand Volume 1 1	NE All Familiar 1.000 2040	
U.S. Q ino Description (0) See Original (0) S	United Performance Measures:	NB 982 2046 52.8 18.9 C	pt/h/ln m1/h	Direction Description III Driver Population Al Capacity Adjustment Factor, CAF 1. Adjusted Capacity, cadj 10	All Familiar 1.000 1990 Demand Volume 1 1	NE All Familiar 1.000 2040	
Lon LO des Description to vets, v. v. 3 o of Service, LOS Lon Description of Lense, N a Type	IS and Performance Measures:	NB 982 2046 52.8 18.9 C	pt/h/ln m1/h	Driver Population Al Capacity Adjustment Factor, CAF 1. Adjusted Capacity, cadj 19	All Familiar 1.000 1990 Demand Volume 1 1	All Familian 1.000 2040	
ion ion Description ette, v. 5. c 5. c 5. c 5. c 6. c 6. f 5. f 5. f 5. f 5. f 5. f 5. f 5. f 5	1. EB 805 1990 40.5 10.1 C 5tep 1: Input Data 18 2 12	NB 982 2046 52.8 18.9 C	pt/h/ln m1/h	Capacity Adjustment Factor, CAF 1. Adjusted Capacity, cadj 19	1.300 1990 Demand Volume 1 ES	1.000 2040 2	
ion ion Description vite, v. 5 - 5 - 5 - 6 - 6 - 6 - 6 - 6 - 6 - 6 - 6	1. EB 805 1990 40.5 18.1 C Step 1: Input Data 18 2 12	NB 982 2046 52.8 18.9 C	pt/h/ln m1/h	Adjusted Capacity, cadj 19	Demand Volume	2840 2 45	
ion ion Description vite, v. 5 - 5 - 5 - 6 - 6 - 6 - 6 - 6 - 6 - 6 - 6	1. EB 805 1990 40.5 18.1 C Step 1: Input Data 18 2 12	NB 982 2046 52.8 18.9 C	pt/h/ln m1/h		Demand Volume	2	
ion Description ett, v. vy. C of Service, LOS ion Description of Description of New N	EB BD5 1998 40.5 10.1 C C Step 1: Input Data 1 1 2 12	NB 982 2046 52.8 18.9 C	pt/h/ln m1/h		1	WB	such /h
ette, v. 5. of Service, LOS 5. 5. 5. 5. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0. 0.	005 1998 49.5 18.1 C 5tep 1: Input Data 1 13 2	982 2848 52.8 18.9 C	pt/h/ln m1/h		1	WB	ush /h
y, C , D F Service, LOS con con Description of Lama, N 1 There	1998 40.5 18.1 C 55tep 1: Input Data 1 8 2 12	2048 52.8 18.9 C	pt/h/ln m1/h		1	WB	ush /h
c f Service, LOS m Description r Leses, N th Type	40.5 10.1 C Step 1: Input Data E0 2 12	52.8 18.9 C	m1/h		EB	WB	ush /h
, 0 f Service, LOS on Description of Lanex, N Cth Type	18.3 C Step 1: Input Data 18 2 12	18.9 C	mi/h pc/mi/in	Direction 1			unb /h
f Service, LOS on Description of Lames, N Oth Thype	C Step 1: Input Data IN 2 12	C 2	pc/mt/an	Direction Description EB			
ion Ion Description of Lames, N Lith Type	Step 1: Input Data 1 EB 2 12	2			1500		
n Description f Lanes, N Ith Type	1 (8 2 12	WB			8.98	8.20	
n Description f Lames, N Ih Type	1 (8 2 12	WB		Number of Lanes, N 2		2	1n
n Description f Lanes, N Ith Type	1 (8 2 12	WB			Specific Grade	Specific Grade	
on Description of Lanes, N dth Type	1 (8 2 12	WB		Percent Grade	-3.58	3,50	2
lon Description of Lames, N Ldth n Type	2 12	WB		Grade Length 1.	1.25	1.25	mi
of Lanes, N 1dth n Type	2 12			Percent Total Trucks 6.	6.00	5.00	x
width in Type			10	Percent Single-Unit Trucks, SUT 30	50	30	
in Type		12	÷t.	Percent Tractor-Trailers, TT 70	7e	78	x
	Specific Grade	Specific Grade			0.0580	0.0600	
	-3,50	3,50		Heavy Vehicle PCE, ET 2.	2.24	3,97	
ade Length	1.25	1.25	=i		0.931	0.842	
Side Lateral Clearance, LCR	1/2		ft		1.000	1.000	
ide Lateral Clearence, LCL	1.21		ft	Demand Flow Rate, v. 80	825	982	pc/h/ln
Type	THETE	TWETL	* L				
oint Density	10.0	0.0	access points/ml				
contraction of the second s			and a period of	Steps 5 and 6; Estimate Speed a	and Benefity and S	Anternal and 1 (M)	
1	1	2		Direction 1		2	
Description	EIF	WB		Direction Description E		WB	
blowe, V	1500	1500	web/h	Demand Flow Rate, v. 89	825	982	pc/h/ln
r Factor, PHF	0.30	0.20	Contract in		42.5	52.0	m1/h
Total Trucks	6.00	5.00	3		1998	2848	pc/h/la
cent Single-Unit Trucks, SUT	10	30	1		1400	1400	pc/h/ln
ent Single-Onit Pocks, Sor	78	20	ŝ	Density at Capacity, Dc 45		45	pc/n/1n pc/n1/1s
and a construction of the second s		in each c			49.5	52.8	mi/h
					47.5	18.9	pc/ml/ls
				Level of service, LOS		18.9	ps/81/10
	up 2: Estimate and Adjust FF5,			the second			
ng FFS							
on on Description	1 10	2		Micycle Level	and descending		
on Description 5 on Base FFS	Base	Base		Direction 1		2	
ed or sake ff5 ree-Flow Speed, Bff5	52.0	52.0	m1/h	Direction 1 Direction Description f8		ND ND	
ree-Flow Speed, BFFS			m1/n		1500	1500	1922
Width Adjustment, flW	12	12	ft m1/h	Peak Hour Factor, PMF 0.	1500	1500	weh
eldth Adjustment, +CM	6.0	6.0	m1/h ft	Number of Olrectional Laws, N 2	0.90	2	10
de Lateral Clearance, LCR			#L #L		2	2 833	veh/ln
e Lateral Clearance, LCL teral Clearance, TLC			ft ft	Directional Demand Flow Mate in Outside Lane, VOL 83 Percent of Segment with Occupied On-Highway Parking, 308P 0		833	veh/1n
teral Clearance, TLC Lateral Clearance Adjustment, FTLC	12	12 8.0	ft mL/h			8	ft
	0.0 TMLTL	TWLTL	102.7 11				ft.
(pe			1000	Effective Width as a Function of Traffic Volume, Wv 18		18	
n Type Adjustment, fM pint Density	0.0	0.0	mi/h access points/ml	Average Effective Width of Outside Lane, We 24 Posted Speed Limit, Sa 50	24	24	ft mi/h
		8.0					ma/ft
as Point Density Adjustment, #A	2.5	0.0	m1/h		4.62	4.62	
w Speed, FFS	49.5	52.0	m1/h		0.0680	0.0600	
				Pavement Condition Rating, P 4		4	
ustments					4.16	4.16	
an .	1	2		Bicycl# LOS D	9.)	D	
n Description	Ell	WS .					
ulation	All Familiar	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".

	ityAnalysisLevelTerrain.xuf -							-	Ċ
START	SEGMENTS DETAI	LS REPORT							
lew	Ctrl+N	¥							
Dpen	Ctrl+O	HCS Two	o-Lane Highway	/ Report					
	Lane 2016				1				
xample Fo	older		Date		8/31/2022				
ave	Ctrl+S		Analysis Yea		2022				
ave As	F12		Time Analyz	ed					
lose	Ctrl+W	Chapter 26: Exam Problem 3	mple Units		U.S. Customary				
nits			Segment 1						
	2.72								
rint	Ctrl+P	Passing Constra			3960				
rint Previe	ew Ctrl+F2	12	Shoulder W		6				
iew		• 55	Access Poin	: Density, pts/mi	0.0				
eport		Forma	tted Report F	Flow Rate, yeh/h					
nport Fro	m CSV	Text R	eport F	5	8.00				
xport To C	SV	1700	Demand/Ca	pacity (D/C)	0.53				
efault Set	ttings Alt+F								
lelp		1	Free-Flow S	NUMBER OF STREET	62.4				
		3.93029		r Coefficient (p)	0.41674				
xit	Alt+F4	-1.28948	PF Power Co		0.76718				
	ising Lane Effective Length?	No		nsity, followers/mi/In	10.7				
	rovement to Percent Followers	0.0	%improven	ent to Speed	0.0				
	egment Data Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h				
	Tangent	3960	Radius, ic	Superenevacion, re	58.8				
	cle Results		6		1.000				
	ge Speed, mi/h	58.8	Percent Foll	owers, %	69.7				
P		1		Sw	itch to Text 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".
START SEGM	IENTS DETAILS	REPORT			
lew	Ctrl+N 🕨				
)pen	Ctrl+O	HCS Two-Lane Highway Segme	nt Text Report		
Open Two Lane 20 xample Folder	16	TWO-LANE HIGHWAY SEGMEN TwoLane3-FacilityAnalysisL	IT ANALYSIS		
ave	Ctrl+S	instance i actiticy inary size			
ave As	F12				
	1.1.00	8/31/2022			
lose	Ctrl+W	2022			
Inits	+	Chapter 26: Example Proble	m 3		
rint	Ctrl+P	U.S. Customary			
rint Preview	Ctrl+F2				
		Facility LOS and Performan			
liew	•		5.50	mi veb-mi/AP	
leport	······ •	Formatted Report F4	1.08	veh-h/p	
mport From CSV		Text Report F6	7.3	followers/mi/ln	
xport To CSV					
efault Settings	Alt+F	Segment 1			
lelp	•	LOS and Performance N	laasunas	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	
xit	Alt+F4		Passing Con Passing Con		
Actual Segmen	t Length, L		3960	ft	
Segment Lengt	h Used in Calculat:	ion	0.75	mi	
Demand Flow R	ate in Analysis Di Nate in Opposing Di	rection, vd	904	veh/h veh/h	
Capacity, cap		eccion, vo	1700	veh/h	
Free-Flow Spe	ed, FFS		62.4	mi/h	
Speed, S			58.8	mi/h	
Percent Follo Follower Dens			69.7 10.7	% followers/mi/ln	
Level of Serv	dice, LOS		10.7	TOILOWERS/WI/IN	
P			Switch to Formatted Rep	port	
			Segment 1>	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.

		HCS Two-La	no Highway	Poport		1			
		HCS IWO-Lai	ne nighway	Report-					
	Project Information	Ť	1			-			
	Analyst		Date		8/31/2022	_			
	Agency		Analysis Year		2022	-			
-	lurisdiction		Time Analyzed	1		_			
P	Project Description	Chapter 26: Example Problem 3	Units		U.S. Customary				
		Se	egment 1			1			
V	Vehicle Inputs	0.00				1			
S	Segment Type	Passing Constrained	Length, ft		3960	1			
L	Lane Width, ft	12	Shoulder Wid	th, ft	6	1			
S	Speed Limit, mi/h	55	Access Point D	ensity, pts/mi	0.0	1			
D	Demand and Capacity					1			
D	Directional Demand Flow Rate, veh/h	904	Opposing Der	nand Flow Rate, veh/h		1			
P	Peak Hour Factor	0.94	Total Trucks, 9	i .	8.00	1			
S	Segment Capacity, veh/h	1700	Demand/Capa	icity (D/C)	0.53	1			
Ir	Intermediate Results					1			
S	Segment Vertical Class	1	Free-Flow Spe	ed, mi/h	62.4	1			
S	Speed Slope Coefficient (m)	3.93029	Speed Power	Coefficient (p)	0.41674	1			
P	PF Slope Coefficient (m)	-1.28948	PF Power Coe	fficient (p)	0.76718	1			
In	n Passing Lane Effective Length?	No	Follower Dens	ity, followers/mi/In	10.7	1			
96	Simprovement to Percent Followers	0.0	%improvement	nt to Speed	0.0	1			
S	Subsegment Data					1			
#	F Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h	1			
1	1 Tangent	3960			58.8	1			
V	Vehicle Results					1			
A	Average Speed, mi/h	58.8	Percent Follow	vers. 96	69.7				
p				Swit	ch to Text Report				
<u> </u>				Segme		~ 🗸	All Segments		

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.

	- HCS Highways			- a
START SEGMENTS DETA	ILS REPORT			
	HCS Two-Lane Highway	Segment Text Report		
	TWO-LANE HIGHWAY S			
File Name: Analyst: Agency: Jurisdiction:	TwoLane3-FacilityAnal	ysisLevelTerrain.xuf		
Date: Analysis Year: Time Analyzed:	8/31/2022 2022			
Project Description: Units:	Chapter 26: Example F U.S. Customary	roblem 3		
Facility Length	Facility LOS and Peri	Formance Measures	mi	
Facility VMT Facility VMT Facility VHD Facility Average Follower		1122 1.08 7.3	wi veh-mi/AP veh-h/p followers/mi/ln	
Facility Level of Service,	LOS	с. с	TDIIOWERS/MI/IN	
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Segment Length Used in Cal	culation	0.75	mi	
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Free-Flow Speed, FFS		62.4	mi/h	
Speed, S		58.8	mi/h	
Percent Followers, PF		69.7	% followers/mi/ln	
Follower Density, FD Level of Service, LOS		10.7	tollowers/ml/in	
		Switch to Formatted Rep	lort	■ -
		Segment 1>	 All Segments 	

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.

	HCS Two-Lar	ne Highway I	Report					
Project Information					1			
Analyst		Date		8/31/2022				
Agency		Analysis Year		2022				
Jurisdiction		Time Analyzed	0		1			
Project Description	Chapter 26: Example Problem 3	Units		U.S. Customary	1			
	Se	egment 1			1			
Vehicle Inputs	2051				1			
Segment Type	Passing Constrained	Length, ft		3960	1			
Lane Width, ft	12	Shoulder Widt	h, ft	6				
Speed Limit, mi/h	55	Access Point D	ensity, pts/mi	0.0	1			
Demand and Capacity	2014 2010	1.			1			
Directional Demand Flow Rate, veh/h	904	Opposing Den	hand Flow Rate, veh/h					
Peak Hour Factor	0.94	Total Trucks, %	17	8.00				
Segment Capacity, veh/h	1700	Demand/Capa	city (D/C)	0.53				
Intermediate Results					1			
Segment Vertical Class	1	Free-Flow Spe	ed, mi/h	62.4	1			
Speed Slope Coefficient (m)	3.93029	Speed Power 0	Coefficient (p)	0.41674				
PF Slope Coefficient (m)	-1.28948	PF Power Coef	ficient (p)	0.76718	1			
In Passing Lane Effective Length?	No	Follower Dens	ity, followers/mi/ln	10.7				
%Improvement to Percent Followers	0.0	%improvemen	t to Speed	0.0	1			
Subsegment Data	ada.			1.	1			
# Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h	1			
1 Tangent	3960	-	-	58.8	1			
Vehicle Results								
Average Speed, mi/h	58.8	Percent Follow	ers, %	69.7	1			
	1	1	Switz	ch to Text Report	12			
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- 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"

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xit		Alt+F4	-1.28948	PF Power Coel	Deriver and the second s	0.76718			
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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"

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Su	ubsegment Data									
*	Segment Type		Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h				
2	Tangent		3960	-	-	58.8				
	ehicle Results									
Ax	verage Speed, mi/h		58.8	Percent Followe	rs, 96	69.7	_			
P					Swit	ch to Text Report				
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- 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

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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

		HCS Two-La	ane Highway	Report	
De	oject Information	1100 1110 20	ine nightidy	nepore	
-	alyst	1	Date		8/31/2022
-	ency		Analysis Year		2022
	isdiction		Time Analyz	37	
Pro	ject Description	Chapter 26: Example Problem 3	-		U.S. Customary
		S	egment 1		
Ve	hicle Inputs				
Sec	gment Type	Passing Constrained	Length, ft		3960
Lan	ne Width, ft	12	Shoulder Wi	dth, ft	б
Spe	eed Limit, mi/h	55	Access Point	Density, pts/mi	0.0
De	mand and Capacity				
Din	ectional Demand Flow Rate, veh/h	904	Opposing D	emand Flow Rate, veh/h	
Pea	ak Hour Factor	0.94	Total Trucks,	%	8.00
Seg	gment Capacity, veh/h	1700	Demand/Ca	pacity (D/C)	0.53
Int	termediate Results				
Seg	gment Vertical Class	1	Free-Flow Sp	eed, mi/h	62.4
Spe	eed Slope Coefficient (m)	3.93029	Speed Powe	Coefficient (p)	0.41674
PF	Slope Coefficient (m)	-1.28948	PF Power Co	efficient (p)	0.76718
In F	Passing Lane Effective Length?	No	Follower Der	nsity, followers/mi/In	10.7
%Ir	mprovement to Percent Followers	0.0	%Improvem	ent to Speed	0.0
Su	bsegment Data				
#	Segment Type	Length, ft	Radius, ft	Superelevation, %	Average Speed, mi/h

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

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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, fa(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)

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	
	OR defisity 245	

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	
Α	≤ 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		

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/ln)

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
Е	> 7.5	> 9.3
F	Demand excee	ds 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).

Fo	ur-Lane Highways	S	ix-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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