	HCS™
	Service Volumes Module

USER GUIDE

UF Transportation Institute UNIVERSITY of FLORIDA

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Introduction

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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.

General Controls

Menu Items

New – Creates a new Service Volumes file (*.xsv) and starts a new analysis project; shortcut is Ctrl+N

Basic Freeway Segment – Creates a new Service Volumes file (*.xsv) and starts a new Basic Freeway Segment analysis project

Multilane Highway Segment – Creates a new Service Volumes file (*.xsv) and starts a new Multilane Highway Segment analysis project

Merge Freeway Segment – Creates a new Service Volumes file (*.xsv) and starts a new Merge Freeway Segment analysis project

Diverge Freeway Segment – Creates a new Service Volumes file (*.xsv) and starts a new Diverge Freeway Segment analysis project

Weaving Freeway Segment – Creates a new Service Volumes file (*.xsv) and starts a new Weaving Freeway Segment analysis project

Open - Opens an existing Service Volumes file (*.xsv) or Freeways file (*.xuf); shortcut is Ctrl+O

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

Save – Saves an open Service Volumes file (*.xsv) using the current file name; shortcut is Ctrl+S

Save As... – Saves an open Service Volumes file (*.xsv) using a specified file name; shortcut is F12

Close - Closes an existing Service Volumes file (*.xsv); 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 Service Volumes 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 and 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

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; 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 the 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* Service Volumes module; shortcut is Alt+F4

Service Volumes

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.

PLANNING AND PRELIMINARY ENGINEERING ANALYSIS

A frequent objective of planning or preliminary engineering analysis is to develop a general idea of the number of lanes that will be required to deliver a target LOS. The primary differences are that many default values will be used and the demand volume will be usually expressed as an AADT. Thus, a planning and preliminary engineering analysis starts by converting the demand expressed as an AADT to an estimate of the directional peak-hour demand volume (DDHV):

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

where K is the proportion of AADT occurring during the peak hour and D is the proportion of peak-hour volume traveling in the peak direction.

Once the hourly demand volume is estimated, the methodology follows the same path as that for design analysis. Additional details and discussion on planning applications can be found in the *Planning and Preliminary Engineering Applications Guide to the HCM* in Volume 4.

HCM Chapter 13

The Highway Capacity Software (*HCS*) faithfully implements the methodology prescribed in the Highway Capacity Manual (HCM) for analyzing Freeway Weaving Segments.

SERVICE VOLUMES AND SERVICE FLOW RATES

The methodology uses demand volumes in vehicles per hour converted to demand flow rates in passenger cars per hour. Therefore, service flow rates and service volumes would originally be estimated in terms of flow rates in passenger cars per hour. They would then be converted back to demand volumes in vehicles per hour.

Service volumes and service flow rates for weaving segments are stated in terms of the maximum volume (or flow) levels that can be accommodated without violating the definition of the LOS. The volume ratio, the proportion of total traffic that weaves, is held constant. Any change in the volume ratio would cause a change in all service volumes or service flow rates.

A large number of characteristics will influence service volumes and service flow rates, including the PHF, percent heavy vehicles, and any of the weaving segment's geometric attributes. Therefore, the definition of a representative "typical" case with broadly applicable results is virtually impossible. Each base must be individually considered.

HCM Chapter 14

The Highway Capacity Software (*HCS*) faithfully implements the methodology prescribed in the Highway Capacity Manual (HCM) for analyzing Freeway Merge and Diverge Segments.

SERVICE VOLUMES AND SERVICE FLOW RATES

For ramp-freeway junctions, service flow rate or service volumes could be defined in several ways. It might be argued that since ramp-freeway junction capacities are usually limited by the upstream or downstream freeway segment, service flow rates and service volumes should be based on basic freeway criteria applied to the upstream or downstream freeway segments. This, however, would ignore the levels of service defined for the ramp influence area, which are the only unique service descriptors for ramps.

Levels of service for ramp-freeway junctions related to the density within the ramp influence area. The methodology estimates this density by using a series of algorithms affected by demand flows on the freeway, ramp, and adjacent ramps; ramp geometrics; and distances to adjacent ramps. The methodology uses demand volumes in vehicles per hour converted to demand flow rates in passenger cars per hour. Therefore, service flow rates and service volumes would originally be estimated in terms of flow rates in passenger cars per hour. They would then be converted back to demand volumes per hour.

Because the balance of ramp and freeway demands has a significant impact on densities, there are several ways to consider service flow rates and volumes:

- The limiting total upstream demand volume that produces a given LOS within the ramp influence area. The split between arriving freeway volume and ramp volume would have to be specified.
- The limiting volume entering the ramp influence area that produces a given LOS within the ramp influence area. Since this relies on the approaching freeway volume, the split between freeway and ramp demand would still have to be specified.
- The limiting ramp volume that produces a given LOS within the ramp influence area, based on a fixed upstream freeway demand.

All of these concepts are viable for establishing a ramp service flow rate or service volume.

In addition to different ways of interpreting a service volume or service flow rate, a large number of characteristics will influence the result, including the PHF, percentage of heavy vehicles, length of acceleration or deceleration lane(s), ramp FFS, and any relevant data for adjacent ramps. Therefore, defining a representative "typical" case with broadly applicable results is virtually impossible. Each case must be individually considered.

Service Volumes Data

Project Properties

The Project Properties section provides fields for both general and site information. The general information can be entered into the respective fields: Analyst, Agency, Date, and Time Analyzed. The site information can be entered into the respective fields: Jurisdiction, Analysis Year, and Project Description.

Geometric Data

For both basic freeway and multilane highway segments, the number of lanes in the analysis direction 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.

For both merge and diverge freeway segments, the number of lanes, Free-Flow Speed, and Terrain Type are entered for both the freeway and the ramp. If Specific Grade is chosen for Terrain Type, then Percent Grade and Grade Length will enable for the user to change. Freeway Length, Ramp Side, the lengths of acceleration/deceleration lanes, and indication of a Highway or C-D Roadway. Calculation Approaches is specified for merge freeway segments.

For weaving freeway segments, the number of lanes in the analysis direction 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. Free-Flow Speed, Weaving Configuration, Number of Maneuver Lanes, Short Length, Interchange Density, Minimum Freeway-to-Ramp Lane Changes, Minimum Ramp-to-Freeway Lane Changes, and Minimum Ramp-to-Ramp Lane Changes can also be entered.

Demand Data

For basic freeway, multilane highway, and weaving freeway segments, Target LOS, Peak Hour Factor, Total Trucks, Percent Single-Unit Trucks, Percent Tractor-Trailers, *K*-factor, and *D*-factor are included as inputs. Basic freeway and freeway weaving segments allow input of Proportion of CAVs. Freeway weaving segments also require the Percent of Ramp-to-Freeway Flow, Percent of Ramp-to-Ramp Flow, and Percent of Freeway-to-Ramp Flow.

For both merge and diverge freeway segments, Target LOS, *K*-Factor, *D*-Factor, and Proportion of CAVs are specified. Peak Hour Factor, Total Trucks, Single-Unit Trucks, Tractor-Trailers, Driver Population, and Proportion of On-./Off-Ramp Demand can be entered for both the freeway and the ramp. Proportion of Flow in Lane 1 and 2 can also be entered for merge freeway segments.

Maximum Service Flow Rates

The maximum service flow rate (MSF) is determined by the target LOS specified. The exhibits below provide values from the base speed-flow curves of the HCM exhibits for each LOS. When using these exhibits, the FFS should be rounded to the nearest 5 mi/h and no interpolation is permitted.

FFS	Maximun	n Service Flow	w Rates for 1	Farget LOS (pc/h/ln)
(mi/h)	Α	В	С	D	E
75	820	1,310	1,750	2,110	2,400
70	770	1,250	1,690	2,080	2,400
65	710	1,170	1,630	2,030	2,350
60	660	1,080	1,560	2,010	2,300
55	600	990	1,430	1,900	2,250

Maximum Service Flow Rates for Basic Freeway Segments under Base Conditions:

Note: All values rounded to the nearest 10 pc/h/ln.

Maximum Service Flow Rates for Multilane Highway Segments under Base Conditions:

FFS	Maximu	m Service Flo	w Rates for	Target LOS (pc/h/ln)
(mi/h)	Α	В	C	D	E
60	660	1,080	1,550	1,980	2,200
55	600	990	1,430	1,850	2,100
50	550	900	1,300	1,710	2,000
45	290	810	1,170	1,550	1,900

Note: FFS is measured in kilometers per hour for metric units.

Basic Freeway Service Volumes Report

The report page shows a formatted report version of the analysis in dynamic form, reacting to changes in the Basic 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 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 or by using the menu items or shortcuts.

Multilane Highway Service Volumes Report

The report page shows a formatted report version of the analysis in 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 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 or by using the menu items or shortcuts.

Freeway Merge Service Volumes Report

The report page shows a formatted report version of the analysis in dynamic form, reacting to changes in the Merge 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 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 or by using the menu items or shortcuts.

Freeway Diverge Service Volumes Report

The report page shows a formatted report version of the analysis in dynamic form, reacting to changes in the Diverge 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 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 or by using the menu items or shortcuts.

Freeway Weaving Service Volumes Report

The report page shows a formatted report version of the analysis in dynamic form, reacting to changes in the Weaving 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 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 or by using the menu items or shortcuts.

How To

Create a New File

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



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

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



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 Service Volumes		– 🗆 X
Start New File		Help Topics
Open File	SERVICE VOLUMES	HCS Updates
Example Folder		HCS Overview
Recent		McTrans Website
		HCM/HCS Training
		E-mail McTrans
	MCS2024	About HCS
	UF Transportation Institute McTrans	
Copyright © 2023 University of Florida. All Rights R		HCS™ Service Volumes Version 2024

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

Servic	eVolumes1.xsv - HCS Service Volumes				_	٥	×
=	START BASIC REPORT						
			Project Properties			^	
	Analyst		Jurisdiction				
	Agency		Time Analyzed				
	Analysis Year	2023	Date	10/24/2023			
	Project Description		Units	U.S. Customary			
			Geometric Data				
	Number of Lanes	3	Terrain Type	Level	~		
	Free Flow Speed, mi/h	75.4	Percent Grade, %	-			
(\leftarrow)	Grade Length, mi	-				(-	
Back			Demand Data			N	Vext
	Total Trucks, %	0.00	Peak Hour Factor	0.94			
	Single-Unit Trucks (SUT), %	-	D-factor	0.55			
	Tractor-Trailers (TT), %	~	K-factor	0.10			
	Proportion of CAVs	0					
				and the second		~	
Соругі	ght © 2023 University of Florida. All Rights Reserv	/ed.		HCS [™] Service Vo	lumes Versior	2024 (U	ISC)

- i. If Basic Freeway Segment was selected, you will be brought to the Basic page.
- ii. If Multilane Highway Segment was selected, you will be brought to the Multilane page.
- iii. If Merge Freeway Segment was selected, you will be brought to the Merge page.
- iv. If Diverge Freeway Segment was selected, you will be brought to the Diverge page.
- v. If Weaving Freeway Segment was selected, you will be brought to the Weaving page.

b. Full View

ricevolumes I.xsv - HCS Service	volumes					
						<u> </u>
			Pro	ject Properties		
Analyst				Jurisdiction		
Agency				Time Analyzed		í
rigency				Thire y didiy2ed		1
Analysis Year		2023		Date	10/24/2023	ļ
Project Description				Units	U.S. Customary	
			Ge	ometric Data		
Number of Lanes		3		Terrain Type	Level	
Free Flew Greed with		76.4		Descent Crede %		1
Free Flow Speed, mi/h		75.4		Percent Grade, %	·	
Grade Length, mi		-				
	HCS Basi	c Freeway Report				
oject Information						
alyst		Date	10/24/2023			
iency		Analysis Year	2023			
isdiction		Time Analyzed				
et Description		Units	U.S. Custom	ary		
eometric Data						
umber of Lanes, In	3	Terrain Type	Level			
ee-Flow Speed (FFS), mi/h	75.4	Percent Grade, %	•			
		1	1			
sdalannth mi			Switch to Text Repo	rt Show Service Volume CAV Tab	les 🗧 –	<u></u>

Open an Existing File

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

HCS Service Volumes		- 🗆 ×
. ≡		
	18	
Start		Help
New File		Topics
Open File	Service Volumes	HCS Updates
Example Folder		HCS Overview
Recent		McTrans Website
		HCM/HCS Training
		E-mail McTrans
	MCS2024	About HCS
τ	UNIVERSITY of FLORIDA	
Copyright © 2023 University of Florida. All Rights R		HCS™ Service Volumes Version 2024

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 Service Volumes		>
Start		Help
New File		Topics
Example Folder	SERVICE VOLUMES	HCS Overview
Recent		McTrans Website
		HCM/HCS Training
		E-mail McTrans
	A HCS2024	About HCS
	UF Transportation Institute McTrans	
Copyright © 2023 University of Florida. All Rights	Ri	HCS™ Service Volumes Version 202

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 Service Volumes program.



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 Service Volumes program.

TCS Service Volumes	2. Miles	- 🗆 X
Start		Help
New File		Topics
Open File	SERVICE VOLUMES	HCS Updates
Example Folder		HCS Overview
Recent		McTrans Website
		HCM/HCS Training
		E-mail McTrans
	MCS2024	About HCS
	UF Transportation Institute MCTrans	
Copyright © 2023 University of Florida. All Rights Ri		HCS [™] Service Volumes Version 2024

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 Viev	V
--------------	---

Servic	eVolumes1-BasicEightLaneLevelTerrain.xsv - H	ICS Service Volumes			_	٥	×	
=	START BASIC REPORT							
		Project Properties						
	Analyst		Jurisdiction					
	Agency		Time Analyzed					
	Analysis Year	2022	Date	8/31/2022				
	Project Description		Units	U.S. Customary				
			Geometric Data					
	Number of Lanes	4	Terrain Type	Level	v			
	Free Flow Speed, mi/h	70.0	Percent Grade, %	-				
(\leftarrow)	Grade Length, mi	-					(\rightarrow)	
Back	Demand Data							
	Total Trucks, %	12.00	Peak Hour Factor	0.94				
	Single-Unit Trucks (SUT), %	-	D-factor	0.60				
	Tractor-Trailers (TT), %	-	K-factor	0.10				
	Proportion of CAVs	0						
Convrie	aht © 2023 University of Florida. All Rights Re	served		HCS™ S	envice Volumes Versi	on 2024	(USC)	
copying	ne o coco onnersity of hondu. An highes he			1165 5	errice rotanics versi	COL-	(000)	

b. Full View

vicevolumes r-basicelynicaries						
			Proj	ect Properties		
Analyst				Jurisdiction		
Agency				Time Analyzed		
, igency		2022			0.001.00000	
Analysis Year		2022		Date	8/31/2022	
Project Description				Units	U.S. Customary	
			Geo	metric Data		
			000			
Number of Lanes		4		Terrain Type	Level	~
Free Flow Speed, mi/h		70.0		Percent Grade, %	-	
Grade Length mi						
		D:- [
	HUS	Basic Freeway Report				
roject Information		Date	8/31/2022			
pency	-	Analysis Year	2022			
risdiction		Time Analyzed				
oject Description		Units	U.S. Customar	y		
eometric Data						
umber of Lanes, In	4	Terrain Type	Level			
ree-Flow Speed (FFS), mi/h	70.0	Percent Grade, %				
rada lanoth mi	1					
			Switch to Taxt Report	I Show Service Volume CAV Tabler		and the second s

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"

🔰 ServiceVolumes1.xsv - HCS Service Volumes		-		-	٥	×
START BASIC REPORT						
New Ctrl+N F		Project Properties			^	
Open Ctrl+O Example Folder		Jurisdiction				
Save Ctrl+S Save As F12	2023	Date	10/24/2023			
Close Ctrl+W Units		Units	U.S. Customary			
Print Ctrl+P Print Preview Ctrl+F2		Geometric Data				
View Report Default Settings Alt+F	3 75.4	Terrain Type Percent Grade, %	Level -			
Help		Demand Data				Next
Exit Alt+F4 Forar Irucks '% Single-Unit Trucks (SUT), % Tractor-Trailers (TT), % Proportion of CAVs	0.00	Peak Hour Factor D-factor K-factor	0.94 0.55 0.10		~	Next
Copyright © 2023 University of Florida. All Rights R	eserved.		HCS™ Ser	vice Volumes Versio	n 2024	(USC)

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

ServiceVolumes1.xsv - HCS Service	Volumes		5		- 0 ×
	DRT				
New Ctrl+N	1 +		Project Properties		<u>^</u>
Open Ctrl+C Example Folder			Jurisdiction		
Save Ctrl+S	<u>}</u>		Time Analyzed		
Save As F12		2023	Date	10/24/2023	
Close Ctrl+W	V		Units	U.S. Customary	
Units	•				
Print Ctrl+P Print Preview Ctrl+F.	2		Geometric Data		
View		3	Terrain Type	Level	v
Report		75.4	Percent Grade, %	=	
Default Settings Alt+F		-			0
Help	•		Demand Data		$ \bigcirc $
Exit Alt+F4	1	0.00	Peak Hour Factor	0.94	Next
Single-Unit Trucks (SUT	r), %	-	D-factor	0.55	
Tractor-Trailers (TT), %		-	K-factor	0.10	
Proportion of CAVs		0			
					~
Copyright © 2023 University of Flori	ida. All Rights Res	erved.		HCS™ S	ervice Volumes Version 2024 (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"

ServiceVolumes1.xsv - HCS Service Volumes		5		- 0	×
START BASIC REPORT					
New Ctrl+N +		Project Properties		^	
Open Ctrl+O Example Folder		Jurisdiction			
Save Ctrl+S Save As F12	2023	Time Analyzed Date	10/24/2023	- 1	
Close Ctrl+W		Units	U.S. Customary		
Print Ctrl+P Print Preview Ctrl+F2		Geometric Data			
View Report Default Settings Alt+F	3 75.4	Terrain Type Percent Grade, %	Level -	~	
Help		Demand Data			Next
Exit Alt+F4 Fordar Frucks, % Single-Unit Trucks (SUT), % Tractor-Trailers (TT), % Proportion of CAVs	0.00 - - 0	Peak Hour Factor D-factor K-factor	0.94 0.55 0.10		Next
Copyright © 2023 University of Florida. All Rights Re	served.		HCS™ Ser	vice Volumes Version 2024 ((USC)

- 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"



- 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 Service Volumes		- 🗆 X
. <u></u>		
	A LON	
Start		Help
New File		Topics
Open File	SERVICE VOLUMES	HCS Updates
Example Folder		HCS Overview
Recent		McTrans Website
		HCM/HCS Training
		E-mail McTrans
	HCS 2024	About HCS
	UF Transportation Institute MCTrans	
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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 Settings	×
Analyst	
Agency	
Jurisdiction	
New File Default U	Inits
USC	○ Metric
ОК	Cancel

- 3. You can specify Analyst, Agency, and Jurisdiction by clicking in the corresponding text boxes and typing the desired text.
- 4. Under 'Units', you are given the option of running the analysis in either U.S. Customary (USC) or SI (Metric) units.
- 5. 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.
- 6. When a new file is created, the Analyst, Agency, and Jurisdiction fields will automatically be populated with the text specified in the Default Settings.
- 7. When starting a new file, the inputs and results will display according to the units specified in the Default Settings.

Change the View

- 1. When a file is open, there are three main options for the view of the program:
 - a. Page View: the inputs 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.

🐧 Servia	eVolumes1-BasicEightLaneLevelTerrain.xsv - HCS Serv	ice Volumes			- 0	×
=	START BASIC REPORT					
		Proj	ect Properties			^
	Analyst		Jurisdiction			
	Agency		Time Analyzed			
	Analysis Year	2022	Date	8/31/2022		
	Project Description		Units	U.S. Customary		
		Geo	netric Data			
	Number of Lanes	4	Terrain Type	Level		
	Free Flow Speed, mi/h	70.0	Percent Grade, %	-		
(\leftarrow)	Grade Length, mi	-				(\rightarrow)
Back		Der	nand Data			Next
	Total Trucks, %	12.00	Peak Hour Factor	0.94		
	Single-Unit Trucks (SUT), %	-	D-factor	0.60		
	Tractor-Trailers (TT), %	-	K-factor	0.10		
	Proportion of CAVs	0				
						×
Copyrig	ght © 2023 University of Florida. All Rights Reserved.			HCS [™] Service Volumes	Version	2024 (USC)

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.

					HCS Basic	Freeway
	Pro	oject Properties		Project Information		
nalvst		Jurisdiction		Analyst	T	Date
				Agency		Analysis
gency		Time Analyzed		Jurisdiction		Time A
nalysis Year	2022	Date	8/31/2022	Project Description		Units
and you rear	evee	Dute	0/01/2022	Geometric Data		
roject Description		Units	U.S. Customary	Number of Lanes, In	4	Terrain 1
				Free-Flow Speed (FFS), mi/h	70.0	Percent
				Grade Length, mi		
	Ge	ometric Data		Demand and Capacity	1	
lumber of Laner	4	Terrain Tune	Level a	Peak Hour Factor	0.94	Heavy V
lumber of Lanes	4	Terrain Type	Level	Total Trucks, %	12.00	Adjuster
ree Flow Speed, mi/h	70.0	Percent Grade, %	-	Single-Unit Trucks (SUT), %		K-factor
See de Lana ette anti-				Fractor-Trailers (11), %	·	D-factor
frade Length, mi	-			Target LOS		B
	D	emand Data		Max Service Flow Rate (MSF), pc/h/ln	770	1257
and Tauaha W	12.00	Deale Lines Franker	0.04	Service Flow Rate (SF), veh/h	2750	4488
otal Irucks, %	12.00	Peak Hour Factor	0.94	Service Volume, veh/h	2585	4219
ingle-Unit Trucks (SUT), %	-	D-factor	0.60	One Direction DSV, 1000 veh/day	25.9	42.2
the trailer (TD %		K factor	0.10	Bi-Directional DSV, 1000 veh/day	43.1	70.3
ractor-trailers (11), %	-	K-factor	0.10	Highway Safety Manual - Predic	ted Crashes	
roportion of CAVs	0				Single-vehicle crashes	Multi-ve
				Fatal and Injury - Fl, crashes/year	0.000	0.000
				Property Dmg Only - PDO, crashes/year	0.000	0.000
				Local, crashes/year Copyright © 2021 University of Florida, All Rights	Reserved MCSWR Servi	0.000

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 view of the input screen and results report.

2022 4 70.0	Project Properties Jurisdiction Time Analyzed Date Units Geometric Data Terrain Type	8/31/2022 U.S. Customary Level		
2022 4 70.0	Jurisdiction Time Analyzed Date Units Geometric Data Terrain Type	8/31/2022 U.S. Customary Level		
2022 4 70.0	Time Analyzed Date Units Geometric Data Terrain Type	8/31/2022 U.S. Customary Level		
4 70.0	Date Units Geometric Data Terrain Type	8/31/2022 U.S. Customary Level		
4 70.0	Units Geometric Data Terrain Type	U.S. Customary		
4 70.0	Geometric Data Terrain Type	Level		
4 70.0	Terrain Type	Level		
70.0				
	Percent Grade, %	-		
-				
way Report				
te 8/31/2022				
alysis Year 2022				
ne Analyzed				
its U.S. Customary				
rrain Type Level				
rcent Grade, % -				
	way Report Re & \$/31/0022 alysis Year 2002 Re Analyzed Re Analyzed Res U.S. Customary Rrain Type Level reart Grade, %	res 8/31/2022 alysis Year 2022 ex Analyzed U.S. Customary Hts U.S. Customary main Type Level reard Crade. % -	way Report se 8/31/2022 alysis fear sharzed 1 sits U.S. Customary Train Type Level reant Grade, % -	ree 8/31/2022 alysis Year 2022 hts Analyzed U.S. Cuttomary the U.S. Cuttomary main Type Level Level

- 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".

lew	Ctrl+N •			Project Properties			5
ipen kample Folder	Ctrl+O		-	Jurisdiction			
ave	Ctrl+S			Time Analyzed			
ave As	F12		2022	Date	8/31/2022		
lose	Ctrl+W			Units	U.S. Customary		
nits	•						
rint rint Preview	Ctrl+P Ctrl+F2			Geometric Data			
iew	•	Page View	F9	Terrain Type	Level v		
eport	•	Full View	•	Percent Grade, %	-		
efault Settings	Alt+F		-				
elp	•			Demand Data			
kit Iotai irucks,	Alt+F4 %		12.00	Peak Hour Factor	0.94		
Single-Unit	Trucks (SUT), %		-	D-factor	0.60		
Tractor-Traile	ers (TT), %		-	K-factor	0.10		
Propertion	of CANE		0				
rioportione	/ Criva		0				
						- 1	

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".

New Ctrl+N •				^		
Open Ctrl+O	Pro	iect Properties			HCS Basic F	reew
Example Folder		Joernopennes		Project Information		
Save Ctrl+S		Jurisdiction		Analyst		Date
Save As F12		Time And and		Agency		Ana
		Time Analyzed		Jurisdiction	-	Tim
Close Ctrl+W	2022	Date	8/31/2022	Project Description		Unit
Units •				Geometric Data		
Delet Colum		Units	U.S. Customary	Number of Lanes, In	4	Terra
erine Cui+P				Free-Flow Speed (FFS), mi/h	70.0	Pero
Print Preview Ctrl+F2				Grade Length, mi		_
View 🔸	Page View F9 Geo	ometric Data		Demand and Capacity		
Report +	Full View 🕨 Re	eport -> Right F10	I must will	Peak Hour Factor	0.94	Hea
Default Cattings Alt I F	Re	eport -> Bottom F11	Level	Total Trucks, %	12.00	Adju
Default Settings Ait+F	70.0	Percent Grade, %	-	Single-Unit Trucks (SUT), %	-	K-fa
Help •				Tractor-Trailers (11), %	-	D-18
Exit Alt+F4	-			Service volume table		
	De	mand Data		May Septem Day Pate (MSD) pr/h/le	770	1257
				Service Flow Rate (SE) wah/h	2750	4488
Total Trucks, %	12.00	Peak Hour Factor	0.94	Service How hate (3H), Veryn	2595	4210
Single-Unit Trucks (SUT) %		Defactor	0.60	One Direction DSV 1000 veh/day	25.9	42.2
Single office indexs (501), 10		D Ideloi	0.00	Bi-Directional DSV, 1000 veh/day	43.1	70.3
Tractor-Trailers (TT), %	2	K-factor	0.10	Highway Safety Manual - Predict	ed Crashes	
Descention of CM/s	0				Single-vehicle crashes	Mult
Proportion of CAVS	0			Fatal and Injury - Fl, crashes/year	0.000	0.00
				Property Dmg Only - PDO, crashes/year	0.000	0.00
				Total, crashes/year	0.000	0.00
				Copyright © 2023 University of Florida. All Rights	Reserved. HCS100 Service	e Volume
				12	Service youthers I was	scugres
				5		

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 Example Folder	Ctrl+O			Pro	ject Properties		
Save Save As	Ctrl+S F12				Jurisdiction		
Close	Ctrl+W		2022		Date	8/31/2022	
Units			Longe at		6/1982.1.1		
Print Print Preview	Ctrl+P Ctrl+F2				Units	U.S. Customary	
View		• Pag	e View F9	Geo	ometric Data		
Report		 Full 	View • Repor	t -> Right F10	Terrain Type	Level	~
Default Settings	Alt+F		Repor	t -> Bottom F11	icitoin type	Level	
Help			70.0		Percent Grade, %	-	
inelp			-				
		HCS Ba	sic Freeway Report				
nalvat			Date	8/31/2022			
gency			Analysis Year	2022			
risdiction			Time Analyzed				
oject Description			Units	U.S. Customary			
eometric Data							
umber of Lanes, In		4	Terrain Type	Level			
ee-Flow Speed (FFS), mi/h		70.0	Percent Grade, %				
ade Length, mi							
emand and Canacity	v						

- 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"

View Results of the Analysis

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



a. Page View with Report page displayed

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

	Pr	pject Properties			HCS E
Analyst		lurisdiction		Project Information	
unaryst		Jundaleuon		Analyst	
Agency		Time Analyzed		Agency	
Analysis Year	2022	Date	8/31/2022	Jurisdiction	
and an end of the second				Project Description	
roject Description		Units	U.S. Customary	Geometric Data	2
				Number of Lanes, In	4
	Ge	ometric Data		Free-Flow Speed (FFS), mi/h	70.0
		omenie bata		Grade Length, mi	-
lumber of Lanes	4	Terrain Type	Level ~	Demand and Capacity	-
ree Flow Speed, mi/h	70.0	Percent Grade, %	-	Peak Hour Factor	0.94
and free and the				Total Trucks, %	12.00
frade Length, mi	-			Single-Unit Trucks (SUT), %	
	D	emand Data		Tractor-Trailers (TT), %	-
otal Trucks %	12.00	Peak Hour Factor	0.94	Service Volume Table	-
	12100			Target LOS	A
ingle-Unit Trucks (SUT), %	-	D-factor	0.60	Max service Flow Rate (MSF), pc/n/in	770
ractor-Trailers (TT), %	-	K-factor	0.10	Service Flow Rate (SF), Ven/m	2/50
roportion of CAVs	0			One Direction DSV 1000 veh/day	259
oportion of one				Bi-Directional DSV, 1000 veh/day	43.1
				Highway Safety Manual - Predic	ted Crashes
					Single-vehicle of
					a ago

c. Full View with the report on the bottom of the screen
ServiceVolumes1-BasicEightLaneLeveTerrain.xsv - HCS Service Volumes

_		
_		
_		

				Project	t Properties		
	Analyst				Jurisdiction	(
	Agency				Time Analyzed		
	Analysis Year	2022			Date	8/31/2022	
	Project Description				Units	U.S. Customary	
				Geome	etric Data		
	Number of Lanes	4			Terrain Type	Level	~
	Free Flow Speed, mi/h	70.0			Percent Grade, %	-	
	Grade Length, mi	2					
							~
		HCS Basic Fr	eeway Report				
	Project Information						
	Analyst		Date	8/31/2022			
	Agency		Analysis Year	2022			
	Jurisdiction		Time Analyzed				
	Project Description		Units	U.S. Customa	n/		
	Geometric Data						
	Number of Lanes, In	4	Terrain Type	Level			
	Free-Flow Speed (FFS), mi/h	70.0	Percent Grade, %	-			~
ρ			Switch to	Text Report	Show Service Volume CAV Tables		
C						HCC	M C V 2024 (1920)

- 0 ×

2. There are two types of reports: Formatted and Text

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

	HCS Ba	isic Freew	ay Report				One Direction DSV, 1000 veh/day	58.1	58.6	59.7	60.6	61.0	61.0
Project Information							Bi-Directional DSV, 1000 veh/day	96,9	97.7	99.5	101.0	101,7	101.7
Analyst		Date			8/31/20	122	Service Volume CAV Table - LOS D						
Agency		Analo	rsis Vear		2022		Proportion CAV in Traffic Stream	0%	20%	40%	60%	80%	100%
Jurisdiction		Time	Analyzed		LULL		Max Service Flow Rate (MSF), pc/h/in	2111	2143	2220	2303	2396	2442
Project Description		Units	realized		115 Cu	domary	Service Flow Rate (SF), veh/h	7540	7653	7928	8226	8559	8721
Geometric Data							Service Volume, veh/h	7088	7194	7452	7733	8045	8198
Number of Lanes. In	4	Terra	in Type		Level		One Direction DSV, 1000 veh/day	70.9	71.9	74.5	77.3	80.5	82.0
Free-Flow Speed (FES) mith	70.0	Perce	nt Grade %				Bi-Directional DSV, 1000 veh/day	118.1	119.9	124.2	128.9	134.1	136.6
Grade Length mi	-				_		Service Volume CAV Table - LOS E						
Domand and Canacity							Proportion CAV in Traffic Stream	0%	20%	40%	60%	80%	100%
Demand and Capacity	0.04	Line	. Mahista Adicata	ant Faster (lin)	0.003		Max Service Flow Rate (MSF), pc/h/in	2400	2448	2568	2712	2928	3150
Tatal Tacion	13.00	Heav	y venicie Adjustn	tern ractor (THV	2400		Service Flow Rate (SF), veh/h	8573	8744	9173	9687	10459	11252
Circular Hucks, 20	12.00	Adjus	neu capacity (caa	n' hetutan	2400		Service Volume, veh/h	8058	8220	8623	9106	9831	10577
Single-Unit trucks (SUT), %	5	K-fac	tor (K)		0.10		One Direction DSV, 1000 veh/day	80.6	82.2	86.2	91.1	98.3	105.8
fractor-frailers (11), %	-	D-tac	tor (D)		0.60		Bi-Directional DSV, 1000 veh/day	134.3	137.0	143.7	151.8	163.9	176.3
Service Volume Table			1 -			-							
Target LOS	A	В	c		D	E							
Max Service Flow Rate (MSF), pc/h/ln	770	1257	173		2111	2400							
Service Flow Rate (SF), veh/h	2750	4488	618	1	7540	8573							
Service Volume, veh/h	2585	4219	5812	<u> </u>	7088	8058	_						
One Direction DSV, 1000 veh/day	25.9	42.2	58.1		70.9	80.6							
Bi-Directional DSV, 1000 veh/day	43.1	70,3	96.9		118.1	134.3	-						
Service Volume CAV Table - LOS	\		1		1								
Proportion CAV in Traffic Stream	0%	20%	40%	60%	80%	100%							
Max Service Flow Rate (MSF), pc/h/In	770	770	770	770	770	770							
Service Flow Rate (SF), veh/h	2750	2750	2750	2750	2750	2750	9						
Service Volume, veh/h	2585	2585	2585	2585	2585	2585							
One Direction DSV, 1000 veh/day	25.9	25.9	25.9	25.9	25.9	25.9							
Bi-Directional DSV, 1000 veh/day	43.1	43.1	43.1	43.1	43.1	43.1							
Service Volume CAV Table - LOS	3												
Proportion CAV in Traffic Stream	0%	20%	40%	60%	80%	100%							
Max Service Flow Rate (MSF), pc/h/ln	1257	1257	1257	1257	1257	1257							
Service Flow Rate (SF), veh/h	4488	4488	4488	4488	4488	4488							
Service Volume, veh/h	4219	4219	4219	4219	4219	4219							
One Direction DSV, 1000 veh/day	42.2	42.2	42.2	42.2	42.2	42.2							
Bi-Directional DSV, 1000 veh/day	70.3	70.3	70.3	70.3	70.3	70.3							
Service Volume CAV Table - LOS	2	3- 10			20 20	14							
Proportion CAV in Traffic Stream	0%	20%	40%	60%	80%	100%							
Max Service Flow Rate (MSF), pc/h/in	1731	1747	1778	1804	1817	1817							
	the second se	and the second se	and the second se		and the second se	and the second sec							

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



Service Flow Rate (SF), veh/h

Service Volume, veh/h

Max Service Flow Rate, MSF	2111	2143	2220	2303	2396	2442	pc/h/ln
ervice Flow Rate, SF	7548	7653	7928	8226	8559	8721	veh/h
ervice Volume, SV	7088	7194	7452	7733	8945	8198	veh/h
one pirection Dally Service Volume	70.9	71.9	74.5	77.3	20.5	82.0	1000 Ven/day
1-Direction Daily Service Volume	118.1	119.9	124.2	128.9	154.1	136.6	1000 Ven/day
	Service Volume	Cay Tabl	- LOS F				
arget LOS	A	8	c	D	E	x	
Max service Flow Rate, MSF	2400	2448	2568	2712	2928	3150	pc/h/ln
Jervice Flow Rate, SF	8573	8744	9173	9687	10459	11252	veh/h
Service Volume, SV	8958	8220	8623	9106	9831	10577	veh/h
one Direction Daily Service Volume	80.6	82.2	86.2	91.1	98.3	105.8	1000 ven/day
1-DIVECTION DELLY SEVVICE VOLUME	134.3	157.0	1+5.7	151.8	103.9	1/6.3	Toos Aciil nol
the Ande Francis Comment Consider Helium					1		-
his Basic Freeway Segment Service Volumes	text report a	as create	d in HCS*	Service Vo	lumes Ver:	10n 2024	on 10/24/2023 11:24:05

- 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".

rviceVolumes	s1-BasicEightL	aneLevelTer	rain.xsv*	- HCS Service Volu	imes								ø	
START	F BASIC	EPORT												
New	C	trl+N →												
Open Example Fo	C older	trl+O		HCS Ba	sic Freew	ay Report								
Save	C	trl+S			Date			8/31/202	2					
Save As	F	12			Anal	lysis Year		2022						
Close	C	trl+W			Time	e Analyzed								
Units					Unit	s		U.S. Cust	omary					
Print	C	trl+P												
Print Previe	iew C	trl+F2	-	4	Perc	ent Grade %		Leve						
View				7010	Tere	ent ordet, re								
Report		•	Fo	matted Report	F4									
Default Set	ettings A	lt+F	Tex	t Report	F6	vy Vehicle Adjustm	nent Factor ((HV) 0.893						
Help			-	12.00	Adju	isted Capacity (cad	ij), pc/h/in	2400						
Exit	4	It + EA			K-fa	ctor (K)		0.10						
TIOCI	ctor-maners (11)	/0	2	-	D-fa	ctor (D)		0.60						
Ser	rvice Volume	Table												
Targ	get LOS		_	Α	В	C		D	E					
Max	x Service Flow R	ate (MSF), p	c/h/in	770	1257	1731	1	2111	2400					
Serv	vice Flow Rate (SF), veh/h		2750	4488	6183	3	7540	8573					
Servi	vice Volume, vet	1/în		2585	4219	5812	2	7088	8058					
One	e Direction DSV,	1000 veh/d	ay	25.9	42.2	58.1	1	70.9	80.6					
Bi-D	Directional DSV,	1000 veh/da	ву	43.1	70.3	96.9	9	118.1	134.3					
Ser	rvice Volume	CAV Table	e - LOS A											
Prop	portion CAV in 1	fraffic Stream	n	0%	20%	40%	60%	80%	100%					
Max	x Service Flow R	ate (MSF), p	c/h/in	770	770	770	770	770	770					
R	1 2 212					1	Switch to	Text Report	Show Service Volum	e CAV Tables				
							and the second se	and the second se		and a manufacture of the second se		(max)		

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 BASIC RE	PORT									
New Ctrl+ Open Ctrl+	HCS Basic	Freeway Segme	ents Servie	ce Volumes	Text Repo	rt				
ave Ctri-	-S BASIC F	REEWAY SEGMEN viceVolumes1-	IT SERVICE BasicEight	VOLUMES AI	WALYSIS Terrain.xsv	,				
Close Ctrl+ Jnits	W 8/3	1/2022 2								
Print Ctrl+ Print Preview Ctrl+	P U.S	. Customary								
/iew	•	Stop 1	- Input Da	ata						
Report	Formatted R Text Report	eport F4 F6	4 70.0			ln mi/h				
Help	•		-			% mi				
xit Alt+	F4		0.94			×				
Percent Single-0 Percent Tractor-	mic mucks, SUT Trailers, TT		8			% %				
		Step 2:	Service Vo	olume						
Free-Flow Speed, FF Heavy Vehicle Adjus Number of Lanes, N Peak Hour Factor, P	S tment, fHV HF		70.0 0.893 4 0.94			mi/h ln				
Target LOS Max Service Flow Ra Service Flow Rate, Service Volume, SV One Direction Daily	te, MSF SF	A 770 2750 2585 25.9	B 1257 4488 4219 42 2	C 1731 6183 5812 58 1	D 2111 7540 7088 70.9	E 2400 8573 8058 80.6	% pc/h/ln veh/h 1000 veh/dav			
Bi-Direction Daily	Service Volume	43.1	70.3	96.9	118.1	134.3	1000 veh/day			
P						Switch to F	Formatted Report		5	_
right @ 2022 University of El									 	

- b. Keyboard Shortcuts
 - i. Formatted Report: keyboard shortcut is "F4"
 - ii. Text Report: keyboard shortcut is "F6"
- c. Report Toggle Buttons
 - i. Whether viewing the report in Page View or Full View; a toggle button will be 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. There is also a checkbox next to the toggle button that will allow you to show the Service Volume CAV tables; this is only available for the formatted report.

		LLCC D	- F	D					
		HCS Ba	sic Freewa	y Keport					
Pr	roject Information	-				1			
Ar	nalyst	_	Date			8/31/202	2		
Ag	gency		Analys	s Year		2022			
Ju	risdiction		Time A	nalyzed		_			
Pn	oject Description		Units			U.S. Custo	mary		
G	eometric Data	1				T.			
NU	umber of Lanes, In	4	lerrain	Type		Level			
rn C	ee-Plow Speed (PPS), mi/n	70.0	Percen	t Grade, %		3			
Gr	rade Length, mi	-							
	emand and Capacity	leer	- Lu			Le cen			
Pe	eak Hour Factor	0.94	Heavy	venicie Adjustm	ent Factor (THV)	0.893			
10	ntal Irucks, %	12.00	Adjust	eo Capacity (cad)	i, pc/n/in	2400			
20	actor Trailers (TT) %		D facto	21 (N)		0.10			
	accornales (11), la		Dilaco	x (0)		0.00			
Ta	roet LOS	•	B	6		D	F		
M	ax Service Flow Rate (MSE). pc/h/ln	770	1257	1731	-	2111	2400		
Se	ervice Flow Rate (SF), veh/h	2750	4488	6183		7540	8573		
Se	ervice Volume, veh/h	2585	4219	5812		7088	8058		
Or	ne Direction DSV, 1000 veh/day	25.9	42.2	58.1		70.9	80.6		
Bi	-Directional DSV, 1000 veh/day	43.1	70.3	96.9	1	18.1	134.3		
Se	ervice Volume CAV Table - LOS	A			-				
Pri	oportion CAV in Traffic Stream	0%	20%	40%	60%	80%	100%		
M	ax Service Flow Rate (MSF), pc/h/ln	770	770	770	770	770	770		

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

cevolumes i - basicelgincanecevenienamixsv - ric	5 Service volumes							
START BASIC REPORT								
HCS I	Basic Freeway Segme	ents Servi	ce Volumes	Text Repo	rt			
8	ASTC EDEELIAN SEGME	T SERVICE	VOLUMES A	UAL VETS				
File Name:	ServiceVolumes1-	BasicEight	LaneLevel	Terrain.xsv	i.			
Analyst:								
Agency:								
Date:	8/31/2022							
Analysis Year:	2022							
Time Analyzed:								
Project Description:								
Units:	U.S. Customary							
	Step 1	1: Input D	ata					
Number of Lanes, N		4			ln			
Terrain Type		/0.0			m1/n			
Percent Grade		-			8			
Grade Length		-			mi			
Peak Hour Factor, PHF		0.94			1200			
Percent Total Trucks		12.00			*			
Percent Tractor-Trailers, TT		-			*			
Eree-Elow Speed EES	Step 2:	Service Vi	olume		mi /h			
Heavy Vehicle Adjustment, fHV		0.893			101/11			
Number of Lanes, N		4			ln			
Peak Hour Factor, PHF		0.94						
Target LOS	A	B	C	D	E	8		
Max Service Flow Rate, MSF Service Flow Date SF	770	1257	6183	2111	2400	pc/h/ln veh/h		
Service Volume, SV	2585	4219	5812	7088	8058	veh/h		
One Direction Daily Service Volume	25.9	42.2	58.1	70.9	80.6	1000 veh/day		
Bi-Direction Daily Service Volume	43.1	70.3	96.9	118.1	134.3	1000 veh/day		
				-				
ρ					Switch to	Formatted Report		-
							1100	

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 Ba	sic Freewa	y Report					
Project Information						1		
Analyst		Date			8/31/202	2		
Agency		Analys	is Year		2022			
Jurisdiction		Time A	nalyzed					
Project Description		Units			U.S. Cust	omary		
Geometric Data						i i i		
Number of Lanes, In	4	Terrain	Туре		Level			
Free-Flow Speed (FFS), mi/h	70.0	Percen	t Grade, %		-]		
Grade Length, mi								
Demand and Capacity								
Peak Hour Factor	0.94	Heavy	Vehicle Adjustme	ent Factor (fHV) 0.893			
Total Trucks, %	12.00	Adjust	ed Capacity (cadj)	, pc/h/in	2400			
Single-Unit Trucks (SUT), %		K-facto	or (K)		0.10			
Tractor-Trailers (TT), %		D-facto	or (D)		0.60	l.		
Service Volume Table								
Target LOS	A	В	С		D	E		
Max Service Flow Rate (MSF), pc/h/In	770	1257	1731		2111	2400		
Service Flow Rate (SF), veh/h	2750	4488	6183		7540	8573		
Service Volume, veh/h	2585	4219	5812		7088	8058		
One Direction DSV, 1000 veh/day	25.9	42.2	58.1		70.9	80.6		
Bi-Directional DSV, 1000 veh/day	43.1	70.3	96.9		118.1	134.3		
Service Volume CAV Table - LOS	A							
Proportion CAV in Traffic Stream	0%	20%	40%	60%	80%	100%		
Max Service Flow Rate (MSF), pc/h/in	770	770	770	770	770	770		

- 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"

viceVolumes1-Basic	EightLaneLevelTerra	in.xsv* - HCS Service Vol	umes					 - 0
START BAS	SIC REPORT							
New	Ctrl+N ►							
Open Example Folder	Ctrl+O	HCS Ba	asic Freewa	y Report			4	
Save	Ctrl+S	Ī	Date		1	8/31/2022	-	
Save As	F12		Analysi	s Year		2022	-	
Close	Ctri+W		Time A	nalyzed			1	
Units	•		Units			J.S. Customary		
Print	Ctrl+P	1						
Print Preview	Ctrl+F2	4	Terrain	Туре		Level	_	
View		70.0	Percent	t Grade, %		3	_	
Report		-					-	
Default Settings	Alt+F	0.94	Heavy	Vehicle Adjustmer	nt Factor (fHV)	0.893	-	
Help		12.00	Adjuste	ed Capacity (cadj),	pc/h/in	2400		
Euit	Alt+LEA	-	K-facto	ar (K)	1	0.10	-	
Tractor+train	eis (11), 70		D-facto	or (D)		0.60		
Service Vo	olume Table							
Target LOS		A	В	C	D	E	7	
Max Service	Flow Rate (MSF), pc/l	n/in 770	1257	1731	2111	2400		
Service Flow	v Rate (SF), veh/h	2750	4488	6183	7540	8573		
Service Volu	ume, veh/h	2585	4219	5812	7088	8058		
One Directio	on DSV, 1000 veh/day	25.9	42.2	58.1	70.9	80.6		
Bi-Direction:	al DSV, 1000 veh/day	43.1	70.3	96.9	118.1	134.3		
Service Vo	olume CAV Table	LOS A						
Proportion C	CAV in Traffic Stream	0%	20%	40%	60%	80% 100%	_	
Max Service	Flow Rate (MSF), pc/l	n/in 770	770	770	770	770 770		

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"

viceVolumes1-BasicEightLane	LevelTerrain.xs	W* - HCS Service Volu	imes							1000	٥
START BASIC RE	PORT										
New Ctrl+	IN I										
Open Ctrl+ Example Folder	••	HCS Ba	sic Freeway	y Report							
Save Ctrl+	s	1	Date			8/31/2022					
Save As F12			Analysi:	s Year		2022					
Close Ctri+	W		Time Ar	nalyzed							
Units	•		Units			U.S. Custo	mary				
Print Ctri-	P					-					
Print Preview Ctrl+	F2	4	Terrain	Туре		Level					
View		70.0	Percent	t Grade, %		•					
Report	· · ·	·									
Default Settings	c	1004			a share (Real)	0.003					
Delauri Settings Arti		13.00	Adjuste	venicie Adjustment i	/b//p	2400					
Help	•	12.00	K-facto	r (K)	ADVIR.	0.10					
Exit Alt+	F4		D-facto	or (D)		0.60					
Service Volume Ta	ble					1					
Target LOS		A	В	С	1 1		E				
Max Service Flow Rate	(MSF), pc/h/ln	770	1257	1731	21	11	2400				
Service Flow Rate (SF),	veh/h	2750	4488	6183	75	40	8573				
Service Volume, veh/h		2585	4219	5812	70	68	8058				
One Direction DSV, 10	00 veh/day	25.9	42.2	58.1	70	0.9	80.6				
Bi-Directional DSV, 100	00 veh/day	43.1	70.3	96.9	11	8.1	134.3				
Service Volume CA	AV Table - LO	SA									
Proportion CAV in Traft	fic Stream	0%	20%	40%	60%	80%	100%				
Max Service Flow Rate	(MSF), pc/h/ln	770	770	770	770	770	/70				

- 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

🖶 Print	×			
General Select Printer				
Microsoft XPS Document Writer OneNote for Windows 10				
Status: Ready Preferences Location: Find Printer				
Page Range Image All Image C Pages: Image C Pages:				
Print Cancel Apply				

- 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 Ba	asic Freewa	ay Report			
Project Information		_		_	_	_
Analyst		Date			8/31/202	2
Agency		Analy	sis Year		2022	
Jurisdiction		Time	Analyzed			
Project Description		Units			U.S. Custo	omary
Geometric Data						
Number of Lanes, In	4	Terrai	n Type		Level	
Free-Flow Speed (FFS), mi/h	70.0	Perce	nt Grade, %		-	
Grade Length, mi	-					
Demand and Capacity						
Peak Hour Factor	0.94	Heavy	/ Vehicle Adjustme	ent Factor (fHV	0.893	
Total Trucks, %	12.00	Adjus	ted Capacity (cadj)	l, pc/h/ln	2400	
Single-Unit Trucks (SUT), %	-	K-fact	tor (K)		0.10	
Tractor-Trailers (TT), %	-	D-fac	tor (D)		0.60	
Service Volume Table						
Target LOS	A	В	C		D	E
Max Service Flow Rate (MSF), pc/h/In	770	1257	1731		2111	2400
Service Flow Rate (SF), veh/h	2750	4488	6183		7540	8573
Service Volume, veh/h	2585	4219	5812		7088	8058
One Direction DSV, 1000 veh/day	25.9	42.2	58.1		70.9	80.6
Bi-Directional DSV, 1000 veh/day	43.1	70.3	96.9		118.1	134.3
Service Volume CAV Table - LO	DS A					
Proportion CAV in Traffic Stream	0%	20%	40%	60%	80%	1009

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

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

General Celect Printer	
Microsoft Print to PDF Microsoft XPS Document Writer OneNote for Windows 10	
Status: Ready Location: Comment:	> Preferences Find Printer
Page Range	Number of copies: 1
F	Print Cancel Apply

Glossary of Terms

Acceleration Lane Length

This value defines the length for on-ramp acceleration lanes. The typical length of acceleration lanes for ramps should be obtained from the design standards used by the highway operation agency. It is measured from the intersection of the edge of the travel way for the freeway and the ramp (the first point) and the downstream merge point of the freeway and ramp edges of the travel way (the second point).



The exhibit below illustrates the geometry of a typical two-lane ramp-freeway junction. It is characterized by two separate acceleration lanes, each successively forcing merging maneuvers to the left.



For two-lane ramps, the effective acceleration length must be calculated by the user based on the lengths of the two lanes. In all equations using the length of the acceleration lane L_A , this value is replaced by the effective length of both acceleration lanes L_{Aeff} . The formula for calculating effective acceleration length is:

 $L_{Aeff} = 2^* L_{A1} + L_{A2}$

where

 L_{Aeff} = Effective acceleration length,

 L_{A1} = Length of the shorter acceleration lane, and

 L_{A2} = Difference in length between the longer acceleration lane and the shorter acceleration lane

In merge and diverge areas, the capacity of the two outer lanes is reduced by 100 and 200 veh/h/ln, respectively. When the user sets the acceleration lanes to 1500 feet (or 457.2 meters in metric), only the outer lane of the merge experiences a capacity reduction, as opposed to normally both the outer two lanes.

Agency

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

Analysis Year

This field is provided to document the year for which the analysis is being performed.

Analyst

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

Calculation Approaches

There are two approaches available for service flow rates and service volumes calculations. These include: *Fixed Proportion of Ramp Flow* and *Fixed Freeway Demand*.

- 1. The Ramp demand flow rate will be stated as a fixed percentage of the arriving freeway flow rate. The service flow rates and service volumes are expressed as arriving freeway flow rates that result in the threshold densities within the ramp influence area that define the limits of the various levels of service.
- 2. A fixed freeway demand flow rate will be stated, with service flow rates and service volumes expressed as ramp demand flow rates that result in the threshold densities within the ramp influence area that define the limits of the various levels of service.

CAVs

Connected and automated vehicles, or CAVs, integrate two separate types of technology, communications and automation. The combination of these technologies is required to achieve roadway capacity increases, as described below:

- Connected vehicles transmit data about their status to their surroundings (e.g., roadside infrastructure, other road users). They also receive information about their surroundings (e.g., traffic conditions, weather conditions, presence of potential conflicting vehicles, traffic signal timing) that motorists can use to adjust their driving behavior in response to conditions present at a given time and location. This exchange of information offers potential safety, fuel economy, and environmental benefits. However, because a human is still driving the vehicle, car-following and other behavior that influences freeway capacity is not expected to fundamentally change.
- Automated vehicles take over all or a portion of the driving task. Depending on the level of automation, a human may still need to take over under certain conditions. In the absence of connectivity, the information available to automated vehicles is limited to that which can be gathered by on-board sensors, which is typically constrained by a sensor's line of sight and the rate at which the sensor takes measurements (e.g., 10 time per second). As a result, for both safety and passenger comfort reasons, current adaptive cruise control systems offer minimum time gaps that are similar to, or longer than, the gaps used by human drivers, and thus may decrease roadway capacity when in widespread use.
- Connected and automated vehicles communicate with each other and with roadside infrastructure. The
 connectivity element provides automated driving systems with more complete information about a vehicle's
 surroundings and enables cooperative vehicle maneuvers that improve roadway operations. The vehicles'
 enhanced detection capabilities, as well as redundancy in detection, enable an automated driving system
 to operate more efficiently and more safely than with only an on-board system.

Daily Service Volume

A daily service volume DSV_i is the maximum AADT that can be accommodated by the facility under prevailing conditions while LOS *i* is maintained during the worst 15-min period of the analysis day.

Date

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

Deceleration Lane Length

This value defines the length for off-ramp deceleration lanes. The typical length of deceleration lanes for ramps should be obtained from the design standards used by the highway operation agency. It is measured from the departing point between the edge of the travel way for the freeway and the outer edge of the ramp (the first point) and the downstream intersection point of the freeway and inner ramp edge of the travel way (the second point).



Two common types of diverge geometries are in use with two-lane off-ramps, as shown in the exhibit below. In the first, two successive deceleration lanes are introduced. In the second, a single deceleration lane is used. The left-hand ramp lane splits from Lane 1 of the freeway at the gore area, without a deceleration lane.



Where a single deceleration lane is used, there is no modification to the length of the deceleration lane L_D ; where two deceleration lanes exist, the length is replaced by the effective length L_{Deff} in all equations.

For two-lane ramps in the Freeways module, the effective deceleration length must be calculated by the user based on the lengths of the two lanes. Where two deceleration lanes exist, the length of the deceleration lane L_D is replaced by the effective length L_{Deff} in all equations. The formula for calculating effective deceleration length is:

 $L_{Deff} = 2^* L_{D1} + L_{D2}$

where

- L_{Deff} = Effective deceleration length,
- L_{D1} = Length of the shorter deceleration lane, and
- L_{D2} = Difference in length between the longer deceleration lane and the shorter deceleration lane

In merge and diverge areas, the capacity of the two outer lanes is reduced by 100 and 200 veh/h/ln, respectively. When the user sets the deceleration lanes to 1500 feet (or 457.2 meters in metric), only the outer lanes of the diverge experiences a capacity reduction, as opposed to normally both of the outer two lanes.

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:

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

Directional distribution vary, but a typical value for both urban and rural freeways is 0.55. As with all default values, locally or regionally calibrated values are preferred and yield more accurate results. Both the *K*-factor and the *D*-factor have a significant impact on the estimated hourly demand volume.

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 segments are representative of traffic streams composed primarily of commuters or drivers who are familiar with the facility.

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 control devices.
- 2. The theoretical speed when both density and flow rate are zero.

Freeway Demand

The number of vehicles, per hour, using the freeway mainline.

Grade Length

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

Interchange Density

The average number of interchanges per mile (or per kilometer in metric), measured over 3 miles upstream and 3 miles downstream (or over 4.8 kilometers upstream and 4.8 kilometers downstream in metric) from the midpoint of the weaving segment

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:

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

On urban freeways, the typical range of *K*-factors is from 0.08 to 0.10. On rural freeways, values typically range between 0.09 and 0.13. As with all default values, locally or regionally calibrated values are preferred and yield more accurate results.

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.

Level of Service (LOS)

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 basic freeway and multilane highway segments is defined by density. 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., 1,000 to 1,800 pc/h/ln for basic freeway segment (depending on FFS) and 1,400 pc/h/ln for multilane highway segments. Density describes a motorist's proximity to other vehicles and is related to motorist's freedom to maneuver within the traffic stream. Unlike speed, however, density is sensitive to flow rates throughout the range of flows.

Units: USC

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

Units: Metric

Density is measured in passenger cars per kilometer per lane. The criteria for LOS is based on the following:

LOS	<u>Density (pc/km/ln)</u>
A	≤ 6.8
В	> 6.8–11.2
С	> 11.2–16.2
D	> 16.2–21.7
E	> 21.7–28.0
F	Demand exceeds capacity OR density > 28.0

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%.

Minimum Freeway-to-Ramp Lane Changes

Minimum number of lane changes that a freeway-to-ramp weaving vehicle must make to complete the freeway-to-ramp movement successfully. This is only applicable for one-sided weaving segments. This is denoted as LC_{FR}.

Minimum Ramp-to-Freeway Lane Changes

Minimum number of lane changes that a ramp-to-freeway weaving vehicle must make to complete the ramp-to-freeway movement successfully. This is only applicable for one-sided weaving segments. This is denoted as LC_{RF}.

Minimum Ramp-to-Ramp Lane Changes

Minimum number of lane changes that must be made by one ramp-to-ramp vehicle to execute the desired maneuver successfully. This is only applicable for two-sided weaving segments. This is denoted as LC_{RR}.

Number of Lanes

This specifies the number of lanes on the freeway in the analysis direction. If there is a weaving segment, the number of auxiliary lanes is also included.

Number of Lanes on Ramp

This specifies the number of lanes on the ramp roadway (on- or off-ramp). There can be 1 or 2 lanes.

Number of Maneuver Lanes

Number of lanes from which weaving maneuvers may be made with either one or no lane changes; denoted as N_{WL} .

For one-sided weaving segments, the value of N_{WL} is either 2 or 3. The determination is made by a review of the geometric design and the configuration of the segment.

For two-sided weaving segments, the value of N_{WL} is always 0 by definition.

Peak Hour Factor (PHF)

The hourly volume during the analysis hour divided by the peak 15-min flow rate within the analysis hour; 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 of Freeway-to-Ramp Flow

The flow rate of the freeway-to-ramp movement set as a percentage of the total flow rate.

Percent of Ramp-to-Freeway Flow

The flow rate of the ramp-to-freeway movement set as a percentage of the total flow rate.

Percent of Ramp-to-Ramp Flow

The flow rate of the ramp-to-ramp movement set as a percentage of the total flow rate.

Project Description

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

Proportion of CAVs

This is the proportion of CAVs in the traffic stream. CAV is a connected automated vehicle, defined here as a vehicle with an operating cooperative adaptive cruise control system. The range of proportion of CAVs in the traffic stream is from 0 to 100.

The proportion of CAVs is used in determining a Capacity Adjustment Factor where CAVs are present in the traffic stream (CAF_{CAV}).

Proportion of Flow in Lanes 1 and 2

The flow rate in freeway lanes 1 and 2 immediately upstream of the ramp influence area is set at a percentage converted from a proportion—of the approaching freeway flow rate.

Proportion of Ramp Demand

The ramp flow is set at a percentage—converted from a proportion--of the approaching freeway flow rate.

Roadway Type

Roadway types include Multilane Highways or Collector-Distributor (C-D) Roadways and Freeways. For Weaving segments, the LOS criteria changes based on the roadway type. For Merge and Diverge segments, the FFS range is somewhat lower (45-60 mi/h in USC or 72.4-96.6 km/h in metric) and can be estimated by using the methodology in HCM Chapter 12 if no field measurements are available. The capacity checks and the maximum desirable flow rates of the ramp influence areas also change based on the roadway type.

Rolling Terrain

Any combination of grades and horizontal or vertical alignment that causes heavy vehicles to reduce their speed substantially below that 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 is the distance in feet (or meters in metric) of each segment.

Default Segment Lengths

- Basic: 5280 ft (or 1609.3 m in metric)
- Merge: 1500 ft (or 457.2 m in metric)
- Diverge: 1500 ft (or 457.2 m in metric)
- Weaving: 3000 ft (or 914.4 m in metric)

Service Flow Rate

Service flow rates are the maximum rates of flow (within a 15-min period) that can be accommodated without exceeding the limits of the various levels of service. As is the case for service volumes, service flow rates can be found for LOS A-E, but none is defined for LOS F.

Service Volume

Service volume is the maximum hourly volume that can be accommodated without exceeding the limits of the various levels of service during the worst 15 min of the analysis hour. Service volumes can be found for LOS A-E. LOS F, which represents unstable flow, does not have a service volume.

Short Length

Short length is a measure of weaving segment length, which is the distance between the merge and diverge that form the weaving segment. Short length is the distance in feet (or meters in metric) between the end points of any barrier markings (solid white lines) that prohibit or discourage lane changing.

Side of Junction

This refers to the ramp side or location of the ramp relative to the freeway. There are two types: *right-hand* and *left-hand*.

Single-Unit Trucks (SUT)

Single-Unit Trucks 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 a roadway segment or extended roadway segment expressed as a percentage

Target LOS

Target LOS is used in a planning and/or 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 (LOS).

Terrain Type

An extended length of highway containing a number of upgrades or 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 projection, etc.

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 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.

Weaving Configuration

Configuration of a weaving segment refers to the way that entry and exit lanes are linked. The configuration determines how many lane changes a weaving driver must make to complete the weaving maneuver successfully. There are two types of weaving configurations: *one-sided* and *two-sided*.

• A *one-sided weaving segment* is one in which no weaving maneuvers require more than two lane changes to be completed successfully. The following illustrates two examples of one-sided weaving segments:



• A *two-sided weaving segment* is one in which at least one weaving maneuver requires three or more lane changes to be completed successfully or in which a single-lane on-ramp is closely followed by a single-lane off-ramp on the opposite side of the freeway. The following illustrates two examples of two-sided weaving segments:

(a) Two-Sided Weaving Section	(b) Two-Sided Weaving Section

a) Two-Sided Weaving Section with Single-Lane Ramps

(b) Two-Sided Weaving Section with Three Lane Changes

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