Tools and Data Requirements

- **The Purpose:** To describe available tools and data sources for TCR (Planning level) capacity analysis for transportation facilities and corridors.

- **The Sub-Sections:**
  - Decision Tools
  - HCM 2010
  - Facility Characteristics
  - Two-Lane Highways
  - Freeways
  - Multilane Highways
  - Multimodal Analysis
  - Corridor Performance
  - Forecasting
  - Data Sources

Decision Support Methodology for Selecting Traffic Analysis Tool

K162

Decision Support Methodology for Selecting Traffic Analysis Tools

For criteria definitions, please refer to the 'Criteria Definitions' worksheet or the "readme.txt" file

Project Name: _____ **Analyst:** _____ **Date:** _____

Press This Button to START

Recalculate

1	2	3							4						
		Tool Category Relevance							Column 2 x Column 3						
Analysis Context	Context Relevance	Sketch Plan	TDM	Analytical (HCM)	Traffic Opt	Macro Sim	Meso Sim	Micro Sim	Sketch Plan	TDM	Analytical (HCM)	Traffic Opt	Macro Sim	Meso Sim	Micro Sim
Please select only ONE analysis context. Enter a '5' on the selected category.															
Planning	5	10	10	5	0	5	5	0	50	50	25	0	25	25	0
Design	0	-99	5	10	10	10	10	10	0	0	0	0	0	0	0
Operations/Construction	0	5	0	10	10	10	10	10	0	0	0	0	0	0	0
								Subtotal	50	50	25	0	25	25	0
								Relevance Weights Above 0	1						
								WEIGHTED SUBTOTAL	50	50	25	0	25	25	0

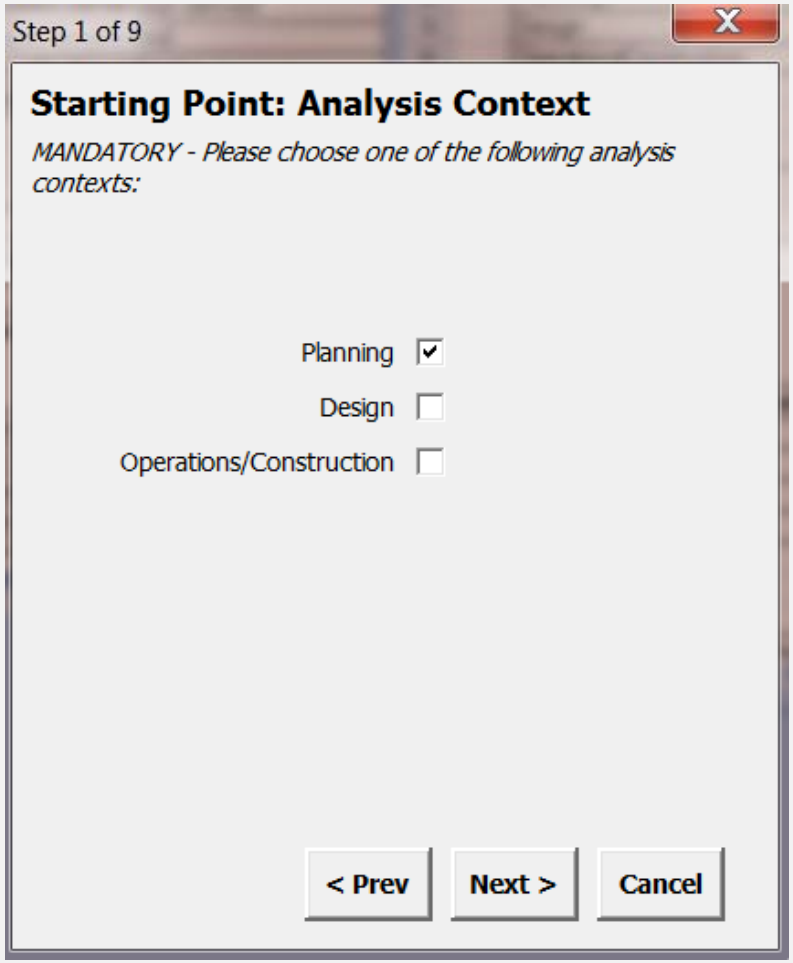
1	2	3							4						
		Tool Category Relevance							Column 2 x Column 3						
Criteria	Sub-Criteria Relevance	Sketch Plan	TDM	Analytical (HCM)	Traffic Opt	Macro Sim	Meso Sim	Micro Sim	Sketch Plan	TDM	Analytical (HCM)	Traffic Opt	Macro Sim	Meso Sim	Micro Sim
1 Geographic Scope (0 = not relevant, 5 = most relevant)															
Isolated Location	0	0	0	10	5	0	0	0	0	0	0	0	0	0	0
Segment	5	10	0	10	0	5	5	5	50	0	50	0	25	25	25
Corridor/Small Network	0	5	10	0	0	5	5	5	0	0	0	0	0	0	0
Region	0	5	10	-99	-99	-99	-99	-99	0	0	0	0	0	0	0

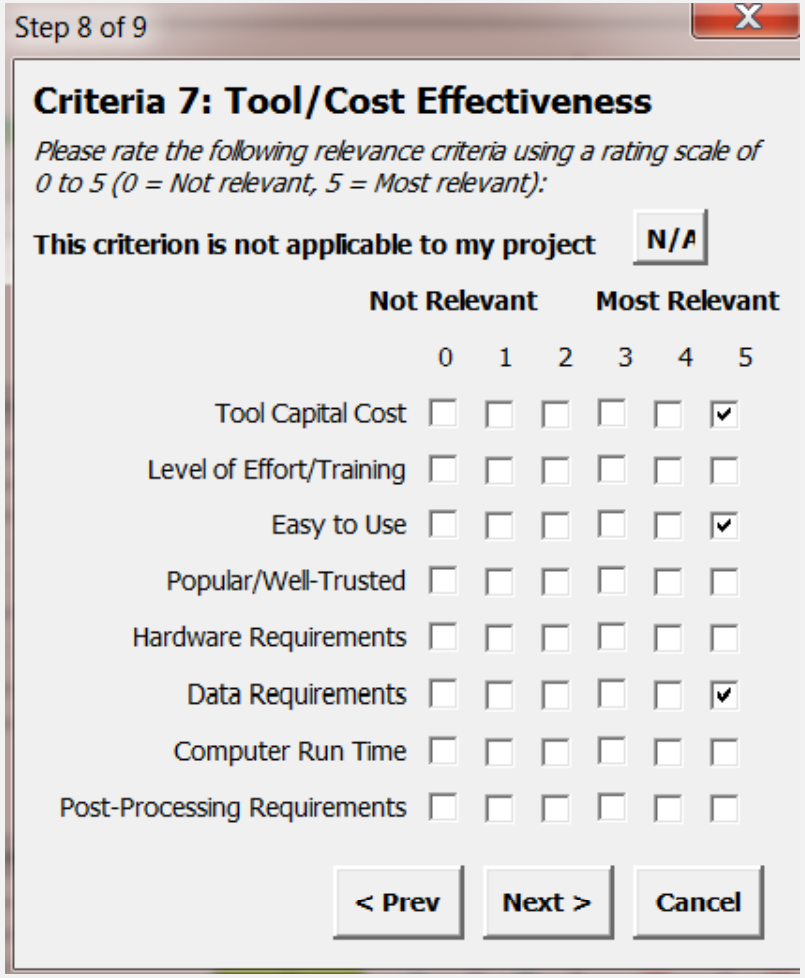
http://ops.fhwa.dot.gov/trafficanalysistools/index.htm

Decision Support Methodology Automated Tool

(HTML, XLS 786KB)

Decision Support Tool Criteria Input Tables





Decision Support Tool Output

Criteria Weights

	5		6	7							8						
	Context/Criteria (0 = not relevant, 5 = most relevant)			Weighted Subtotals							Column 6 x Column 7						
			Criteria Relevance	Sketch Plan	TDM	Analytical (HCM)	Traffic Opt	Macro Sim	Meso Sim	Micro Sim	Sketch Plan	TDM	Analytical (HCM)	Traffic Opt	Macro Sim	Meso Sim	Micro Sim
0	Analysis Context		1	50	50	25	0	25	25	0	50	50	25	0	25	25	0
1	Geographic Scope		1	50	0	50	0	25	25	25	50	0	50	0	25	25	25
2	Facility Type		4	25	35	30	18	30	30	35	100	140	120	70	120	120	140
3	Travel Mode		1	38	38	38	38	38	38	38	38	38	38	38	38	38	38
4	Management Strategy/Applications		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Traveler Response		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Performance Measures		3	19	31	44	41	38	44	44	56	94	131	122	113	131	131
7	Tool/Cost Effectiveness		5	50	0	50	42	17	0	0	250	0	250	208	83	0	0
										WEIGHTED TOTALS	544	321	614	438	403	339	334

Most Appropriate Tool Categories:

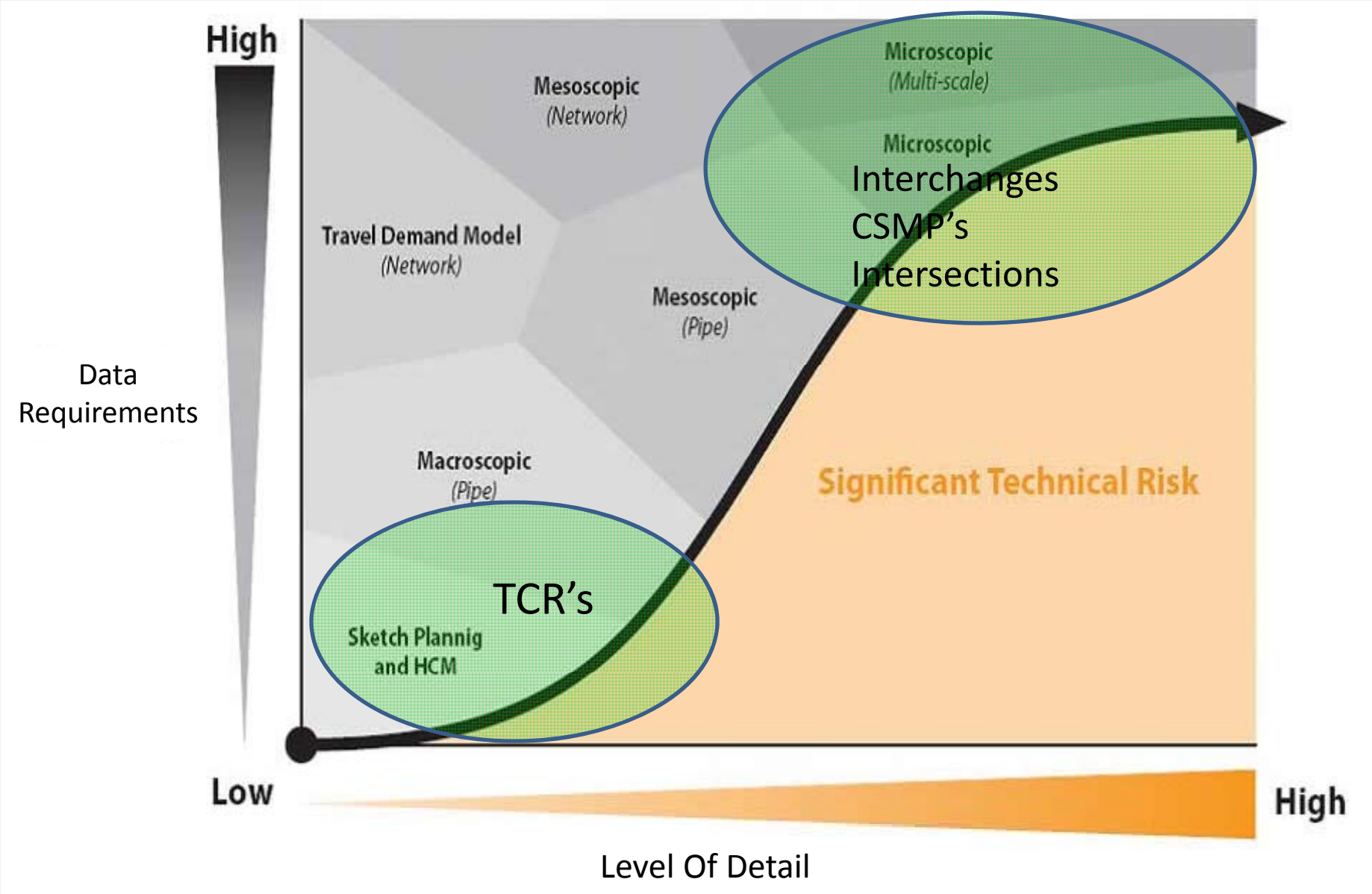
1. Analytical (HCM)
2. Sketch Plan

Tool Categories:

- Sketch Plan = Sketch-planning methodologies and tools
- TDM = Travel demand models
- Analytical (HCM) = Analytical/deterministic tools (HCM-based)
- Traffic Opt = Traffic optimization tools
- Macro Sim = Macroscopic simulation models
- Meso Sim = Mesoscopic simulation models
- Micro Sim = Microscopic simulation models

Please see the 'Tool Definitions' worksheet for more details

Recalculate


High
Low
Data Requirements
Mesoscopic
(Network)
Microscopic
(Multi-scale)
Microscopic
Interchanges
CSMP's
Intersections
Travel Demand Model
(Network)
Mesoscopic
(Pipe)
Macroscopic
(Pipe)
Significant Technical Risk
TCR's
Sketch Plannig
and HCM
High
Level Of Detail

HCM2010
HIGHWAY CAPACITY MANUAL
TRB
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HCM 2010

The Library has purchased online access to Highway Capacity Manual (HCM) 2010. You can now access HCM 2010 from :

Highway Capacity Manual, 2010 (Vol. 1-3)
http://trb.metapress.com/content/p6v332

Highway Capacity Manual, 2010. (Vol. 4)
Username: CaltransStaff
Password: hwyc2p2010 (Username and password for use by Caltrans staff only).
http://hcm2010.org/login

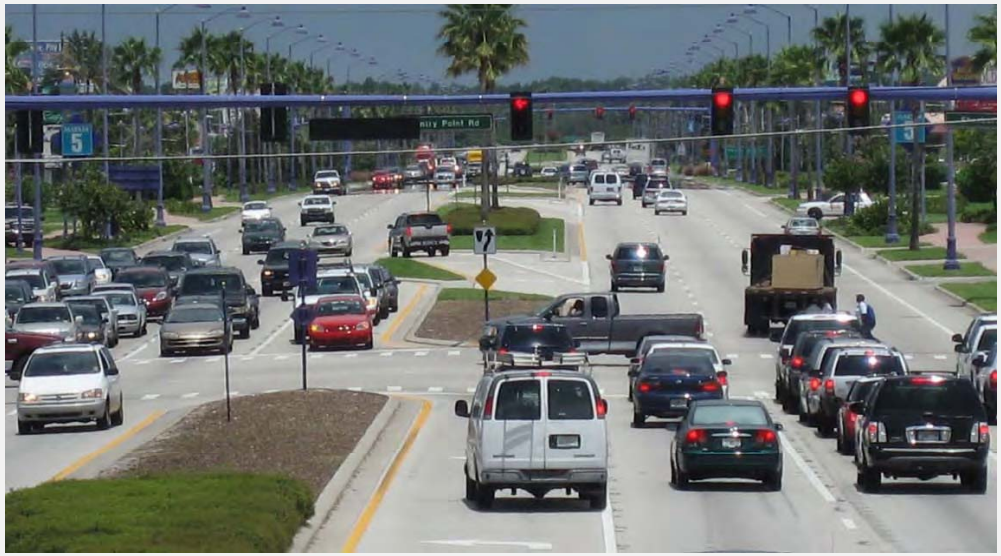
HCM 2010 Overview

- New Active Traffic Management chapter
- Changes to the unsignalized intersection methods
- New multimodal urban streets : ped, bike, transit & auto modes
- New signalized intersection method
- New material on the use of alternative tools
- New freeway weaving method
- Enhancements to the freeway facilities method
- Enhanced planning methods and applications

Highway System Structure

Uninterrupted Flow Roadways

- Freeway Facilities
- Basic Freeway Segments
- Merge Diverge Segments (Weaving)
- Ramps and Ramp Junctions
- Two-Lane Highways
- Multilane Highways



Interrupted Flow Roadways

- Urban Streets Segments
- Intersections (Signalized & Unsignalized)
- Off-street pedestrian and Bicycle Facilities
- Interchange Ramp Terminals
- Roundabouts

(a) Examples of Class I Two-Lane Highways

(b) Examples of Class II Two-Lane Highways

(c) Examples of Class III Two-Lane Highways

Levels Of Service for Two-Lane Highways

LOS	Class I Highways ATS (mi/h)	Class I Highways PTSF (%)	Class II Highways PTSF (%)	Class III Highways PFFS (%)
A	>55	≤35	≤40	>91.7
B	>50–55	>35–50	>40–55	>83.3–91.7
C	>45–50	>50–65	>55–70	>75.0–83.3
D	>40–45	>65–80	>70–85	>66.7–75.0
E	≤40	>80	>85	≤66.7

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Streets
TRANSYT-7F
TWSC
AWSC
Roundabouts
Warrants
DAITA
Facilities
Freeways
Weaving
Ramps
Multilane
TwoLane
LOSPLAN

HCS Two-Lane Highways

File Edit View Reports Window Help

Directional Report Quick

DIRECTIONAL TWO-LANE HIGHWAY SEGMENT ANALYSIS

General Information

Analyst	Robert J Peters	Highway	SR-1
Agency/Co.	Caltrans	From/To	A to B
Date	3/12/2013 Units: U. S. Customary	Jurisdiction	District 7
Analysis Time Period	Peak Hour	Analysis Year	2013
Project Description	Existing PM 1.0 to PM 5.0		

Input Data

Data for the analysis direction only.

Terrain: Level

Percent Trucks Crawling: 0.0 TCS Difference: 0.0 mi/h

Shoulder Width: 6.0 ft Grade: + % Length: mi

Lane Width: 12.0 ft

Segment Length: 5.0 mi

Peak Hour Factor, PHF: 0.90

Trucks and Buses: 5 %

Recreational Vehicles: 0 %

Percent No-Passing Zones: 20 %

Access-Point Density: 8 / mi

(•) Class I Highway ( ) Class II Highway

( ) Class III Highway

Analysis Direction Volume: 539 vph

Opposing Direction Volume: 441 vph

Average Travel Speed

	Analysis Direction	Opposing Direction
Passenger-Car Equivalents for Trucks, ET	1.1	1.1
Passenger-Car Equivalents for RVs, ER	1.0	1.0
Heavy-vehicle Adjustment Factor, fHV	0.995	0.995
Grade Adjustment Factor, fg	1.00	1.00
Directional Flow Rate, vi	602 pc/h	754 pc/h

Highway Class

Peak Volume

Truck Volumes

HCS Two-Lane Highways Results

Directional Flow Rate, vi	602 pc/h	754 pc/h

Free-Flow Speed

	Measured	Estimated	
Field Measured Speed, SFM	mi/h	Base Free-Flow Speed, BFFS	60.0 mi/h
Observed Total Demand, v	veh/h	Adj. for Lane and Shoulder Width, fLS	0.0 mi/h
		Adj. for Access Point Density	2.0 mi/h
Free-Flow Speed, FFS	58.0 mi/h		
Adj for No-Passing Zones, fnp	0.7 mi/h		
Average travel speed, ATSd	46.8 mi/h	Percent Free Flow Speed, PFFS	80.7 %

Percent Time Spent Following

	Analysis Direction	Opposing Direction
Passenger-Car Equivalents for Trucks, ET	1.0	1.0
Passenger-Car Equivalents for RVs, ER	1.0	1.0
Heavy-vehicle Adjustment Factor, fHV	1.000	1.000
Grade Adjustment Factor, fg	1.00	1.00
Directional Flow Rate, vi	599 pc/h	750 pc/h

Base Percent Time-Spent-Following, BPTSF	60.0 %
Adjustment for no-passing zone, fnp	20.3
Percent Time-Spent-Following, PTSF	69.0 %

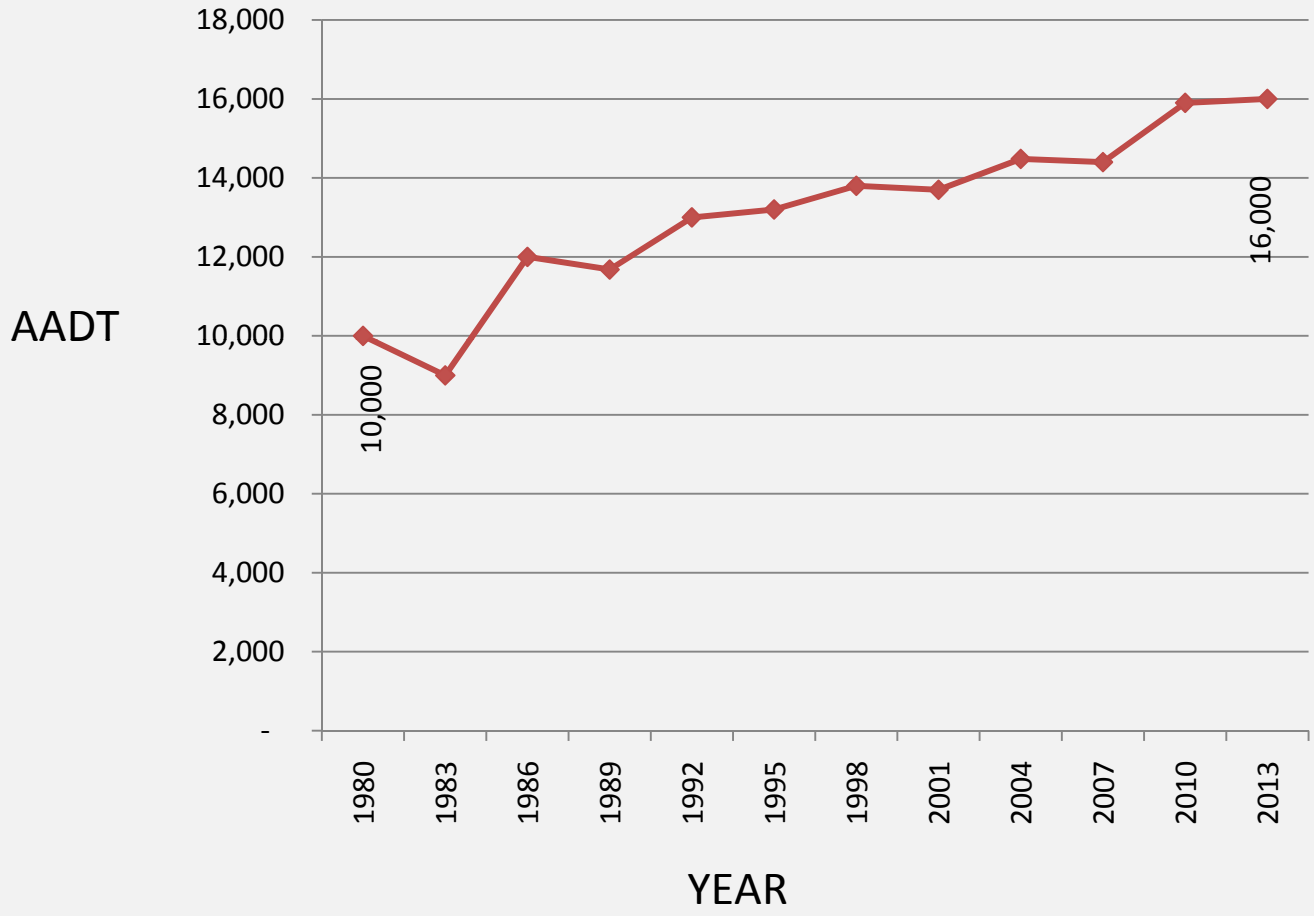
Level of Service and Other Performance Measures

Level of Service, LOS	D
Volume-to-Capacity Ratio, v/c	0.35
Peak 15-minute Vehicle Travel	749 veh-mi
Peak-Hour Vehicle Travel	2695 veh-mi
Peak 15-minute Total Travel Time, TT	16.0 veh-hr

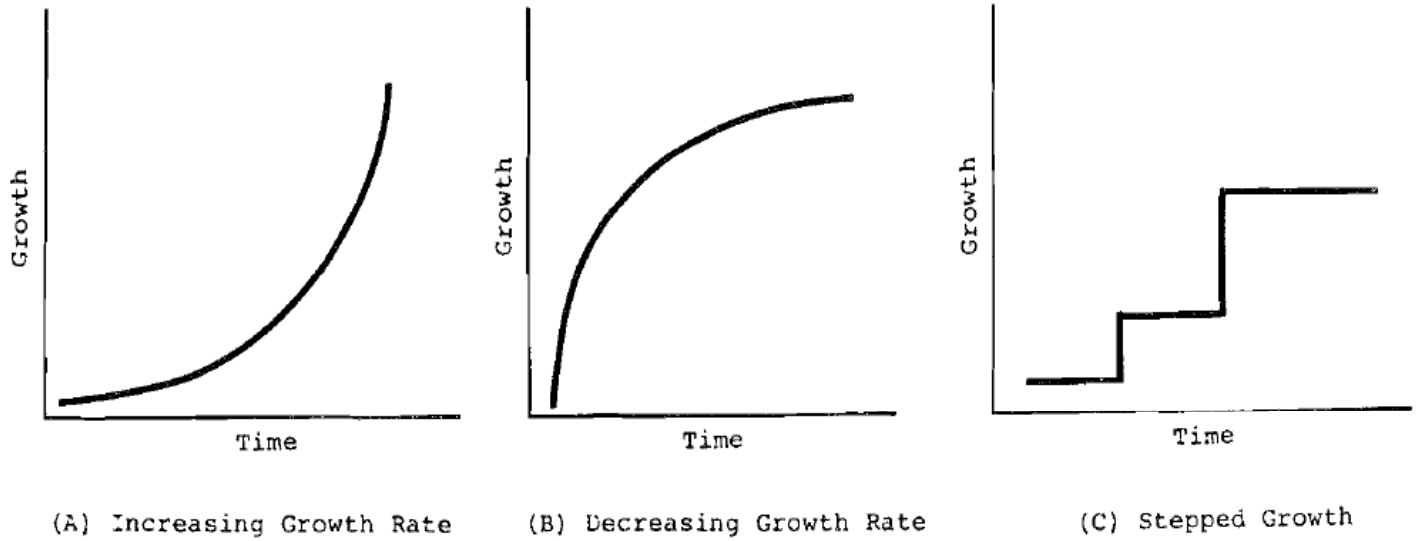
Daily No. of Peak Hours	Peak Hourly Volume	Seg. Length (Miles)	Free Flow Speed (MPH)	Calculated Speed (MPH)	Peak VHD
1	1000	5	60	46.8	23.5

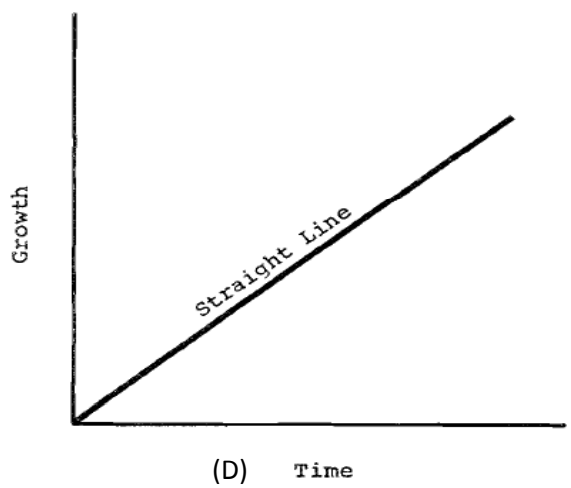
Peak Hour Traffic Data		
Peak Period Length		1
Peak Hour Direction		S/B
Peak Hour Time of Day		AM
Peak Hour Directional Split (BY)		55/45
Peak Hour Directional Split (HY)		55/45
Peak Hour VMT (BY)		1000
Peak Hour VMT (HY)		2000
Peak Hour V/C (BY)		0.35
Peak Hour V/C (HY)		
Peak Hour Avg. Speed (mph)(BY)		47
Peak Hour Avg. Speed (mph)(HY)		
Peak Hour Vehicle Hours of Delay (35 mph) (BY)		
Peak Hour Vehicle Hours of Delay (35 mph) (HY)		
Peak Hour VHD (35 MPH) Method		PeMS
Peak Hour Vehicle Hours of Delay (60 mph) (BY)		23.5
Peak Hour Vehicle Hours of Delay (60 mph) (HY)		N/A
Peak Hour VHD (60 MPH) Method		N/A

Establish Traffic Growth Trend Based on Existing Data

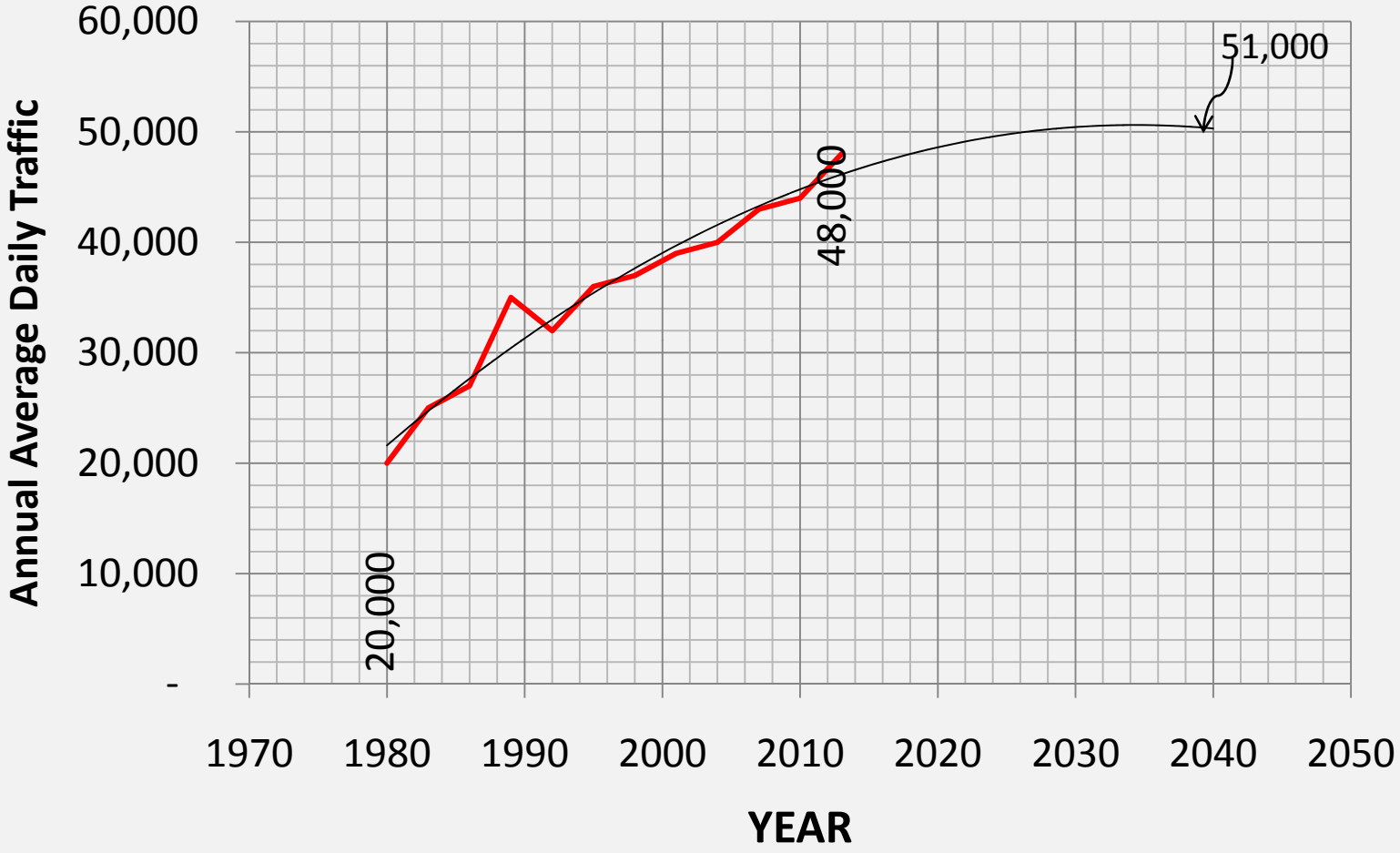


Types of Growth

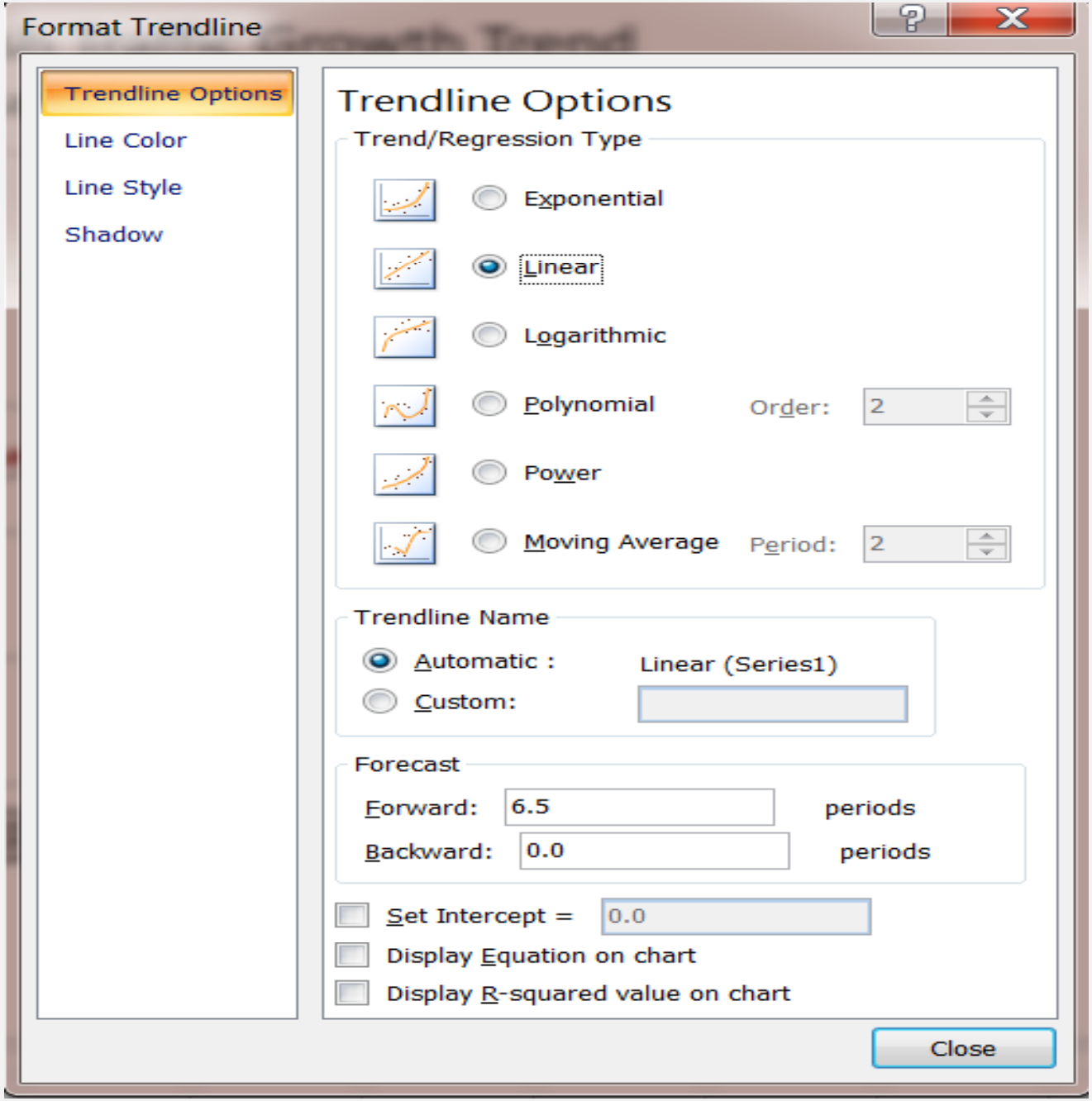




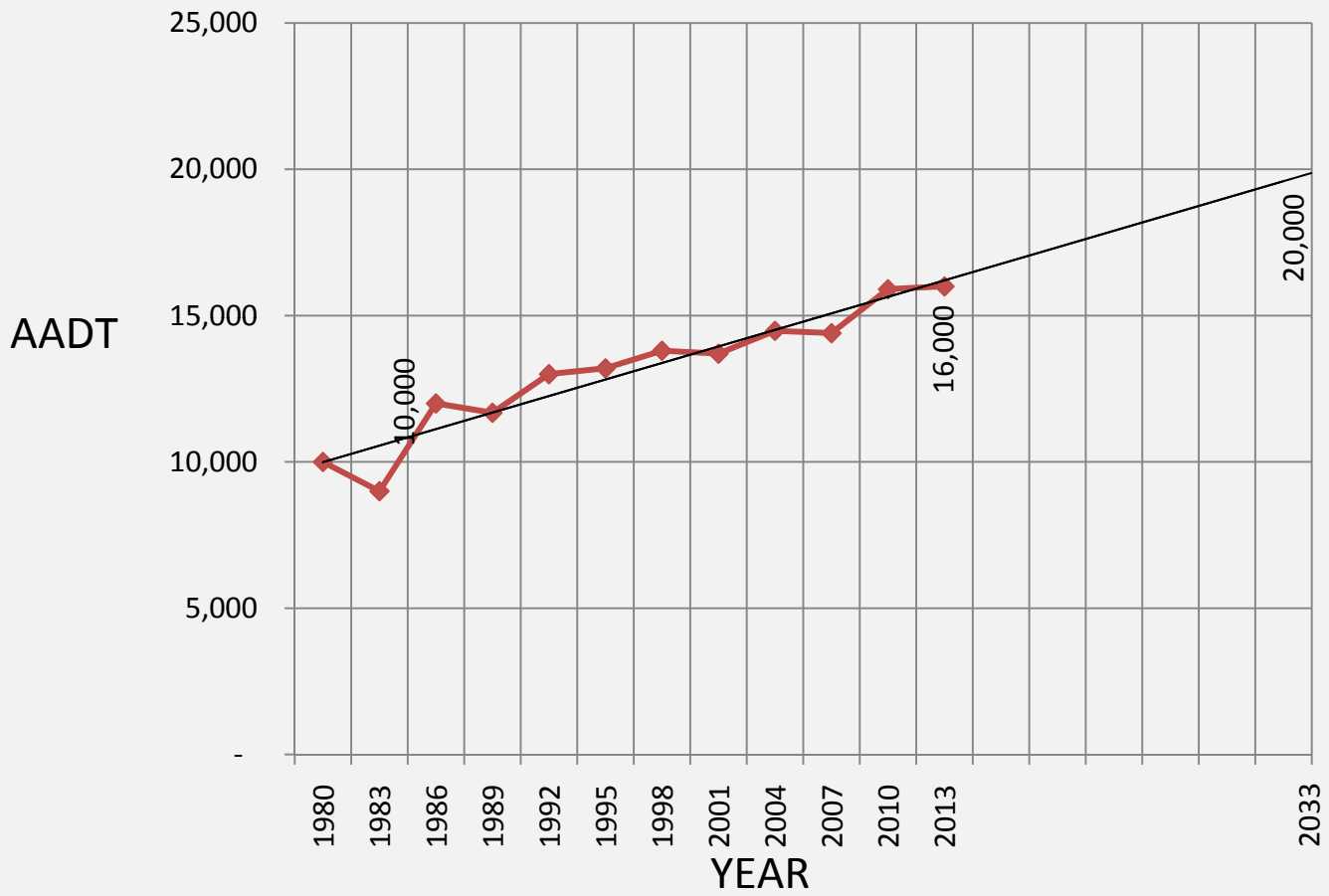
Example of Decreasing Growth



Excel Chart Trendline Options for Growth



Develop Traffic Projection



Annual Growth Rate Calculation

Segment #		1
Basic System Operations		
AADT (BY)		10,000
AADT (HY)		20,000
AADT: Growth Rate/Year		2.3%
LOS Method		HCM
LOS (BY)		D
LOS (HY)		E
LOS Concept		E
VMT (BY)		50,000
VMT (HY)		100,00
Vehicle Occupancy Rate (BY)		1.1
Vehicle Occupancy Rate (HY)		1.2
Daily Vehicle Hours of Delay (35 MPH)(BY)		
Daily Vehicle Hours of Delay (35 MPH)(HY)		
Daily VHD (35 MPH) Method		PeMS
Daily Vehicle Hours of Delay (60 MPH)(BY)		
Daily Vehicle Hours of Delay (60 MPH)(HY)		
Daily VHD (60 MPH) Method		N/A
Truck Traffic		
Total Average Annual Daily Truck Traffic (AADTT) (BY)		600
Total Average Annual Daily Truck Traffic (AADTT) (HY)		1,200
Total Trucks (% of AADT) (BY)		6
Total Trucks (% of AADT)(HY)		6
5+ Axle Average Annual Daily Truck Traffic (AADTT)(BY)		300
5+ Axle Average Annual Daily Truck Traffic (AADTT)(HY)		600
5+ Axle Trucks (as % of AADT)(BY)		3%
5+ Axle Trucks (as % of AADT)(HY)		3%

$$g = (x/y)^{1/Z}$$

g = **average annual growth rate**

x = future (base) year volume

y = earlier year volume

Z = number of years

$$g = \left(\frac{16{,}000}{10{,}000}\right)^{1/20}$$

$$g = 1.023$$

Free-Flow Speed

	Measured		Estimated		
Field Measured Speed, SFM		mi/h	Base Free-Flow Speed, BFFS	60.0	mi/h
Observed Total Demand, v		veh/h	Adj. for Lane and Shoulder Width, fLS	0.0	mi/h
			Adj. for Access Point Density	2.0	mi/h
Free-Flow Speed, FFS	58.0	mi/h			
Adj for No-Passing Zones, fnp	0.6	mi/h			
Average travel speed, ATSd	40.5	mi/h	Percent Free Flow Speed, PFFS	69.9	%

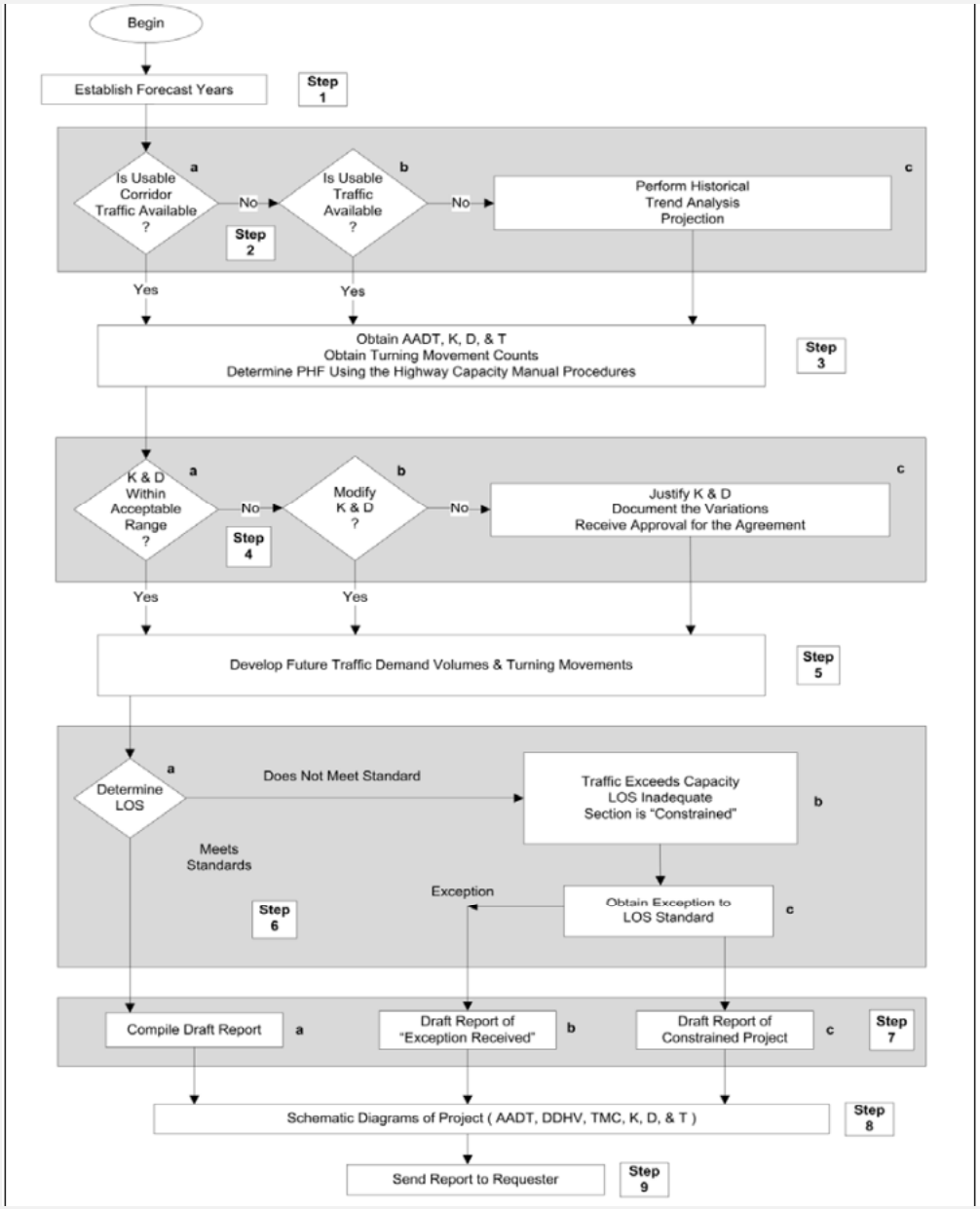
Percent Time Spent Following

	Analysis Direction	Opposing Direction
Passenger-Car Equivalents for Trucks, ET	1.0	1.0
Passenger-Car Equivalents for RVs, ER	1.0	1.0
Heavy-vehicle Adjustment Factor, fHV	1.000	1.000
Grade Adjustment Factor, fg	1.00	1.00
Directional Flow Rate, vi	1198 pc/h	980 pc/h
Base Percent Time-Spent-Following, BPTSF	82.6 %	
Adjustment for no-passing zone, fnp	11.8	
Percent Time-Spent-Following, PTSF	89.1 %	

Level of Service and Other Performance Measures

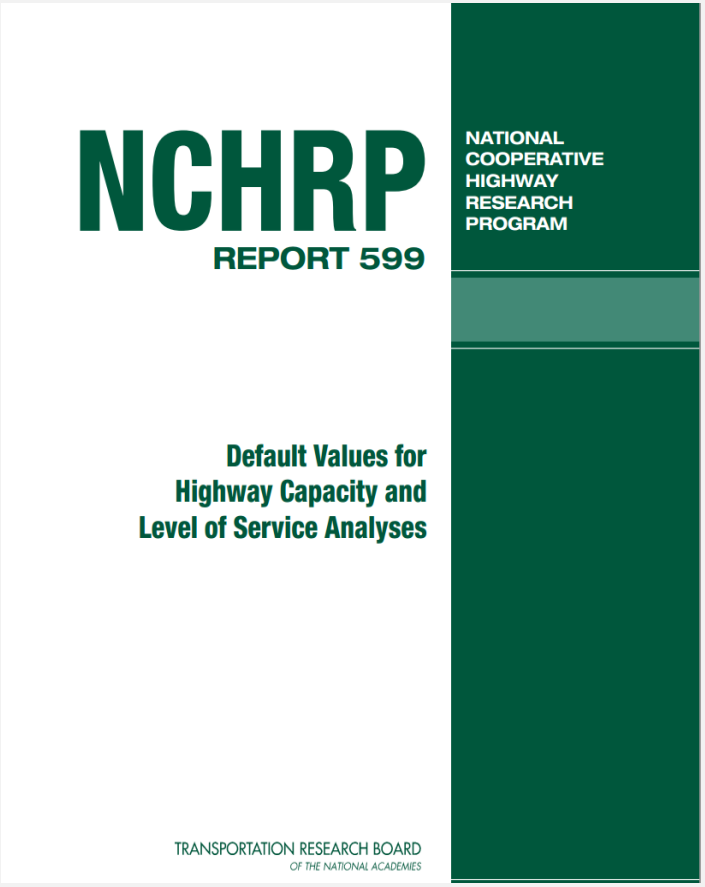
Level of Service, LOS: E

Project Level Traffic Forecasting Process



Default Values

- NCHRP Report 599, Default Values for Highway Capacity and Level of Service Analyses



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AWSC
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DAITA
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Freeways
Weaving
Ramps
Multilane
TwoLane
LOSPLAN
ARTPLAN
HIGHPLAN
FREEPLAN

HCS LOSPLAN Two-Lane HIGHPLAN

HIGHPLAN 2009: Large/Other Urbanized Area - [Project Properties]

File View Help

LOS

untitled.xhp

Roadway Information

Highway Name	SR-1
From	PM 0.0 To PM 5.0
Area Type	Large/Other Urbanized
Peak Direction	Northbound
Off Peak Direction	Southbound
Study Period	K100

File Information

File Name	untitled.xhp
Analyst	Robert J. Peters
Analysis Date	3/13/2013
Agency	Caltrans
Notes	

The area type sets the default values that will initially appear in the data input fields. Note that changing the area type at any time during an analysis will reset all data input fields to the default values corresponding to the selected area type.

<<-- Properties | Highway Data & LOS Results | Service Volumes | -->>

HCS LOSPLAN Two-Lane HIGHPLAN

HIGHPLAN 2009: Large/Other Urbanized Area - [Highway Data & LOS Results]

File View Help

LOS untitled.xhp

Roadway Variables

Num. of Lanes (both dir.)	2	Left Turn Impact	☐
Terrain	Level	Median	☐
Posted Speed	55	Passing Lanes	☐
Free-Flow Speed	60	Spacing	0.0
Segment Length	5.0	% No Passing Zones	80

AADT Volumes

Traffic Variables

AADT	10000	Peak Dir. Hr. Vol.	517	Base Capacity	1700
K factor	0.094	Off-peak Dir. Hr. Vol.	423	Local Adj. Factor	1.00
D factor	0.550				
PHF	0.925	% Heavy Vehicles	2.0		

For the variables highlighted in blue, local values must be used.

<<-- Properties | Highway Data & LOS Results | Service Volumes -->>

HCS LOSPLAN Two-Lane HIGHPLAN

HIGHPLAN 2009: Large/Other Urbanized Area - [Service Volumes]

File View Help

LOS untitled.xhp

Lanes **Hourly Volume in Peak Direction**

	A	B	C	D	E
1	120	480	890	1240	1560

Lanes **Annual Average Daily Traffic**

	A	B	C	D	E
2	2400	9400	17300	24100	30300

Lanes **Hourly Volume in Both Directions**

	A	B	C	D	E
2	220	880	1620	2260	2840

Notes

<<-- Properties Highway Data & LOS Results Service Volumes -->>

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Roundabouts
Warrants
DAITA
Facilities
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Weaving
Ramps
Multilane
TwoLane
LOSPLAN

HCS Freeway Facilities

File View Reports Help

C:\Program Files (x86)\HCS2010\HCS\Example\HCMExample3-FreewayFacilities.xff

Add New Segment | Insert New Segment | Delete Segment | Add Time Period | Delete Time Period

Time Period 1 | Show Segments All | Facility Length (mi) 6.000

Facility-wide Values: Time Period Duration (min) 15 | Jam Density (pc/mi/ln) 190

Note: Only the 'From', 'To', 'Segment Type', 'Length', and 'Terrain' fields can be modified on this screen, and only for the first time

	From	To	Input Segment Type	Length (ft)	Terrain	Edit Segment	Adjusted Demand (veh/h)	% Trucks	% RVs	Number of Lanes	Free-Flow Speed (mi/h)	Adj. On-Ramp Demand (veh/h)	On-Ramp % Trucks	On-Ramp % RVs	On-Ramp Lanes	On-Ramp FFS (mi/h)	Adj. Off-Ramp Demand (veh/h)	Off-Ramp % Trucks	Off-Ramp % RVs	Off-Ramp Lanes	Off-Ramp FFS (mi/h)
1	a	b	Basic Se...	5280	Level	Edit	5001	5.00	0.00	3	60										
2	b	c	On-Ramp	1500	Level	Edit	5501	5.00	0.00	3	60	500	5.00	0.00	1	40					
3	c	d	Basic Se...	2280	Level	Edit	5501	5.00	0.00	3	60										
4	d	e	Off-Ramp	1500	Level	Edit	5501	5.00	0.00	3	60						300	5.00	0.00	1	40
5	e	f	Basic Se...	5280	Level	Edit	5201	5.00	0.00	3	60										
6	f	g	Weaving	2640	Level	Edit	5800	5.00	0.00	4	60	599	5.00	0.00	1	40	400	5.00	0.00	1	40
7	g	h	Basic Se...	5280	Level	Edit	5400	5.00	0.00	4	60										
8	h	i	On-Ramp	1140	Level	Edit	5900	5.00	0.00	4	60	500	5.00	0.00	1	40					
9	i	j	Ramp O...	360	Level	Edit	5900	5.00	0.00	4	60										
10	j	k	Off-Ramp	1140	Level	Edit	5900	5.00	0.00	4	60						300	5.00	0.00	1	40
11	k	l	Basic Se...	5280	Level	Edit	5600	5.00	0.00	4	60										

<<-- Inputs | Time Period Results | Overall Results | Reports -->>

HCS Freeway Facilities

HCS 2010 Freeway Facilities - [Time Period Results]

File View Reports Help

C:\Program Files (x86)\HCS2010\HCS\Example\HCMExample3-FreewayFacilities.xff

Time Period 1 Facility Length (mi) 6.000

	Segment	Input Segment Type	Analysis Segment Type	Adjusted Demand (veh/h)	Vol. Served (veh/h)	Adjusted Capacity (pc/h)	Adjusted Capacity (veh/h)	d/c Ratio	v/c Ratio	Queue Length Interval End (ft)	Queue Start Time Step	Queue End Time Step	Max Queue Length (ft)	Max Queue Time Step	Average Speed (mi/h)	Density (pc/mi/ln)	Density (veh/mi/ln)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)
1	a-b	Basic	Basic	5001	5001	6900	6732	0.74	0.74	0	0	0	0	0	59.8	28.6	27.9	1.00	1.00
2	b-c	OnRamp	Basic	5501	5501	6900	6732	0.82	0.82	0	0	0	0	0	53.2	35.3	34.4	0.32	0.28
3	c-d	Basic	Basic	5501	5501	6900	6732	0.82	0.82	0	0	0	0	0	58.6	32.1	31.3	0.44	0.43
4	d-e	OffRamp	Basic	5501	5501	6900	6732	0.82	0.82	0	0	0	0	0	55.9	33.6	32.8	0.31	0.28
5	e-f	Basic	Basic	5201	5201	6900	6732	0.77	0.77	0	0	0	0	0	59.4	29.9	29.2	1.01	1.00
6	f-g	Weaving	Weaving	5800	5800	8050	7854	0.74	0.74	0	0	0	0	0	45.4	32.7	31.9	0.66	0.60
7	g-h	Basic	Basic	5400	5400	9200	8976	0.60	0.60	0	0	0	0	0	60.0	23.1	22.5	1.00	1.00
8	h-i	OnRamp	Basic	5900	5900	9200	8976	0.66	0.66	0	0	0	0	0	54.9	27.5	26.8	0.24	0.22
9	i-j	RampOv...	Basic	5900	5900	9200	8976	0.66	0.66	0	0	0	0	0	54.9	27.5	26.8	0.07	0.07
10	j-k	OffRamp	Basic	5900	5900	9200	8976	0.66	0.66	0	0	0	0	0	58.1	26.0	25.4	0.22	0.22
11	k-l	Basic	Basic	5600	5600	9200	8976	0.62	0.62	0	0	0	0	0	59.9	23.9	23.4	1.00	1.00
12	Facility														57.2	27.8	27.1	6.28	6.00

<<-- Inputs | Time Period Results | Overall Results | Reports -->>

HCS Freeway Facilities

HCS 2010 Freeway Facilities - [Overall Results]

File View Reports Help

C:\Program Files (x86)\HCS2010\HCS\Example\HCMExample3-FreewayFacilities.xff

	Segment	Input Segment Type	Analysis Segment Type	Maximum d/c Ratio	Average Speed (mi/h)	Average Density (pc/mi/ln)	Average Density (veh/mi/ln)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	VMT Demand (veh-mi)	VMT Volume (veh-mi)	VHT (veh-hrs)	VHD (veh-hrs)
1	a-b	Basic	Basic	0.86	58.9	29.8	29.1	1.02	1.00	6,425.5	6,425.5	109.0	1.9
2	b-c	OnRamp	Basic	0.97	52.6	36.4	35.5	0.32	0.28	1,995.7	1,995.7	37.9	4.7
3	c-d	Basic	Basic	0.97	56.7	33.9	33.1	0.46	0.43	3,033.5	3,033.5	53.5	3.0
4	d-e	OffRamp	Basic	0.97	55.7	34.5	33.6	0.31	0.28	1,995.7	1,995.7	35.8	2.6
5	e-f	Basic	Basic	0.92	58.1	31.2	30.4	1.03	1.00	6,625.0	6,625.0	114.1	3.7
6	f-g	Weaving	Weaving	0.90	45.7	33.0	32.2	0.66	0.50	3,687.1	3,687.1	80.6	19.1
7	g-h	Basic	Basic	0.75	59.9	23.7	23.1	1.00	1.00	6,924.3	6,924.3	115.6	.1
8	h-i	OnRamp	Basic	0.82	54.2	28.6	27.9	0.24	0.22	1,635.2	1,635.2	30.2	2.9
9	i-j	RampOv...	Basic	0.82	54.2	28.6	27.9	0.08	0.07	516.4	516.4	9.5	.9
10	j-k	OffRamp	Basic	0.82	57.9	26.8	26.2	0.22	0.22	1,635.2	1,635.2	28.2	1.0
11	k-l	Basic	Basic	0.77	59.8	24.6	24.0	1.00	1.00	7,173.8	7,173.8	119.9	.3
12	Facility				56.7	28.7	28.0	6.34	6.00	41,647.5	41,647.5	734.4	40.3

<<-- Inputs Time Period Results Overall Results Reports -->>

HCS 2010 Freeway Facilities

Project Properties

Analyst	Danielle Soriano	**Freeway Name**	HCM 2010 Example 3	**Analysis Period**	AM Peak
Analysis Date	8/22/2011 6:00:00 AM	**From**	a	**Version Date**	10/10/2012
Agency	UF-TRC	**To**	l		
Location	N/A	**Analysis Direction**	Eastbound		
User Notes	Example file that corresponds with Example 3 in HCM 2010 Chapter 10				
File Name	C:\Users\s123234\AppData\Local\Temp\preview.xml				

Facility-wide Values

Jam Density (pc/h/ln)	190	**Time Period Duration (min)**	15	**Facility Length (mi)**	**6.00000**

Segment Input Data

Time Period 1

Mainline Data

Seg #	From	To	Type	Length	Terrain	Adj. Demand	% Trucks	% RVs	# Lanes	FFS
1	a	b	Basic Segment	5280	Level	5001	5.00	0.00	3	60
2	b	c	On Ramp	1500	Level	5501	5.00	0.00	3	60
3	c	d	Basic Segment	2280	Level	5501	5.00	0.00	3	60
4	d	e	Off Ramp	1500	Level	5501	5.00	0.00	3	60
5	e	f	Basic Segment	5280	Level	5201	5.00	0.00	3	60
6	f	g	Weaving	2640	Level	5800	5.00	0.00	4	60
7	g	h	Basic Segment	5280	Level	5400	5.00	0.00	4	60
8	h	i	On Ramp	1140	Level	5900	5.00	0.00	4	60
9	i	j	Ramp Overlap	360	Level	5900	5.00	0.00	4	60
10	j	k	Off Ramp	1140	Level	5900	5.00	0.00	4	60
11	k	l	Basic Segment	5280	Level	5600	5.00	0.00	4	60

RampData

Seg #	Type	Adj. Demand	% Trucks	% RVs	Lanes	Accel/Decel Length	FFS
2	On Ramp	500	5.00	0.00	1	500	40
4	Off Ramp	300	5.00	0.00	1	500	40
8	On Ramp	500	5.00	0.00	1	500	40
10	Off Ramp	300	5.00	0.00	1	500	40

Weaving Segment Data

Seg #	Ramp to Ramp Prop.	On-Ramp					Off-Ramp				
		Adj. Demand	% Trucks	% RVs	Lanes	FFS	Adj. Demand	% Trucks	% RVs	Lanes	FFS
6	0.093	599	5.00	0.00	1	40	400	5.00	0.00	1	40

HCS Freeway Facilities

Seg #	From	To	Type	Adj. Demand	Vol. Served	Capacity (pc/h)	Capacity (veh/h)	d/c Ratio	v/c ratio	Queue Length(ft)	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	Mainline Delay (min/veh)	System Delay (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)	LOS
1	a	b	Basic Segment	5001	5001	6900	6732	0.74	0.74	0	59.8	28.6	27.9	1.00	1.00	0.0	0.0	1250.3	1250.3	20.9	0.1	D
2	b	c	On Ramp	5501	5501	6900	6732	0.82	0.82	0	53.2	35.3	34.4	0.32	0.28	0.0	0.0	390.7	390.7	7.3	0.8	E
3	c	d	Basic Segment	5501	5501	6900	6732	0.82	0.82	0	58.6	32.1	31.3	0.44	0.43	0.0	0.0	593.9	593.9	10.1	0.2	D
4	d	e	Off Ramp	5501	5501	6900	6732	0.82	0.82	0	55.9	33.6	32.8	0.31	0.28	0.0	0.0	390.7	390.7	7.0	0.5	D
5	e	f	Basic Segment	5201	5201	6900	6732	0.77	0.77	0	59.4	29.9	29.2	1.01	1.00	0.0	0.0	1300.3	1300.3	21.9	0.2	D
6	f	g	Weaving	5800	5800	8050	7854	0.74	0.74	0	45.4	32.7	31.9	0.66	0.50	0.2	0.2	725.0	725.0	16.0	3.9	D
7	g	h	Basic Segment	5400	5400	9200	8976	0.60	0.60	0	60.0	23.1	22.5	1.00	1.00	0.0	0.0	1350.0	1350.0	22.5	0.0	C
8	h	i	On Ramp	5900	5900	9200	8976	0.66	0.66	0	54.9	27.5	26.8	0.24	0.22	0.0	0.0	318.5	318.5	5.8	0.5	C
9	i	j	Ramp Overlap	5900	5900	9200	8976	0.66	0.66	0	54.9	27.5	26.8	0.07	0.07	0.0	0.0	100.6	100.6	1.8	0.2	D
10	j	k	Off Ramp	5900	5900	9200	8976	0.66	0.66	0	58.1	26.0	25.4	0.22	0.22	0.0	0.0	318.5	318.5	5.5	0.2	C
11	k	l	Basic Segment	5600	5600	9200	8976	0.62	0.62	0	59.9	23.9	23.4	1.00	1.00	0.0	0.0	1400.0	1400.0	23.4	0.0	C

HCS Freeway Facilities

Overall Results

Segment	Segment Type	Maximum d/c Ratio	Avg. Speed (mi/h)	Density (pc/mi/in)	Density (veh/mi/in)	Avg. Travel Time (min/veh)	Free-Flow Travel Time (min/veh)	VMT Demand (veh-min)	VMT Volume (veh-min)	VHT (veh-hrs)	VHD (veh-hrs)
a-b	Basic	0.86	58.9	29.8	29.1	1.02	1.00	6,425.5	6,425.5	109.04	1.95
b-c	OnRamp	0.97	52.6	36.4	35.5	0.32	0.28	1,995.7	1,995.7	37.93	4.67
c-d	Basic	0.97	56.7	33.9	33.1	0.46	0.43	3,033.5	3,033.5	53.52	2.96
d-e	OffRamp	0.97	55.7	34.5	33.6	0.31	0.28	1,995.7	1,995.7	35.83	2.57
e-f	Basic	0.92	58.1	31.2	30.4	1.03	1.00	6,625.0	6,625.0	114.11	3.70
f-g	Weaving	0.90	45.7	33.0	32.2	0.66	0.50	3,687.1	3,687.1	80.60	19.15
g-h	Basic	0.75	59.9	23.7	23.1	1.00	1.00	6,924.3	6,924.3	115.55	0.15
h-i	OnRamp	0.82	54.2	28.6	27.9	0.24	0.22	1,635.2	1,635.2	30.18	2.92
i-j	RampOverlap	0.82	54.2	28.6	27.9	0.08	0.07	0,516.4	0,516.4	9.53	0.92
j-k	OffRamp	0.82	57.9	26.8	26.2	0.22	0.22	1,635.2	1,635.2	28.24	0.99
k-l	Basic	0.77	59.8	24.6	24.0	1.00	1.00	7,173.8	7,173.8	119.89	0.32
Freeway			56.7	28.7	28.0	6.34	6.00	41,647.5	41,647.5	0,734.4	0,040.3

Density-Based LOS by Segment

Segment	1	2	3	4	5	6	7	8	9	10	11
Time Step	Basic	On Ramp	Basic	Off Ramp	Basic	Weaving	Basic	On Ramp	Ramp Overlap	Off Ramp	Basic
1	D	E	D	D	D	D	C	C	D	C	C
2	D	E	E	E	D	E	D	D	D	D	D
3	D	E	E	E	E	E	D	E	E	D	D
4	D	E	D	D	D	D	C	C	D	C	C
5	C	C	C	C	C	C	B	C	C	B	C

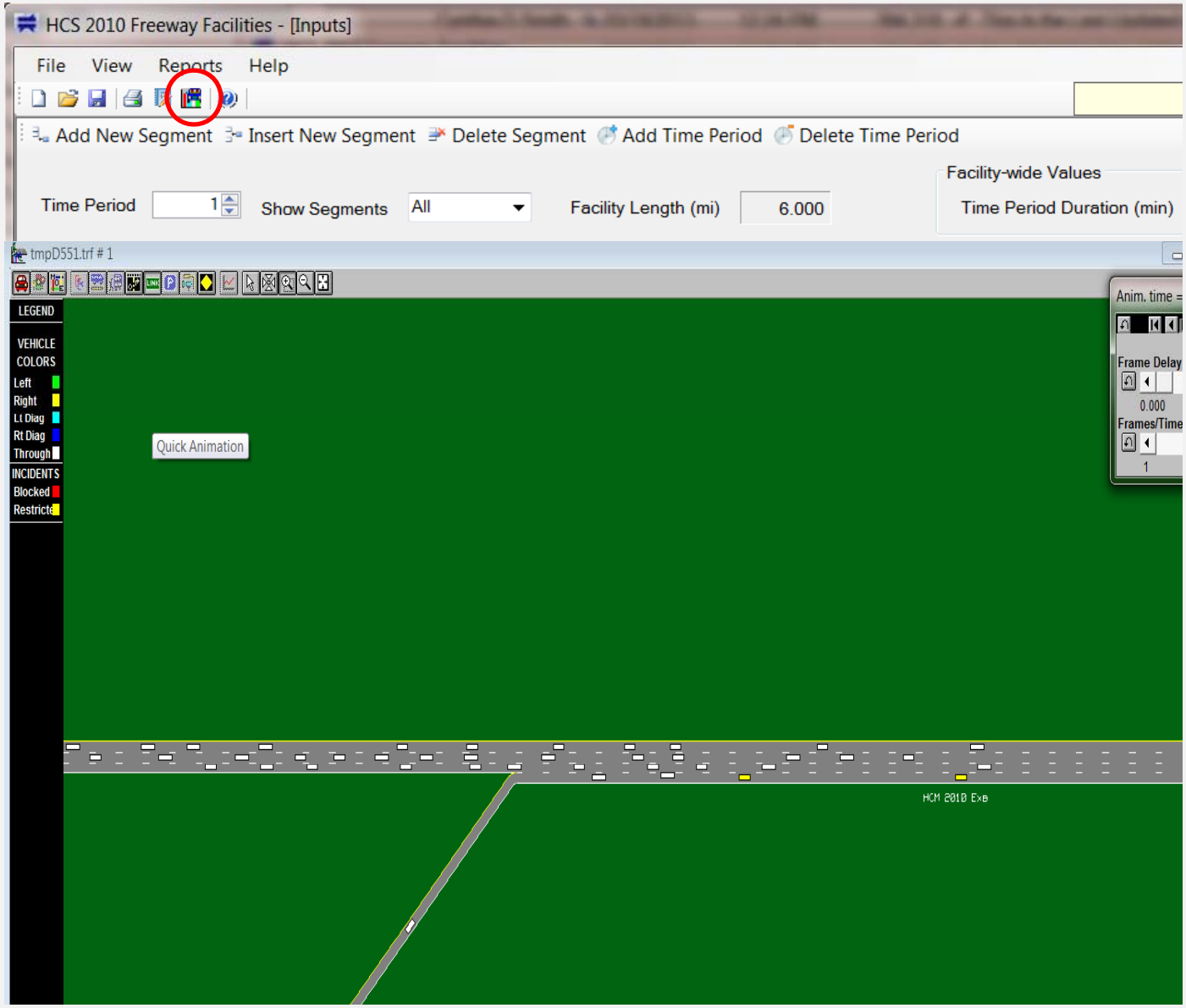
Demand-Based LOS by Segment

Time Step	1	2	3	4	5	6	7	8	9	10	11
1	.	.	.	.	.	.	.	.	.	.	.
2	.	.	.	.	.	.	.	.	.	.	.
3	.	.	.	.	.	.	.	.	.	.	.
4	.	.	.	.	.	.	.	.	.	.	.
5	.	.	.	.	.	.	.	.	.	.	.

Peak Hour VMT (BY)		41,647
Peak Hour VMT (HY)		N/A
Peak Hour V/C (BY)		<1
Peak Hour V/C (HY)		N/A
Peak Hour Avg. Speed (mph)(BY)		56.7
Peak Hour Avg. Speed (mph)(HY)		

<<-- Inputs | Time Period Results | Overall Results | Reports -->>

Freeway Facilities Results Conversion to CORSIM



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HCS LOSPLAN FREEPLAN

FREEPLAN 2009: Large Urbanized Area - [Project Properties]

File View Help

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Roadway Information

Freeway Name	Sample Freeway
From	To
Area Type	Large Urbanized
Peak Direction	Eastbound
Off Peak Direction	Westbound
Study Period	K100

File Information

File Name	Freeway in LOSPLAN.xfp
Analyst	
Analysis Date	3/13/2013
Agency	
Notes	

The area type sets the default values that will initially appear in the data input fields. Note that changing the area type at any time during an analysis will reset all data input fields to the default values corresponding to the selected area type.

For the variables highlighted in blue on the following screen, local values must be used.

<<-- | Project Properties | Segment Data | LOS Results | Service Volumes | -->>

HCS LOSPLAN FREEPLAN

FREEPLAN 2009: Large Urbanized Area - [Segment Data]

File View Help

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Add New Row | Insert New Row | Delete Row

Facility-wide Values

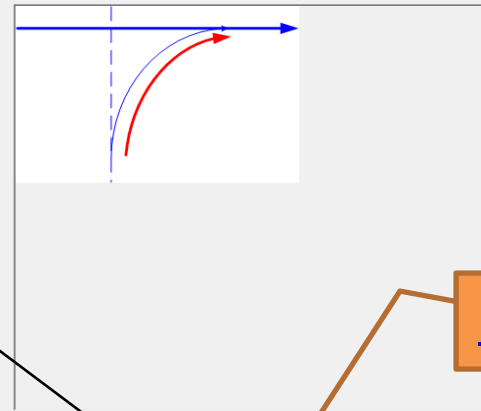
AADT	100000	K Factor	0.091	D Factor	0.55	Peak Hour Factor	0.950
Local Adj. Factor	0.97	% Heavy Vehicles	4.0	Ramp Metering		Facility Length (mi)	6.000

	From	To	Segment Type	Edit Int	Segment Length	InBetween Length	Hourly Volume	Number Thru Lanes	Number Aux Lanes	Posted Speed	Free Flow Speed	Terrain
1	a	b	Basic Se...	Edit	5538		5005	3	0			
2	b	c	On Ramp	Edit	1500		5005	3	0			
3	c	d	Basic Se...	Edit	2000		5455	3	0			
4	d	e	Off Ramp	Edit	1500		5455	3	0			
5	e	f	Basic Se...	Edit	4000		5185	3	0			
6	f	g	Basic Se...	Edit	2640		5185	3	0			
7	g	h	Basic Se...	Edit	4000		5185	3	0			
8	h	i	On Ramp	Edit	1500		5185	3	0			
9	i	j	Basic Se...	Edit	4000		5635	3	0			
10	j	k	Off Ramp	Edit	1500		5635	3	0			
11	k	l	Basic Se...	Edit	3500		5365	3	0			

<<-- | Project Properties | Segment Data | LOS Results | Service Volumes | -->>

Interchange Data

Segment # 2: From b to c



	Ramp Number	Ramp Type	Demand (veh/h)	% Heavy Vehicles	Number of Lanes	Accel/Decel Length	Free Flow Speed	Off-Ramp Analysis	Edit
	1	On Ra...	450	2	1	1000	40		Edit

Ramp Volumes

HCS LOSPLAN FREEPLAN

FREEPLAN 2009: Large Urbanized Area - [LOS Results]

File View Help

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	Segment	Segment Type	Dir. Hourly Volume	Adj. Dir. Capacity	Average Speed	Density	Segment LOS	Hot Spots
1	a-b	Basic	5005	6234	58.9	31.4	D	View
2	b-c	OnRamp	5005	6053	52.9	32.8	D	View
3	c-d	Basic	5455	6239	56.9	35.3	E	View
4	d-e	OffRamp	5455	5877	55.7	34.2	D	View
5	e-f	Basic	5185	6236	58.2	32.8	D	View
6	f-g	Basic	5185	6236	58.2	32.8	D	View
7	g-h	Basic	5185	6236	58.2	32.8	D	View
8	h-i	OnRamp	5185	6055	52.6	34.0	D	View
9	i-j	Basic	5635	6241	55.9	37.2	E	View
10	j-k	OffRamp	5635	5879	55.6	35.4	E	View
11	k-l	Basic	5365	6235	57.4	34.5	D	View

Daily No. of Peak Hours	Peak Hourly Volume	Segement Length (Miles)	Free Flow Speed (MPH)	Calculated Speed (MPH)	Peak VHD
1	5365	6	60	57.1	27.2

Segment #		1
Basic System Operations		
AADT (BY)		
AADT (HY)		
AADT: Growth Rate/Year		
LOS Method		HCM
LOS (BY)		E
LOS (HY)		
LOS Concept		
VMT (BY)		50,000
VMT (HY)		100,00
Vehicle Occupancy Rate (BY)		1.1
Vehicle Occupancy Rate (HY)		1.2
Daily Vehicle Hours of Delay (35 MPH)(BY)		0
Daily Vehicle Hours of Delay (35 MPH)(HY)		0
Daily VHD (35 MPH) Method		PeMS
Daily Vehicle Hours of Delay (60 MPH)(BY)		27.2
Daily Vehicle Hours of Delay (60 MPH)(HY)		
Daily VHD (60 MPH) Method		N/A

Length (mi) 6.000 | Free Flow Delay (sec/veh) 18.6 | LOS Threshold Delay (sec/veh) 3.6 | Avg. Speed (mi/h) 57.1 | Density (pc/mi/ln) 33.7 | LOS E

<<-- Project Properties | Segment Data | LOS Results | Service Volumes | -->>

HCS LOSPLAN FREEPLAN

FREEPLAN 2009: Large Urbanized Area - [Service Volumes]

File View Help

C:\Projects\Training\Freeway in LOSPLAN.xfp

Notes

* For oversaturated conditions during the peak hour, subtract 10% from LOS E (capacity) volumes. This number becomes the new maximum service volume for LOS D, and LOS E cannot be achieved.

Lanes — Hourly Volume in Peak Direction

Lanes	A	B	C	D	E*
2	1000	1520	2300	3020	3180
3	1320	2460	3620	4680	5260
4	1880	3400	4920	6280	7340
5	2480	4300	6220	8020	9420
6	3220	5760	8280	10360	11500

Lanes — Hourly Volume in Both Directions

Lanes	A	B	C	D	E*
4	1820	2780	4190	5500	5780
6	2410	4460	6600	8500	9550
8	3410	6190	8960	11420	13330
10	4500	7820	11320	14570	17110
12	5870	10460	15050	18820	20900

Lanes — Annual Average Daily Traffic

Lanes	A	B	C	D	E*
4	20000	30500	46000	60500	63500
6	26500	49000	72500	93400	104...
8	37500	68000	98500	125...	146...
10	49500	86000	124...	160...	188...
12	64500	114...	165...	206...	229...

<<-- | Project Properties | Segment Data | LOS Results | Service Volumes | -->>

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(a) Divided suburban multilane highway

(b) Undivided suburban multilane highway

(c) Suburban multilane highway with TWLTL

(d) Undivided rural multilane highway

HCS MULTILANE HIGHWAY

MULTILANE HIGHWAYS OPERATIONAL ANALYSIS

Analyst	Al Arana	Highway	SR-299
Agency/Co.	Caltrans	From/To	PM 23.0 / PM 28.0
Date	1/6/2011	Units: U. S. Customary	Jurisdiction	Dist-1
Analysis Time Period	PM Peak Hour	Analysis Year	2013
Project Description	Example 2 - Grade		

FREE-FLOW SPEED

Direction	1	2
Free-flow speed:	○ Field measured, FFS ● Base FFS, BFFS	○ Field measured, FFS ● Base FFS, BFFS
	55.0 mph	55.0 mph
Median type	● Divided ○ Undivided	● Divided ○ Undivided
	F M 0.0 mph	F M 0.0 mph
Lane width, LW	12.0 ft	12.0 ft
	F LW 0.0 mph	F LW 0.0 mph
Lateral clearance:		
Right edge	6.0 ft	6.0 ft
Left edge	6.0 ft	6.0 ft
Total lateral clearance	12.0 ft	12.0 ft
	F LC 0.0 mph	F LC 0.0 mph
Access points/mile	10	0
	F A 2.5 mph	F A 0.0 mph
Free-flow speed, FFS	52.5 mph	55.0 mph
Use Speed curve for:	55.0 mph	55.0 mph

HCS MULTILANE HIGHWAY

VOLUME				
Direction	1		2	
Volume, V	3000		2000	
Peak-hour factor, PHF	0.90		0.90	
Peak 15-minute volume, v15	833	veh/h	556	veh/h
Number of lanes, N	2		2	
Terrain:	Grade		Grade	
Grade	-4.00	%	4.00	%
Length	1.14	mi	1.14	mi
Trucks and buses	6	%	6	%
ET	1.5		3.0	
Recreational vehicles	0	%	0	%
ER	1.2		3.0	
Heavy vehicle adjustment	fHV	0.971	fHV	0.893
Driver population factor	fP	1.00	fP	1.00
Flow rate, vp	1716	pc/h/ln	1244	pc/h/ln

RESULTS				
Direction	1		2	
Flow rate, vp	1716	pc/h/ln	1244	pc/h/ln
Free-flow speed, FFS	52.5	mph	55.0	mph
Average passenger-car travel speed, S	53.7	mph	55.0	mph
Level of Service, LOS	D		C	
Density, D	32.0	pc/mi/ln	22.6	pc/mi/ln

Peak Hour Traffic Data		
Peak Period Length		1
Peak Hour Direction		S/B
Peak Hour Time of Day		PM
Peak Hour Directional Split (BY)		60/40
Peak Hour Directional Split (HY)		60/40
Peak Hour VMT (BY)		4200
Peak Hour VMT (HY)		
Peak Hour V/C (BY)		<1
Peak Hour V/C (HY)		
Peak Hour Avg. Speed (mph)(BY)		53.7
Peak Hour Avg. Speed (mph)(HY)		
Peak Hour Vehicle Hours of Delay (35 mph) (BY)		
Peak Hour Vehicle Hours of Delay (35 mph) (HY)		
Peak Hour VHD (35 MPH) Method		PeMS
Peak Hour Vehicle Hours of Delay (60 mph) (BY)		0
Peak Hour Vehicle Hours of Delay (60 mph) (HY)		N/A
Peak Hour VHD (60 MPH) Method		N/A

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HCS LOSPLAN ARTPLAN

ARTPLAN 2009: Large Urbanized Area - [Project Properties]

File View Help

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Roadway Information

Road Name	Test
Peak Direction	Northbound
Off Peak Direction	Southbound
Area Type	Large Urbanized
Class	2

File Information

File Name	urbanmulti85-100.xap
Analyst	
Analysis Date	7/30/2009
Agency	
Notes	Table 1, Table 4, Table 7

Analysis Information

Modal Analysis	Multimodal
Type of Analysis	Multimodal / Auto Only / Isolated Signal Only
Study Period	K100

The area type sets the default values that will initially appear in the data input fields. Note that changing the area type at any time during an analysis will reset all data input fields to the default values corresponding to the selected area type.

For the variables highlighted in blue on the following screens, local values must be used.

<<-- | Properties | Intersection | Segment (Auto) | Segment (MM) | Ped SubSegment | LOS Results (Auto) | LOS Results (MM) | Service Volumes | -->>

HCS LOSPLAN ARTPLAN

ARTPLAN 2009: Large Urbanized Area - [Intersection Data]

File View Help

C:\Program Files (x86)\HCS2010\HCS\LOSPLAN\Service Volume Table Input Files\Urban (1

Add New Row | Insert New Row | Delete Row

Facility-wide Values

Control Type: Semiactuated

Base Saturation Flow Rate (pc/h/ln): 1950

Peak Direction | Off-Peak Direction

	Cross Street Name	Cycle Length	Thru g/C	Arrival Type	# Thru Lanes	% Left Turns	% Right Turns	Excl. Left Turn Lane	Number LT Lanes	Total Left Turn Storage	Left g/C	Excl. Right Turn Lane
1												
2		120	0.44	4	2	12	12	✓	1	235	0.1	
3		120	0.44	4	2	12	12	✓	1	235	0.1	
4		120	0.44	4	2	12	12	✓	1	235	0.1	
5		120	0.44	4	2	12	12	✓	1	235	0.1	
6		120	0.44	4	2	12	12	✓	1	235	0.1	
7		120	0.44	4	2	12	12	✓	1	235	0.1	

<<-- | Properties | Intersection | Segment (Auto) | Segment (MM) | Ped SubSegment | LOS Results (Auto) | LOS Results (MM) | Service Volumes | -->>

HCS LOSPLAN ARTPLAN

ARTPLAN 2009: Large Urbanized Area - [Segment Data (Auto)]

File View Help

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Facility-wide Values

Arterial Length (mi) 2.000 K Factor 0.097 D Factor 0.55 Peak Hour Factor 0.925 % Heavy Vehicles 2.0

Peak Direction | Off-Peak Direction

	Segment	Length	AADT	Adj. Dir. Hourly Volume	# of Thru Lanes	Posted Speed	Free Flow Speed	Median Type
1	-	1760	34000	1814	2	45	50	Restrictive
2	-	1760	34000	1814	2	45	50	Restrictive
3	-	1760	34000	1814	2	45	50	Restrictive
4	-	1760	34000	1814	2	45	50	Restrictive
5	-	1760	34000	1814	2	45	50	Restrictive
6	-	1760	34000	1814	2	45	50	Restrictive

<<-- | Properties | Intersection | Segment (Auto) | Segment (MM) | Ped SubSegment | LOS Results (Auto) | LOS Results (MM) | Service Volumes | -->>

HCS LOSPLAN ARTPLAN

ARTPLAN 2009: Large Urbanized Area - [LOS Results (Auto)]

File View Help

C:\Program Files (x86)\HCS2010\HCS\LOSPLAN\Service Volume Table Input Files\Urban (1

Peak Direction | Off-Peak Direction

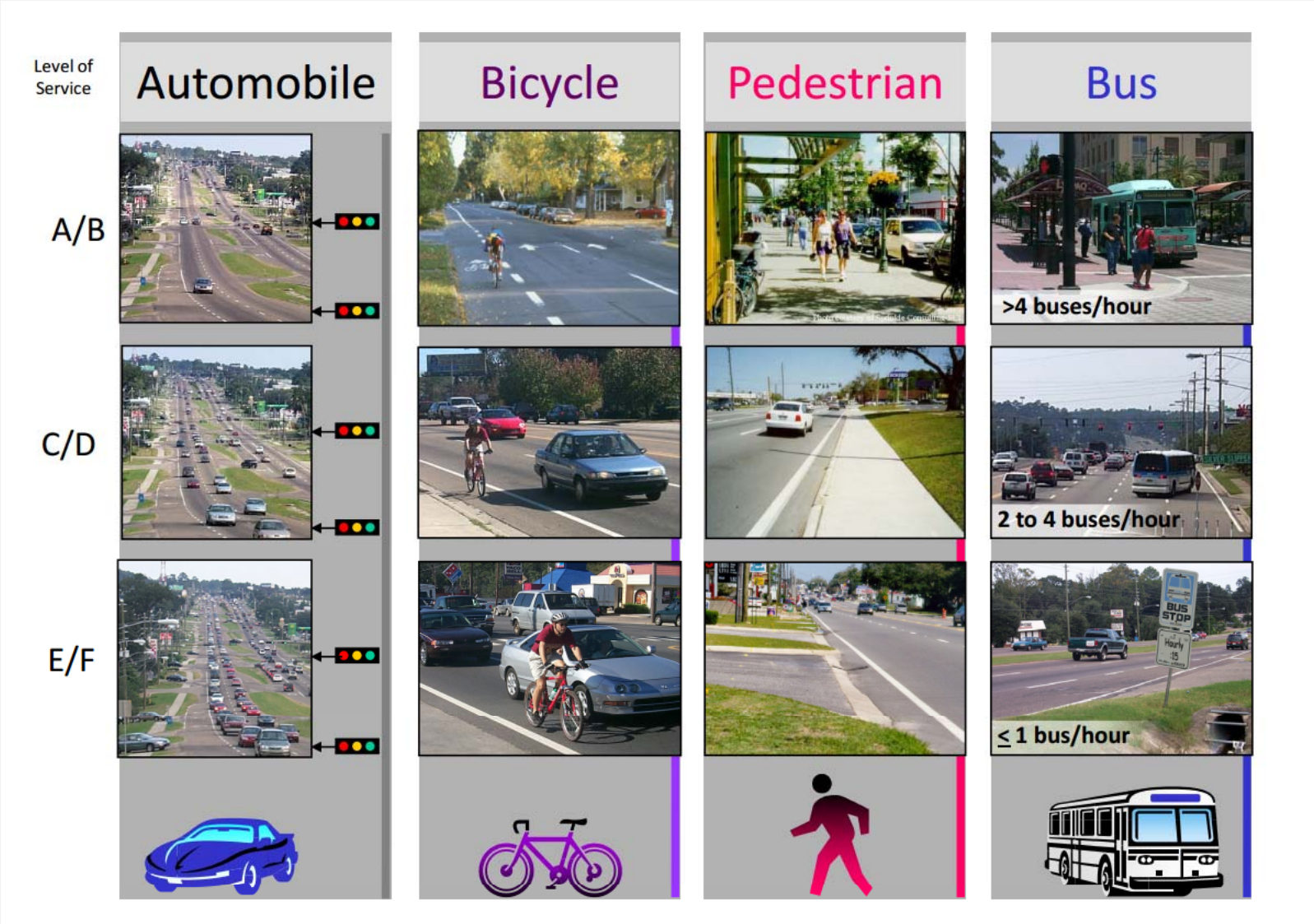
	Segment	Thru Mvmt Flow Rate	Adj. Sat. Flow Rate	v/c	Control Delay	Thru Mvmt Intersection LOS	Queue Storage Ratio	Average Speed	Segment LOS
1	-	1726	3767	1.041	49.3	D	0.84	15.2	E
2	-	1726	3767	1.041	49.3	D	0.84	15.2	E
3	-	1726	3767	1.041	49.3	D	0.84	15.2	E
4	-	1726	3767	1.041	49.3	D	0.84	15.2	E
5	-	1726	3767	1.041	49.3	D	0.84	15.2	E
6	-	1726	3767	1.041	49.3	D	0.84	15.2	E

Peak Hour Traffic Data		
Peak Period Length		1
Peak Hour Direction		S/B
Peak Hour Time of Day		PM
Peak Hour Directional Split (BY)		55/45
Peak Hour Directional Split (HY)		55/45
Peak Hour VMT (BY)		3,627
Peak Hour VMT (HY)		
Peak Hour V/C (BY)		1.04
Peak Hour V/C (HY)		
Peak Hour Avg. Speed (mph)(BY)		15.23

Length (mi) 2.000 | Wtd. g/C 0.44 | Free Flow Delay (sec/veh) 328.6 | LOS Threshold Delay (sec/veh) 49.1 | Avg. Speed (mi/h) 15.23 | LOS E

<<-- | Properties | Intersection | Segment (Auto) | Segment (MM) | Ped SubSegment | LOS Results (Auto) | LOS Results (MM) | Service Volumes | -->>

Examples of LOS By Mode for Urban Roadways



HCS LOSPLAN ARTPLAN

ARTPLAN 2009: Large Urbanized Area - [LOS Results (Multimodal)]

File View Help

C:\Program Files (x86)\HCS2010\HCS\LOSPLAN\Service Volume Table Input Files\Urban (1

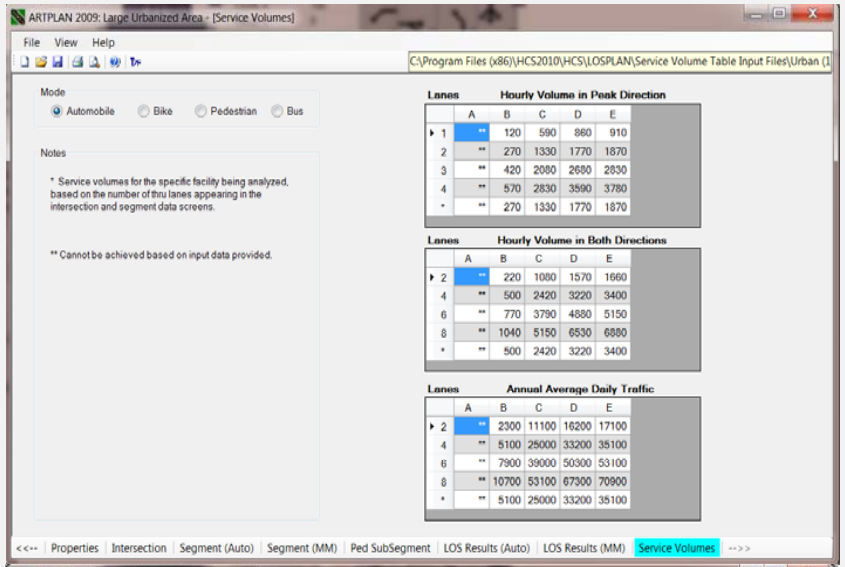
Peak Direction | Off-Peak Direction

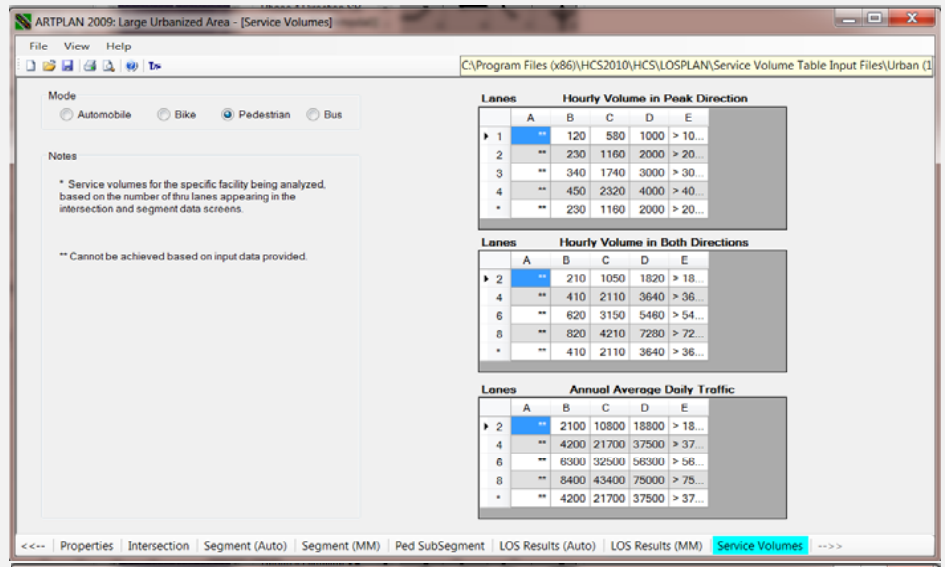
	Segment	Bike Score	Bike LOS	Ped LOS SubSeg (1)	Ped LOS SubSeg (2)	Ped LOS SubSeg (3)	Ped Score Segment	Ped LOS Segment	Adj. Buses	Bus LOS
1	-	2.70	C	C			3.40	C	1.05	E
2	-	2.70	C	C			3.40	C	1.05	E
3	-	2.70	C	C			3.40	C	1.05	E
4	-	2.70	C	C			3.40	C	1.05	E
5	-	2.70	C	C			3.40	C	1.05	E
6	-	2.70	C	C			3.40	C	1.05	E

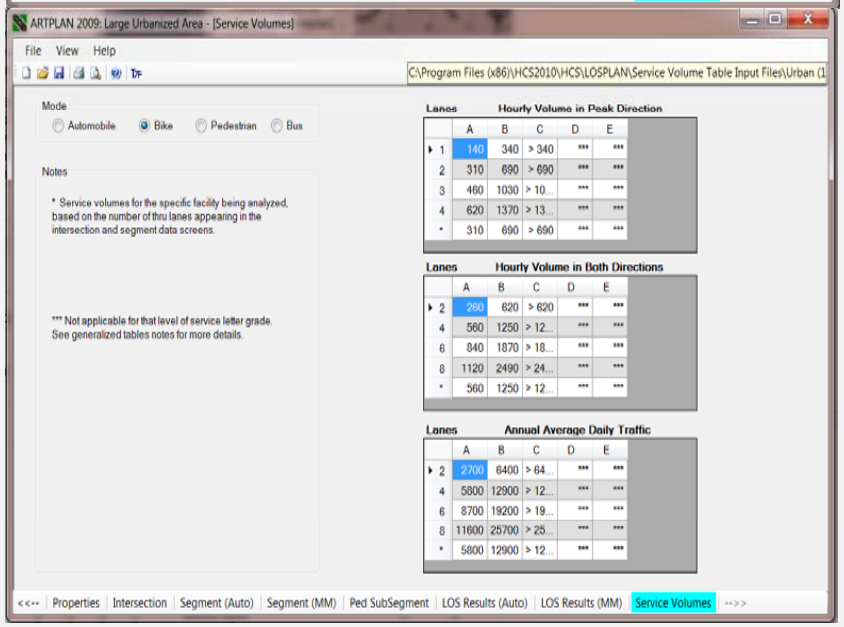
Bike Score	2.70	Pedestrian Score	3.40	Adj. Buses	1.05
Bike LOS	C	Pedestrian LOS	C	Bus LOS	E

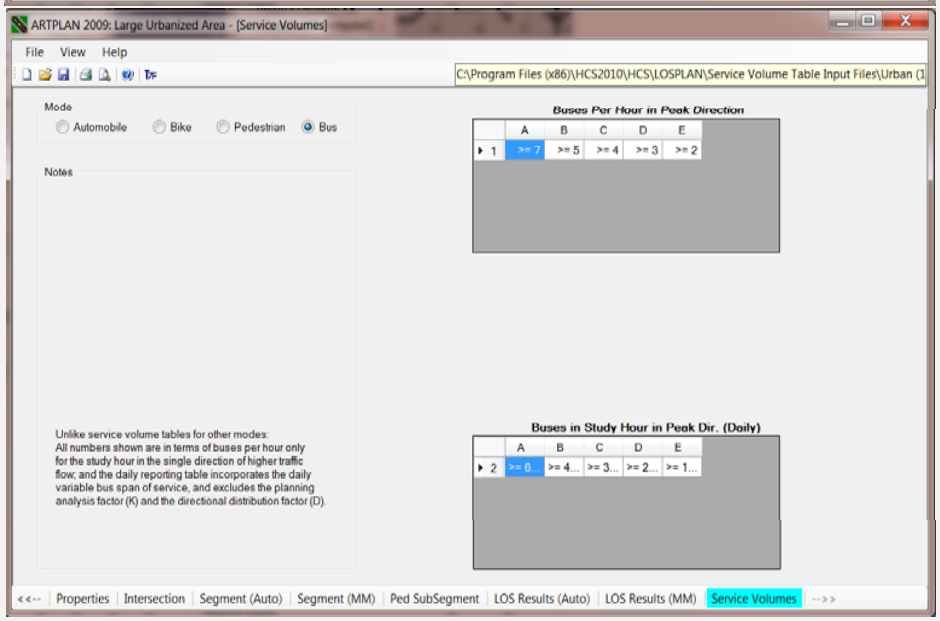
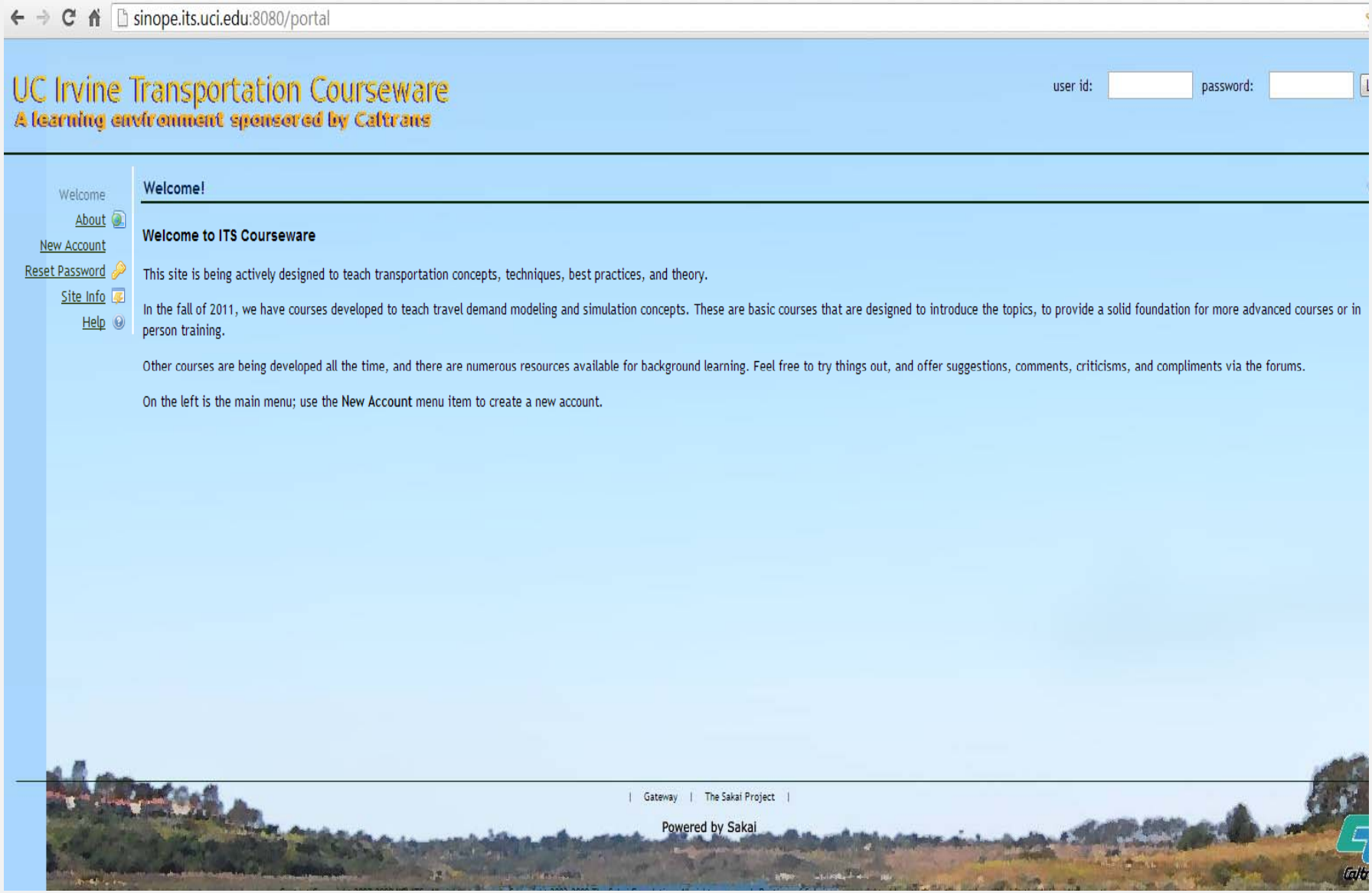
<<-- | Properties | Intersection | Segment (Auto) | Segment (MM) | Ped SubSegment | LOS Results (Auto) | LOS Results (MM) | Service Volumes | -->>

HCS LOSPLAN ARTPLAN









Other Learning Sources