I-5 HOV LANE EXTENSION PA/ED

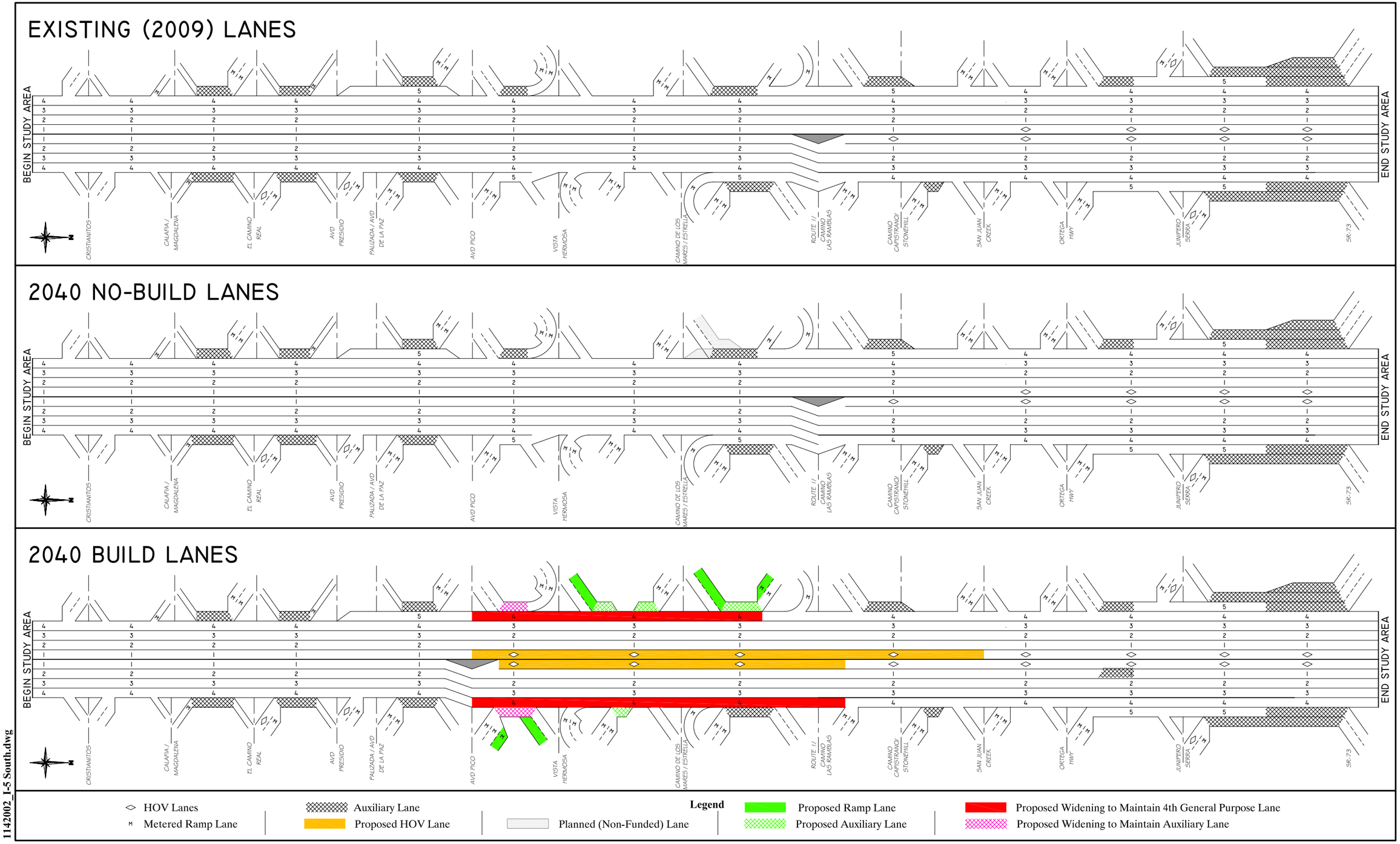
TRAFFIC STUDY APPENDICES

EA 0F9600

MAY 2010

APPENDIX A

I-5 LANE SCHEMATICS FOR ALTERNATIVES 1 & 2



1142002_I-5 South.dwg

AUSTIN-FOUST ASSOCIATES, INC.

I-5 HOV EXTENSION PA/ED - LANE SCHEMATIC

February 18, 2010

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	5	3.3/8.7	XX	XX

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA

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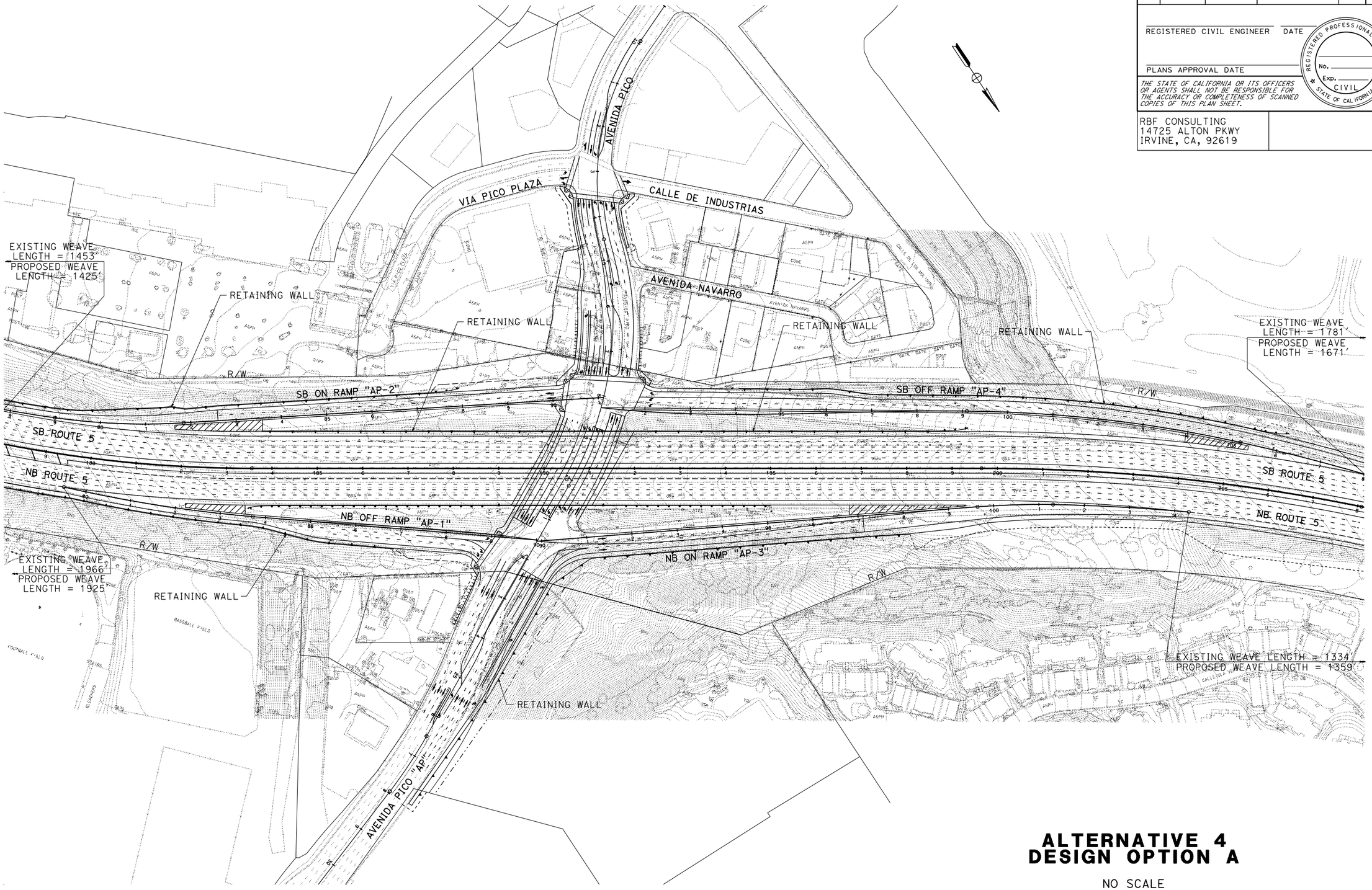
RBF CONSULTING
14725 ALTON PKWY
IRVINE, CA, 92619



ALTERNATIVE 4
DESIGN OPTION A

NO SCALE

REVISED BY	DATE REVISED		
YOUR NAME HERE	YOUR NAME HERE		
CALCULATED-DESIGNED BY	CHECKED BY		
JVOELPEL			
CONSULTANT FUNCTIONAL SUPERVISOR			
YOUR NAME HERE			

26-FEB-2010 08:31

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STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 00-00-00

DATE PLOTTED => 26-FEB-2010
TIME PLOTTED => 08:31

BORDER LAST REVISED 4/11/2008

RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3

USERNAME => JVOELPEL
DGN FILE => Alt 4A.dgn

CU 00000

EA 000000

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12	Ora	5	3.3/8.7	XX	XX

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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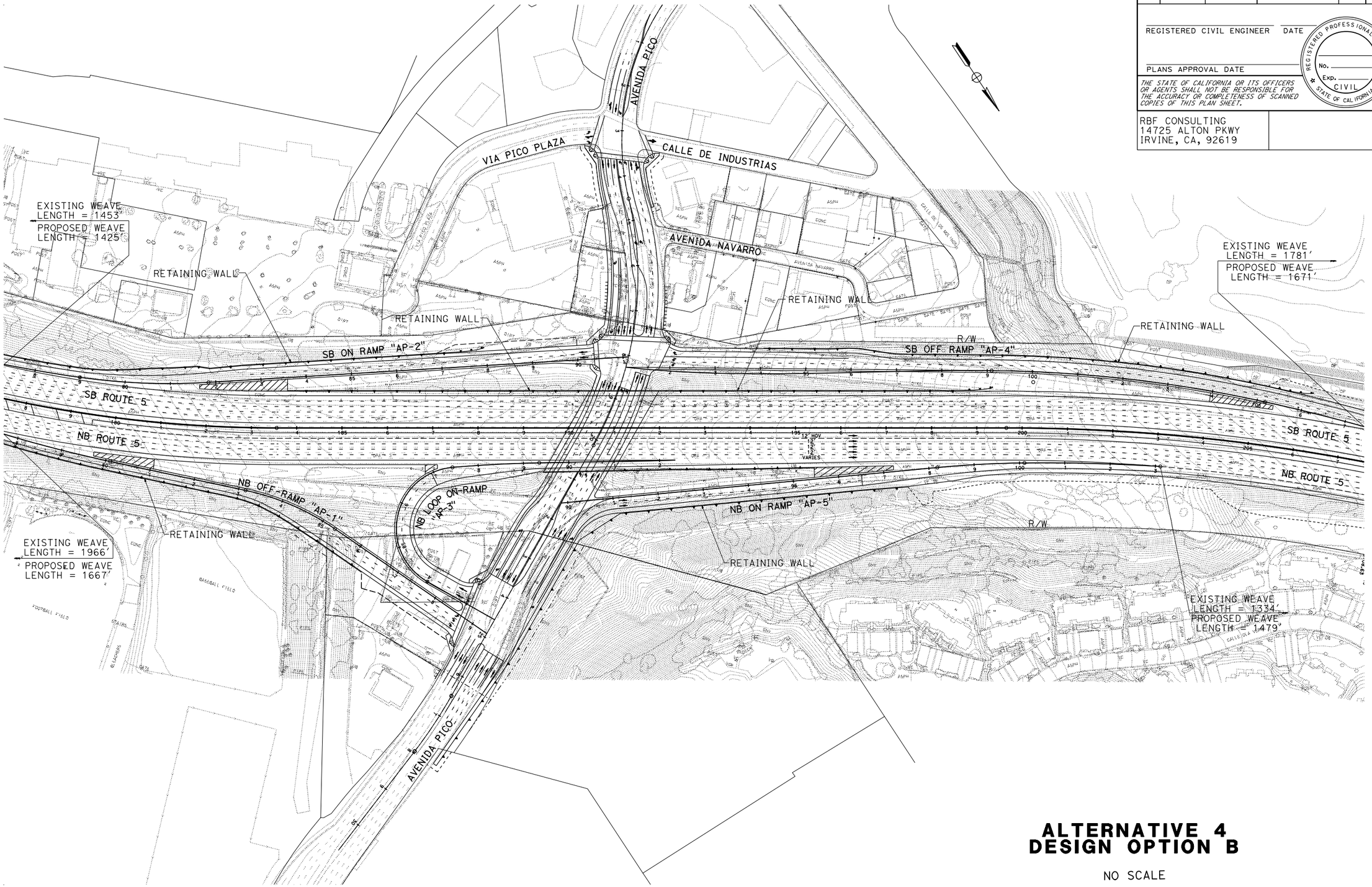
IRVINE, CA, 92619



ALTERNATIVE 4
DESIGN OPTION B

NO SCALE

REVISED BY	DATE REVISED

26-FEB-2010 08:46

JVOELPEL

CALCULATED-DESIGNED BY

CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR

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STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISION 00-00-00

DATE PLOTTED => 26-FEB-2010
TIME PLOTTED => 08:46

BORDER LAST REVISED 4/11/2008

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DGN FILE => Alt 4B.dgn

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APPENDIX B

PEAK HOUR FREEWAY VOLUMES

2009 I-5 Freeway Volumes

I-5											
NORTHBOUND						SOUTHBOUND					
	AM		PM				AM		PM		
LOCATION	GP	HOV	GP	HOV	ADT	LOCATION	GP	HOV	GP	HOV	ADT
NB Mainline s/o Cristianitos	**4,200**		**4,400**		**70,000**	SB Mainline s/o Cristianitos	**4,450**		**4,830**		**71,100**
Cristianitos NB Off	170		150		2,100	Cristianitos SB On	120		310		3,100
I-5 Mainline at Cristianitos	**4,030**		**4,250**		**67,900**	I-5 Mainline at Cristianitos	**4,330**		**4,520**		**68,000**
Cristianitos NB On	250		200		2,600	Cristianitos SB Off	170		180		2,500
NB Mainline s/o Avd Magdalena	**4,280**		**4,450**		**70,500**	SB Mainline s/o Avd Calafia	**4,500**		**4,700**		**70,500**
Avd Magdalena NB Off	140		160		1,900	Avd Calafia SB On	90		70		1,200
I-5 Mainline at Avd Magdalena	**4,140**		**4,290**		**68,600**	I-5 Mainline at Avd Calafia	**4,410**		**4,630**		**69,300**
Avd Magdalena NB On	450		430		5,100	Avd Calafia SB Off	260		520		5,800
NB Mainline s/o El Camino Real	**4,590**		**4,720**		**73,700**	SB Mainline s/o El Camino Real	**4,670**		**5,150**		**75,100**
S El Camino Real NB Off	130		130		1,600	S El Camino Real SB On	140		200		2,400
I-5 Mainline at El Camino Real	**4,460**		**4,590**		**72,100**	I-5 Mainline at El Camino Real	**4,530**		**4,950**		**72,700**
S El Camino Real NB On	580		550		6,600	S El Camino Real SB Off	510		880		10,200
NB Mainline s/o Avd Presidio	**5,040**		**5,140**		**78,700**	SB Mainline s/o Avd Presidio	**5,040**		**5,830**		**82,900**
Avd Presidio NB Off	180		230		2,600	Avd Presidio SB On	230		220		3,200
I-5 Mainline at Avd Presidio	**4,860**		**4,910**		**76,100**	I-5 Mainline at Avd Presidio	**4,810**		**5,610**		**79,700**
Avd Presidio NB On	530		420		5,500						
NB Mainline s/o Avd de la Paz	**5,390**		**5,330**		**81,600**	SB Mainline s/o Avd Palizada	**4,810**		**5,610**		**79,700**
Avd de la Paz NB On	780		700		8,600	Avd Pailzada SB Off	810		1210		14,800
NB Mainline s/o Avd Pico	**6,170**		**6,030**		**90,200**	SB Mainline s/o Avd Pico	**5,620**		**6,820**		**94,500**
Avd Pico NB Off	800		760		10,700	Avd Pico SB On	550		790		10,300
I-5 Mainline at Avd Pico	**5,370**		**5,270**		**79,500**	I-5 Mainline at Avd Pico	**5,070**		**6,030**		**84,200**
Avd Pico NB On	1,110		1,370		14,600	Avd Pico SB Off	1,000		1,020		14,300
NB Mainline s/o Vista Hermosa	**6,480**		**6,640**		**94,100**	SB Mainline s/o Vista Hermosa	**6,070**		**7,050**		**98,500**
Vista Hermosa NB Off	330		420		4,100	Vista Hermosa SB On	420		390		4,000
I-5 Mainline at Vista Hermosa	**6,150**		**6,220**		**90,000**	I-5 Mainline at Vista Hermosa	**5,650**		**6,660**		**94,500**
Vista Hermosa NB Loop On	80		70		1,300	Vista Hermosa SB Off	860		1,200		12,400
Vista Hermosa NB Direct On	1,040		840		11,600						
NB Mainline s/o Camino De Los Mares	**7,270**		**7,130**		**102,900**	SB Mainline s/o Camino De Estrella	**6,510**		**7,860**		**106,900**
Camino De Los Mares NB Off	390		530		6,200	Camino De Estrella SB On	480		520		6,600
I-5 Mainline at Camino De Los Mares	**6,880**		**6,600**		**96,700**	I-5 Mainline at Camino De Estrella	**6,030**		**7,340**		**100,300**
Camino De Los Mares NB Loop On	380		300		4,500	Camino De Estrella SB Off	740		1,420		16,300
Camino De Los Mares NB Direct On	800		800		10,700						
NB Mainline s/o Route 1/Camino Las Ramblas	**8,060**		**7,700**		**111,900**	SB Mainline s/o Route 1/Camino Las Ramblas	**6,770**		**8,760**		**116,600**
Route 1/Camino Las Ramblas NB Off	1,220		1,630		15,000	Route 1/Camino Las Ramblas SB On	890		1,070		14,600
I-5 HOV Net On/Off	(700)		(600)			Route 1/Camino Las Ramblas SB Loop On	120		90		1,300
I-5 Mainline at Route 1/Camino Las Ramblas	**6,140**	**700**	**5,470**	**600**	**96,900**	I-5 Mainline at Route 1/Camino Las Ramblas	**5,760**		**7,600**		**100,700**
Route 1/Camino Las Ramblas NB On (Loop & Direct)	440		370		6,400	Route 1/Camino Las Ramblas SB Off	760		1,270		14,000
	340		180		3,400						
I-5 HOV Net On/Off	(300)	300	(200)	200							
NB Mainline s/o Camino Capistrano/Stonehill	**6,620**	**1,000**	**5,820**	**800**	**106,700**						
Camino Capistrano/Stonehill NB On	1,510		1,040		19,800						
NB Mainline s/o San Juan Creek	**8,130**	**1,000**	**6,860**	**800**	**126,500**	SB Mainline s/o San Juan Creek	**6,520**		**8,870**		**114,700**
						I-5 HOV Net On/Off	1,200	**1,200**	1,400	**1,400**	
San Juan Creek NB Off	60		100		900	San Juan Creek SB On	350		440		5,600
I-5 Mainline at San Juan Creek	**8,070**	**1,000**	**6,760**	**800**	**125,600**	I-5 Mainline at San Juan Creek	**4,970**	**1,200**	**7,030**	**1,400**	**109,100**
I-5 HOV Net On/Off	(300)	300	(200)	200							
San Juan Creek NB On	320		300		3,700	San Juan Creek SB Off	730		1,160		10,700
NB Mainline s/o Ortega Hwy	**8,090**	**1,300**	**6,860**	**1,000**	**129,300**	SB Mainline s/o Ortega Hwy	**5,700**	**1,200**	**8,190**	**1,400**	**119,800**
Ortega NB Off	750		710		11,700	Ortega SB On	590		610		6,800
I-5 Mainline at Ortega Hwy	**7,340**	**1,300**	**6,150**	**1,000**	**117,600**	I-5 Mainline at Ortega Hwy	**5,110**	**1,200**	**7,580**	**1,400**	**113,000**
I-5 HOV Net On/Off	50	(50)	(50)	50		I-5 HOV Net On/Off	(50)	50	(50)	50	
Ortega NB On	1,380		1,320		14,700	Ortega SB Off	1,360		1,680		17,200
NB Mainline s/o Junipero Serra	**8,770**	**1,250**	**7,420**	**1,050**	**132,300**	SB Mainline s/o Junipero Serra	**6,520**	**1,150**	**9,310**	**1,350**	**130,200**
Junipero Serra NB Off	320		280		4,900	Junipero Serra SB On	330		360		3,900
I-5 Mainline at Junipero Serra	**8,450**	**1,250**	**7,140**	**1,050**	**127,400**	I-5 Mainline at Junipero Serra	**6,190**	**1,150**	**8,950**	**1,350**	**126,300**
I-5 HOV Net On/Off	50	(50)	(50)	50		I-5 HOV Net On/Off	50	(50)	(50)	50	0
Junipero Serra NB On	560		660		6,600	Junipero Serra SB Off	660		700		7,700
NB Mainline s/o SR-73 Junction	**9,060**	**1,200**	**7,750**	**1,100**	**134,000**	SB Mainline s/o SR-73 Junction	**6,800**	**1,200**	**9,700**	**1,300**	**134,000**
NB Off to SR-73	2,810		1,670		23,500	SB On from SR-73	1,200		3,000		23,500
I-5 NB Mainline	**6,250**	**1,200**	**6,080**	**1,100**	**110,500**	I-5 SB Mainline	**5,600**	**1,200**	**6,700**	**1,300**	**110,500**

2040 I-5 Freeway Volumes - No-Build Scenario

I-5											
NORTHBOUND						SOUTHBOUND					
	AM		PM				AM		PM		
LOCATION	GP	HOV	GP	HOV	ADT	LOCATION	GP	HOV	GP	HOV	ADT
NB Mainline s/o Cristianitos	**6,010**		**6,290**		**100,000**	SB Mainline s/o Cristianitos	**6,360**		**6,910**		**100,000**
Cristianitos NB Off	240		220		3,700	Cristianitos SB On	160		340		5,600
I-5 Mainline at Cristianitos	**5,770**		**6,070**		**96,300**	I-5 Mainline at Cristianitos	**6,200**		**6,570**		**94,400**
Cristianitos NB On	400		270		2,700	Cristianitos SB Off	480		450		4,600
NB Mainline s/o Avd Magdalena	**6,170**		**6,340**		**99,000**	SB Mainline s/o Avd Calafia	**6,680**		**7,020**		**99,000**
Avd Magdalena NB Off	210		240		3,100	Avd Calafia SB On	130		90		2,600
I-5 Mainline at Avd Magdalena	**5,960**		**6,100**		**95,900**	I-5 Mainline at Avd Calafia	**6,550**		**6,930**		**96,400**
Avd Magdalena NB On	740		450		9,100	Avd Calafia SB Off	330		770		8,600
NB Mainline s/o El Camino Real	**6,700**		**6,550**		**105,000**	SB Mainline s/o El Camino Real	**6,880**		**7,700**		**105,000**
S El Camino Real NB Off	190		300		4,700	S El Camino Real SB On	200		310		4,200
I-5 Mainline at El Camino Real	**6,510**		**6,250**		**100,300**	I-5 Mainline at El Camino Real	**6,680**		**7,390**		**100,800**
S El Camino Real NB On	650		560		7,200	S El Camino Real SB Off	510		880		10,700
NB Mainline s/o Avd Presidio	**7,160**		**6,810**		**107,500**	SB Mainline s/o Avd Presidio	**7,190**		**8,270**		**111,500**
Avd Presidio NB Off	470		540		3,900	Avd Presidio SB On	500		290		3,500
I-5 Mainline at Avd Presidio	**6,690**		**6,270**		**103,600**	I-5 Mainline at Avd Presidio	**6,690**		**7,980**		**108,000**
Avd Presidio NB On	530		430		9,400						
NB Mainline s/o Avd de la Paz	**7,220**		**6,700**		**113,000**	SB Mainline s/o Avd Palizada	**6,690**		**7,980**		**108,000**
Avd de la Paz NB On	900		710		10,000	Avd Pailzada SB Off	1,000		1,240		15,000
NB Mainline s/o Avd Pico	**8,120**		**7,410**		**123,000**	SB Mainline s/o Avd Pico	**7,690**		**9,220**		**123,000**
Avd Pico NB Off	830		900		10,700	Avd Pico SB On	740		960		10,400
I-5 Mainline at Avd Pico	**7,290**		**6,510**		**112,300**	I-5 Mainline at Avd Pico	**6,950**		**8,260**		**112,600**
Avd Pico NB On	1,280		1,580		15,700	Avd Pico SB Off	1,250		1,100		15,400
NB Mainline s/o Vista Hermosa	**8,570**		**8,090**		**128,000**	SB Mainline s/o Vista Hermosa	**8,200**		**9,360**		**128,000**
Vista Hermosa NB Off	520		600		11,200	Vista Hermosa SB On	520		430		11,100
I-5 Mainline at Vista Hermosa	**8,050**		**7,490**		**116,800**	I-5 Mainline at Vista Hermosa	**7,680**		**8,930**		**116,900**
Vista Hermosa NB Loop On	300		320		1,800	Vista Hermosa SB Off	1,300		1,690		16,600
Vista Hermosa NB Direct On	1,410		1,030		14,900						
NB Mainline s/o Camino De Los Mares	**9,760**		**8,840**		**133,500**	SB Mainline s/o Camino De Estrella	**8,980**		**10,620**		**133,500**
Camino De Los Mares NB Off	470		820		10,200	Camino De Estrella SB On	590		770		7,600
I-5 Mainline at Camino De Los Mares	**9,290**		**8,020**		**123,300**	I-5 Mainline at Camino De Estrella	**8,390**		**9,850**		**125,900**
Camino De Los Mares NB Loop On	470		330		6,500	Camino De Estrella SB Off	830		1,490		20,600
Camino De Los Mares NB Direct On	1,380		820		16,700						
NB Mainline s/o Route 1/Camino Las Ramblas	**11,140**		**9,170**		**146,500**	SB Mainline s/o Route 1/Camino Las Ramblas	**9,220**		**11,340**		**146,500**
						Route 1/Camino Las Ramblas SB On	1,180		1,380		18,800
Route 1/Camino Las Ramblas NB Off	1,410		1,640		16,400	Route 1/Camino Las Ramblas SB Loop On	230		190		2,800
I-5 HOV Net On/Off	(1,150)	1,150	(960)	960							
I-5 Mainline at Route 1/Camino Las Ramblas	**8,580**	**1,150**	**6,570**	**960**	**130,100**	I-5 Mainline at Route 1/Camino Las Ramblas	**7,810**		**9,770**		**124,900**
Route 1/Camino Las Ramblas NB Loop On	450		420		6,400	Route 1/Camino Las Ramblas SB Off	830		1,280		14,100
Route 1/Camino Las Ramblas NB Direct On	360		220		3,500						
I-5 HOV Net On/Off	0	0									
NB Mainline s/o Camino Capistrano/Stonehill	**9,390**	**1,150**	**7,210**	**960**	**140,000**	SB Mainline s/o Camino Capistrano/Stonehill	**8,640**		**11,050**		**139,000**
Camino Capistrano/Stonehill NB On	1,530		1,680		21,000						
NB Mainline s/o San Juan Creek	**10,920**	**1,150**	**8,890**	**960**	**161,000**	SB Mainline s/o San Juan Creek	**8,640**		**11,050**		**139,000**
						I-5 HOV Net On/Off	1,440	(1,440)	1,580	(1,580)	
San Juan Creek NB Off	690		550		15,100	San Juan Creek SB On	750		600		7,900
I-5 Mainline at San Juan Creek	**10,230**	**1,150**	**8,340**	**960**	**145,900**	I-5 Mainline at San Juan Creek	**6,450**	**1,440**	**8,870**	**1,580**	**131,100**
I-5 HOV Net On/Off	(90)	90	(190)	190		San Juan Creek SB Off	1,070		1,440		19,400
San Juan Creek NB On	790		480		4,600						
NB Mainline s/o Ortega Hwy	**10,930**	**1,240**	**8,630**	**1,150**	**150,500**	SB Mainline s/o Ortega Hwy	**7,520**	**1,440**	**10,310**	**1,580**	**150,500**
Ortega NB Off	1,180		940		13,300	Ortega SB On	760		760		12,600
I-5 Mainline at Ortega Hwy	**9,750**	**1,240**	**7,690**	**1,150**	**137,200**	I-5 Mainline at Ortega Hwy	**6,760**	**1,440**	**9,550**	**1,580**	**137,900**
I-5 HOV Net On/Off	(80)	80	(90)	90		I-5 HOV Net On/Off	(10)	10	110	(110)	
Ortega NB On	1,910		1,930		25,300	Ortega SB Off	1,800		2,210		24,600
NB Mainline s/o Junipero Serra	**11,580**	**1,320**	**9,530**	**1,240**	**162,500**	SB Mainline s/o Junipero Serra	**8,570**	**1,430**	**11,650**	**1,690**	**162,500**
Junipero Serra NB Off	610		390		7,700	Junipero Serra SB On	500		530		9,100
I-5 Mainline at Junipero Serra	**10,970**	**1,320**	**9,140**	**1,240**	**154,800**	I-5 Mainline at Junipero Serra	**8,070**	**1,430**	**11,120**	**1,690**	**153,400**
I-5 HOV Net On/Off	(80)	80	(100)	100		I-5 HOV Net On/Off	50	(50)	(50)	50	
Junipero Serra NB On	1,180		990		14,700	Junipero Serra SB Off	860		1,480		16,100
NB Mainline s/o SR-73 Junction	**12,070**	**1,400**	**10,030**	**1,340**	**169,500**	SB Mainline s/o SR-73 Junction	**8,880**	**1,480**	**12,650**	**1,640**	**169,500**
NB Off to SR-73	4,390		2,580		37,000	SB On from SR-73	2,030		4,430		37,000
I-5 NB Mainline	**7,680**	**1,400**	**7,450**	**1,340**	**132,500**	I-5 SB Mainline	**6,850**	**1,480**	**8,220**	**1,640**	**132,500**

2040 I-5 Freeway Volumes - Build Scenario

I-5											
NORTHBOUND						SOUTHBOUND					
	AM		PM				AM		PM		
LOCATION	GP	HOV	GP	HOV	ADT	LOCATION	GP	HOV	GP	HOV	ADT
NB Mainline s/o Cristianitos	**6,010**		**6,290**		**100,000**	SB Mainline s/o Cristianitos	**6,360**		**6,910**		**100,000**
Cristianitos NB Off	240		220		4,500	Cristianitos SB On	150		330		5,500
I-5 Mainline at Cristianitos	**5,770**		**6,070**		**95,500**	I-5 Mainline at Cristianitos	**6,210**		**6,580**		**94,500**
Cristianitos NB On	400		270		3,500	Cristianitos SB Off	470		440		4,500
NB Mainline s/o Avd Magdalena	**6,170**		**6,340**		**99,000**	SB Mainline s/o Avd Calafia	**6,680**		**7,020**		**99,000**
Avd Magdalena NB Off	200		230		3,000	Avd Calafia SB On	130		90		2,700
I-5 Mainline at Avd Magdalena	**5,970**		**6,110**		**96,000**	I-5 Mainline at Avd Calafia	**6,550**		**6,930**		**96,300**
Avd Magdalena NB On	730		440		9,000	Avd Calafia SB Off	340		780		8,700
NB Mainline s/o El Camino Real	**6,700**		**6,550**		**105,000**	SB Mainline s/o El Camino Real	**6,890**		**7,710**		**105,000**
S El Camino Real NB Off	190		300		5,000	S El Camino Real SB On	200		310		4,100
I-5 Mainline at El Camino Real	**6,510**		**6,250**		**100,000**	I-5 Mainline at El Camino Real	**6,690**		**7,400**		**100,900**
S El Camino Real NB On	660		570		7,000	S El Camino Real SB Off	520		900		11,100
NB Mainline s/o Avd Presidio	**7,170**		**6,820**		**107,000**	SB Mainline s/o Avd Presidio	**7,210**		**8,300**		**112,000**
Avd Presidio NB Off	470		540		3,600	Avd Presidio SB On	500		290		3,500
I-5 Mainline at Avd Presidio	**6,700**		**6,280**		**103,400**	I-5 Mainline at Avd Presidio	**6,710**		**8,010**		**108,500**
Avd Presidio NB On	550		450		10,100						
NB Mainline s/o Avd de la Paz	**7,250**		**6,730**		**113,500**	SB Mainline s/o Avd Palizada	**6,710**		**8,010**		**108,500**
Avd de la Paz NB On	930		710		13,500	Avd Pailzada SB Off	990		1,260		18,500
NB Mainline s/o Avd Pico	**8,180**		**7,440**		**127,000**	SB Mainline s/o Avd Pico	**7,700**		**9,270**		**127,000**
I-5 HOV Net On/Off	(1,010)	**1,010**	(720)	**720**		I-5 HOV Net On/Off	720	(720)	1,400	(1,400)	
Avd Pico NB Off	820		890		14,000	Avd Pico SB On	730		950		12,300
I-5 Mainline at Avd Pico	**6,350**	**1,010**	**5,830**	**720**	**113,000**	I-5 Mainline at Avd Pico	**6,250**	**720**	**6,920**	**1,400**	**114,700**
Avd Pico NB On	1,290		1,590		17,000	Avd Pico SB Off	1,260		1,110		15,300
NB Mainline s/o Vista Hermosa	**7,640**	**1,010**	**7,420**	**720**	**130,000**	SB Mainline s/o Vista Hermosa	**7,510**	**720**	**8,030**	**1,400**	**130,000**
Vista Hermosa NB Off	510		590		11,400	Vista Hermosa SB On	510		420		11,300
I-5 Mainline at Vista Hermosa	**7,130**	**1,010**	**6,830**	**720**	**118,600**	I-5 Mainline at Vista Hermosa	**7,000**	**720**	**7,610**	**1,400**	**118,700**
I-5 HOV Net On/Off	(100)	100	(100)	100		I-5 HOV Net On/Off	250	(250)	100	(100)	
Vista Hermosa NB Loop On	300		320		1,800	Vista Hermosa SB Off	1,310		1,700		16,300
Vista Hermosa NB Direct On	1,420		1,040		14,600						
NB Mainline s/o Camino De Los Mares	**8,750**	**1,110**	**8,090**	**820**	**135,000**	SB Mainline s/o Camino De Estrella	**8,060**	**970**	**9,210**	**1,500**	**135,000**
Camino De Los Mares NB Off	470		830		10,200	Camino De Estrella SB On	580		760		7,600
I-5 Mainline at Camino De Los Mares	**8,280**	**1,110**	**7,260**	**820**	**124,800**	I-5 Mainline at Camino De Estrella	**7,480**	**970**	**8,450**	**1,500**	**127,400**
I-5 HOV Net On/Off	(30)	30	(50)	50		I-5 HOV Net On/Off	210	(210)	80	(80)	
Camino De Los Mares NB Loop On	470		330		6,500	Camino De Estrella SB Off	820		1,500		20,600
Camino De Los Mares NB Direct On	1,370		810		16,700						
NB Mainline s/o Route 1/Camino Las Ramblas	**10,090**	**1,140**	**8,350**	**870**	**148,000**	SB Mainline s/o Route 1/Camino Las Ramblas	**8,090**	**1,180**	**9,870**	**1,580**	**148,000**
						Route 1/Camino Las Ramblas SB On	1,380		1,460		19,800
Route 1/Camino Las Ramblas NB Off	1,420		1,650		17,200	Route 1/Camino Las Ramblas SB Loop On	230		210		3,000
I-5 HOV Net On/Off	(130)	130	(150)	150		I-5 HOV Net On/Off	190	(190)	100	(100)	
I-5 Mainline at Route 1/Camino Las Ramblas	**8,540**	**1,270**	**6,550**	**1,020**	**130,800**	I-5 Mainline at Route 1/Camino Las Ramblas	**6,480**	**1,370**	**8,200**	**1,680**	**125,200**
Route 1/Camino Las Ramblas NB Loop On	450		420		6,500	Route 1/Camino Las Ramblas SB Off	820		1,280		14,000
Route 1/Camino Las Ramblas NB Direct On	350		210		3,500						
I-5 HOV Net On/Off	0	0	0	0		I-5 HOV Net On/Off	0	0	0	0	
NB Mainline s/o Camino Capistrano/Stonehill	**9,340**	**1,270**	**7,180**	**1,020**	**140,800**	SB Mainline s/o Camino Capistrano/Stonehill	**7,300**	**1,370**	**9,480**	**1,680**	**139,200**
Camino Capistrano/Stonehill NB On	1,520		1,670		20,000						
NB Mainline s/o San Juan Creek	**10,860**	**1,270**	**8,850**	**1,020**	**160,800**	SB Mainline s/o San Juan Creek	**7,300**	**1,370**	**9,480**	**1,680**	**139,200**
						I-5 HOV Net On/Off	120	(120)	50	(50)	
San Juan Creek NB Off	680		550		15,200	San Juan Creek SB On	770		610		7,800
I-5 Mainline at San Juan Creek	**10,180**	**1,270**	**8,300**	**1,020**	**145,600**	I-5 Mainline at San Juan Creek	**6,410**	**1,490**	**8,820**	**1,730**	**131,400**
I-5 HOV Net On/Off	(90)	90	(200)	200		San Juan Creek SB Off	1,080		1,420		19,600
San Juan Creek NB On	780		480		5,400						
NB Mainline s/o Ortega Hwy	**10,870**	**1,360**	**8,580**	**1,220**	**151,000**	SB Mainline s/o Ortega Hwy	**7,490**	**1,490**	**10,240**	**1,730**	**151,000**
Ortega NB Off	1,180		940		13,700	Ortega SB On	760		770		12,700
I-5 Mainline at Ortega Hwy	**9,690**	**1,360**	**7,640**	**1,220**	**137,300**	I-5 Mainline at Ortega Hwy	**6,730**	**1,490**	**9,470**	**1,730**	**138,300**
I-5 HOV Net On/Off	(80)	80	(100)	100		I-5 HOV Net On/Off	50	(50)	20	(20)	
Ortega NB On	1,930		1,960		25,200	Ortega SB Off	1,880		2,190		24,200
NB Mainline s/o Junipero Serra	**11,540**	**1,440**	**9,500**	**1,320**	**162,500**	SB Mainline s/o Junipero Serra	**8,560**	**1,540**	**11,640**	**1,750**	**162,500**
Junipero Serra NB Off	610		390		7,700	Junipero Serra SB On	500		530		8,900
I-5 Mainline at Junipero Serra	**10,930**	**1,440**	**9,110**	**1,320**	**154,800**	I-5 Mainline at Junipero Serra	**8,060**	**1,540**	**11,110**	**1,750**	**153,600**
I-5 HOV Net On/Off	(80)	80	(100)	100		I-5 HOV Net On/Off	50	(50)	(50)	50	
Junipero Serra NB On	1,180		990		14,700	Junipero Serra SB Off	850		1,460		15,900
NB Mainline s/o SR-73 Junction	**12,030**	**1,520**	**10,000**	**1,420**	**169,500**	SB Mainline s/o SR-73 Junction	**8,860**	**1,590**	**12,620**	**1,700**	**169,500**
NB Off to SR-73	4,390		2,580		37,000	SB On from SR-73	2,030		4,420		37,000
I-5 NB Mainline	**7,640**	**1,520**	**7,420**	**1,420**	**132,500**	I-5 SB Mainline	**6,830**	**1,590**	**8,200**	**1,700**	**132,500**

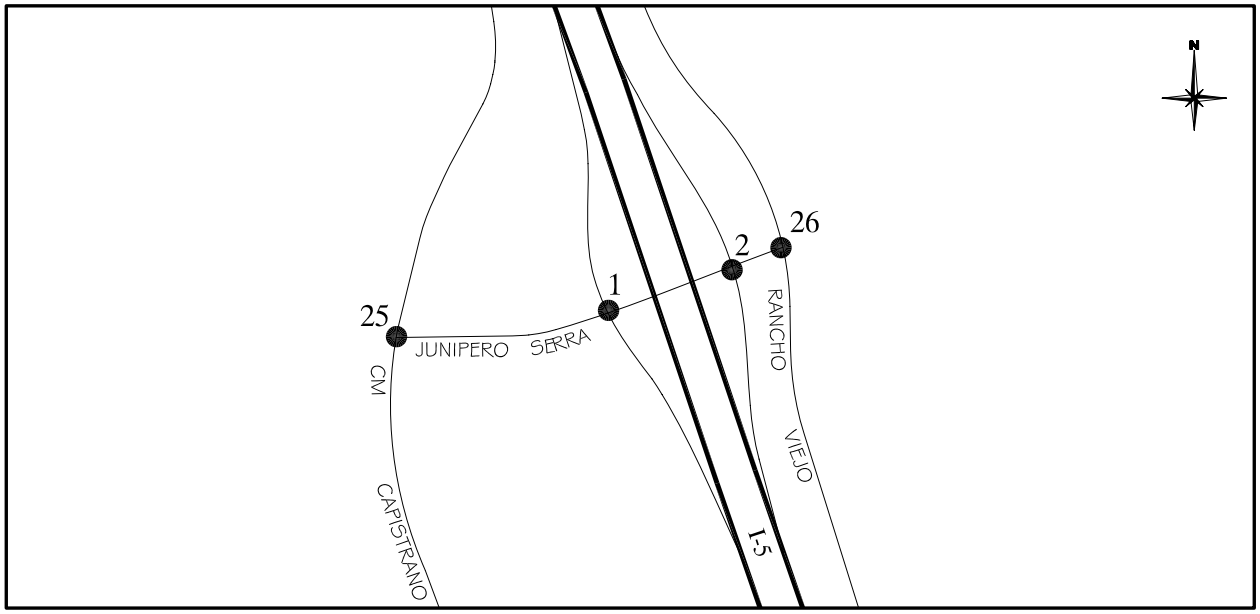
PeMS Counts Comparison

I-5 Northbound					
	AM		PM		
Location	Mainline	HOV	Mainline	HOV	ADT
NB Mainline s/o Avd Magdalena **(PEMS)**	4,300	0	4,500	0	70,000
NB Mainline s/o Avd Magdalena	4,280	0	4,450	0	70,500
Difference	**20**	**0**	**50**	**0**	**-500**
NB Mainline s/o Camino De Los Mares **(PEMS)**	7,000	0	6,800	0	105,000
NB Mainline s/o Camino De Los Mares	7,220	0	7,130	0	102,900
Difference	**-220**	**0**	**-330**	**0**	**2,100**
NB Mainline at Route 1/Camino Las Ramblas **(PEMS)**	7,000	700	6,000	600	108,000
NB Mainline at Route 1/Camino Las Ramblas	6,140	700	5,470	600	96,900
Difference	**860**	**0**	**530**	**0**	**11,100**
NB Mainline s/o Ortega Hwy **(PEMS)**	8,000	1,300	6,500	1,000	118,000
NB Mainline s/o Ortega Hwy	8,090	1,300	6,860	1,000	129,300
Difference	**-90**	**0**	**-360**	**0**	**-11,300**
NB Mainline s/o SR-73 Junction **(PEMS)**	9,000	1,200	7,700	1,000	134,000
NB Mainline s/o SR-73 Junction	9,060	1,200	7,750	1,100	134,000
Difference	**-60**	**0**	**-50**	**-100**	**0**

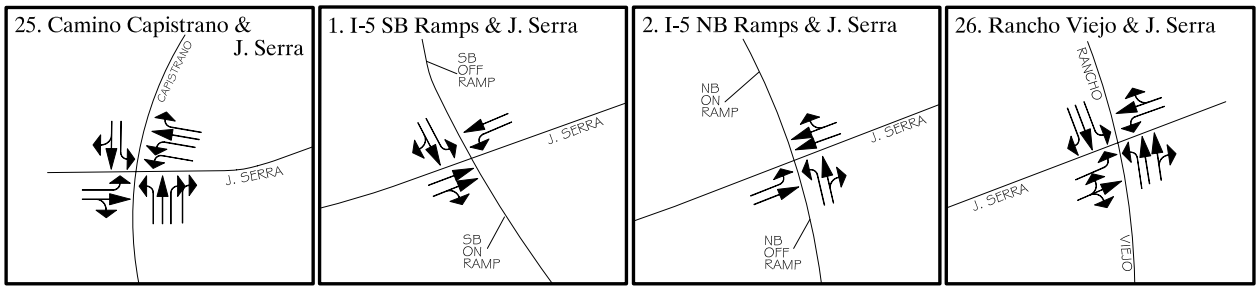
I-5 Southbound					
	AM		PM		
Location	Mainline	HOV	Mainline	HOV	ADT
SB Mainline s/o Avd Calafia **(PEMS)**	4,500	0	4,700	0	70,000
SB Mainline s/o Avd Calafia	4,500	0	4,700	0	70,500
Difference	**0**	**0**	**0**	**0**	**-500**
SB Mainline s/o Camino De Estrella **(PEMS)**	5,800	0	7,500	0	105,000
SB Mainline s/o Camino De Estrella	6,510	0	7,860	0	106,900
Difference	**-710**	**0**	**-360**	**0**	**-1,900**
SB Mainline s/o Route 1/Camino Las Ramblas **(PEMS)**	6,000	0	8,400	0	110,000
SB Mainline s/o Route 1/Camino Las Ramblas	6,770	0	8,760	0	116,600
Difference	**-770**	**0**	**-360**	**0**	**-6,600**
SB Mainline at San Juan Creek **(PEMS)**	4,700	1,000	6,500	1,300	104,000
SB Mainline at San Juan Creek	4,970	1,200	7,030	1,400	109,100
Difference	**-270**	**-200**	**-530**	**-100**	**-5,100**
SB Mainline s/o Ortega Hwy **(PEMS)**	5,500	900	7,900	1,100	118,000
SB Mainline s/o Ortega Hwy	5,700	1,200	8,190	1,400	119,800
Difference	**-200**	**-300**	**-290**	**-300**	**-1,800**
SB Mainline s/o SR-73 Junction **(PEMS)**	6,500	1,000	9,000	1,200	134,000
SB Mainline s/o SR-73 Junction	6,800	1,200	9,700	1,300	134,000
Difference	**-300**	**-200**	**-700**	**-100**	**0**

APPENDIX C

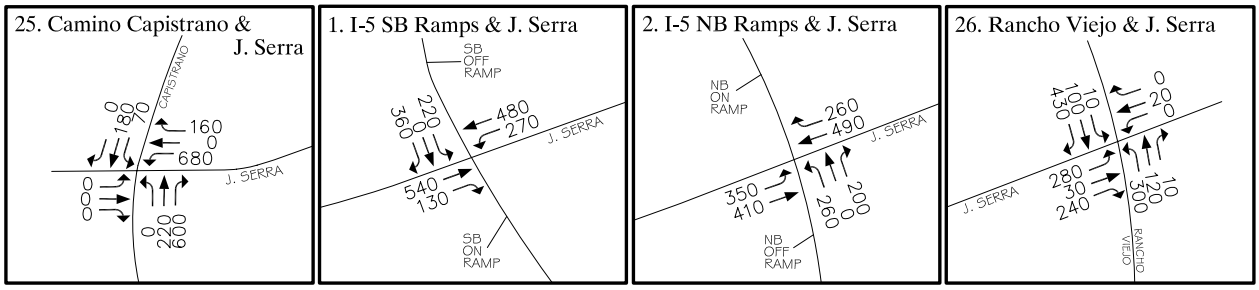
INTERSECTION TURN MOVEMENT VOLUME EXHIBITS



LANE CONFIGURATIONS



AM PEAK HOUR



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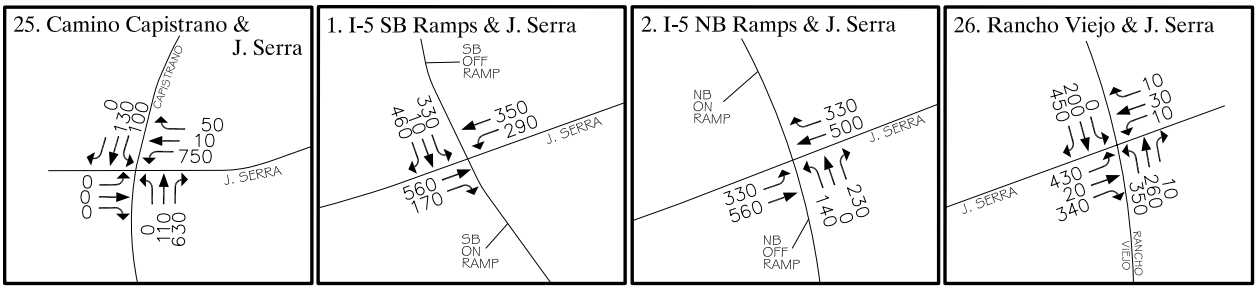
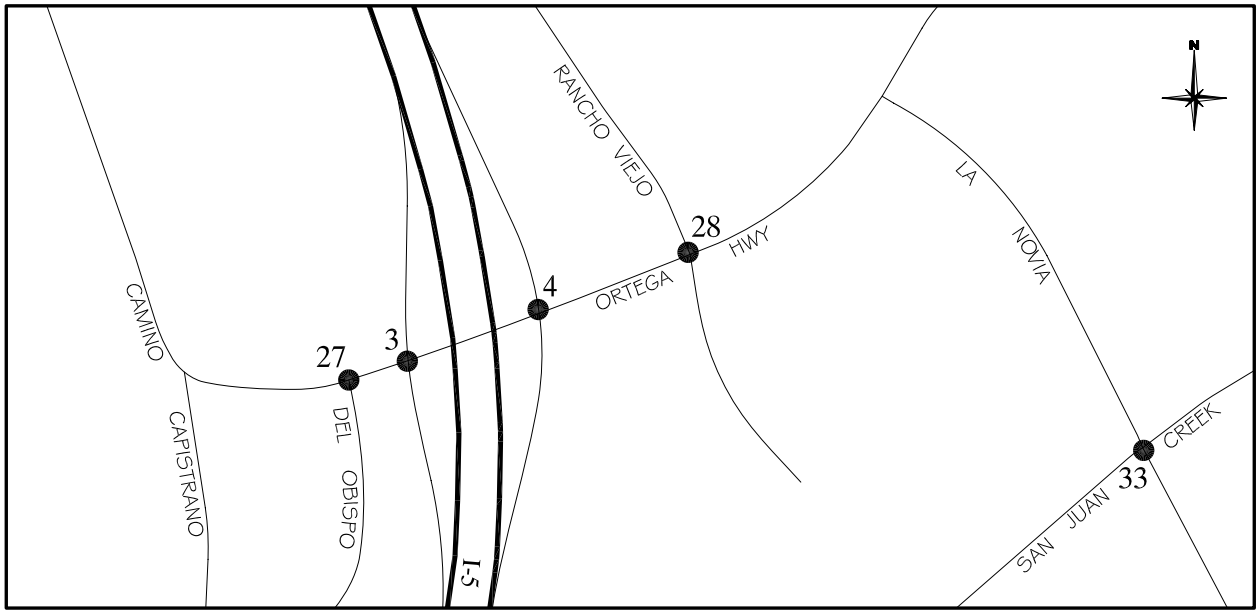


Legend

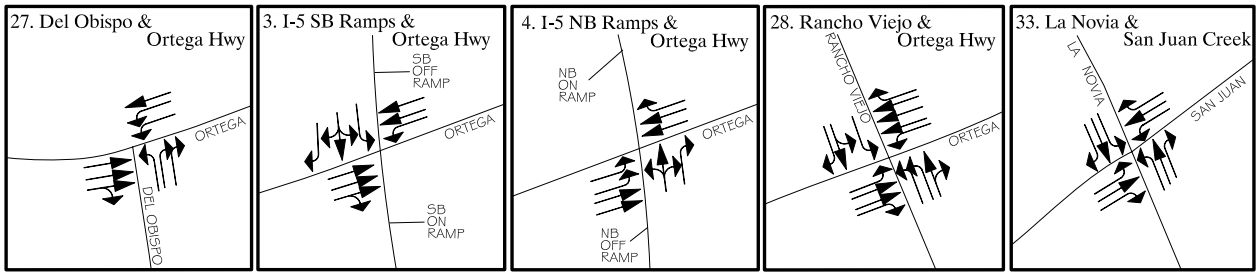
Free right-turn lane
De facto right-turn lane

Figure C-1

EXISTING LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- JUNIPERO SERRA INTERCHANGE



LANE CONFIGURATIONS



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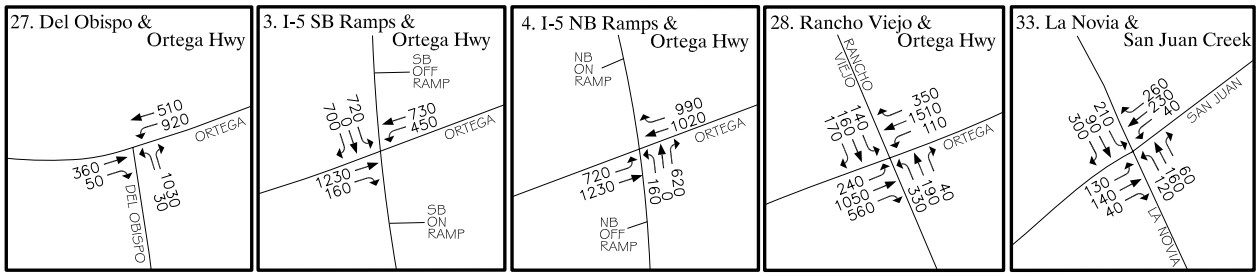

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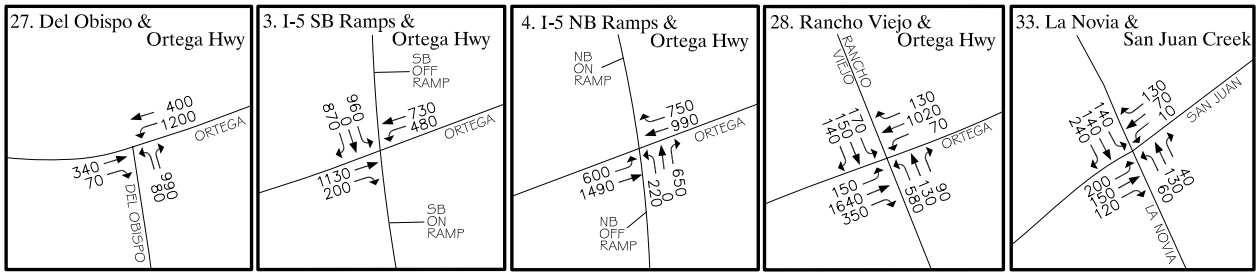


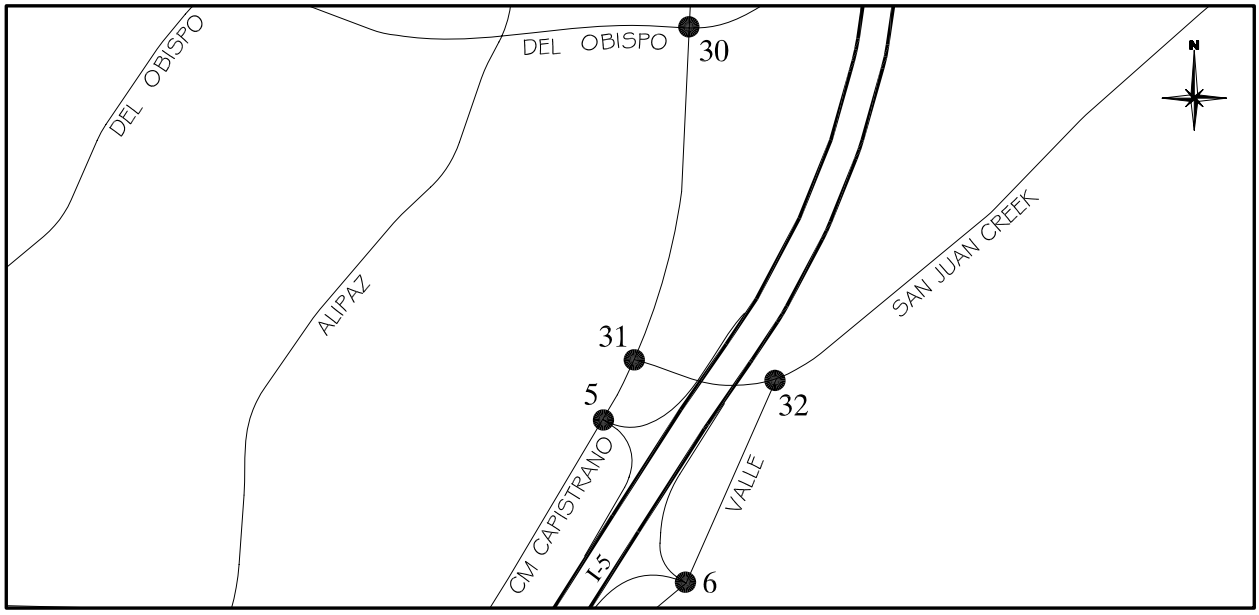
Legend

Free right-turn lane

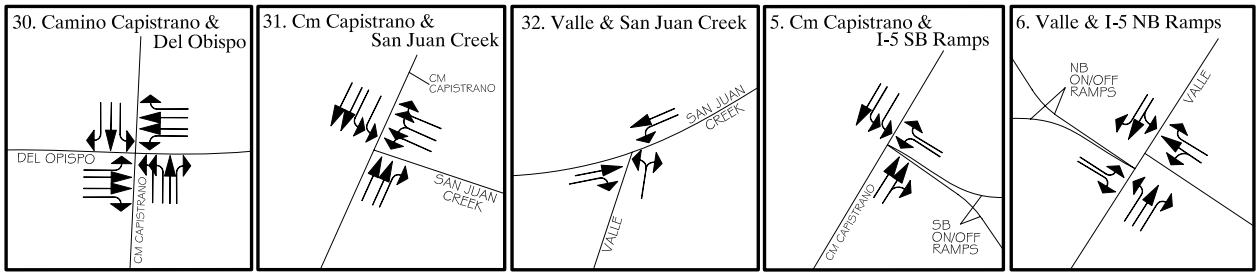
De facto right-turn lane

Figure C-2

EXISTING LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- ORTEGA HWY INTERCHANGE



LANE CONFIGURATIONS



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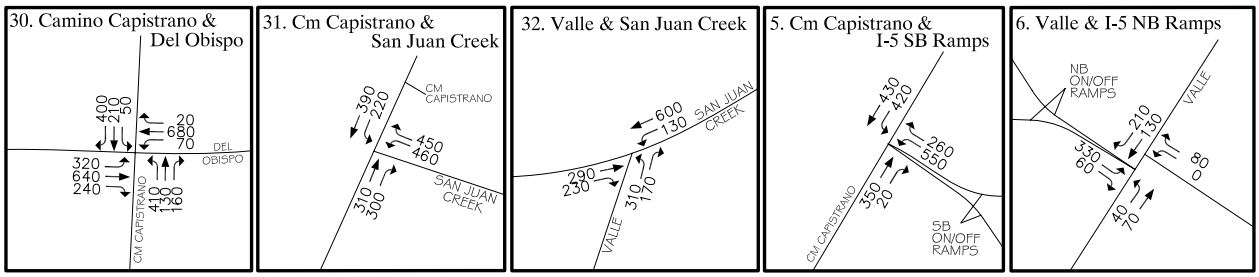
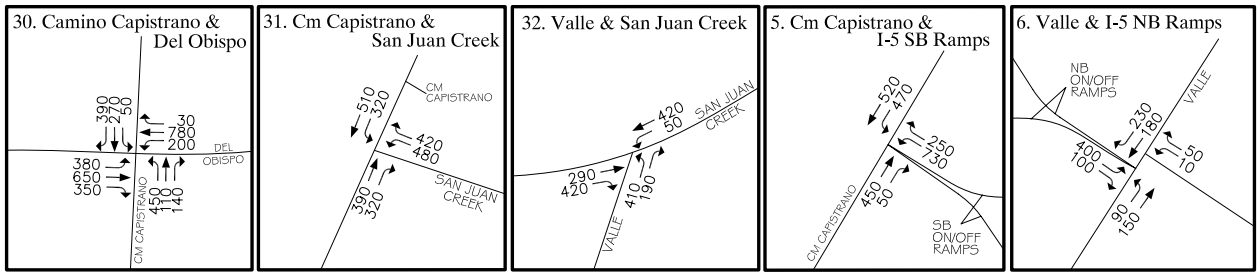


PM PEAK HOUR

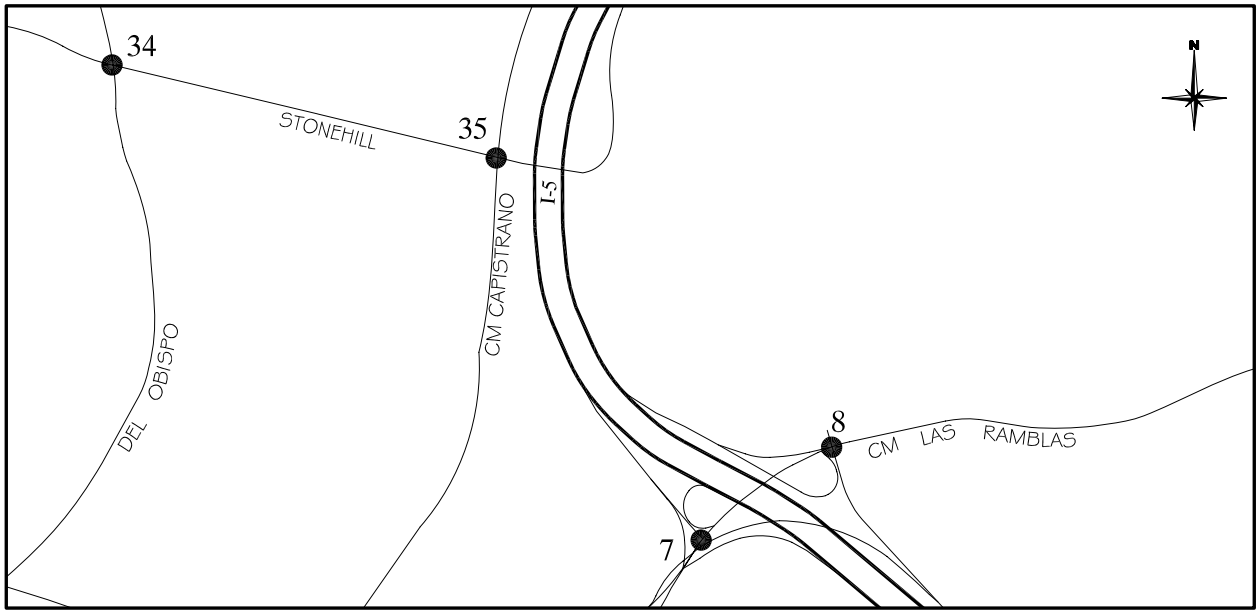


Legend

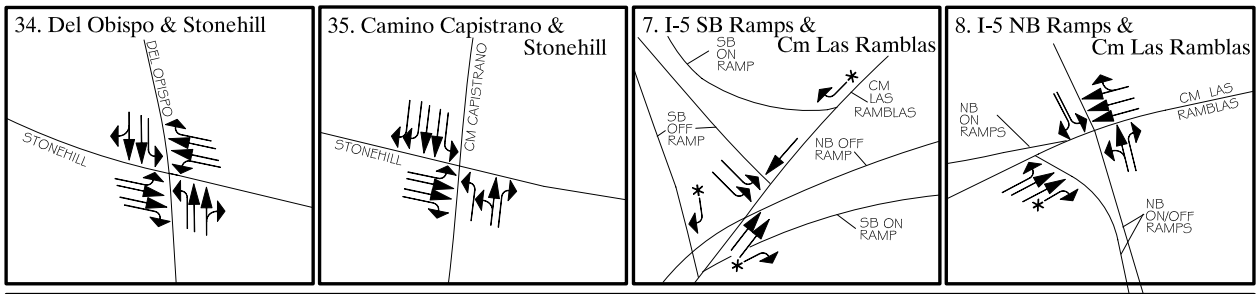
Free right-turn lane
De facto right-turn lane

Figure C-3

EXISTING LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- CAMINO CAPISTRANO/VALLE INTERCHANGE



LANE CONFIGURATIONS



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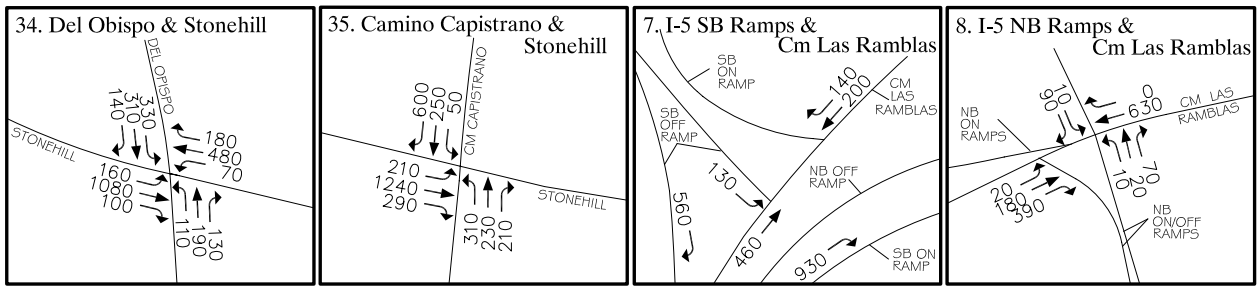

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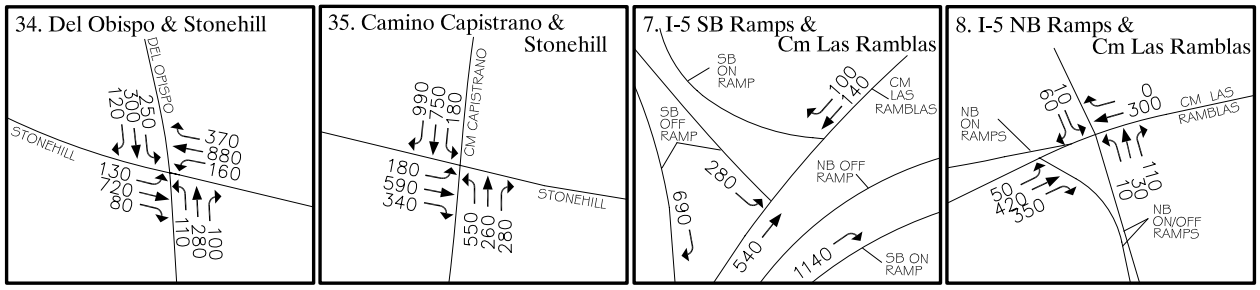


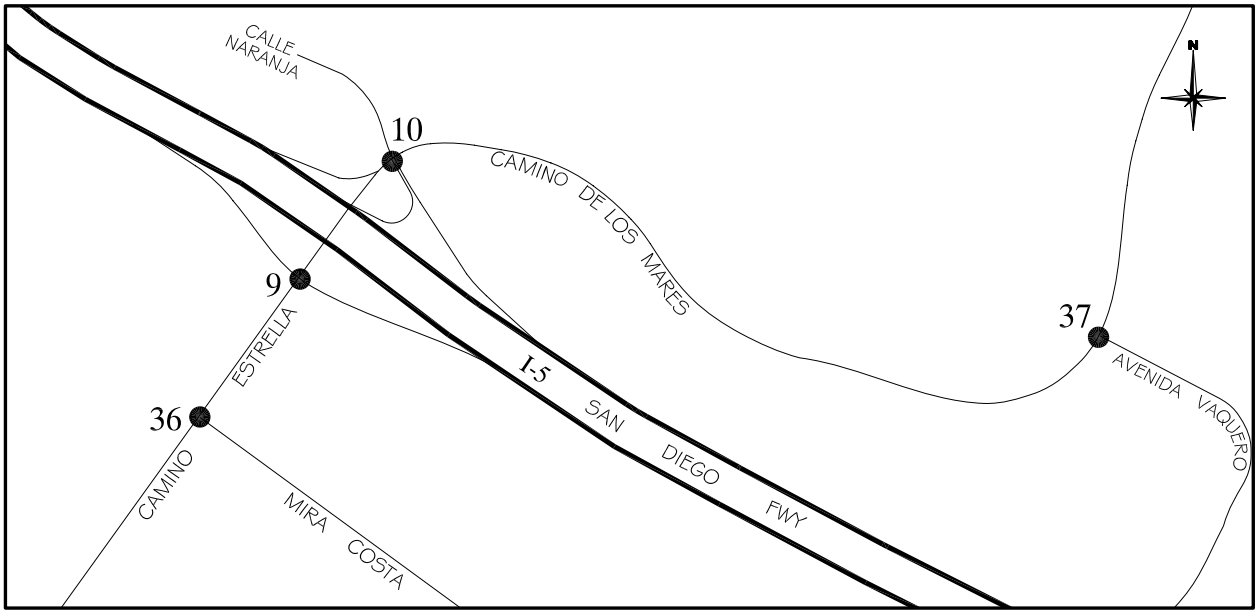
Legend

Free right-turn lane

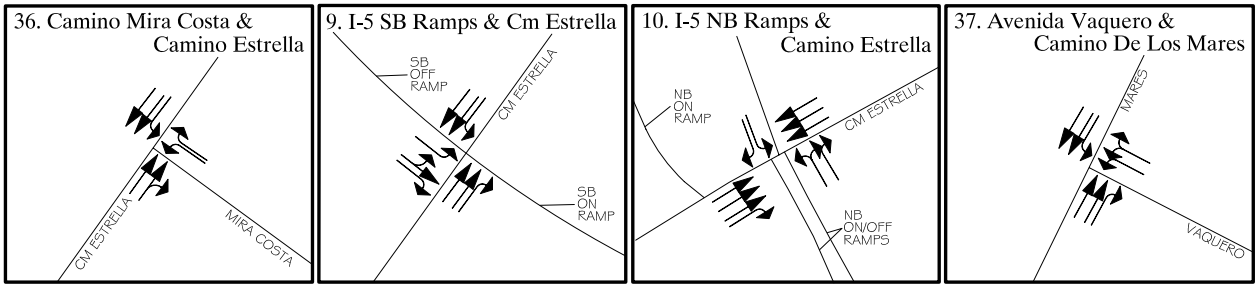
De facto right-turn lane

Figure C-4

EXISTING LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- CAMINO LAS RAMBLAS INTERCHANGE



LANE CONFIGURATIONS



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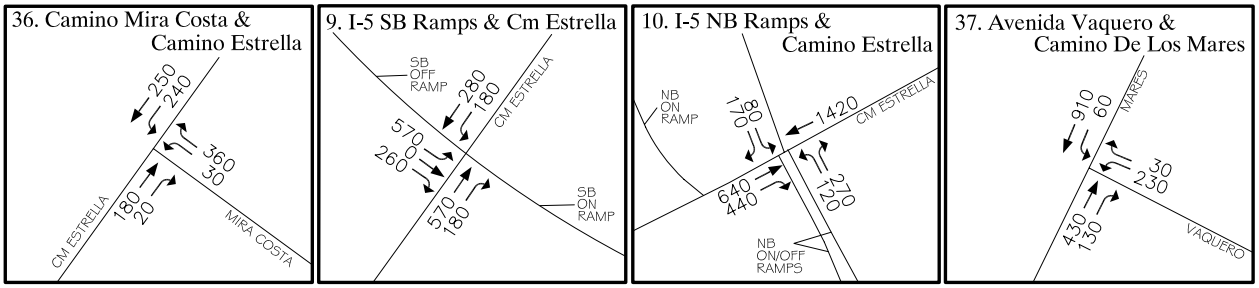

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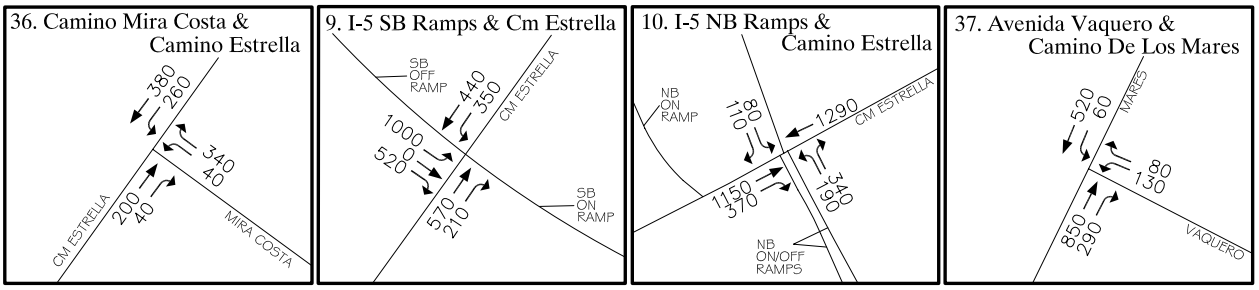


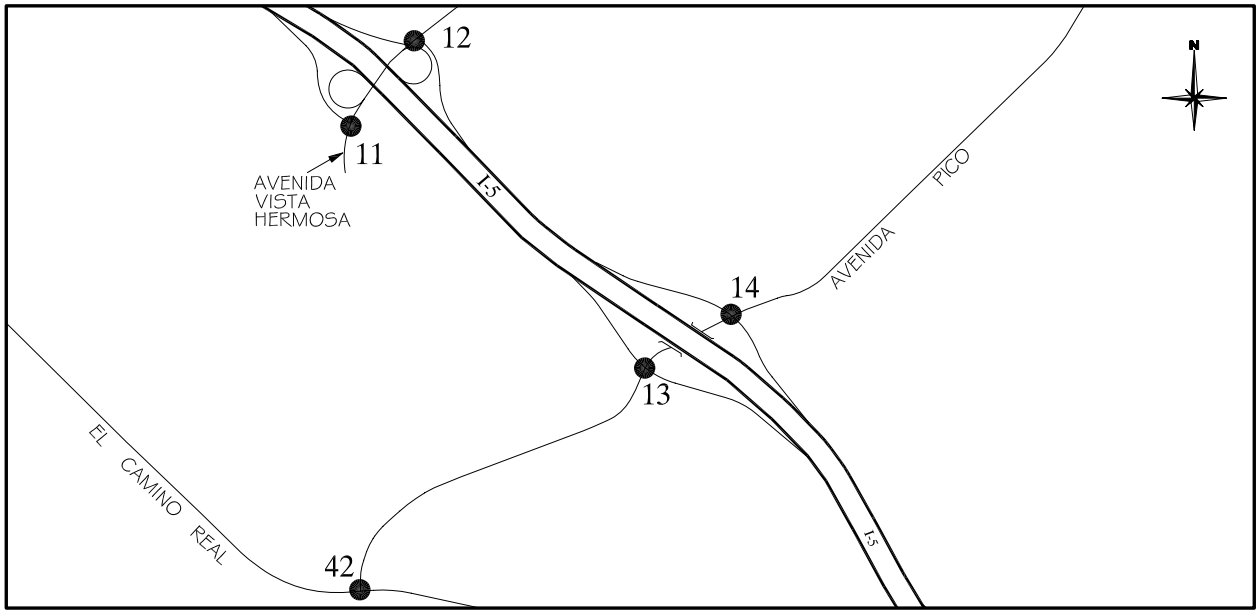
Legend

Free right-turn lane

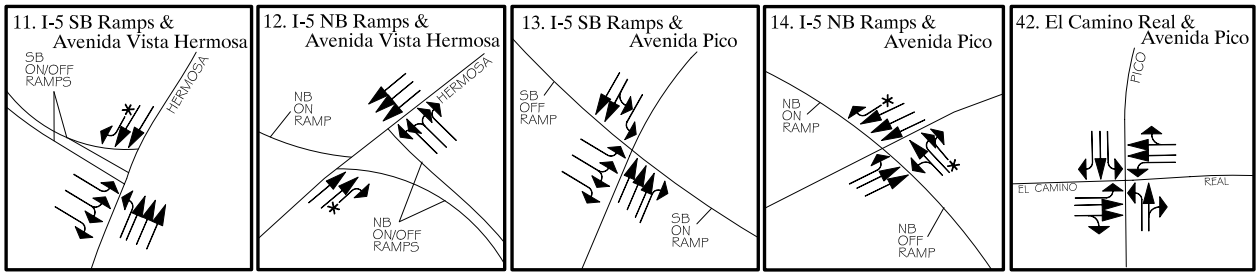
De facto right-turn lane

Figure C-5

EXISTING LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- CAMINO DE ESTRELLA INTERCHANGE



LANE CONFIGURATIONS



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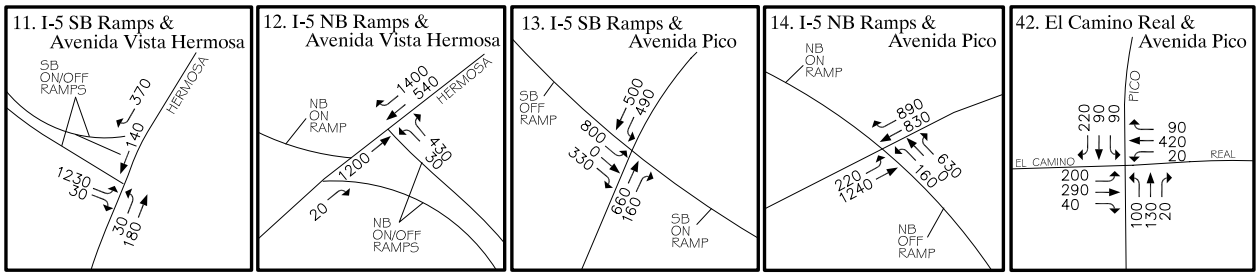

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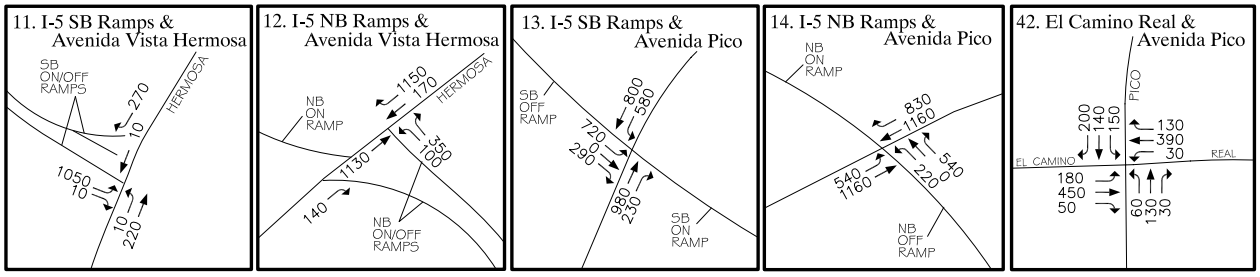
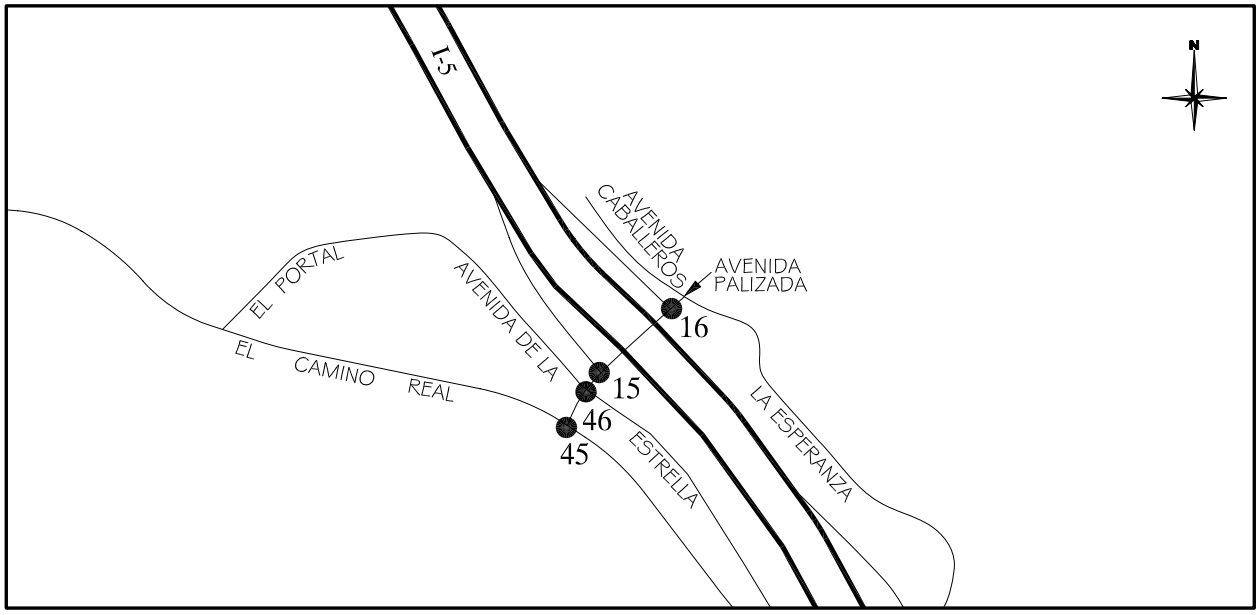


Legend

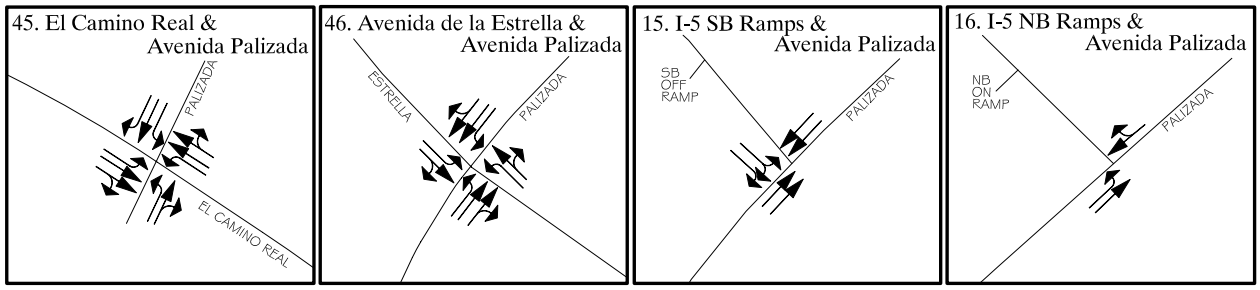
Free right-turn lane

De facto right-turn lane

Figure C-6
EXISTING LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- AVENIDA VISTA HERMOSA & AVENIDA PICO
INTERCHANGES



LANE CONFIGURATIONS



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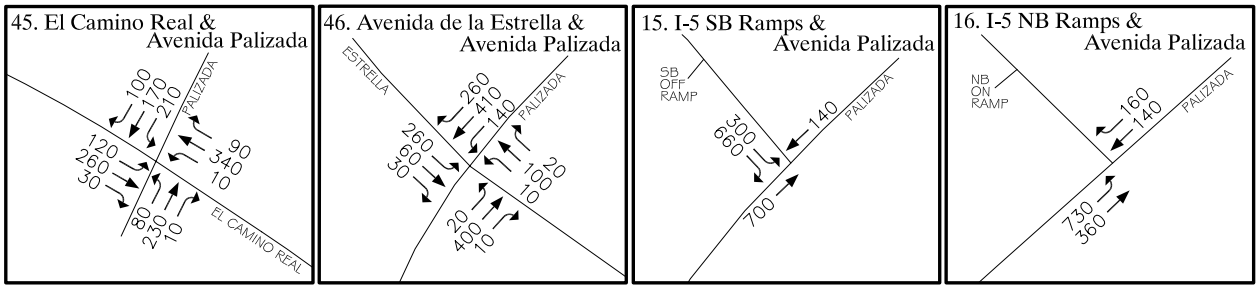
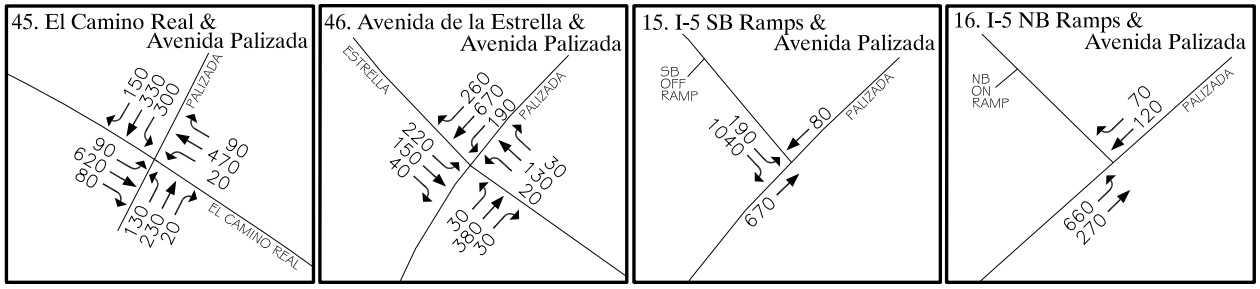


PM PEAK HOUR



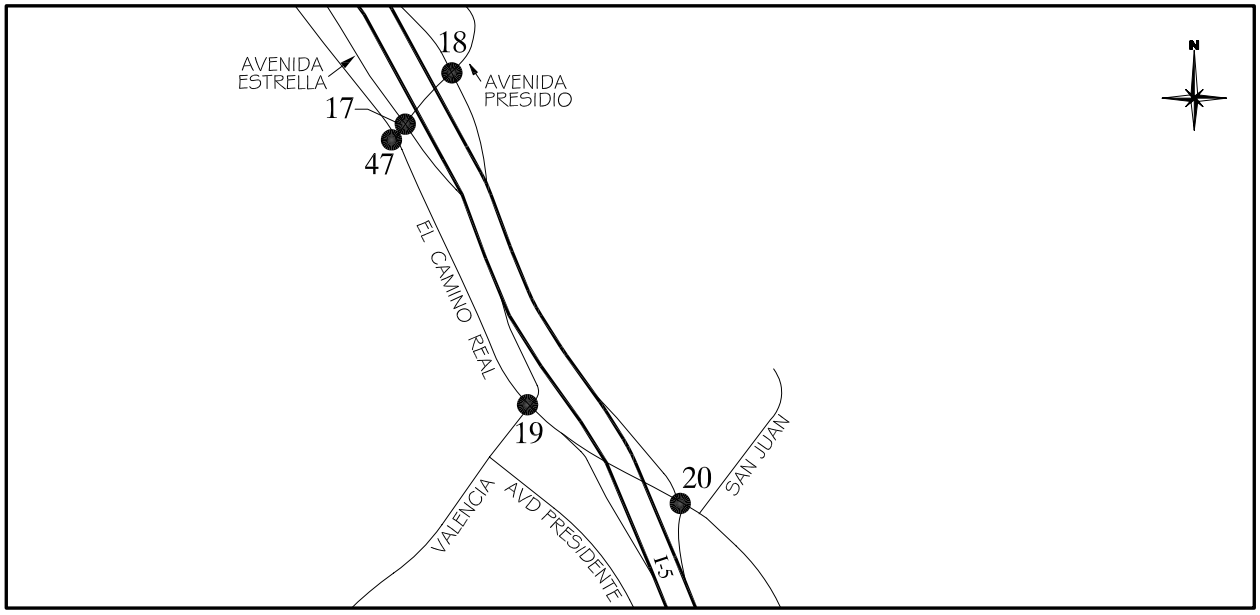
Legend

Free right-turn lane

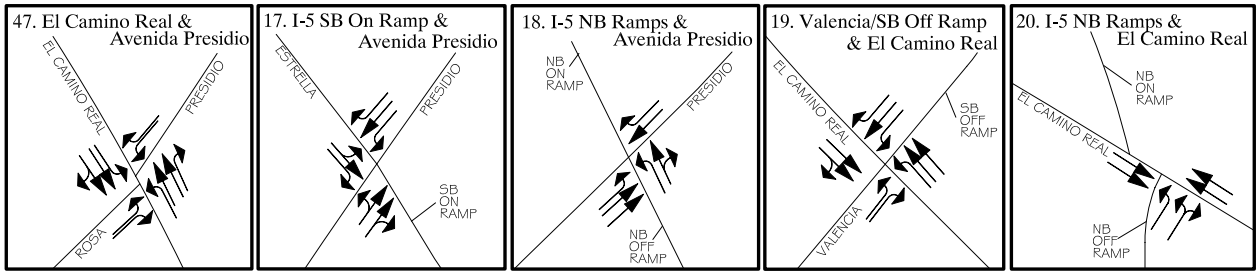
De facto right-turn lane

Figure C-7

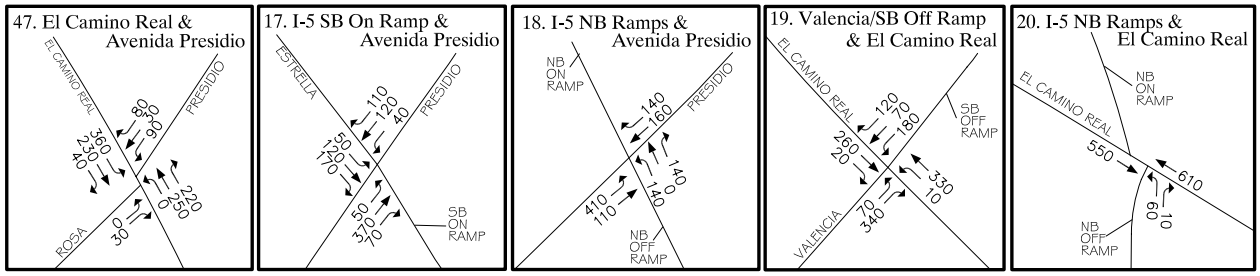
EXISTING LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- AVENIDA PALIZADA INTERCHANGE



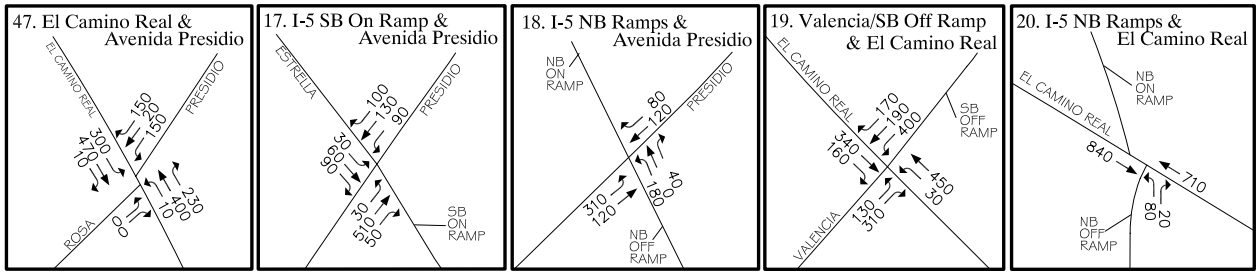
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR

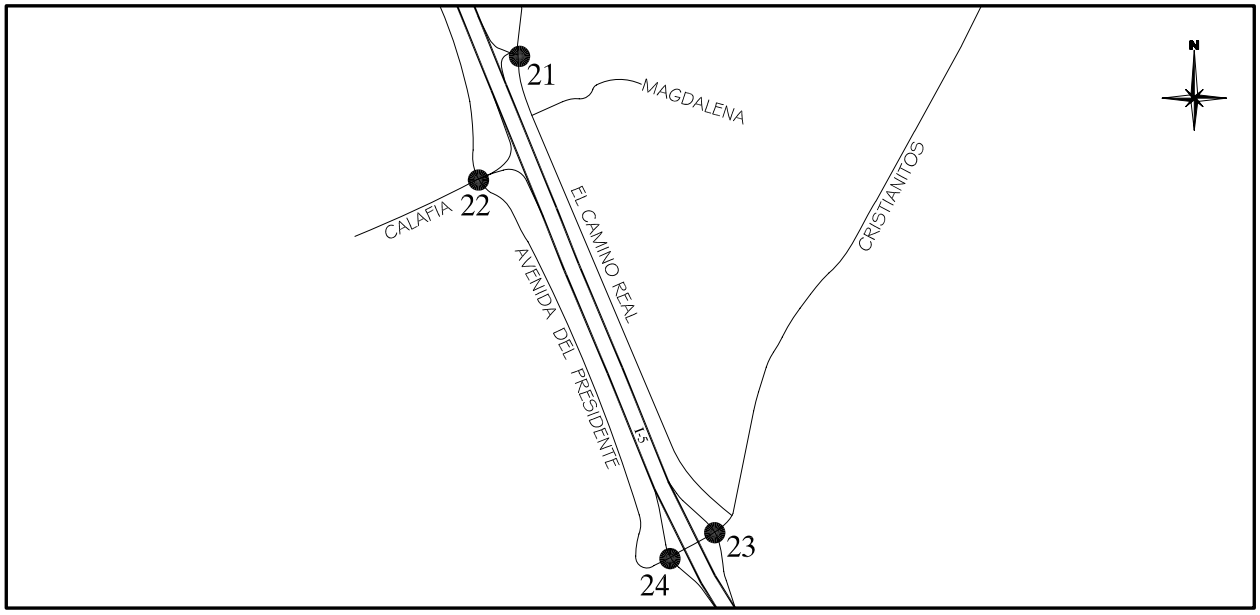


Legend

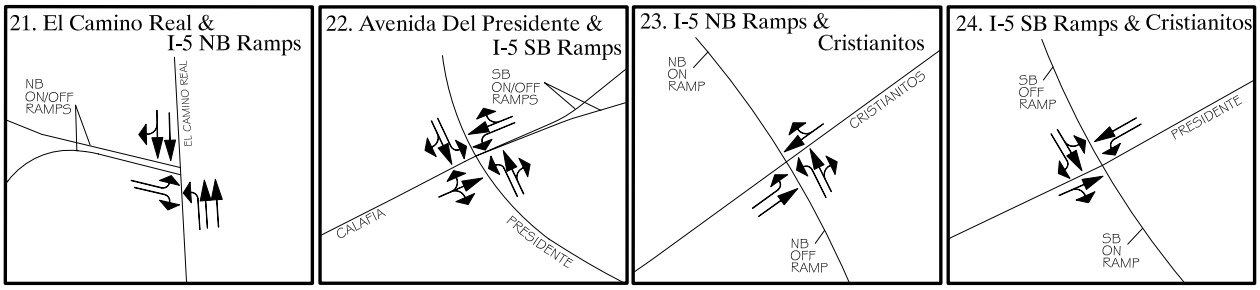
Free right-turn lane

De facto right-turn lane

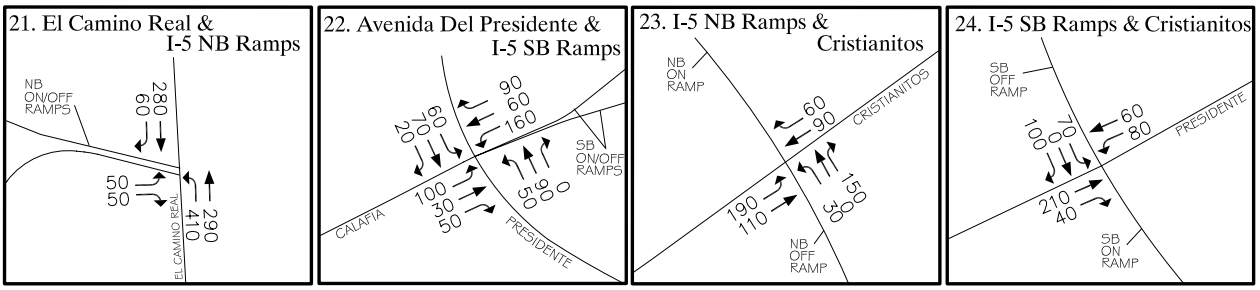
Figure C-8
EXISTING LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- AVENIDA PRESIDIO & EL CAMINO REAL
INTERCHANGES



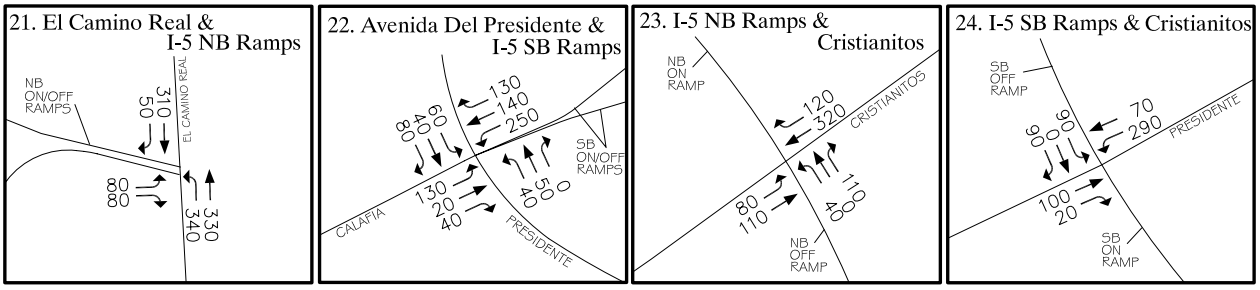
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR

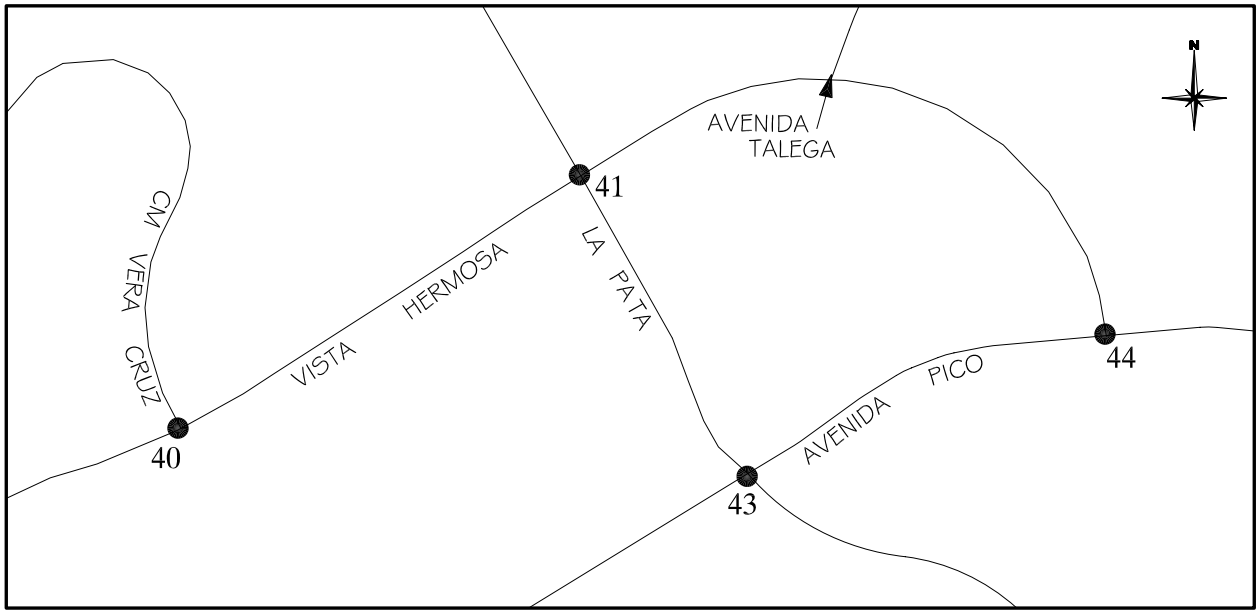


Legend

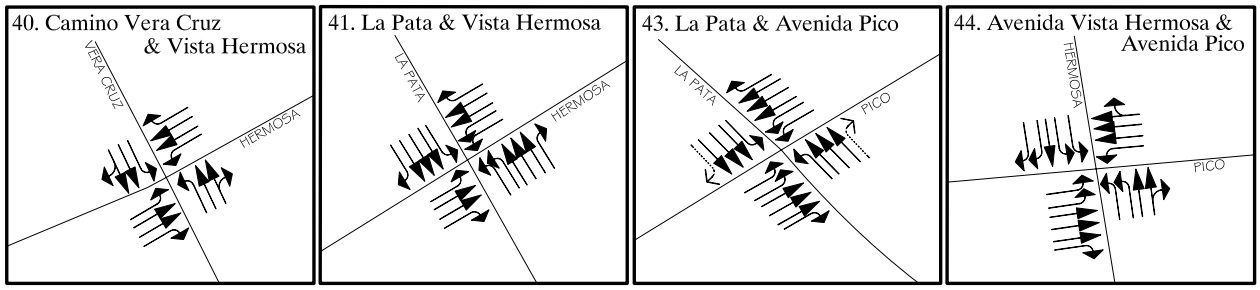
Free right-turn lane

De facto right-turn lane

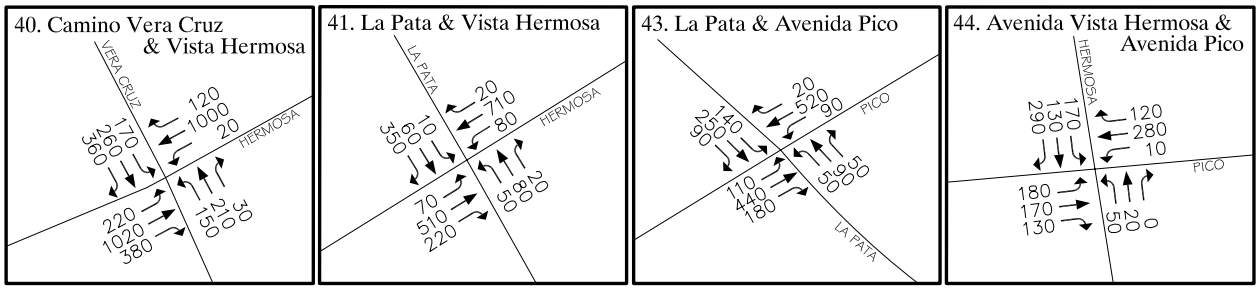
Figure C-9
EXISTING LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- CALAFIA/EL CAMINO REAL & CRISTIANITOS
INTERCHANGES



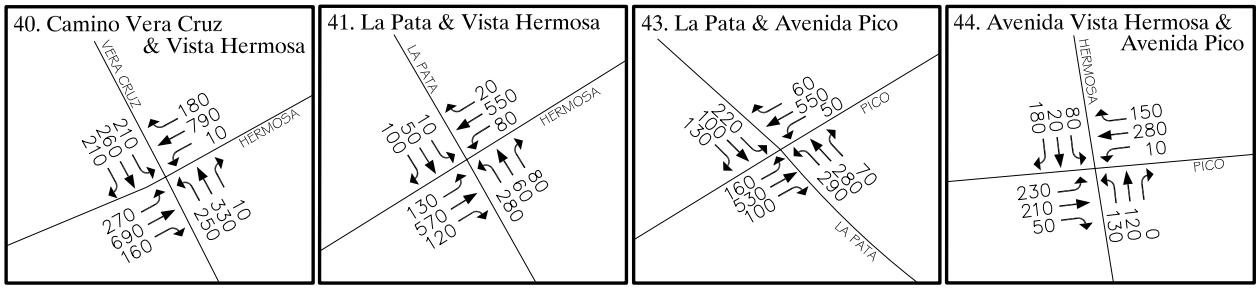
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR



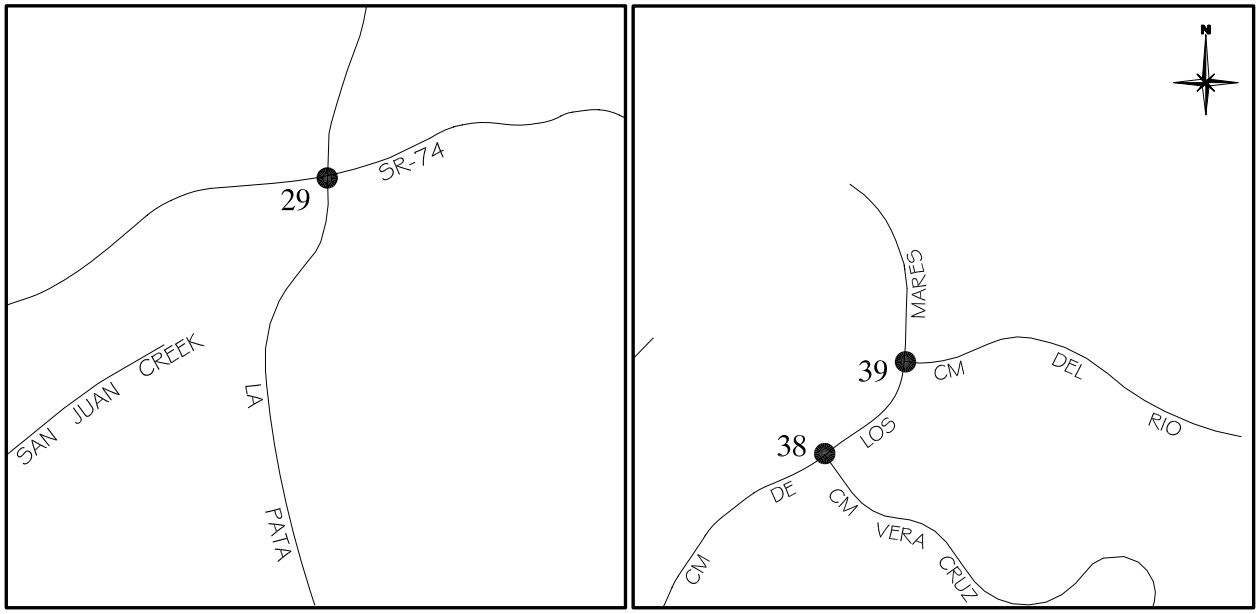
Legend

Free right-turn lane

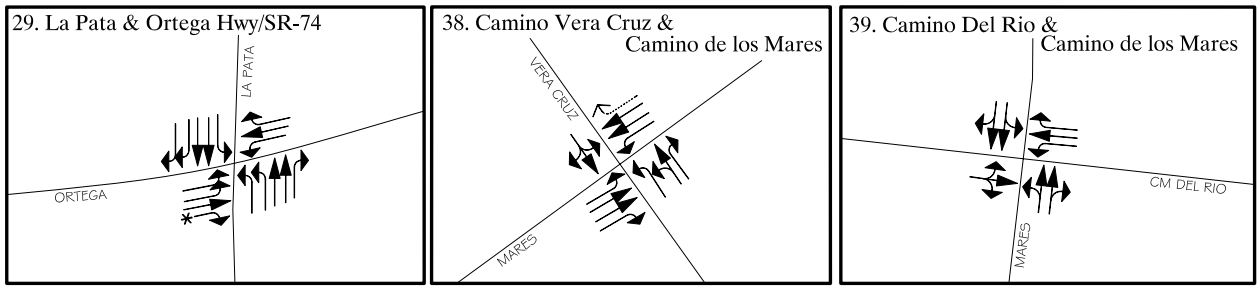
De facto right-turn lane

Figure C-10

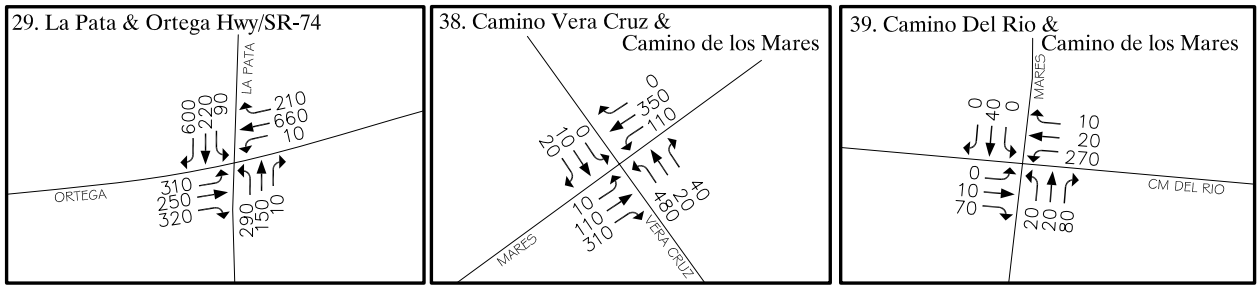
EXISTING LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- LOCAL INTERSECTIONS



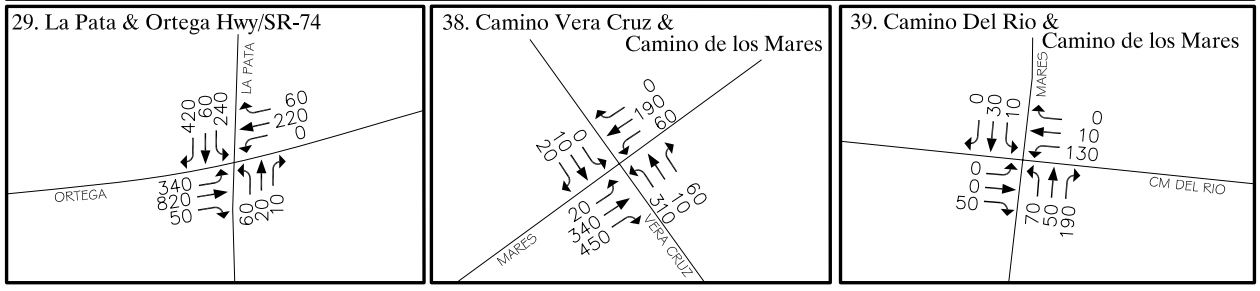
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR



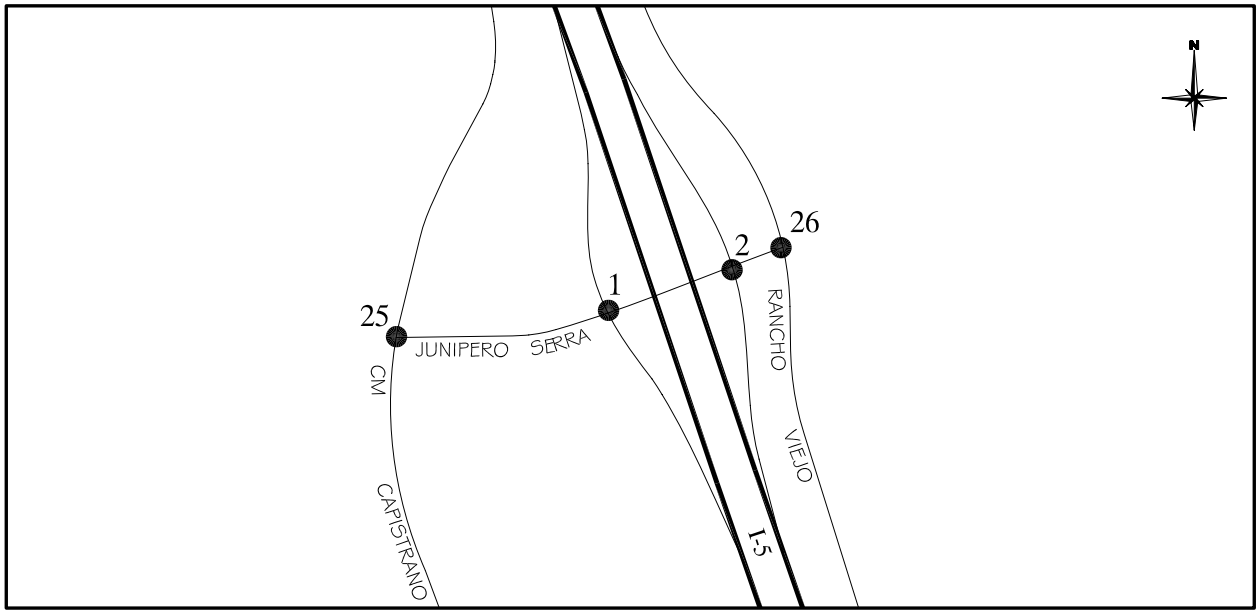
Legend

* Free right-turn lane

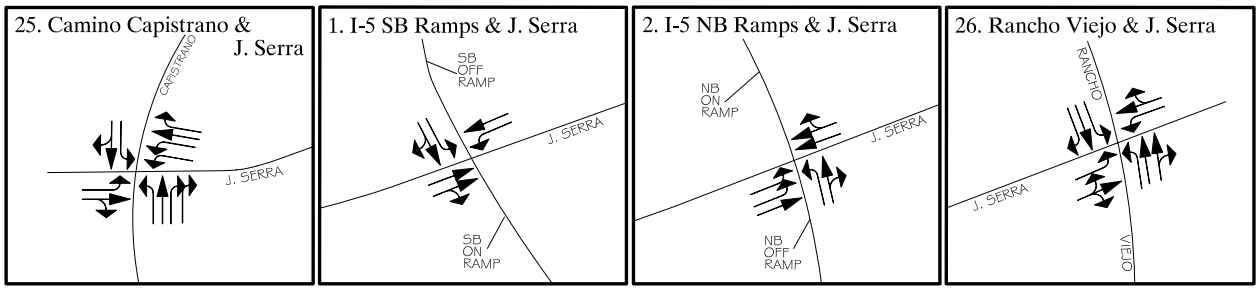
De facto right-turn lane

Figure C-11

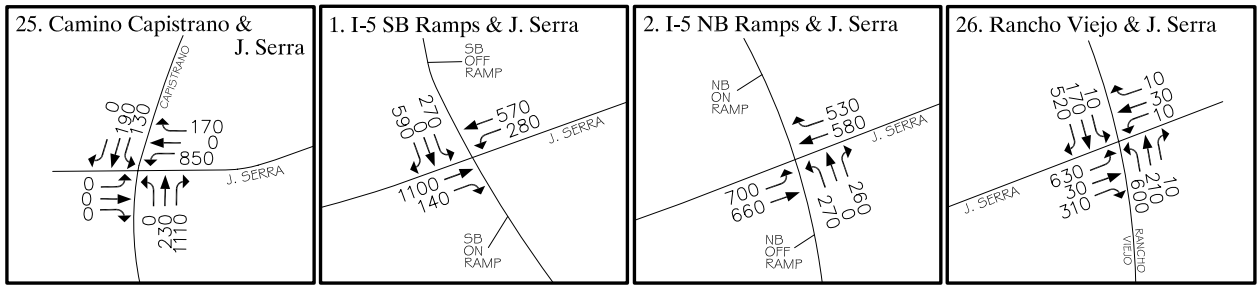
EXISTING LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- LOCAL INTERSECTIONS



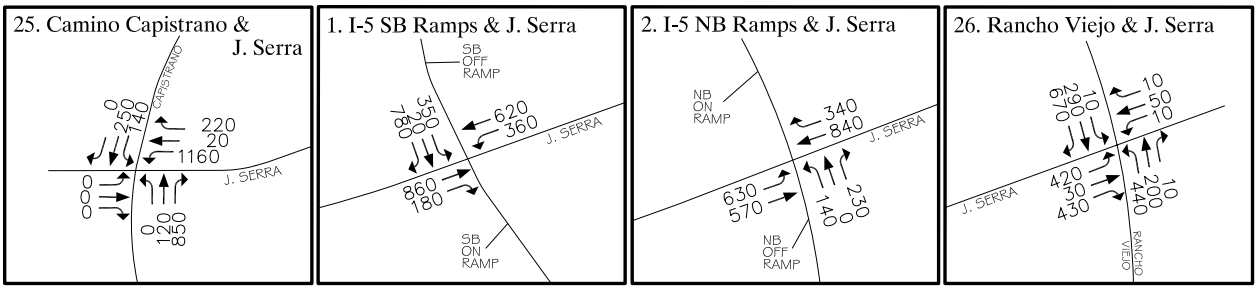
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR



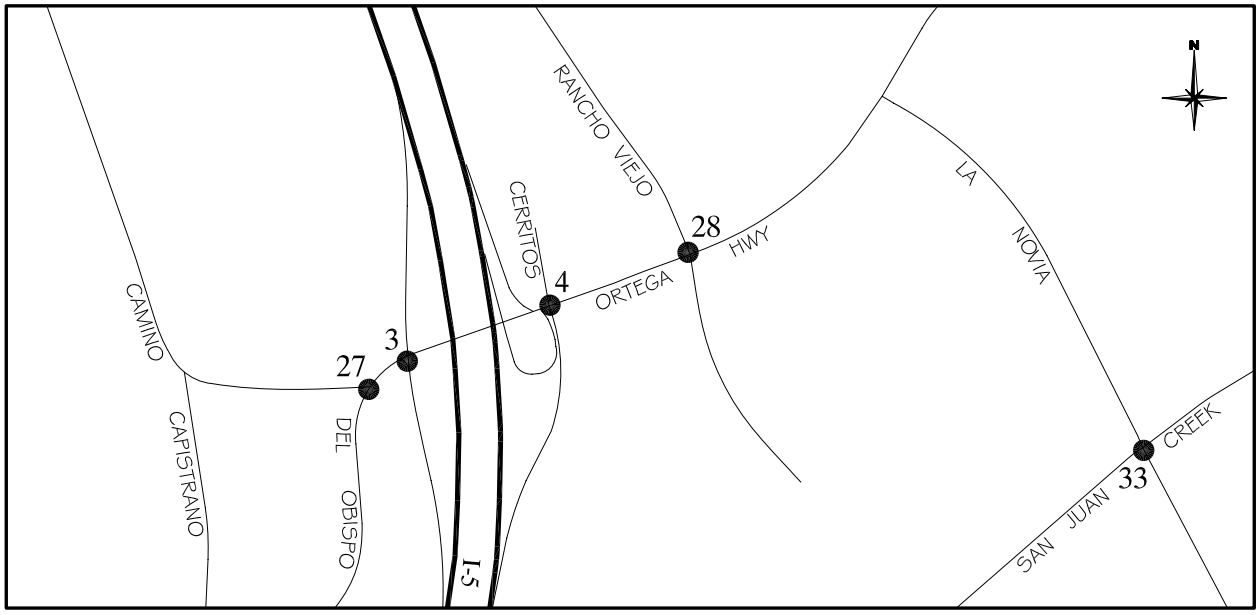
Legend

* Free right-turn lane

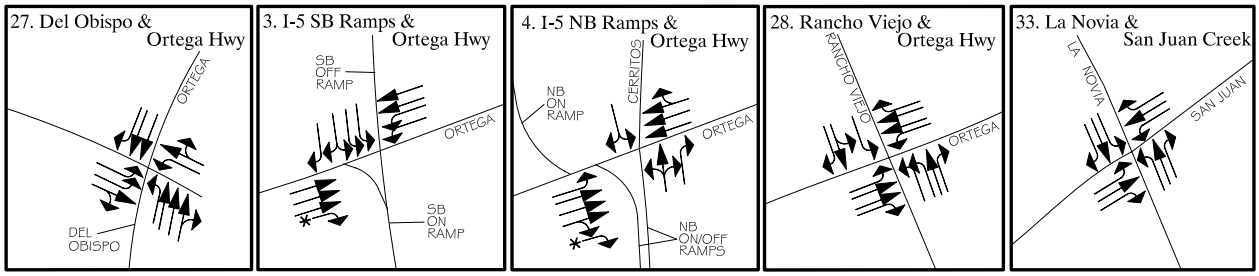
De facto right-turn lane

Figure C-12

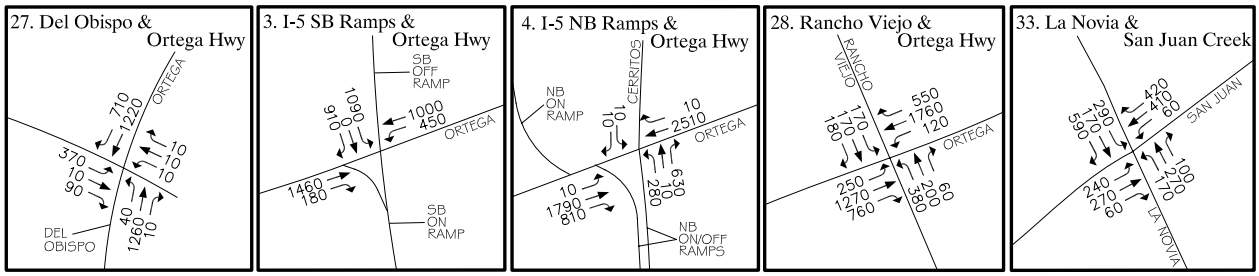
2040 NO-BUILD LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- JUNIPERO SERRA INTERCHANGE



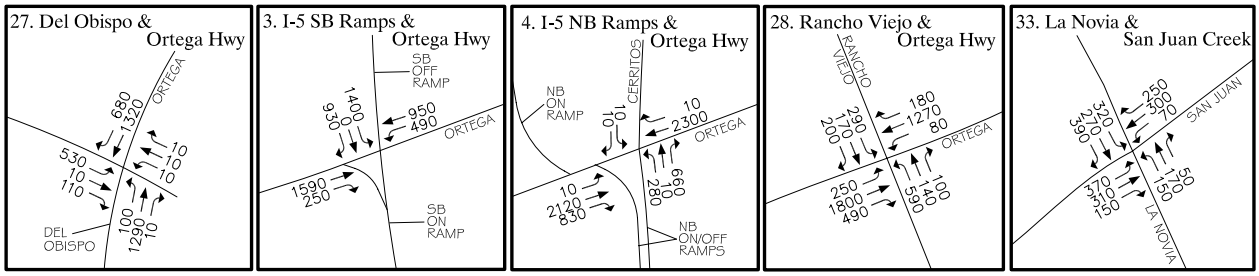
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR



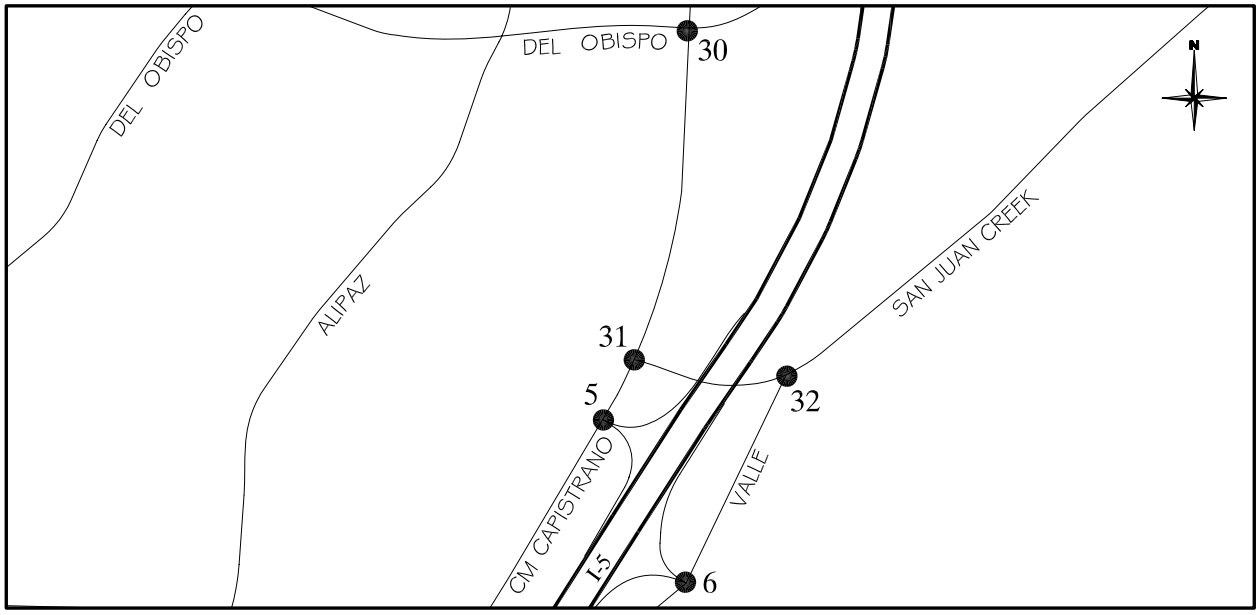
Legend

Free right-turn lane

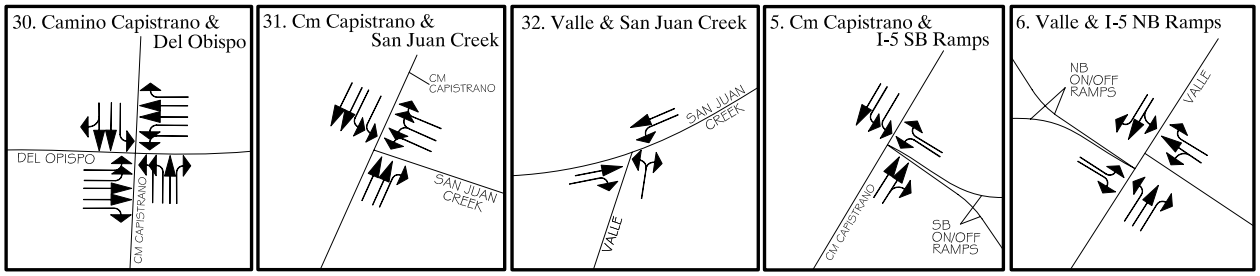
De facto right-turn lane

Figure C-13

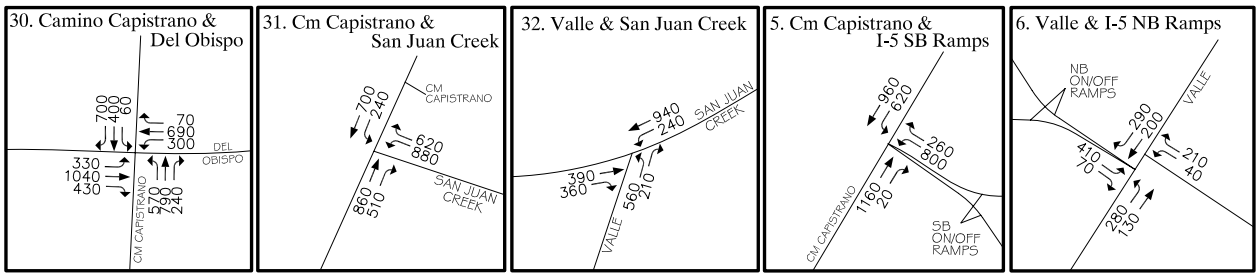
2040 NO-BUILD LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- ORTEGA HWY INTERCHANGE



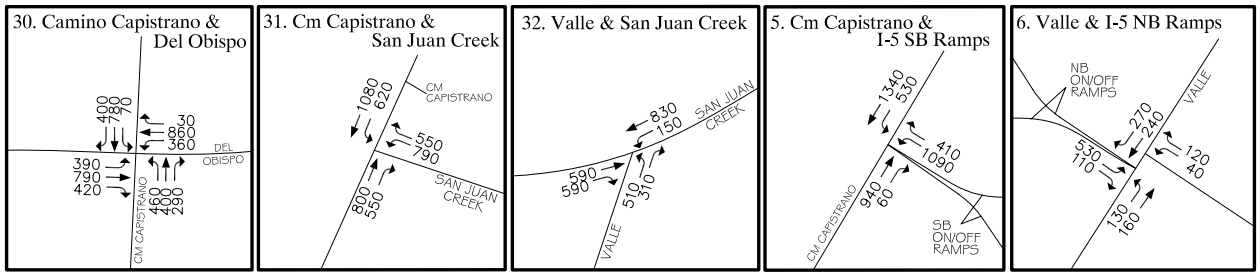
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR



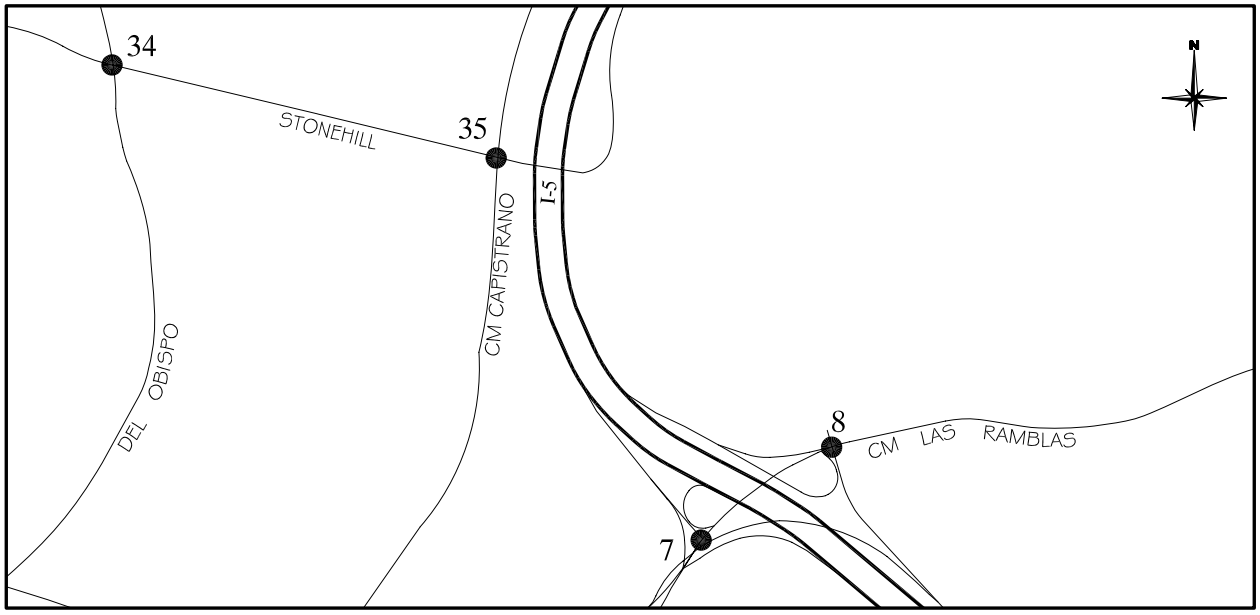
Legend

Free right-turn lane

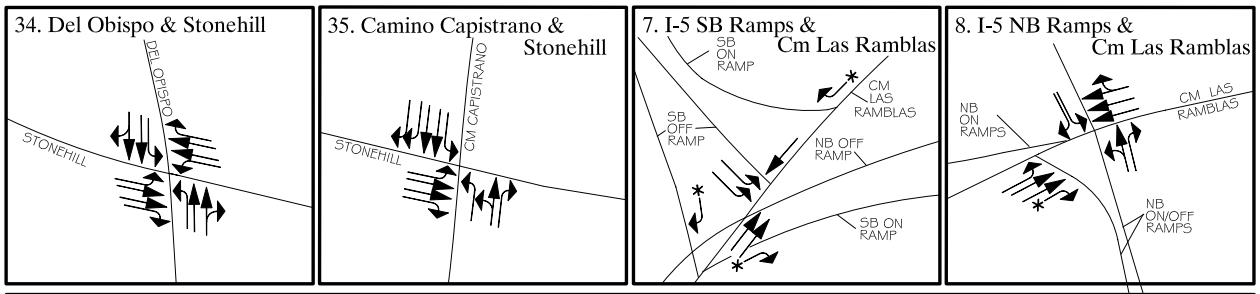
De facto right-turn lane

Figure C-14

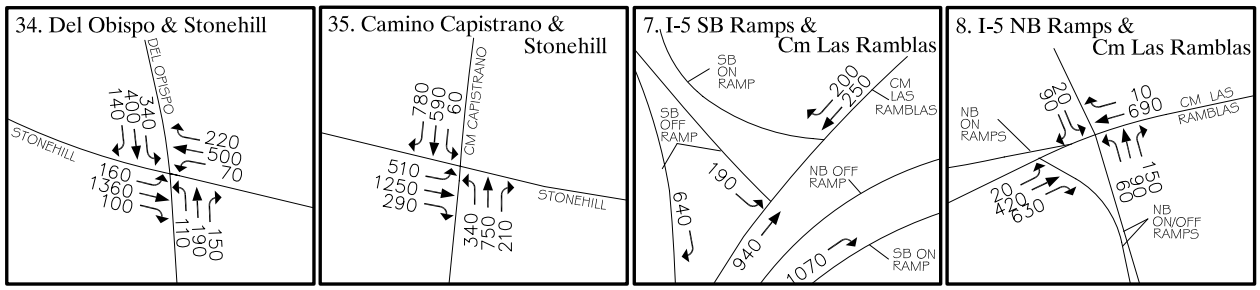
2040 NO-BUILD LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- CAMINO CAPISTRANO & VALLE INTERCHANGE



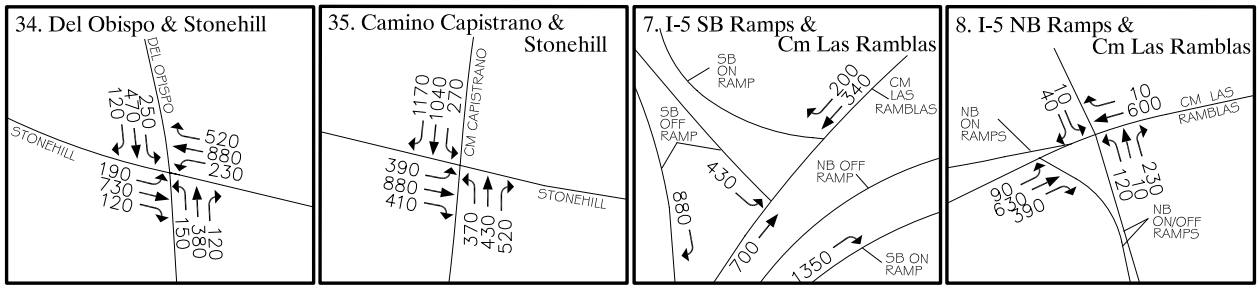
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR

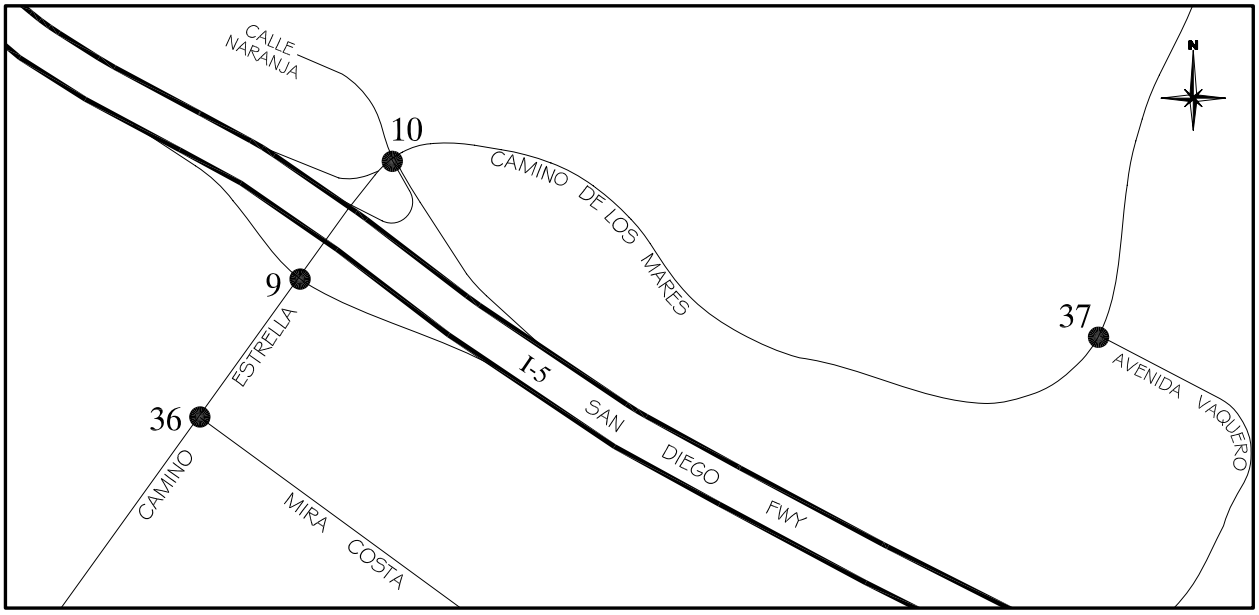


Legend

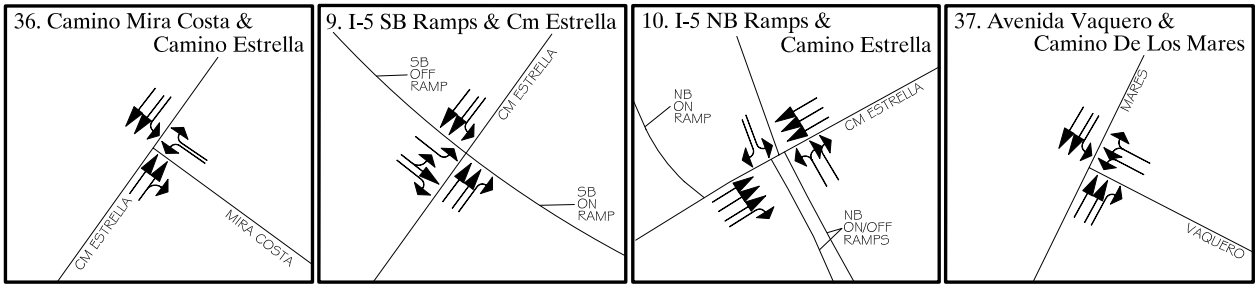
Free right-turn lane
De facto right-turn lane

Figure C-15

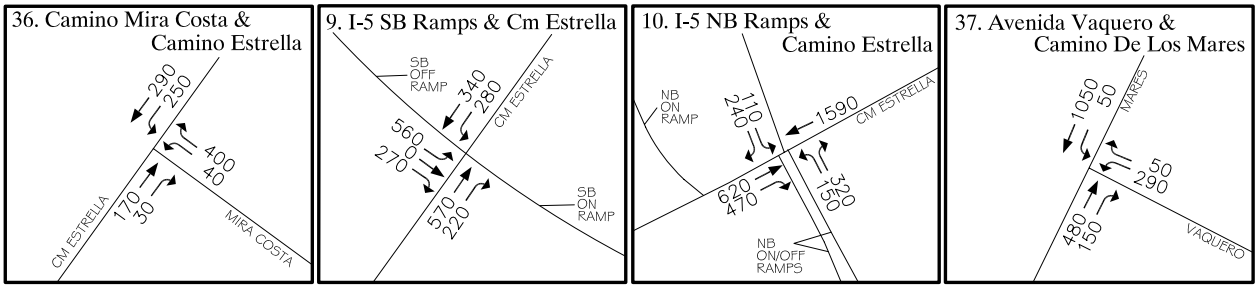
2040 NO-BUILD LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- CAMINO LAS RAMBLAS INTERCHANGE



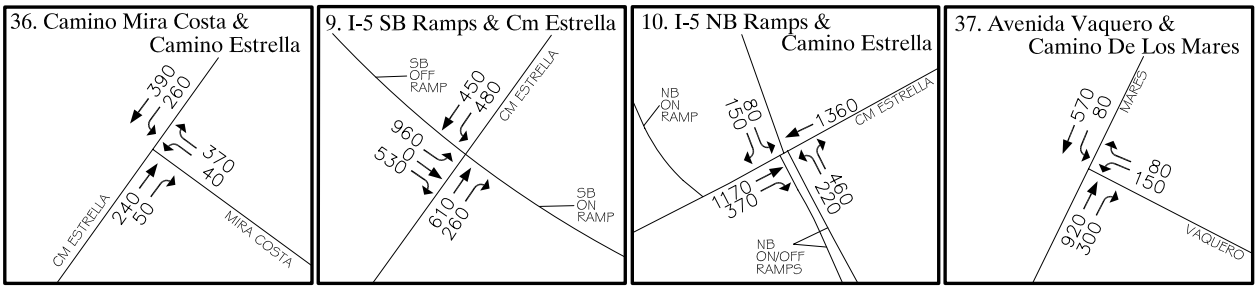
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR



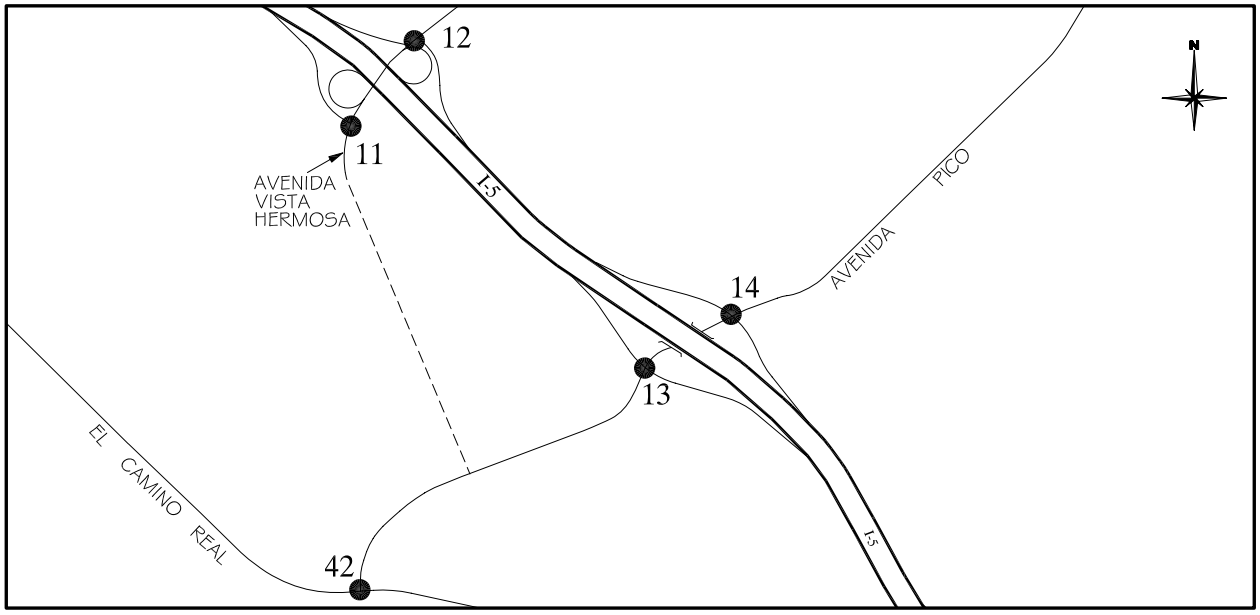
Legend

Free right-turn lane

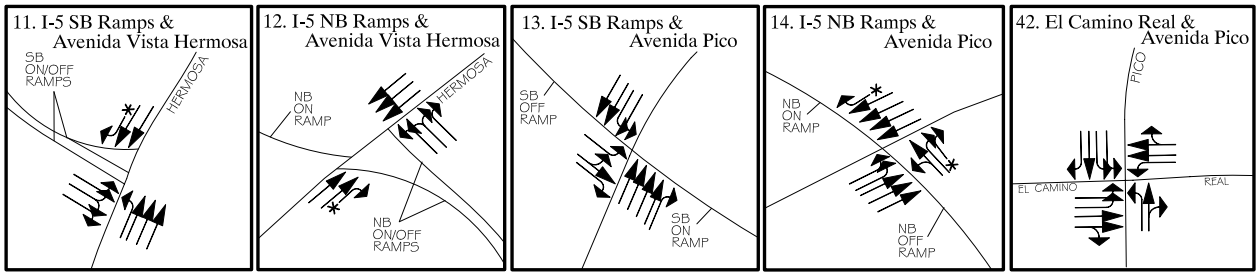
De facto right-turn lane

Figure C-16

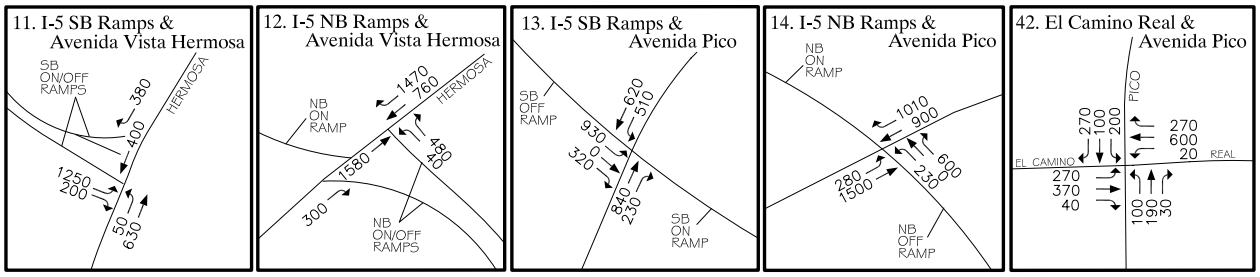
2040 NO-BUILD LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- CAMINO DE ESTRELLA INTERCHANGE



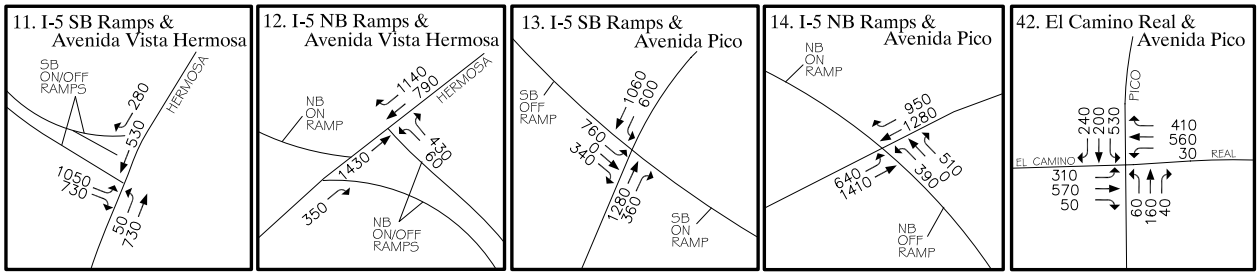
LANE CONFIGURATIONS



AM PEAK HOUR



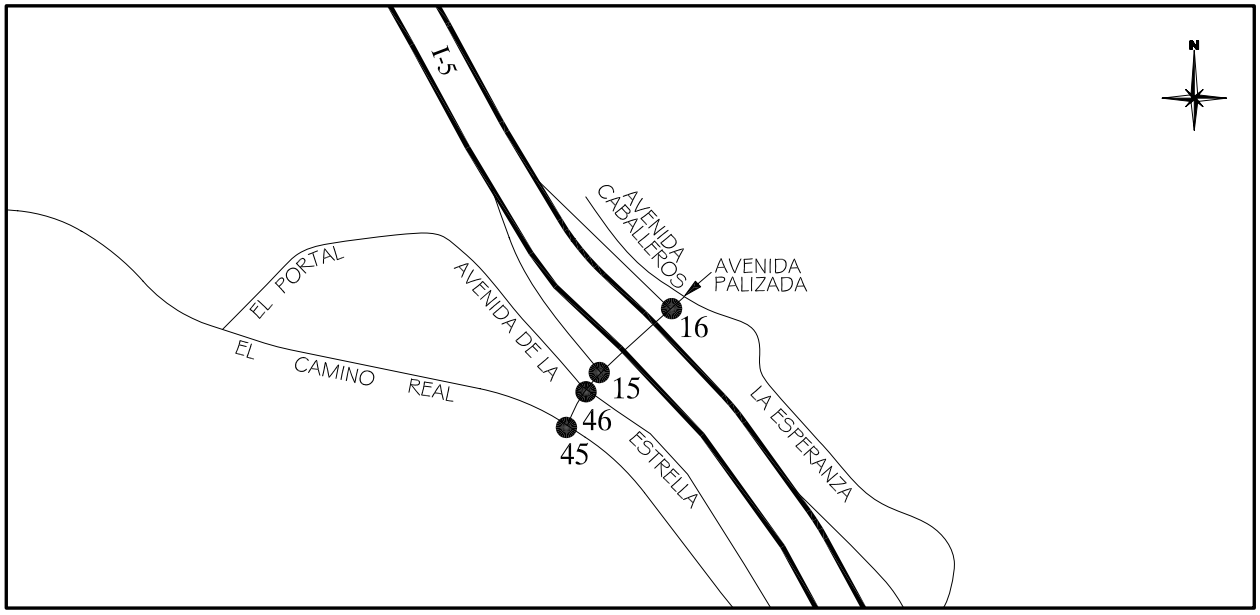
PM PEAK HOUR



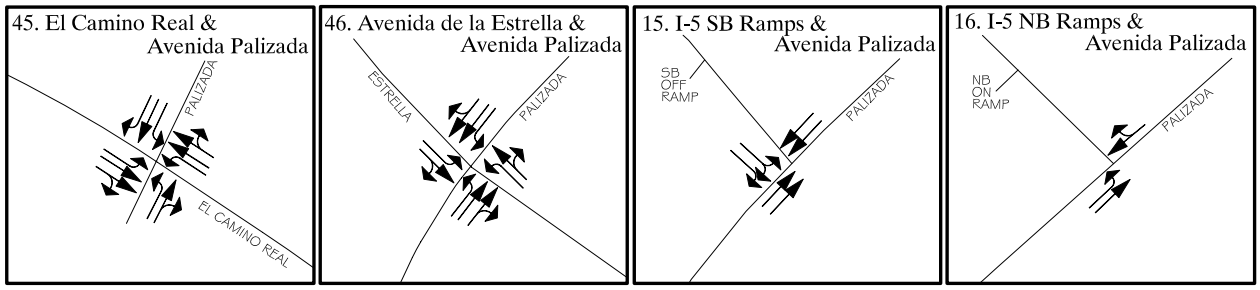
Legend

- Free right-turn lane
- De facto right-turn lane
- Future Roadway

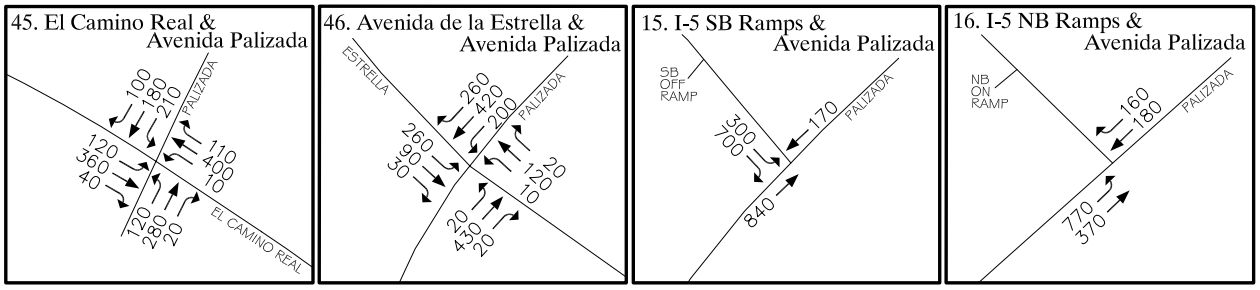
Figure C-17
2040 NO-BUILD LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- AVENIDA VISTA HERMOSA & AVENIDA PICO
INTERCHANGES



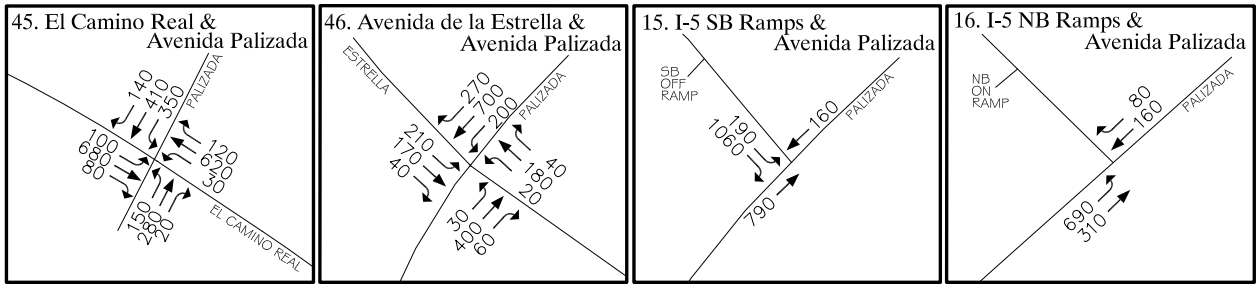
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR



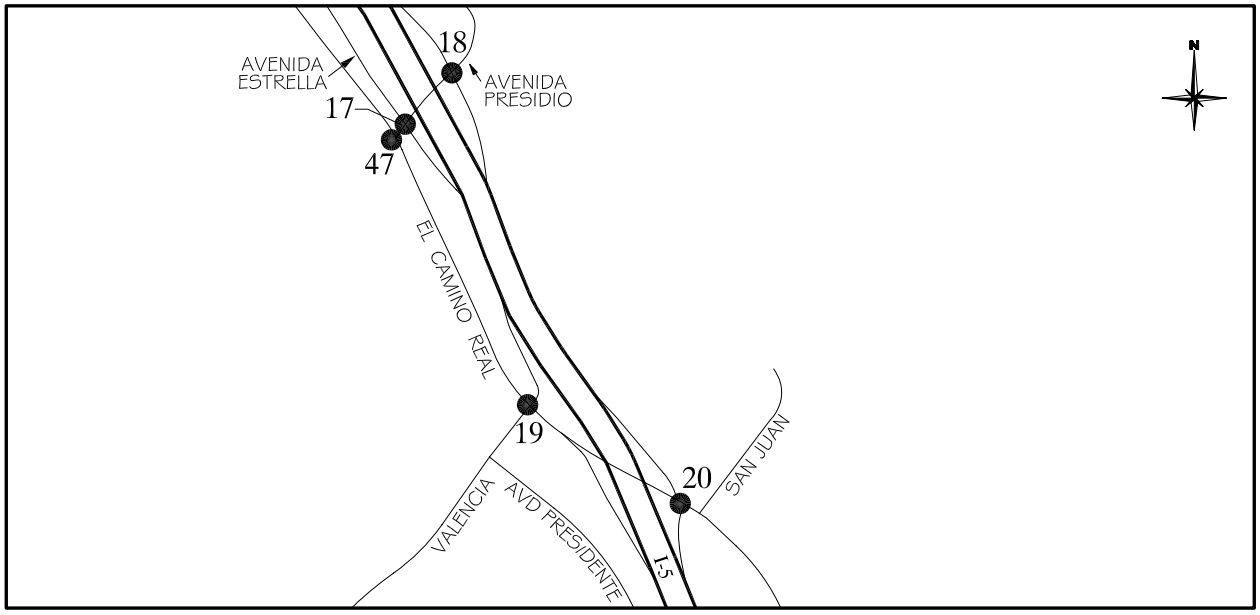
Legend

* Free right-turn lane

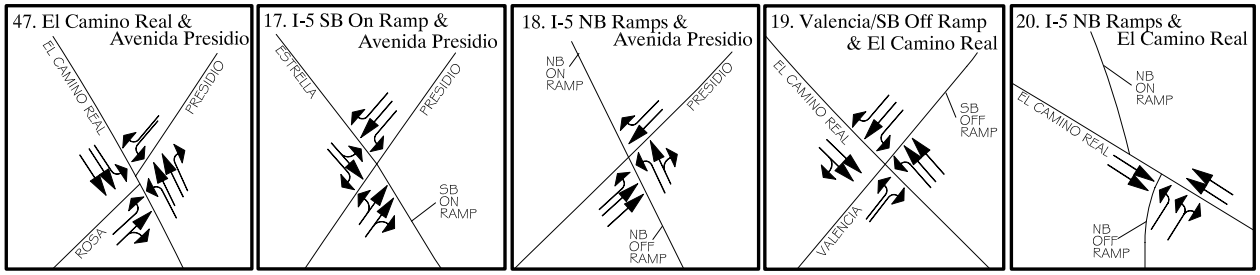
De facto right-turn lane

Figure C-18

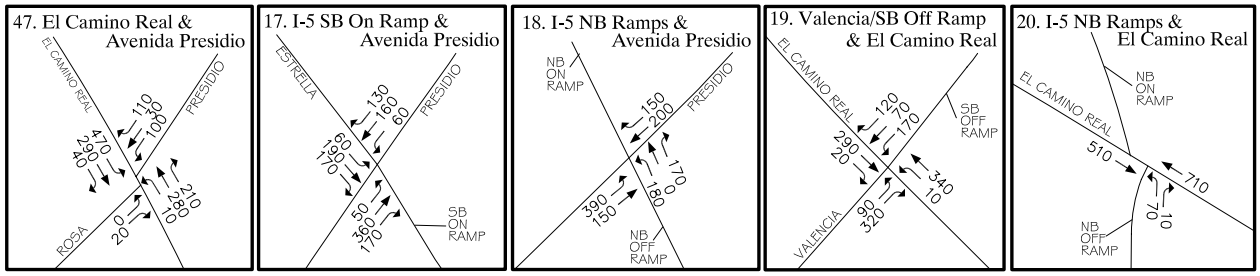
2040 NO-BUILD LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- AVENIDA PALIZADA INTERCHANGE



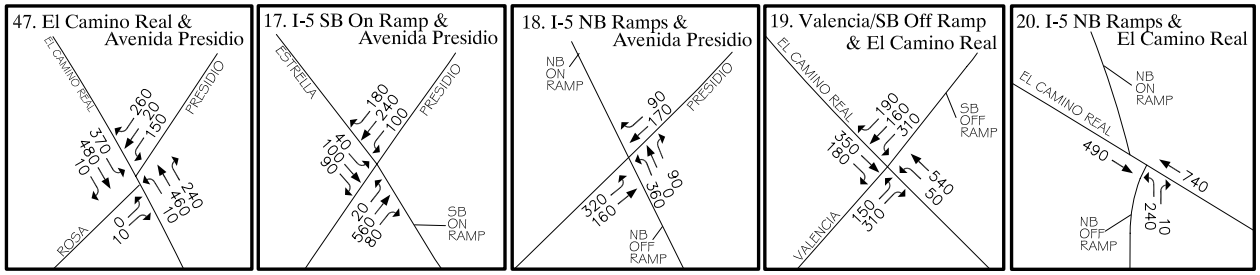
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR

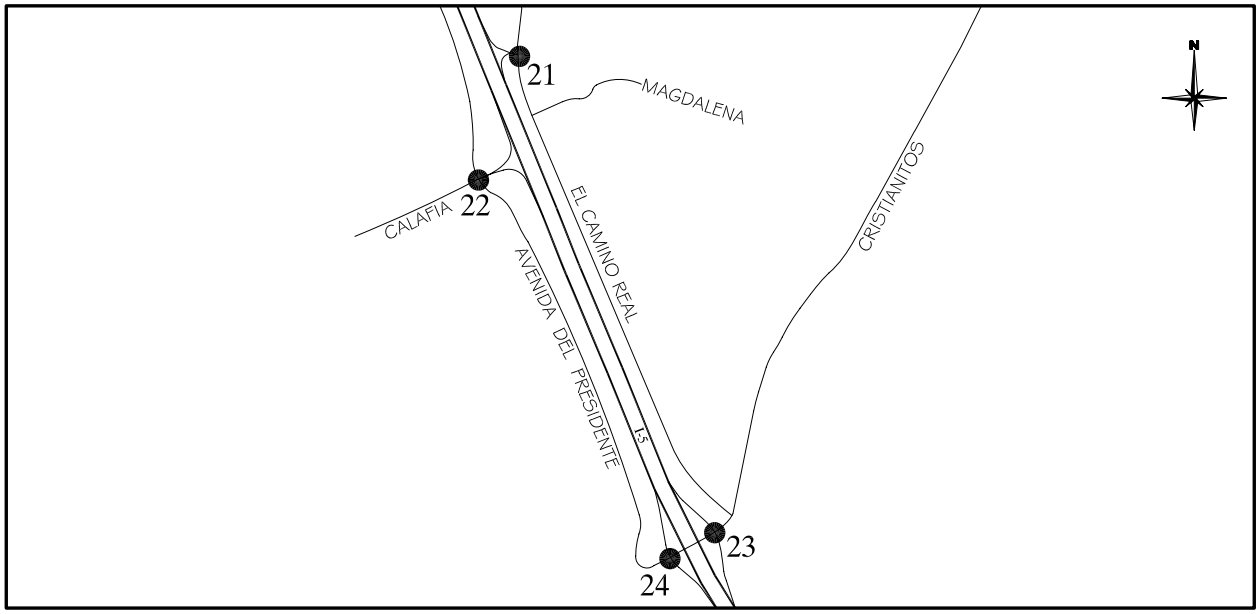


Legend

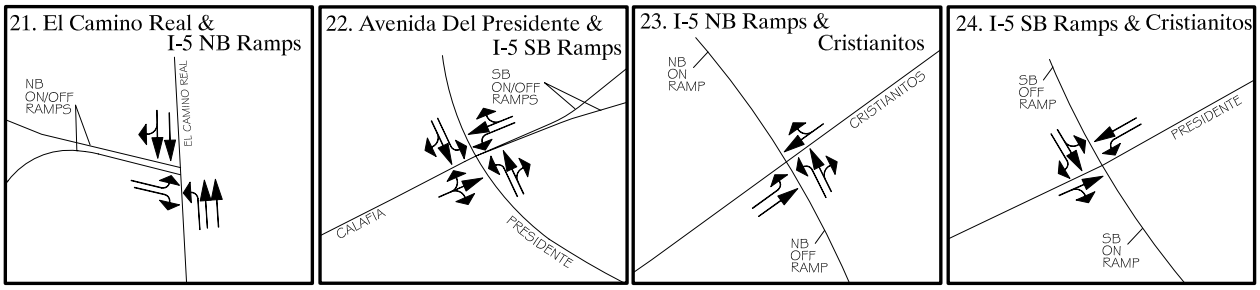
Free right-turn lane

De facto right-turn lane

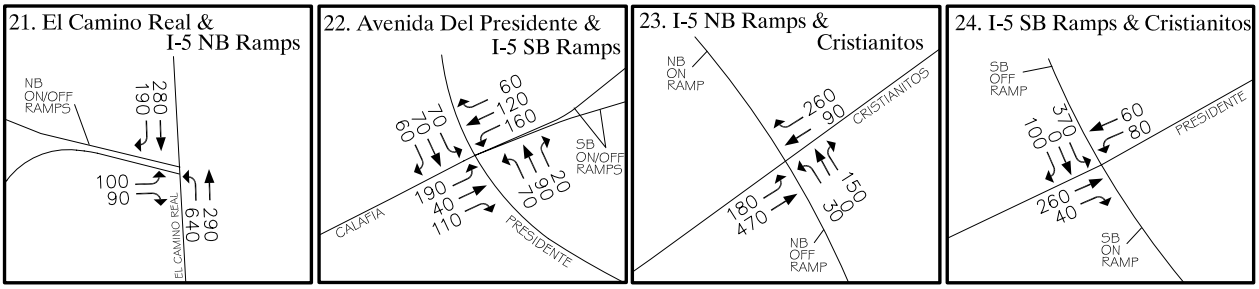
Figure C-19
2040 NO-BUILD LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- AVENIDA PRESIDIO & EL CAMINO REAL
INTERCHANGES



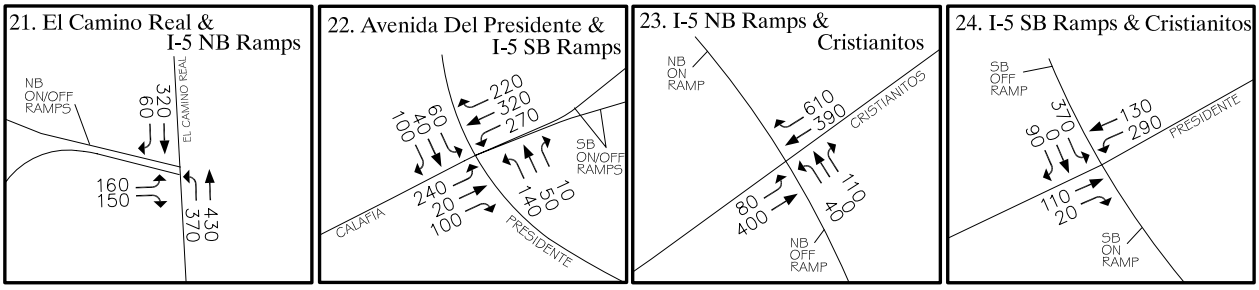
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR

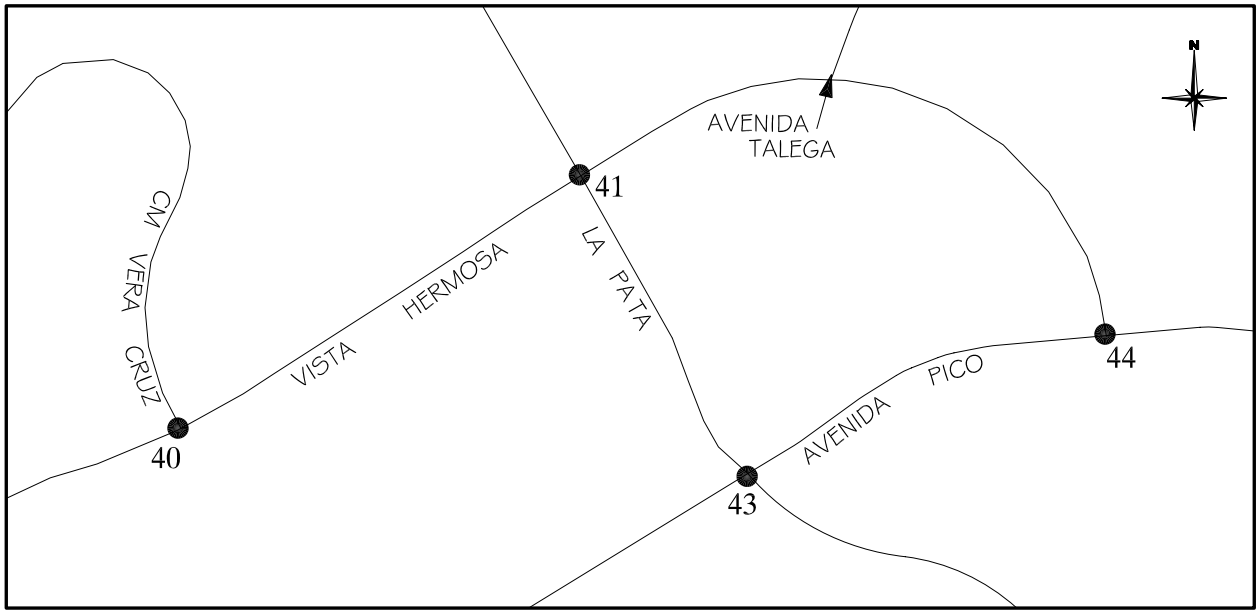


Legend

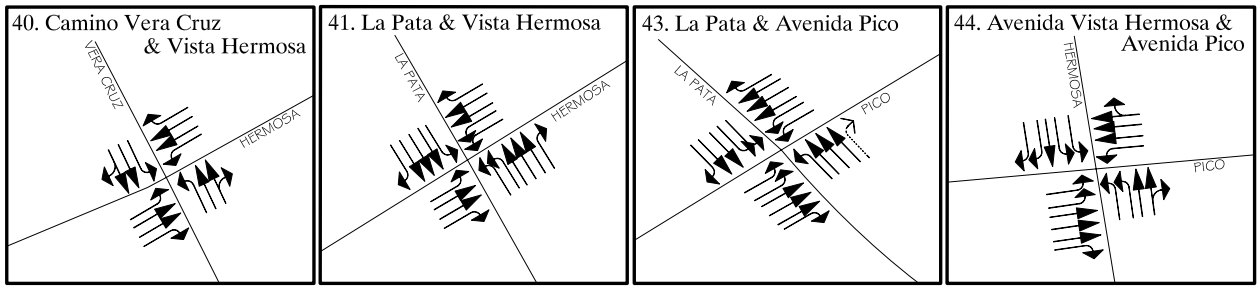
Free right-turn lane

De facto right-turn lane

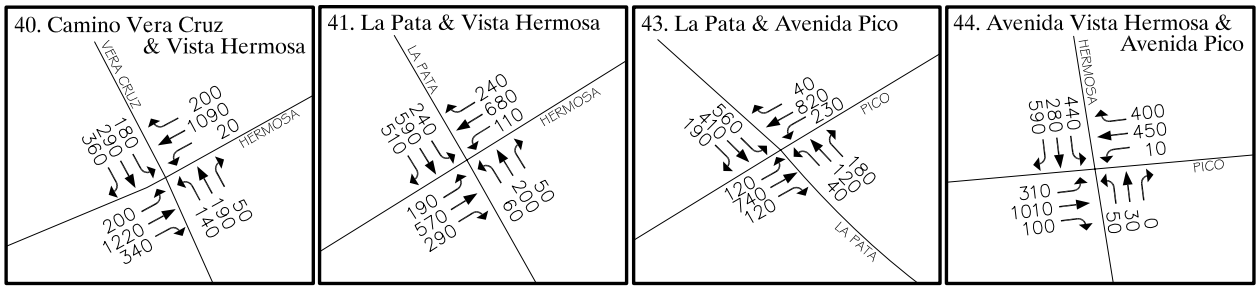
Figure C-20
2040 NO-BUILD LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- CALAFIA/EL CAMINO REAL & CRISTIANITOS
INTERCHANGES



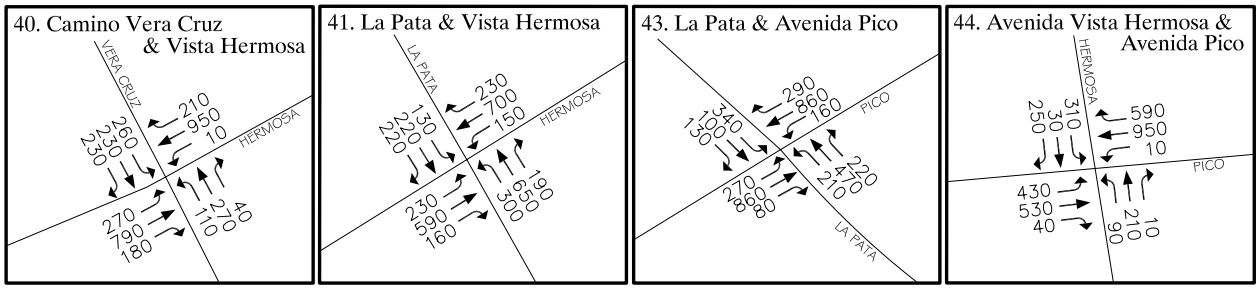
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR



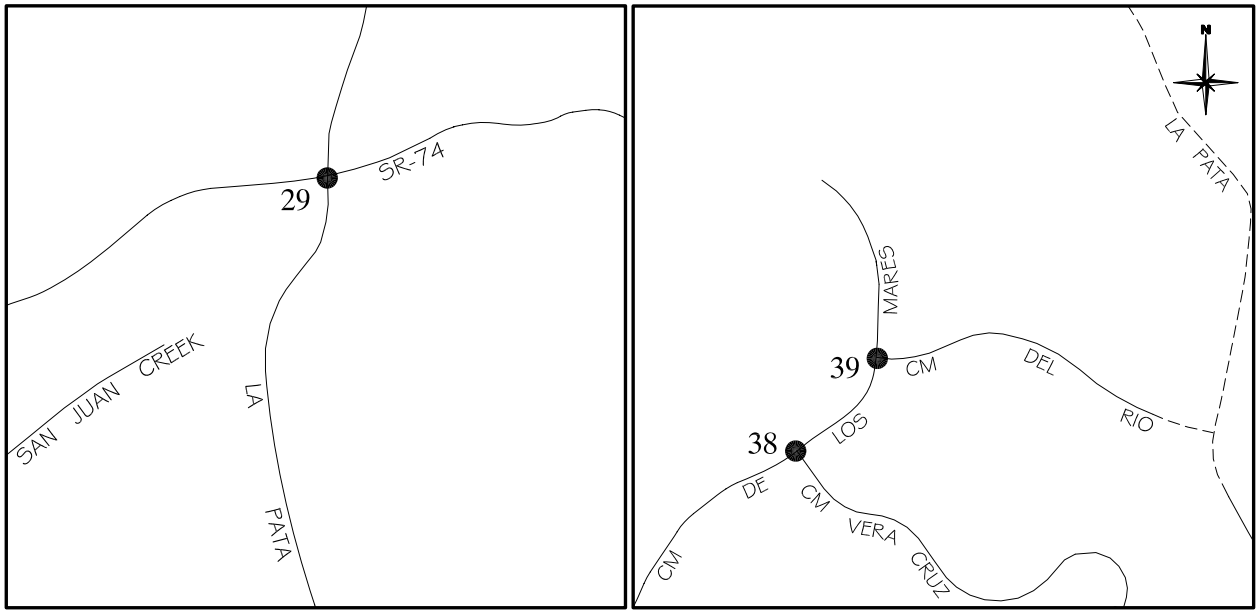
Legend

Free right-turn lane

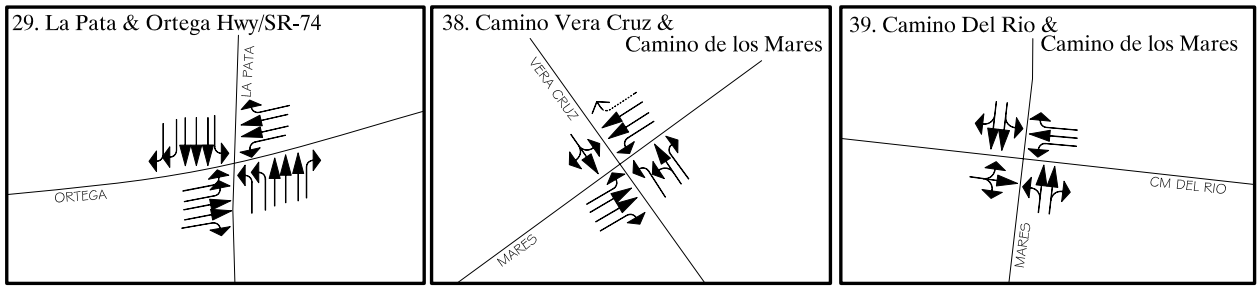
De facto right-turn lane

Figure C-21

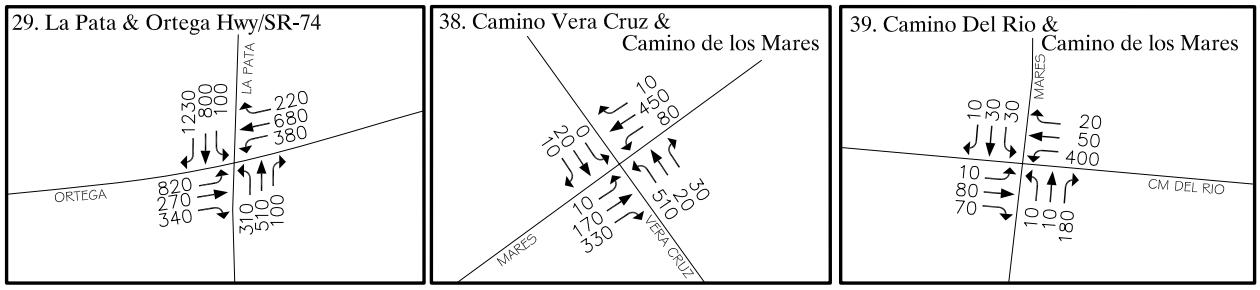
2040 NO-BUILD LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- LOCAL INTERSECTIONS



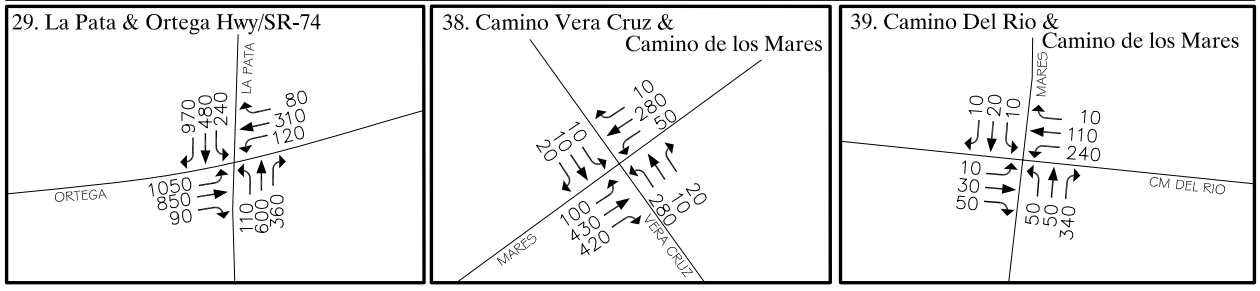
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR

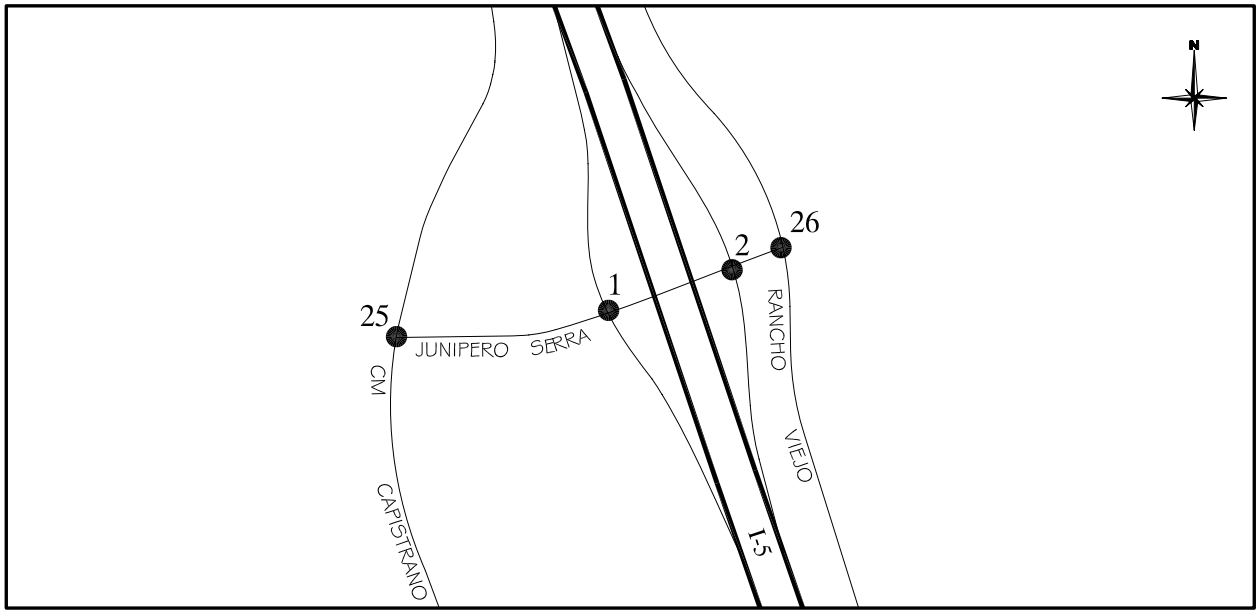


Legend

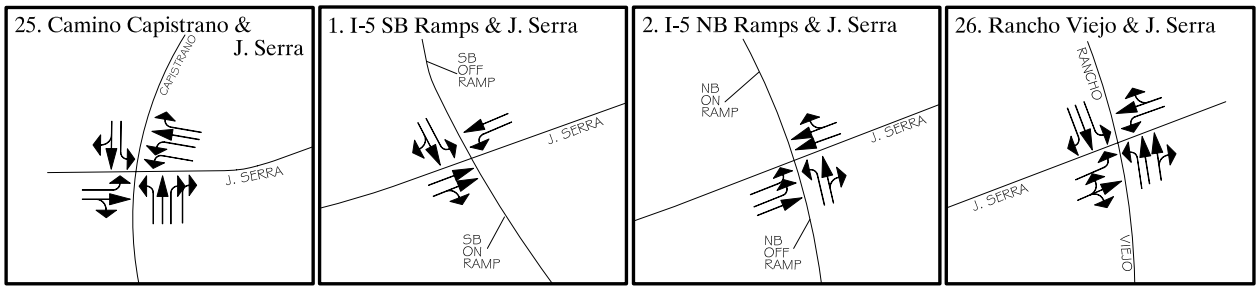
Free right-turn lane
De facto right-turn lane
Future Roadway

Figure C-22

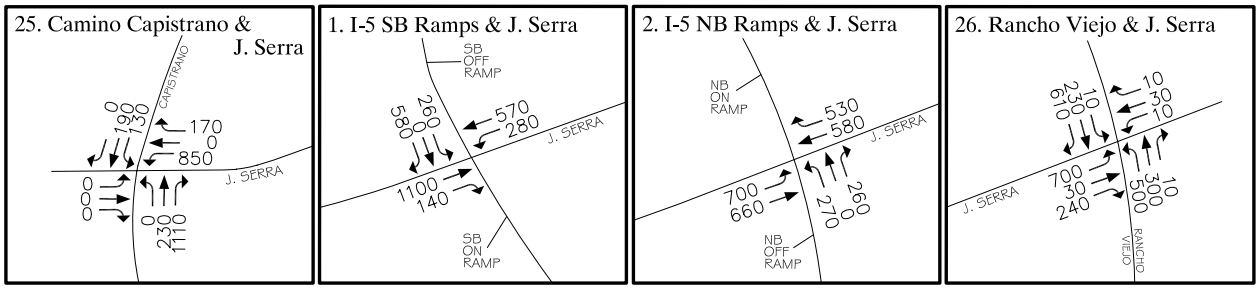
2040 NO-BUILD LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- LOCAL INTERSECTIONS



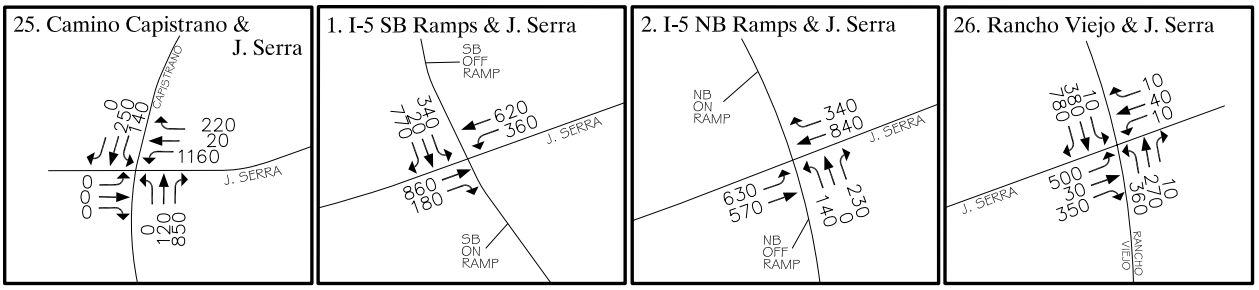
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR

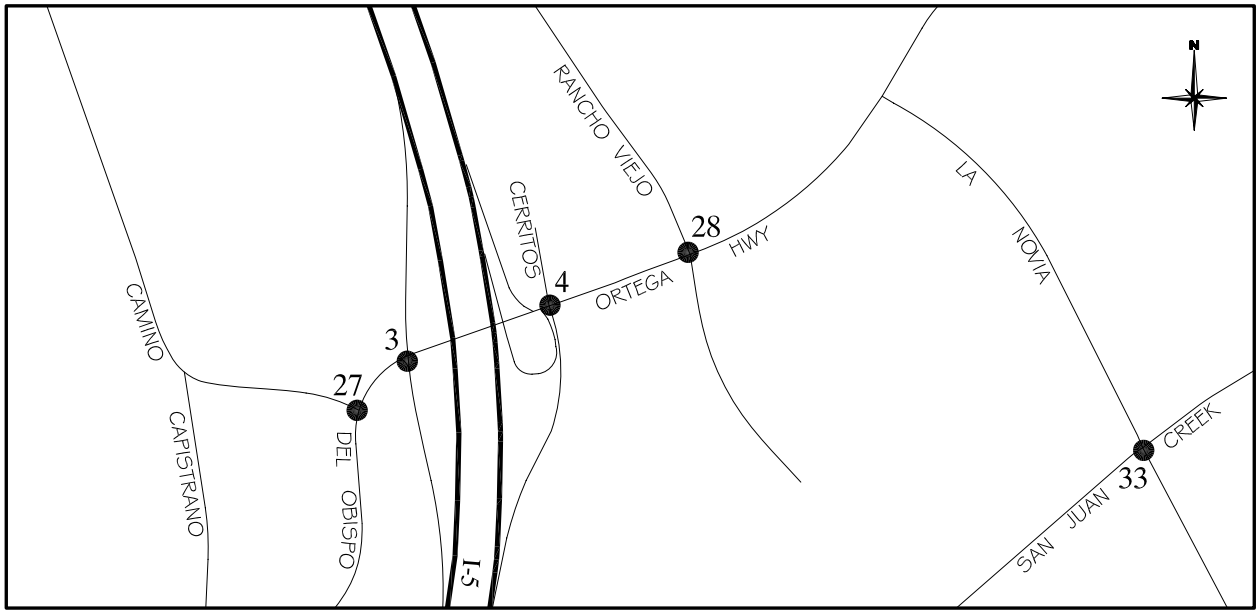


Legend

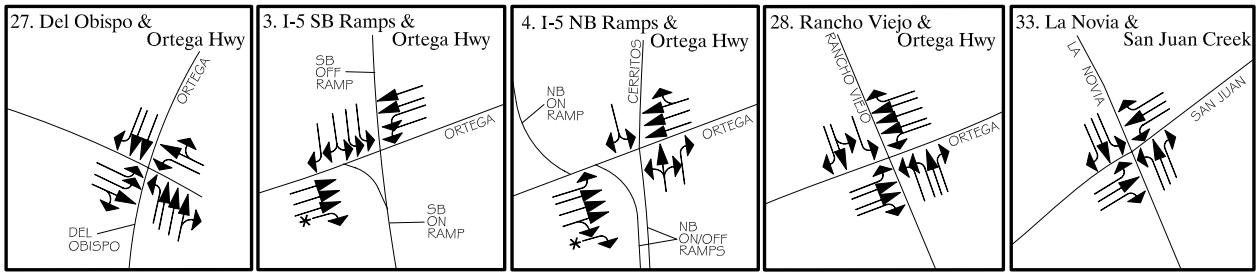
Free right-turn lane
De facto right-turn lane

Figure C-23

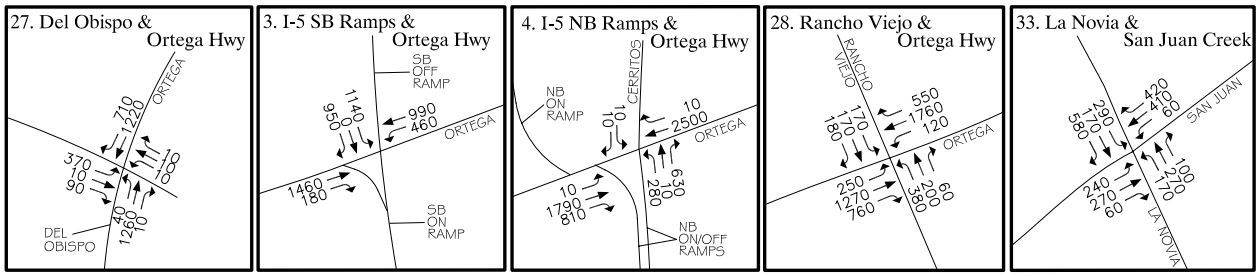
2040 BUILD LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- JUNIPERO SERRA INTERCHANGE



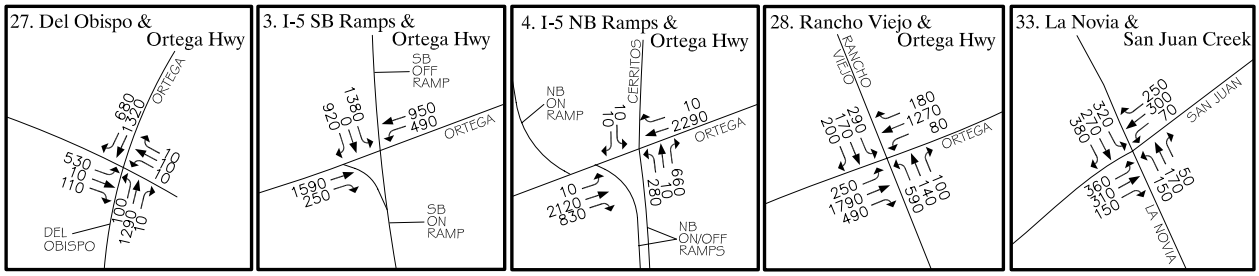
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR



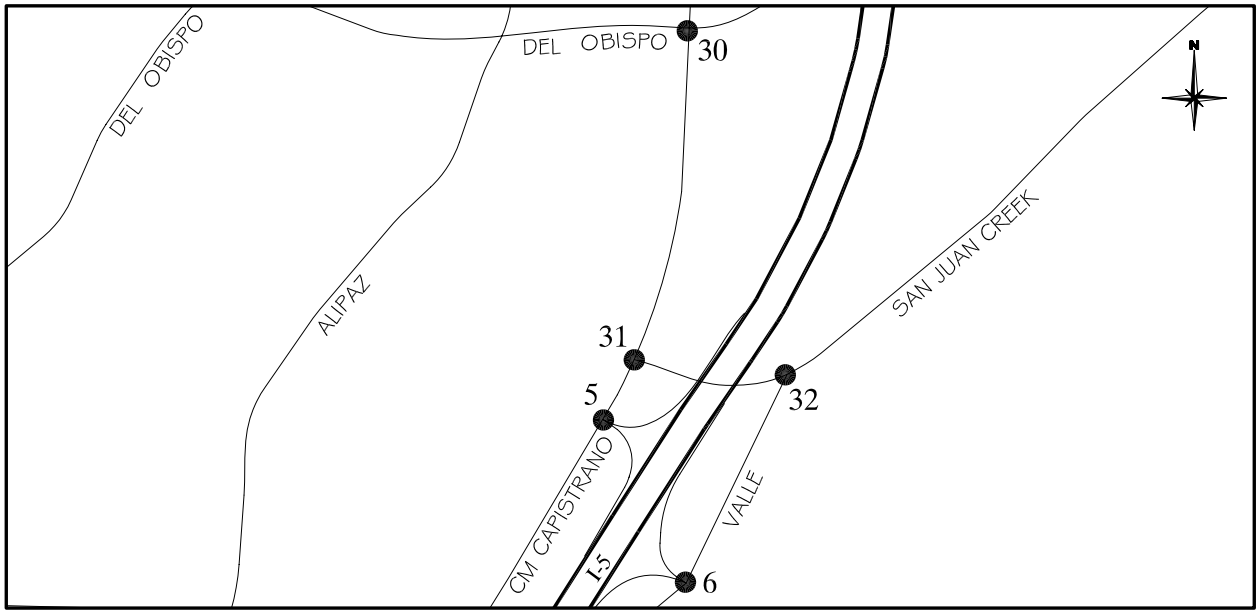
Legend

Free right-turn lane

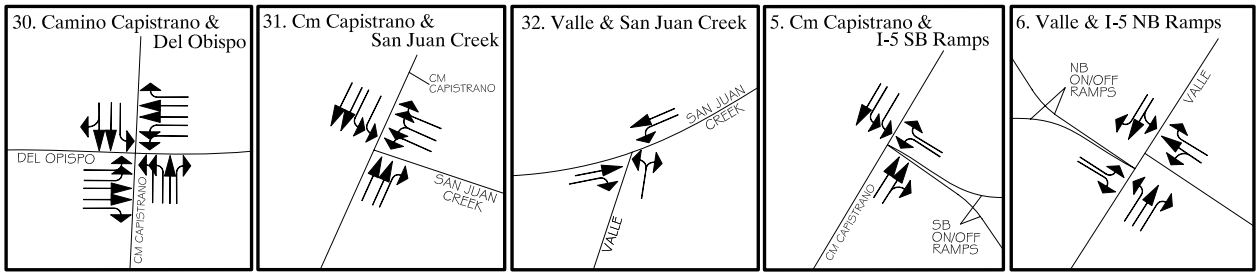
De facto right-turn lane

Figure C-24

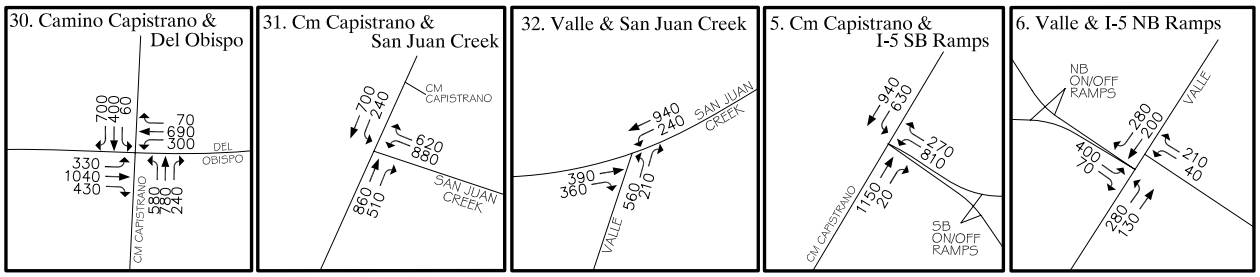
2040 BUILD LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- ORTEGA HWY INTERCHANGE



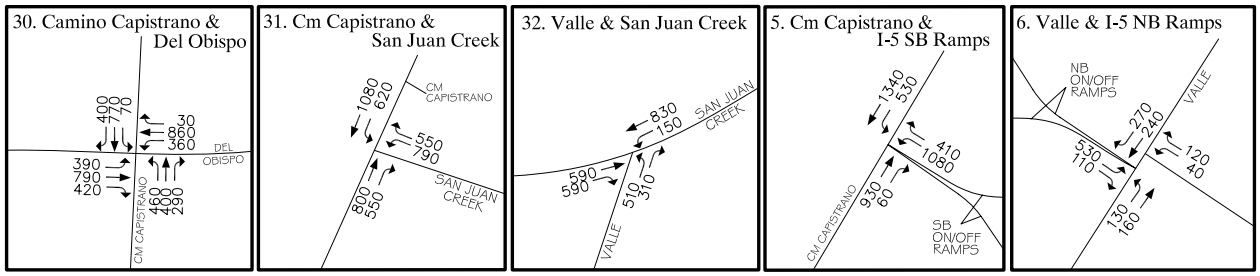
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR



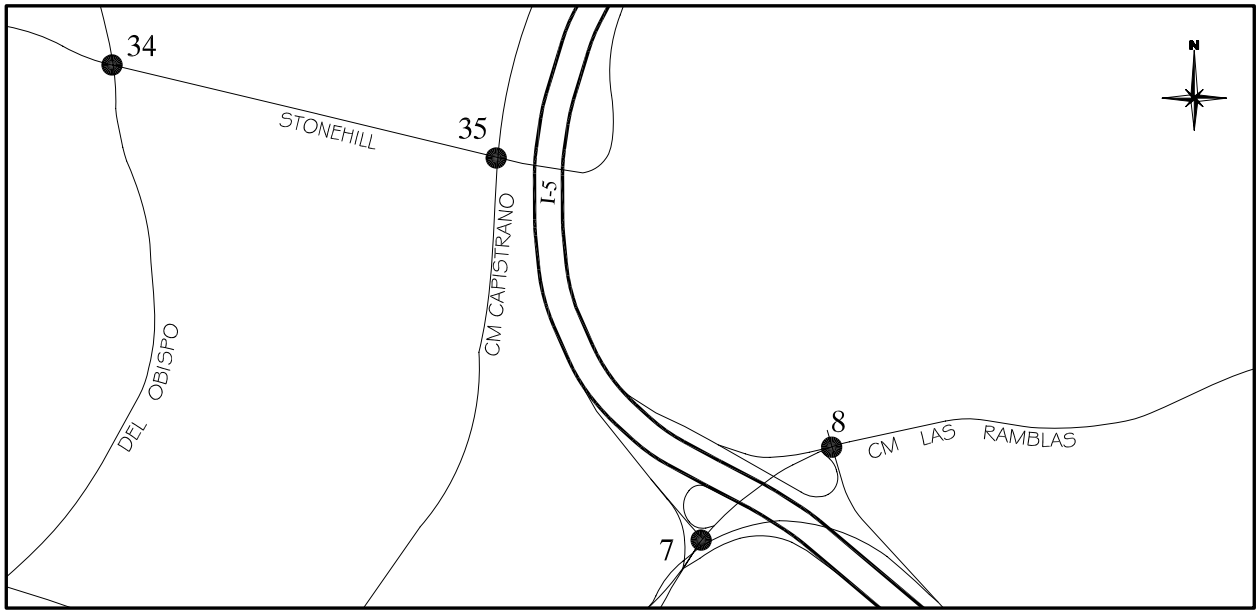
Legend

Free right-turn lane

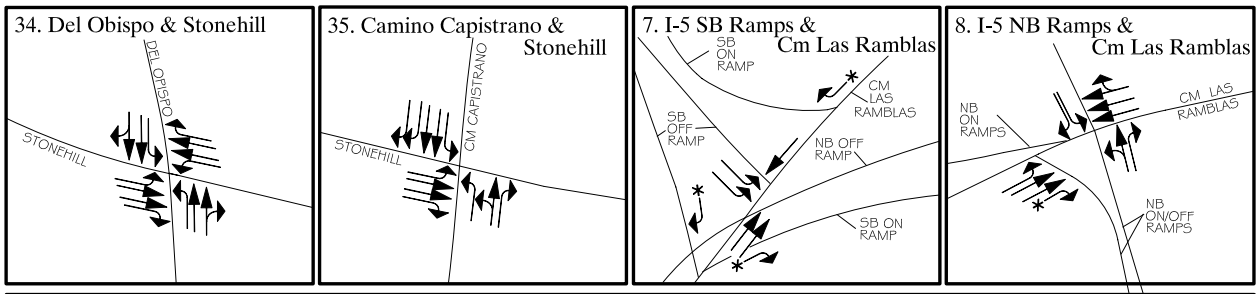
De facto right-turn lane

Figure C-25

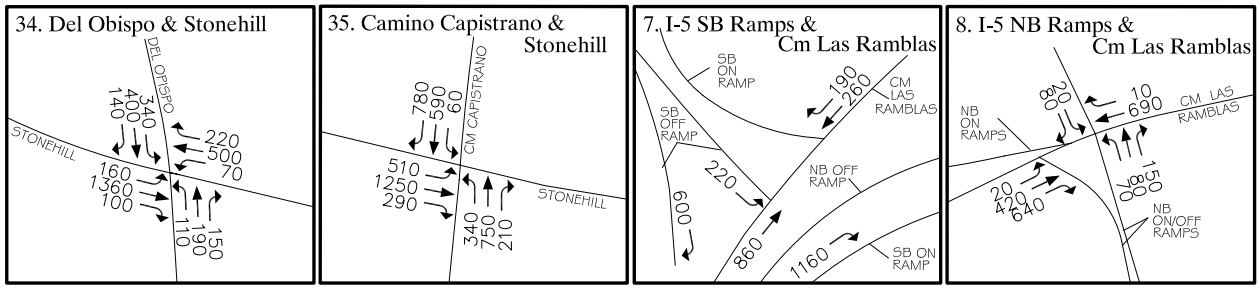
2040 BUILD LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- CAMINO CAPISTRANO/VALLE INTERCHANGE



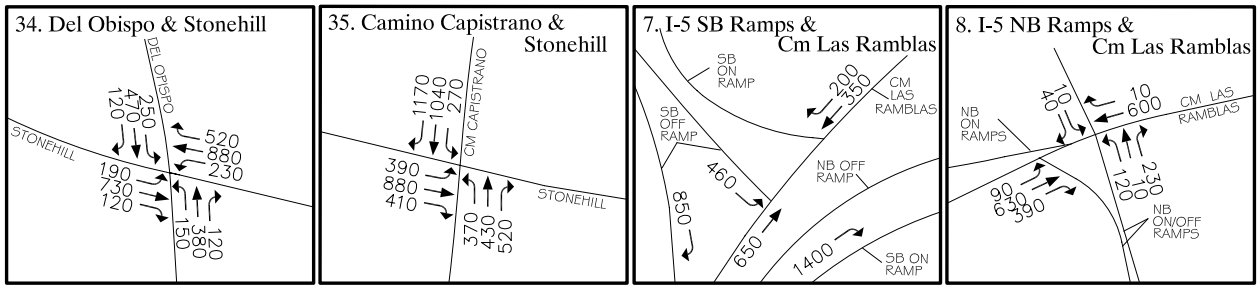
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR

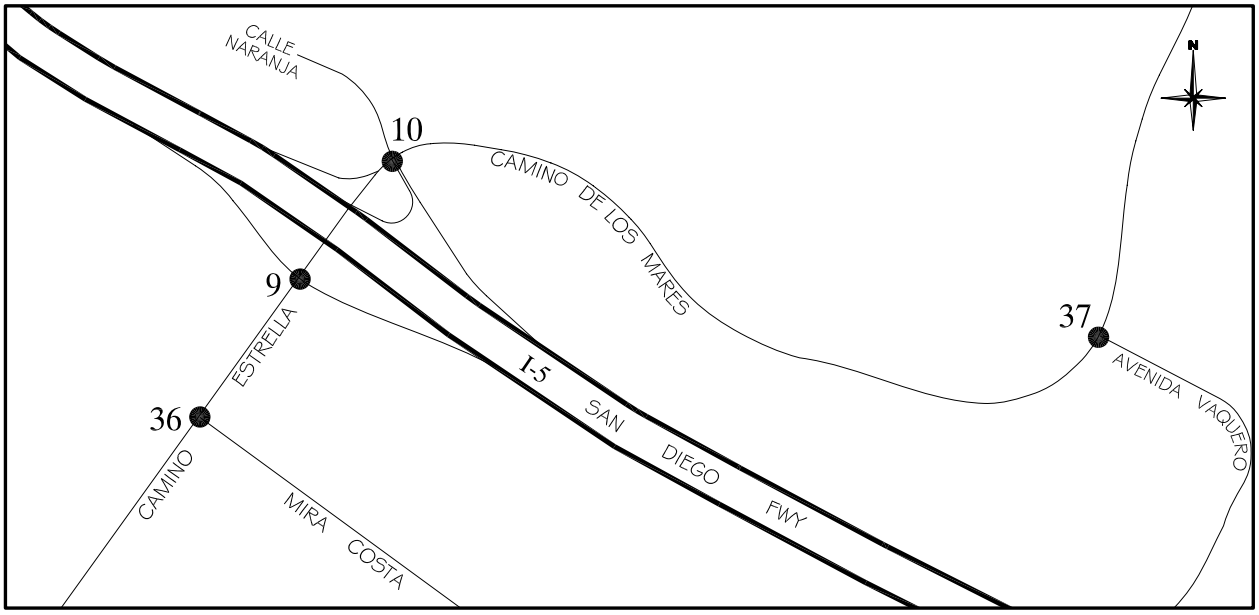


Legend

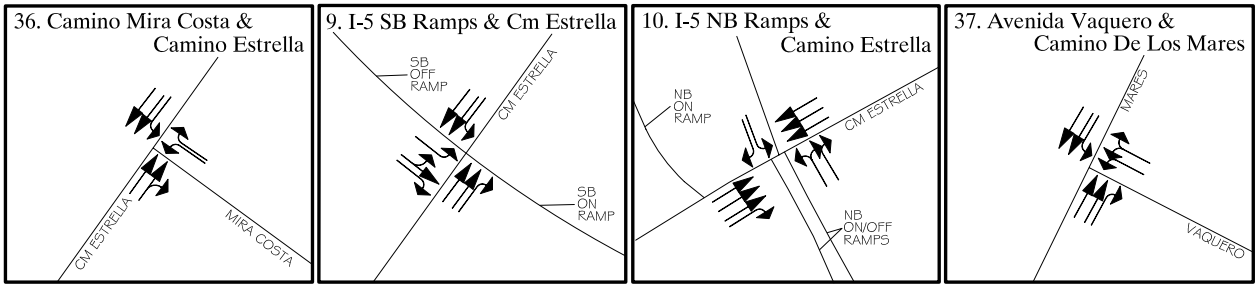
Free right-turn lane
De facto right-turn lane

Figure C-26

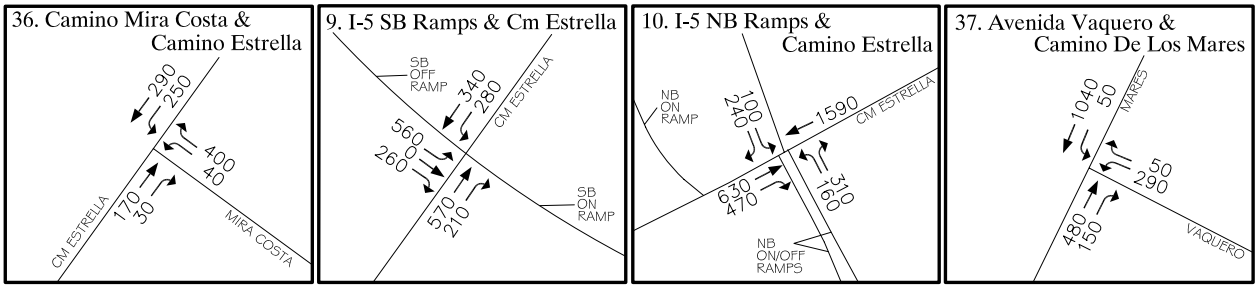
2040 BUILD LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- CAMINO LAS RAMBLAS INTERCHANGE



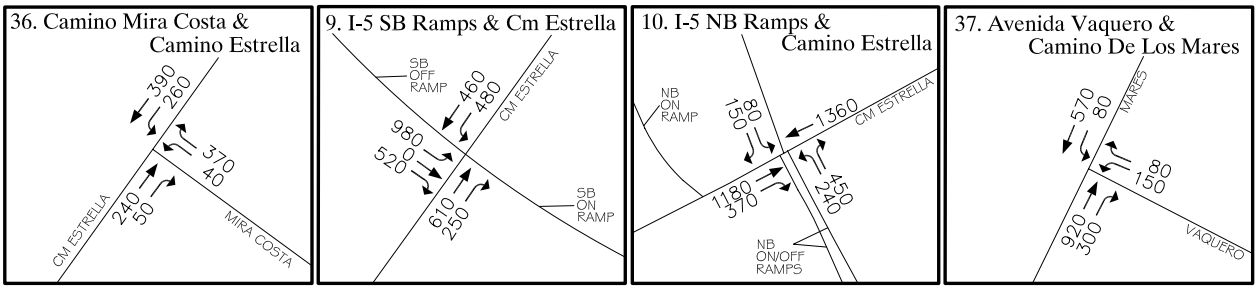
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR



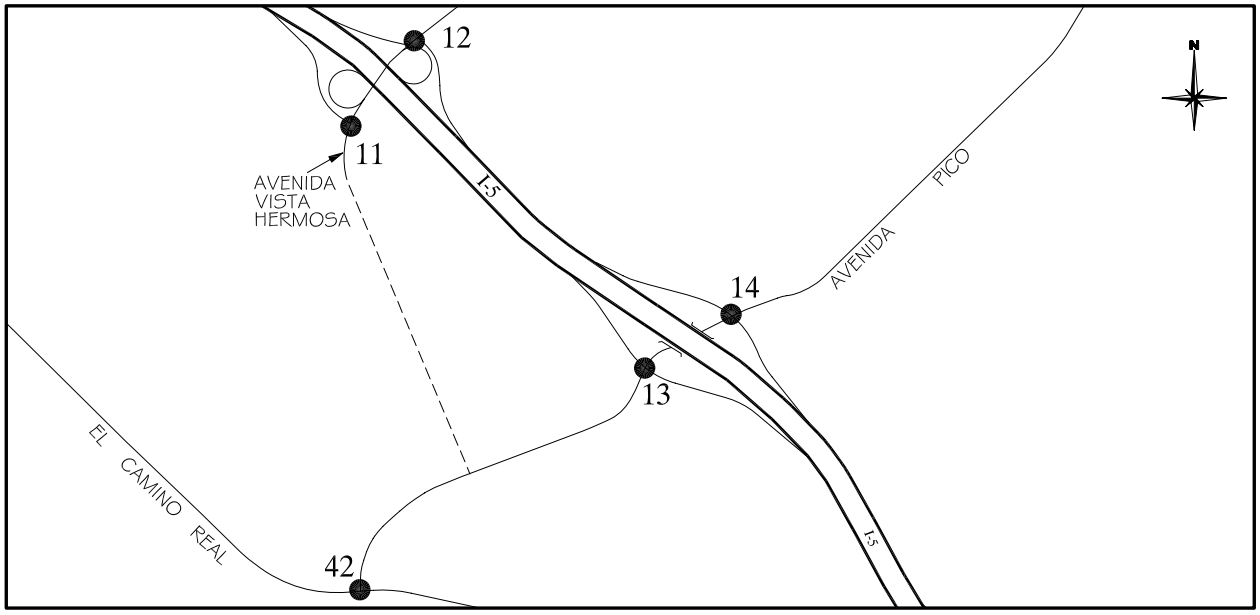
Legend

Free right-turn lane

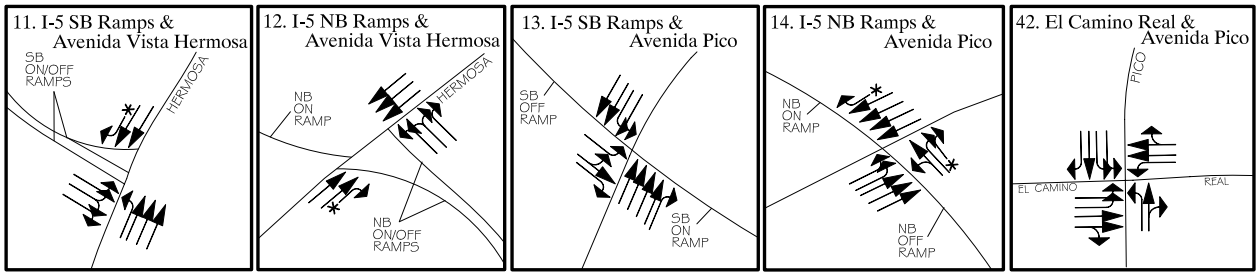
De facto right-turn lane

Figure C-27

2040 BUILD LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- CAMINO DE ESTRELLA INTERCHANGE



LANE CONFIGURATIONS



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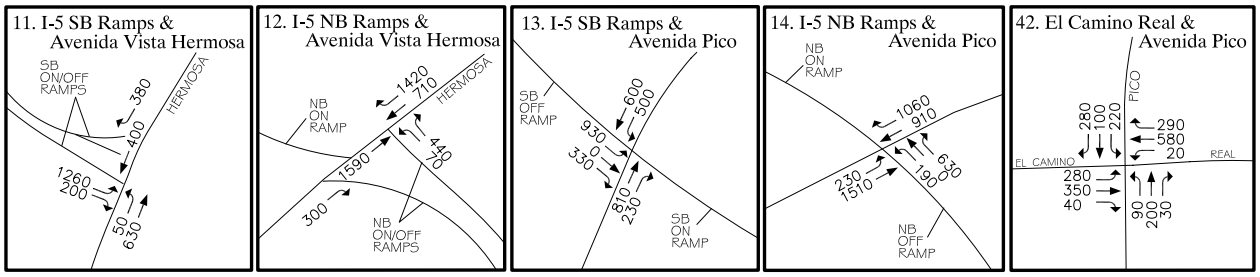
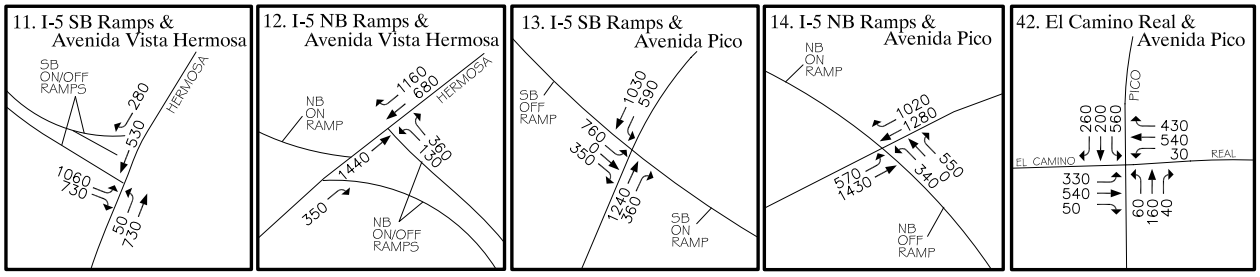


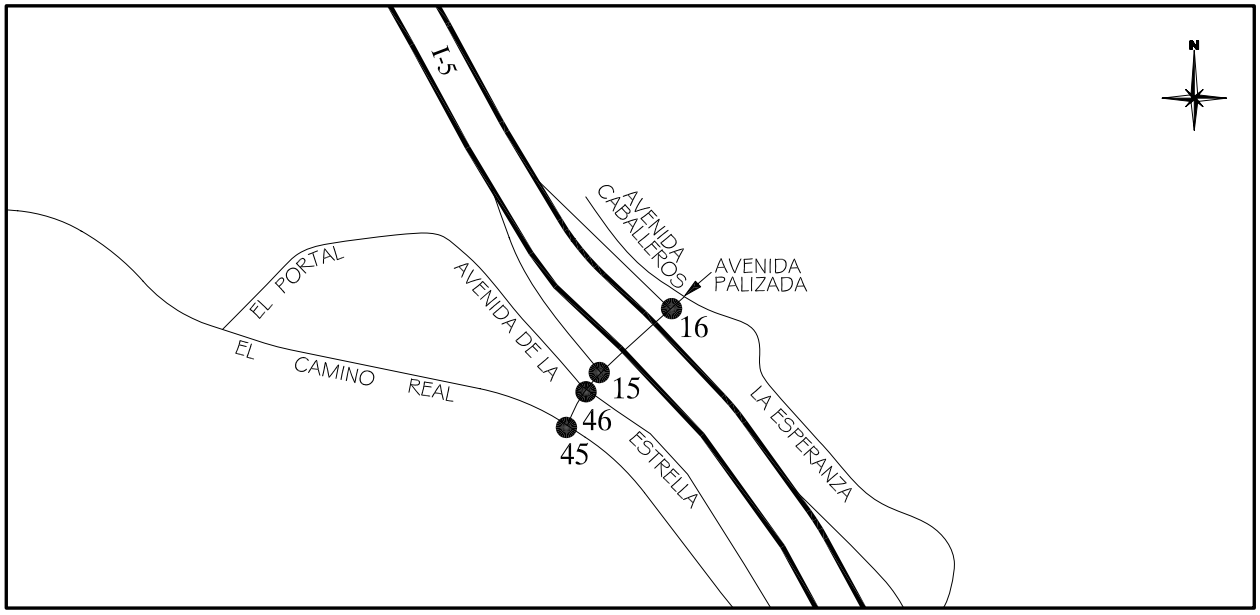
PM PEAK HOUR



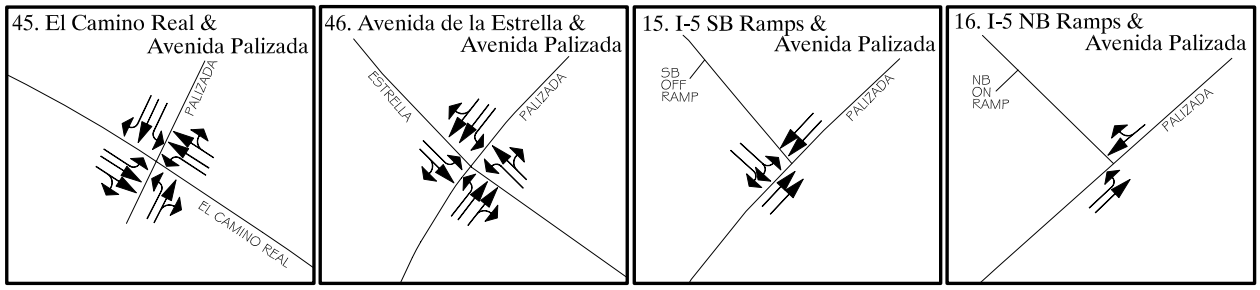
Legend

- Free right-turn lane
- De facto right-turn lane
- Future Roadway

Figure C-28
2040 BUILD LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- AVENIDA VISTA HERMOSA & AVENIDA PICO
INTERCHANGES



LANE CONFIGURATIONS



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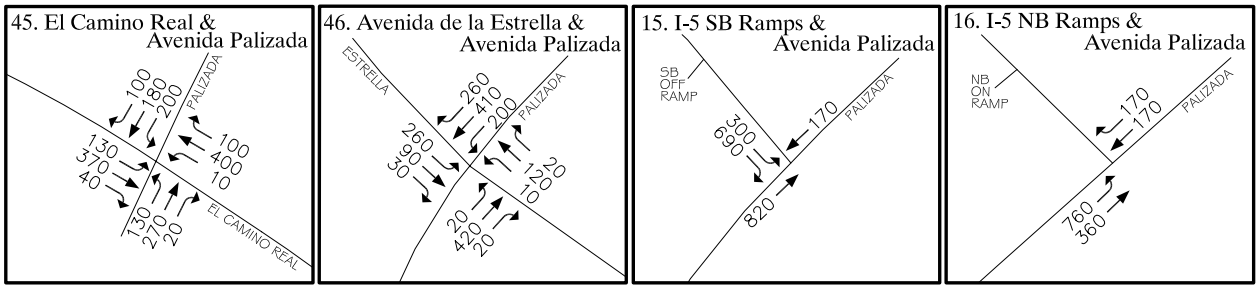
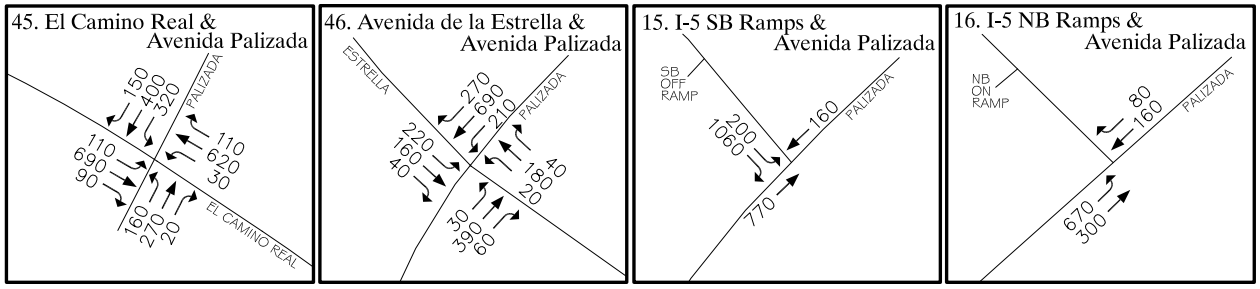


PM PEAK HOUR



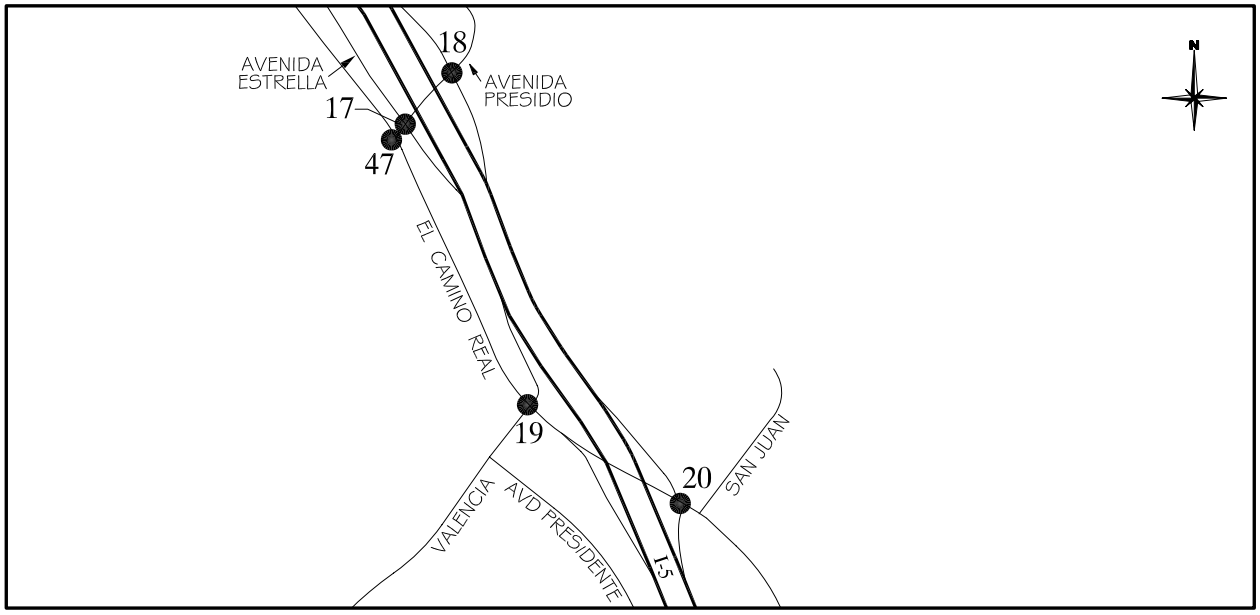
Legend

* Free right-turn lane

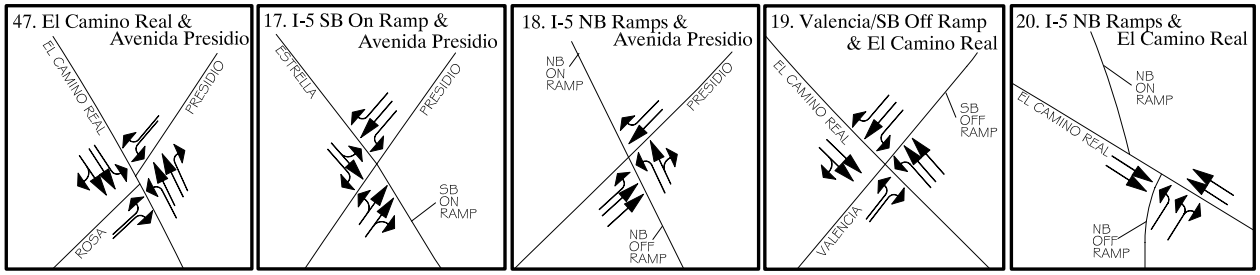
De facto right-turn lane

Figure C-29

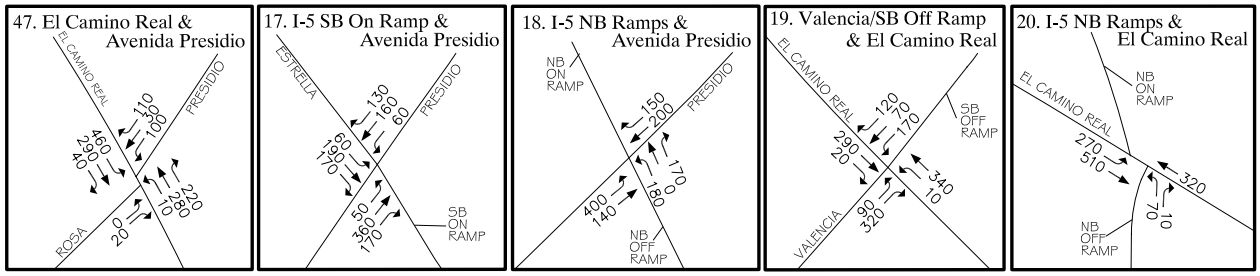
2040 BUILD LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- AVENIDA PALIZADA INTERCHANGE



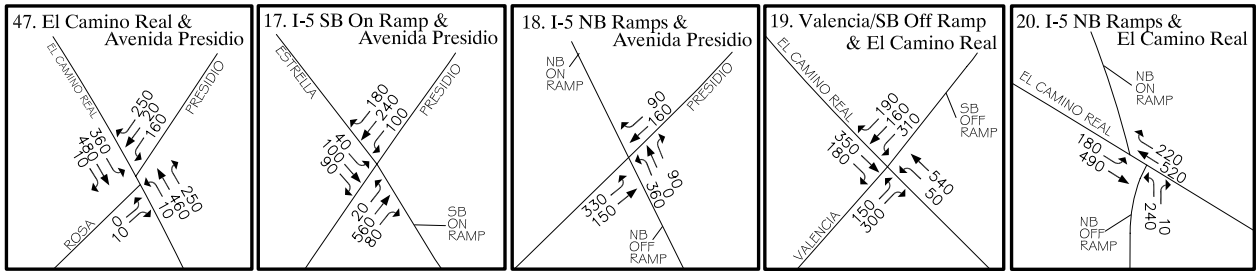
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR

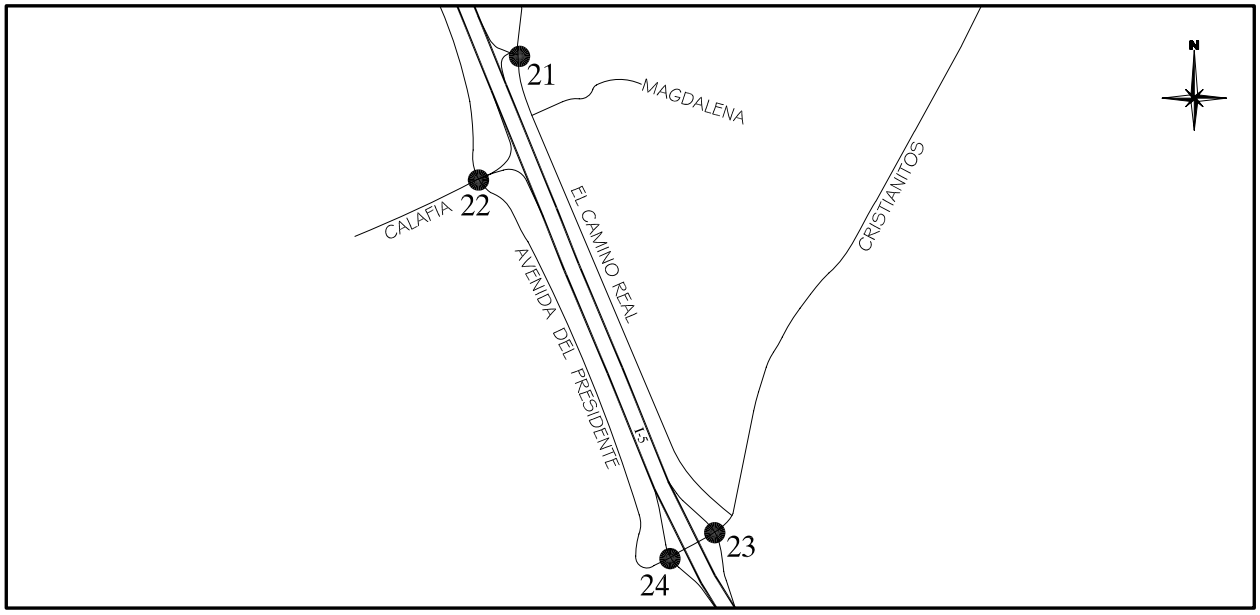


Legend

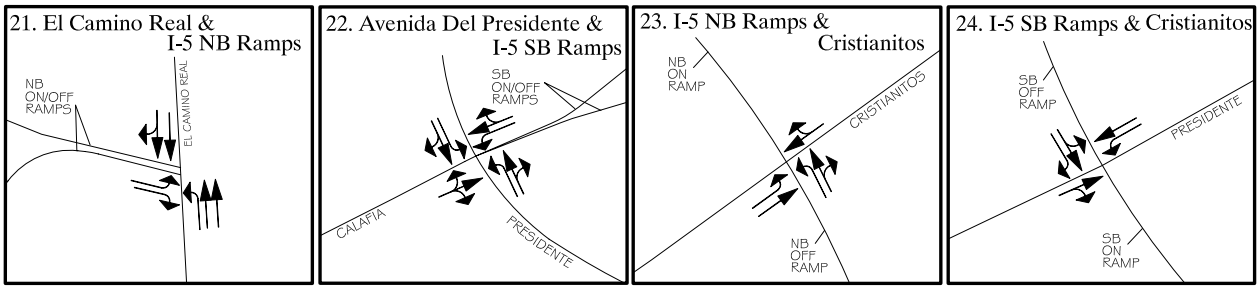
* Free right-turn lane

De facto right-turn lane

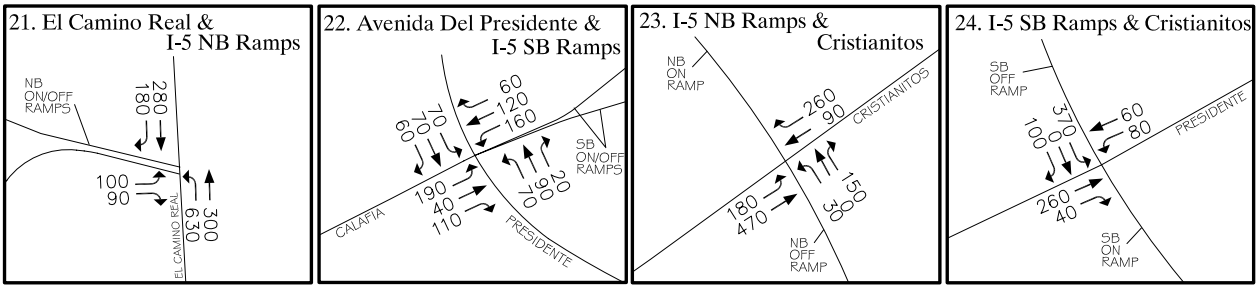
Figure C-30
2040 BUILD LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- AVENIDA PRESIDIO & EL CAMINO REAL
INTERCHANGES



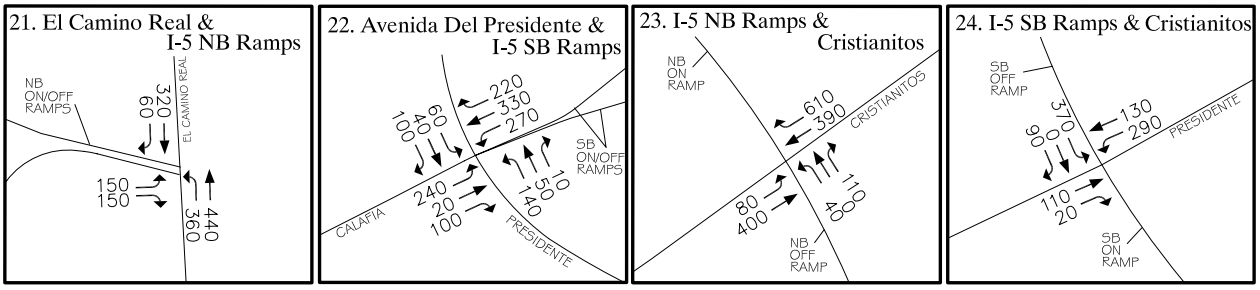
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR

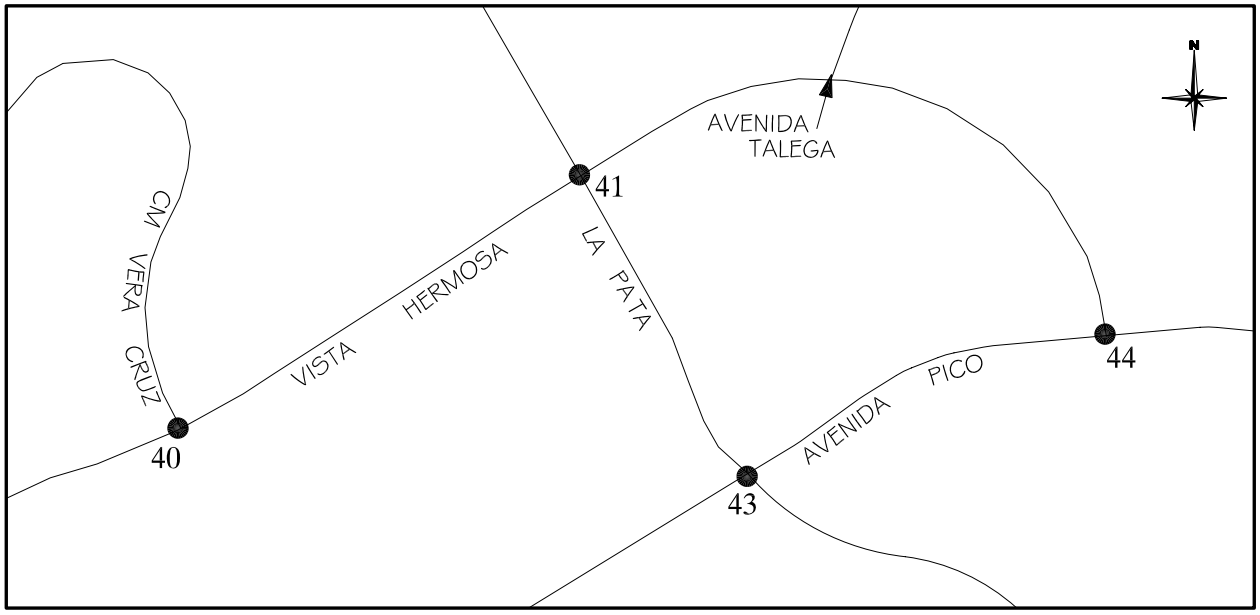


Legend

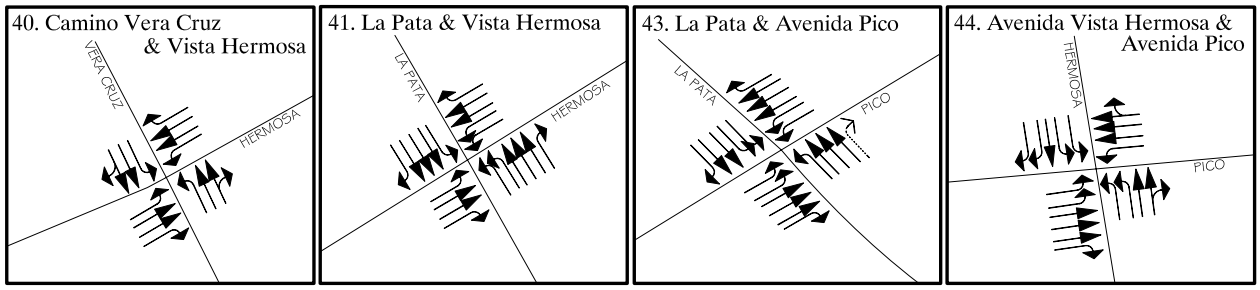
Free right-turn lane

De facto right-turn lane

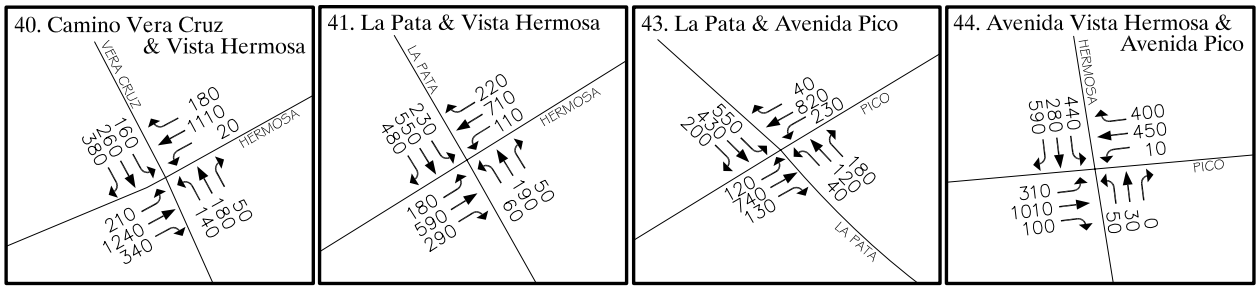
Figure C-31
2040 BUILD LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- CALAFIA/EL CAMINO REAL & CRISTIANITOS
INTERCHANGES



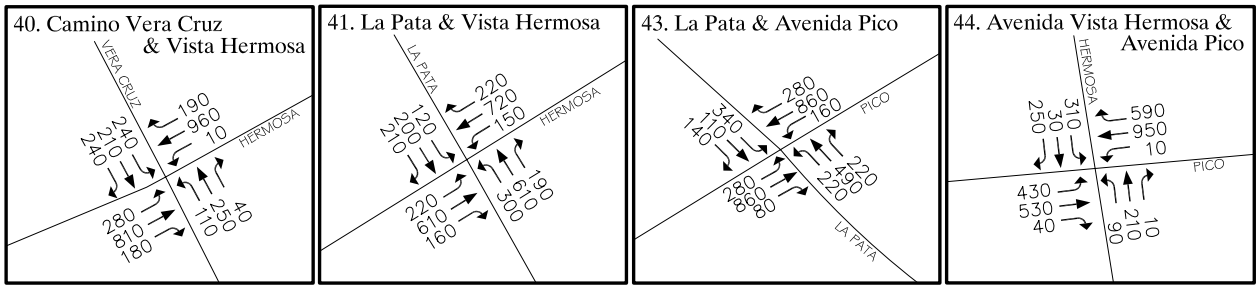
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR



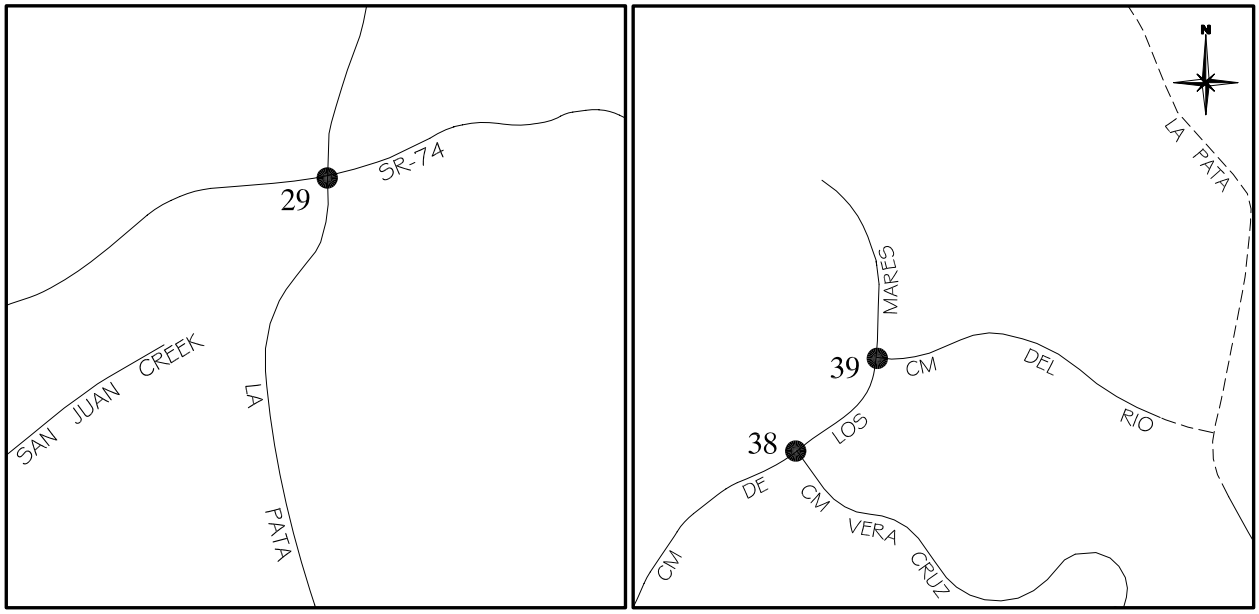
Legend

* Free right-turn lane

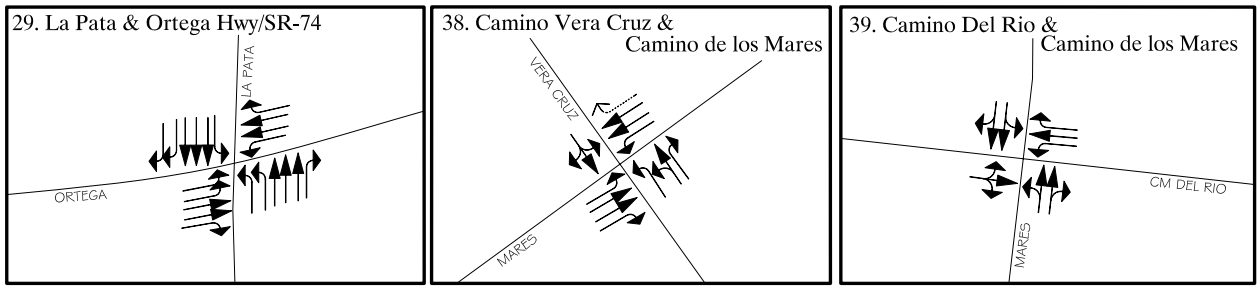
De facto right-turn lane

Figure C-32

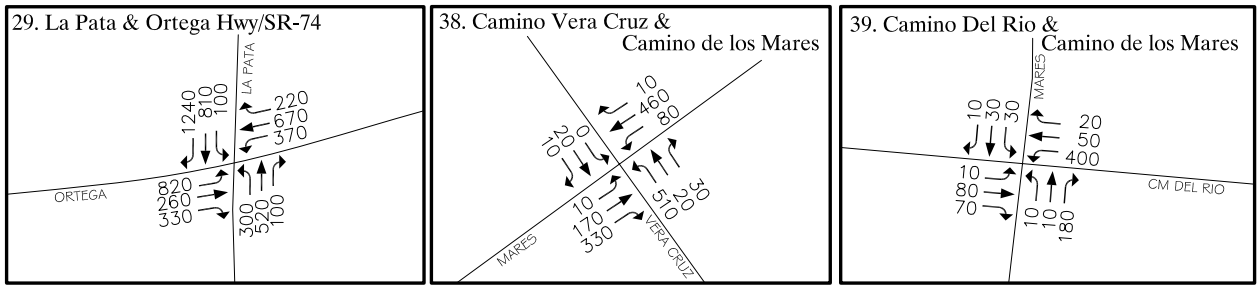
2040 BUILD LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- LOCAL INTERSECTIONS



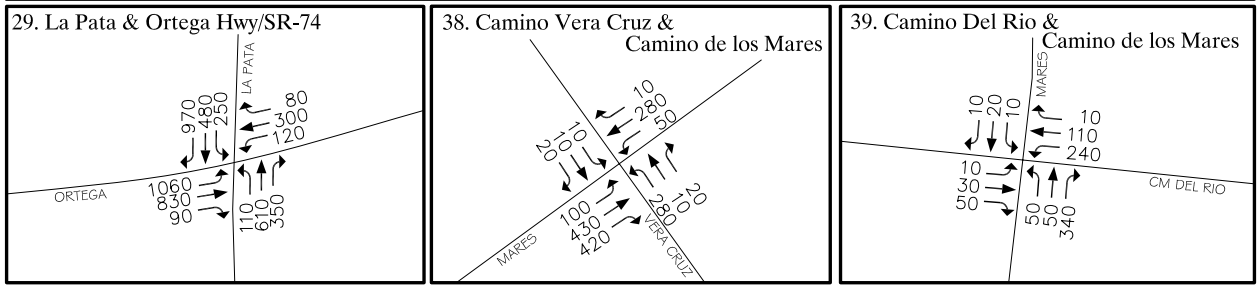
LANE CONFIGURATIONS



AM PEAK HOUR



PM PEAK HOUR



Legend

Free right-turn lane
De facto right-turn lane
Future Roadway

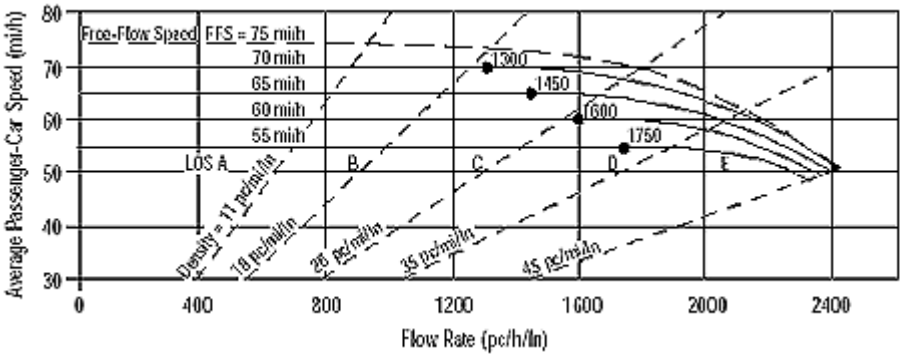
Figure C-33

2040 BUILD LANE CONFIGURATIONS
& PEAK HOUR VOLUMES
- LOCAL INTERSECTIONS

APPENDIX D

MAINLINE LOS WORKSHEETS

BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Cristianitos*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4200*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1192*	pc/h/ln
S	*70.0*	mi/h
D = v_p / S	*17.0*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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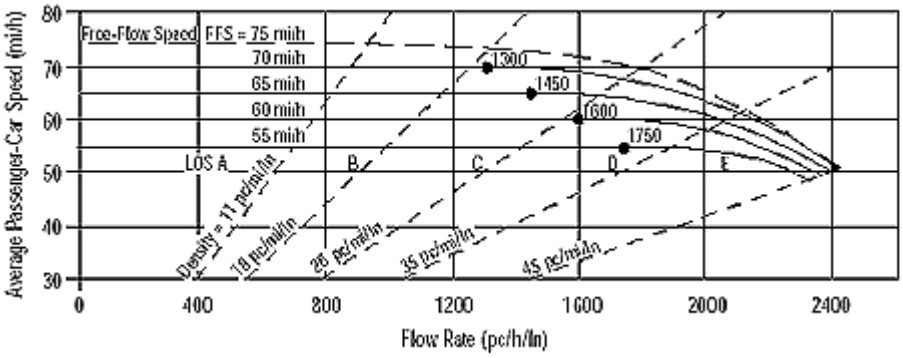
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Avd Magdalena*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4280*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1215*	pc/h/ln
S	*70.0*	mi/h
D = v_p / S	*17.4*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
S - Speed
V - Hourly volume
D - Density
v_p - Flow rate
FFS - Free-flow speed
LOS - Level of service
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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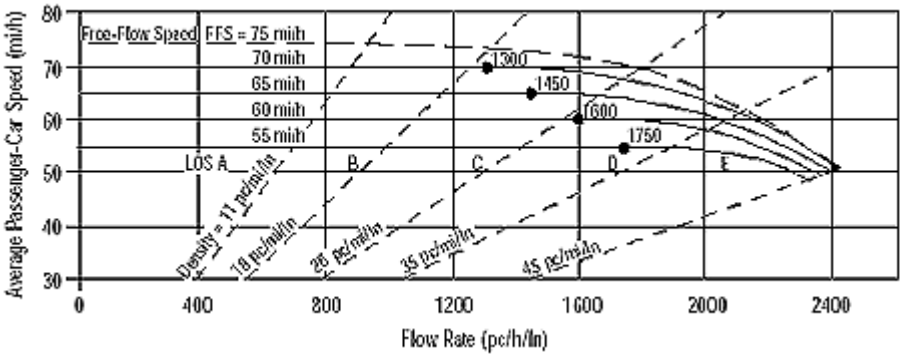

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o El Camino Real*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4590*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade 2.50% Length	*0.65mi*
Driver type adjustment	*1.00*		Up/Down %	*2.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*3.0*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1061*	pc/h/ln
S	*70.0*	mi/h
D = v_p / S	*15.2*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10
E_T - Exhibits 23-8, 23-10, 23-11
f_p - Page 23-12
LOS, S, FFS, v_p - Exhibits 23-2, 23-3
f_{LW} - Exhibit 23-4
f_{LC} - Exhibit 23-5
f_N - Exhibit 23-6
f_{ID} - Exhibit 23-7

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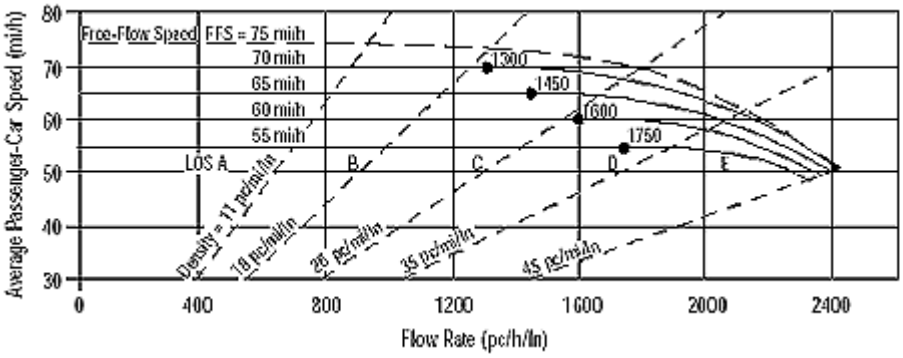

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Avd Presidio*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5040*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1145*	pc/h/ln
S	*70.0*	mi/h
D = v_p / S	*16.4*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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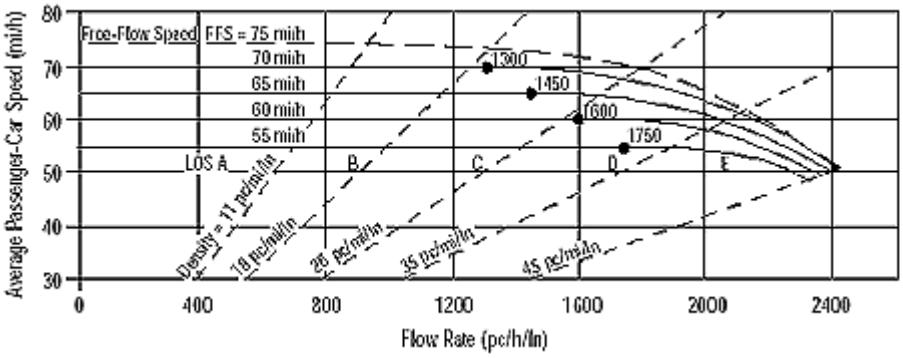

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Avd de la Paz*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5390*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1530*	pc/h/ln
S	*69.7*	mi/h
D = v_p / S	*21.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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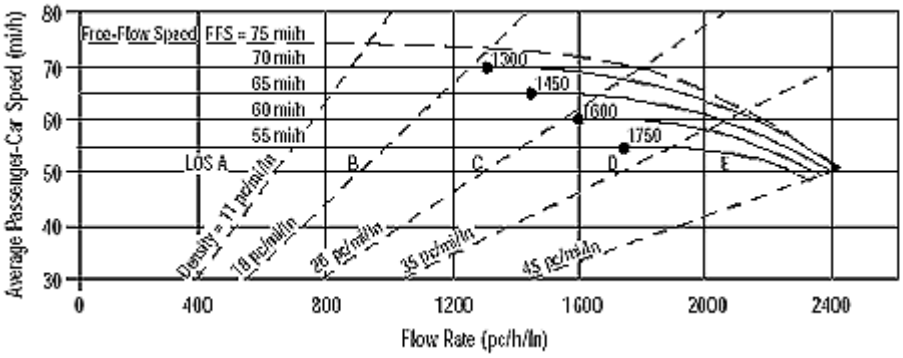

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Avd Pico*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6170*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade -3.50% Length	*0.70mi*
Driver type adjustment	*1.00*		Up/Down %	*-3.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1401*	pc/h/ln
S	*70.0*	mi/h
D = v_p / S	*20.0*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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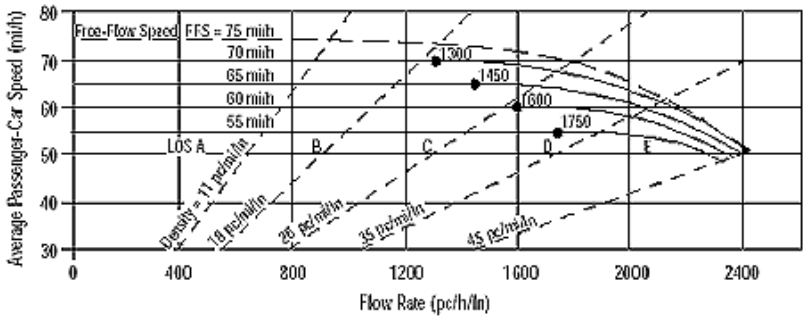

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Vista Hermosa*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6480*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*5*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1472*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*69.9*	mi/h	S	mi/h
D = v_p / S	*21.1*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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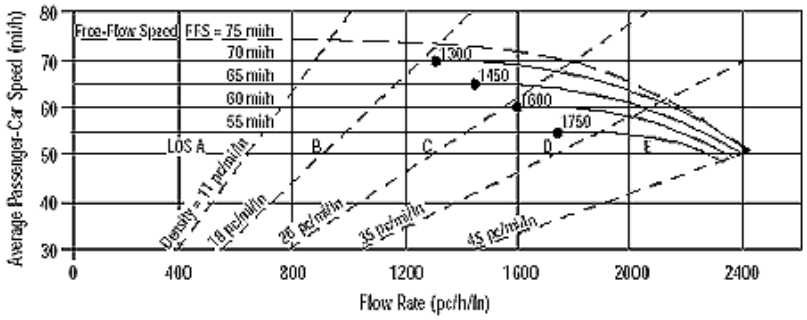

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Cm De Los Mares*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7270*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*4*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*	
Peak-Hr Direction Prop, D			General Terrain:	*Grade*	
DDHV = AADT x K x D		veh/h	Grade 2.50% Length	*0.75mi*	
Driver type adjustment	*1.00*		Up/Down %	*2.50*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*3.0*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs / Calc Speed Adj and FFS

Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2100*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*62.7*	mi/h	S	mi/h
D = v_p / S	*33.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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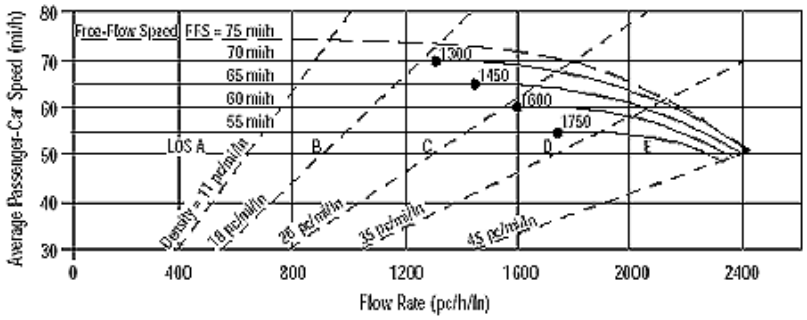

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o SR-1*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8060*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*6*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1525*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*69.7*	mi/h	S	mi/h
D = v_p / S	*21.9*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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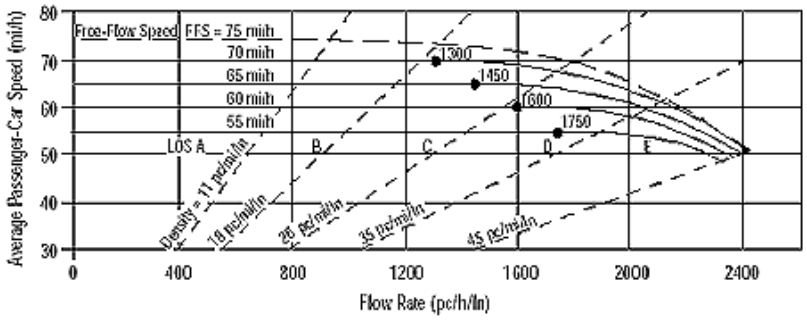

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Camino Capistrano*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6620*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1879*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*66.9*	mi/h	S		mi/h
D = v_p / S	*28.1*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*D*		Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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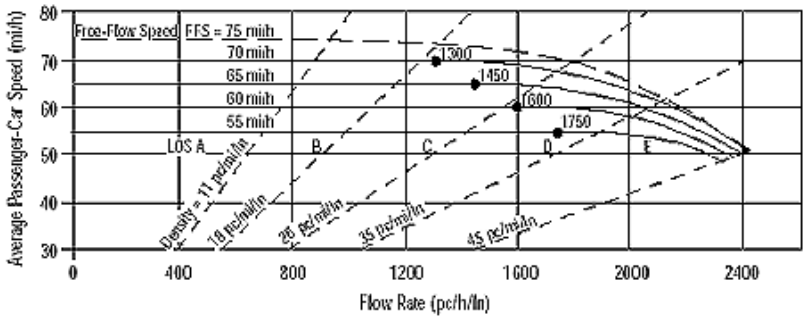

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o San Juan Creek*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*8130*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2308*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*56.7*	mi/h	S	mi/h
D = v_p / S	*40.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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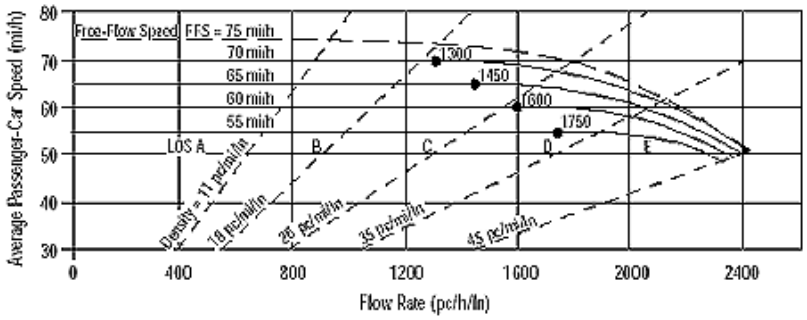

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Ortega Highway*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*8090*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2297*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*57.1*	mi/h	S	mi/h
D = v_p / S	*40.2*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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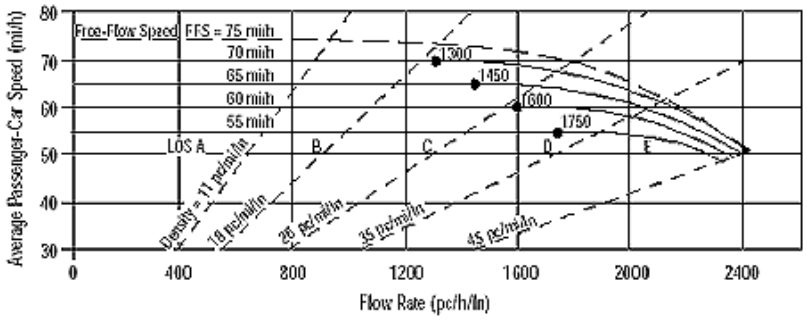

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Junipero Serra*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8770*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*4*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*	
Peak-Hr Direction Prop, D			General Terrain:	*Grade*	
DDHV = AADT x K x D		veh/h	Grade 3.00% Length	*0.35mi*	
Driver type adjustment	*1.00*		Up/Down %	*3.00*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*5*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1992*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*65.0*	mi/h	S	mi/h
D = v_p / S	*30.6*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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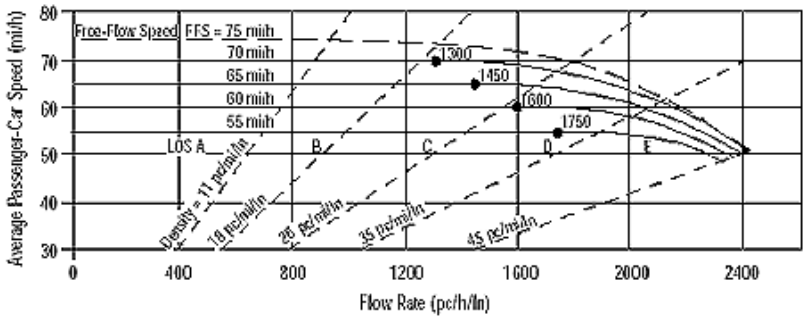

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o SR-73 Junction*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*9060*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*6*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1715*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*68.7*	mi/h	S	mi/h
D = v_p / S	*25.0*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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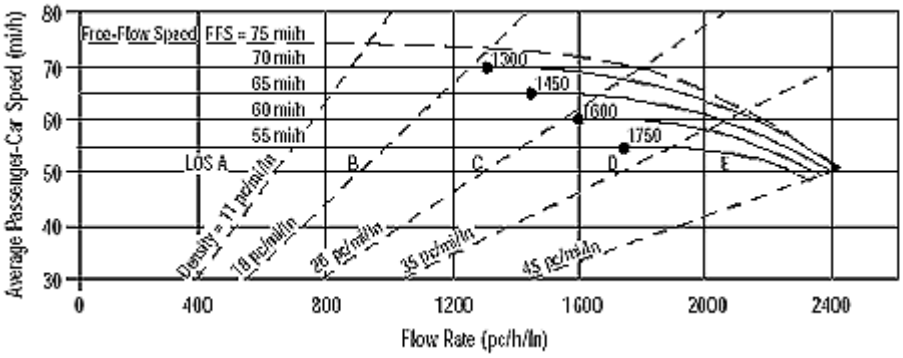

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Cristianitos*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4450*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1263*	pc/h/ln
S	*70.0*	mi/h
D = v_p / S	*18.0*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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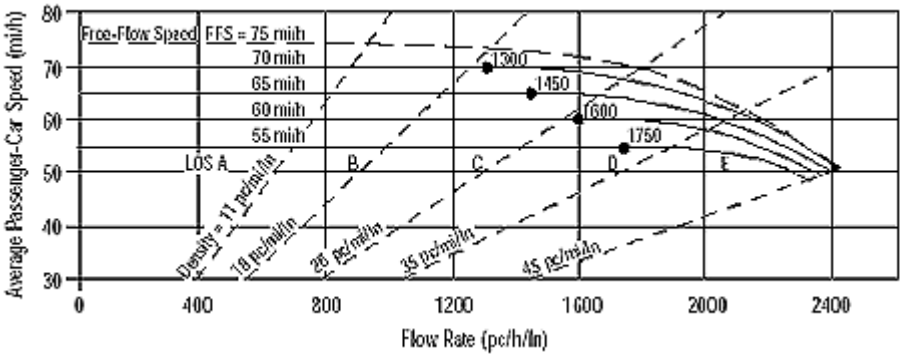

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Calafia*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4500*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1278*	pc/h/ln
S	*70.0*	mi/h
D = v_p / S	*18.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
S - Speed
V - Hourly volume
D - Density
v_p - Flow rate
FFS - Free-flow speed
LOS - Level of service
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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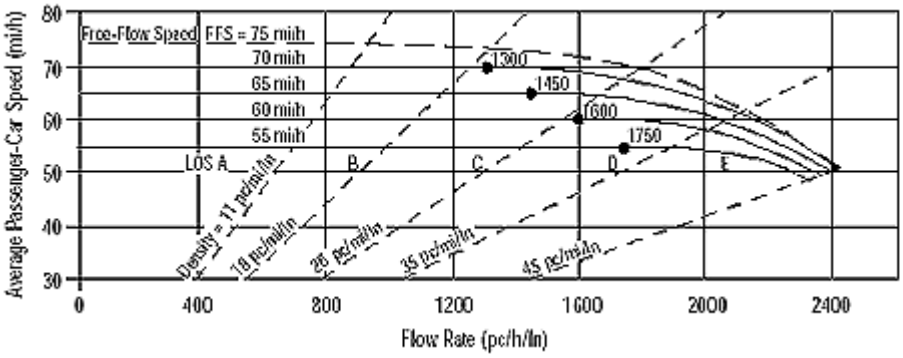

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o El Camino Real*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4670*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade -2.50% Length	*0.65mi*
Driver type adjustment	*1.00*		Up/Down %	*-2.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1061*	pc/h/ln
S	*70.0*	mi/h
D = v_p / S	*15.2*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10
E_T - Exhibits 23-8, 23-10, 23-11
f_p - Page 23-12
LOS, S, FFS, v_p - Exhibits 23-2, 23-3
f_{LW} - Exhibit 23-4
f_{LC} - Exhibit 23-5
f_N - Exhibit 23-6
f_{ID} - Exhibit 23-7

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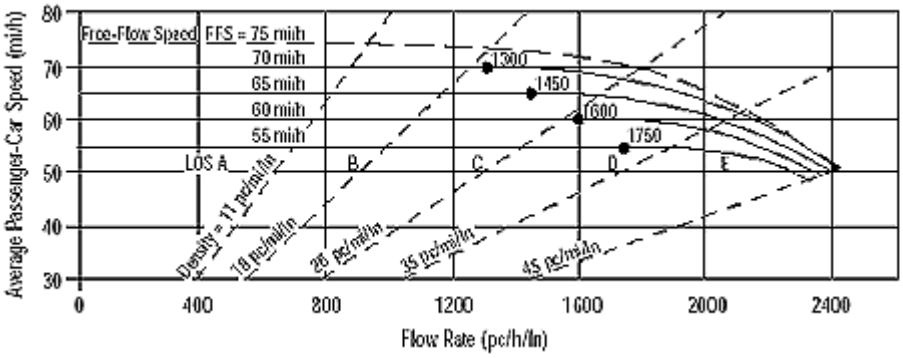

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Presidio*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5040*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1145*	pc/h/ln
S	*70.0*	mi/h
D = v_p / S	*16.4*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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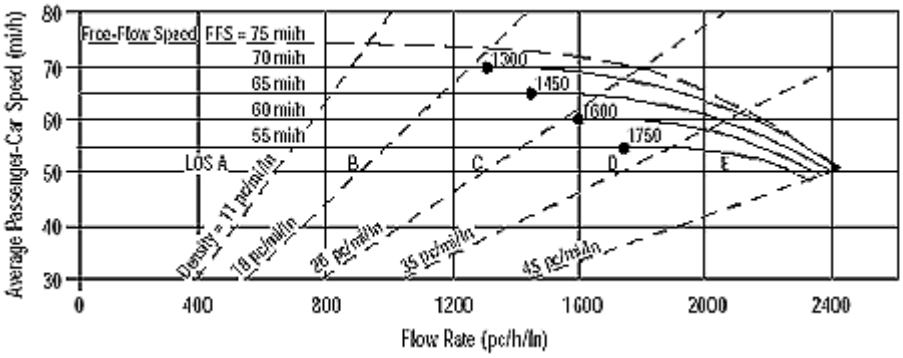

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Palizada*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4810*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1092*	pc/h/ln
S	*70.0*	mi/h
D = v_p / S	*15.6*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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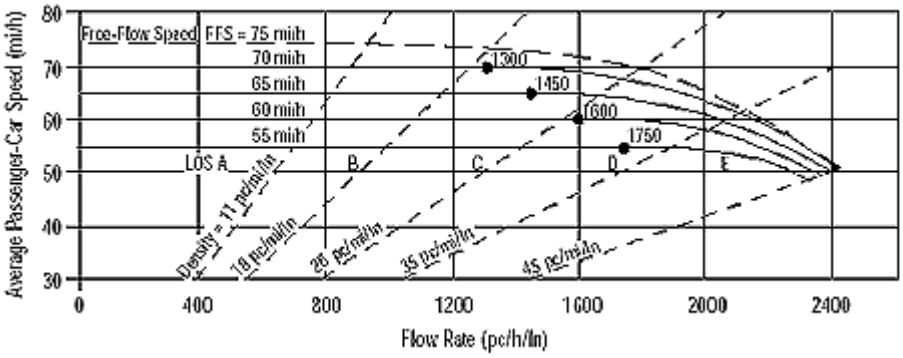

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Pico*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5620*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade 3.50% Length	*0.70mi*
Driver type adjustment	*1.00*		Up/Down %	*3.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*3.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.926*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*6*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1124*	pc/h/ln
S	*70.0*	mi/h
D = v_p / S	*16.1*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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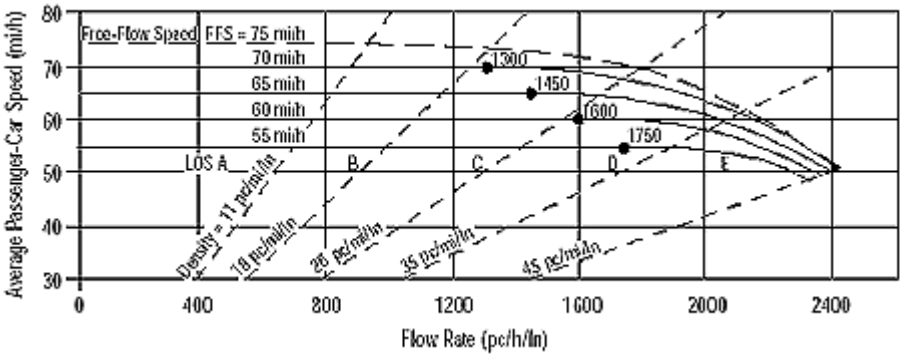

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Vista Hermosa*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6070*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1379*	pc/h/ln
S	*70.0*	mi/h
D = v_p / S	*19.7*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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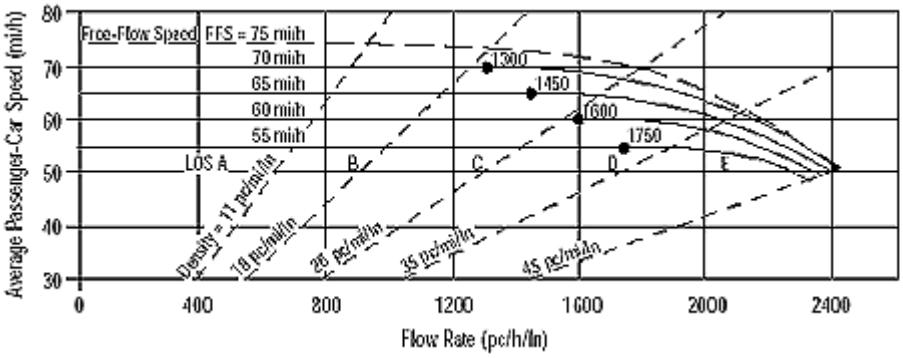

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Cm De Estrella*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6510*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade -2.50% Length	*0.75mi*
Driver type adjustment	*1.00*		Up/Down %	*-2.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1848*	pc/h/ln
S	*67.3*	mi/h
D = v_p / S	*27.5*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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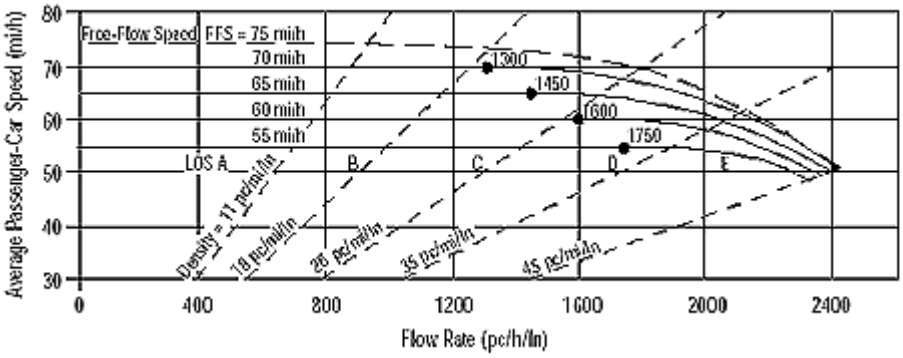

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o SR-1*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6770*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1538*	pc/h/ln
S	*69.7*	mi/h
D = v_p / S	*22.1*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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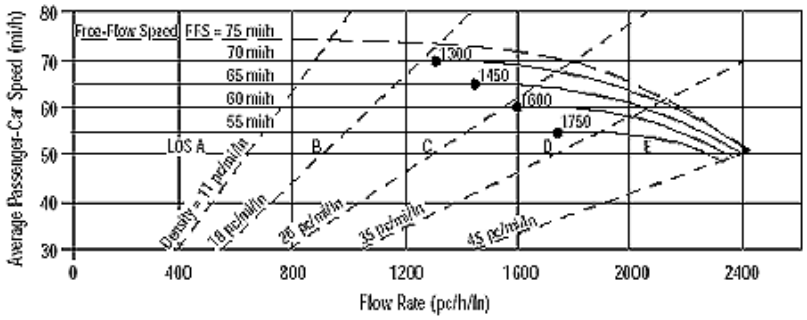

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

General Information		Site Information	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Southbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Camino Capistrano*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6520*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Speed Inputs			Calc Speed Adj and FFS		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*6*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1234*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*70.0*	mi/h	S		mi/h
D = v_p / S	*17.6*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*B*		Required Number of Lanes, N		

Glossary / Factor Location

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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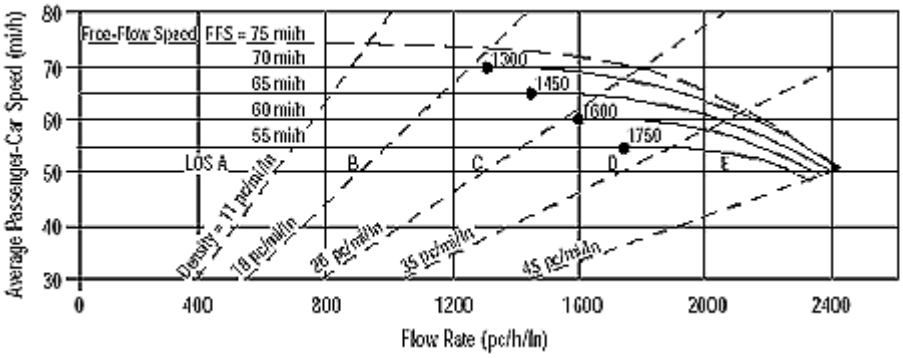

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o San Juan Creek*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6520*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1481*	pc/h/ln
S	*69.8*	mi/h
D = v_p / S	*21.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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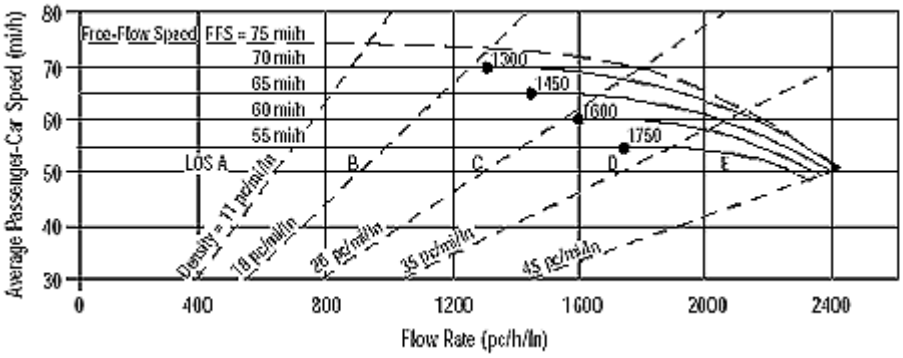

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Ortega Highway*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5700*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1618*	pc/h/ln
S	*69.3*	mi/h
D = v_p / S	*23.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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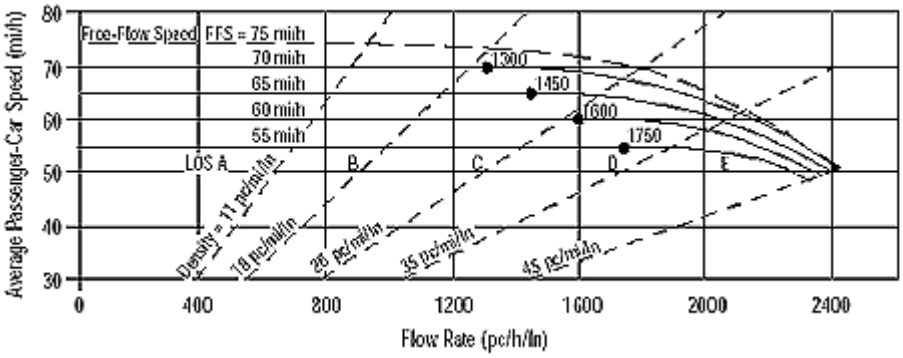

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Junipero Serra*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6520*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade -3.00% Length	*0.35mi*
Driver type adjustment	*1.00*		Up/Down %	*-3.00*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1481*	pc/h/ln
S	*69.8*	mi/h
D = v_p / S	*21.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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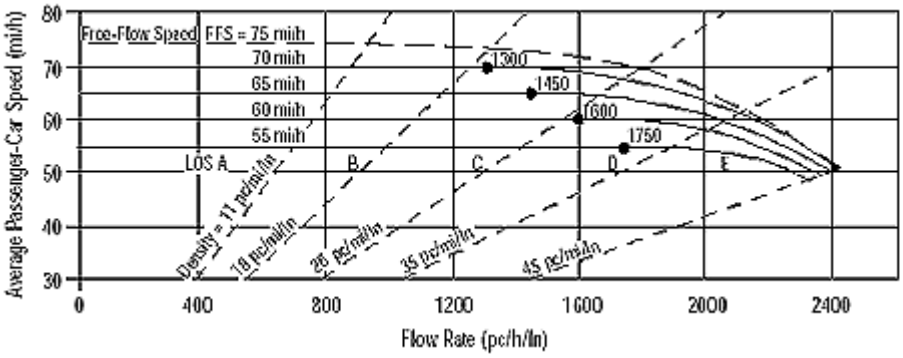
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o SR-73 Junction*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6800*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*6*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1287*	pc/h/ln
S	*70.0*	mi/h
D = v_p / S	*18.4*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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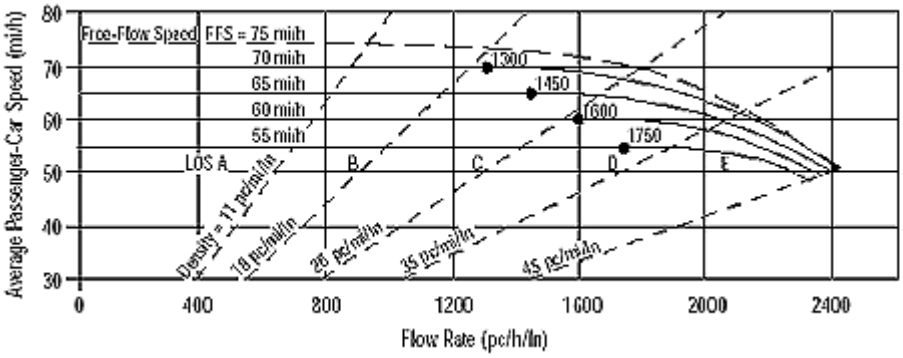

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Cristianitos*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4400*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1249*	pc/h/ln
S	*70.0*	mi/h
D = v_p / S	*17.8*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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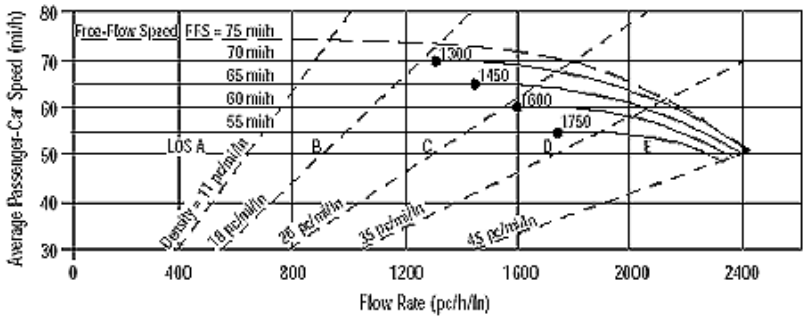

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

General Information		Site Information	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Avd Magdalena*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4450*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Speed Inputs			Calc Speed Adj and FFS		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1263*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*70.0*	mi/h	S	mi/h
D = v_p / S	*18.0*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary / Factor Location

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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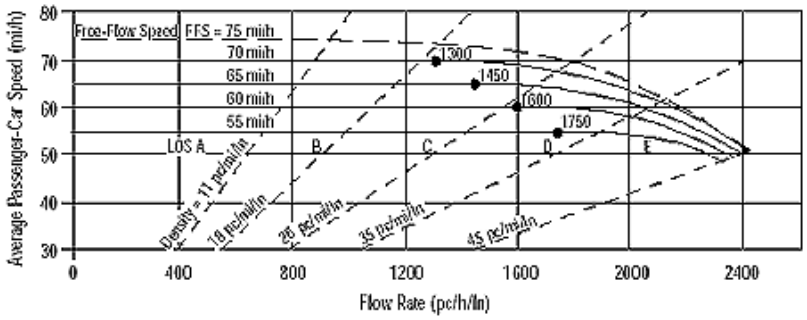

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o El Camino Real*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4720*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*4*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*	
Peak-Hr Direction Prop, D			General Terrain:	*Grade*	
DDHV = AADT x K x D		veh/h	Grade 2.50% Length	*0.65mi*	
Driver type adjustment	*1.00*		Up/Down %	*2.50*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*3.0*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1091*	pc/h/ln
S	*70.0*	mi/h
D = v_p / S	*15.6*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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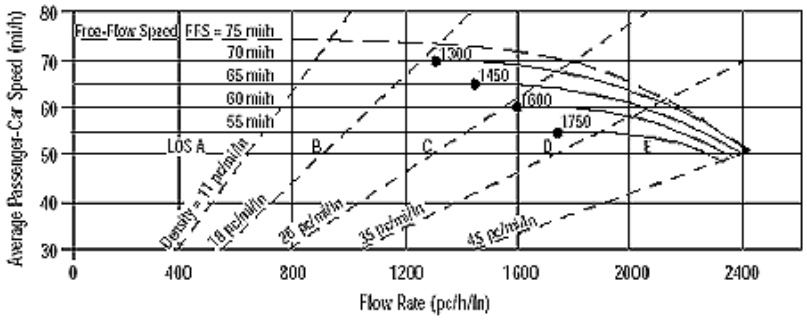

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Avd Presidio*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*5140*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*5*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1167*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*70.0*	mi/h	S	mi/h
D = v_p / S	*16.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*B*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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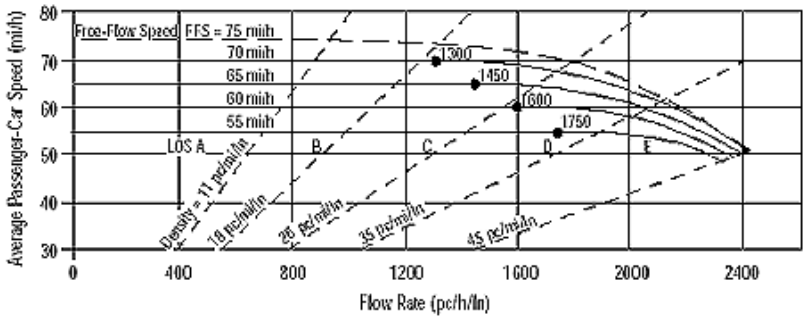

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

General Information		Site Information	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Avd de la Paz*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5330*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Speed Inputs			Calc Speed Adj and FFS		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1513*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*69.8*	mi/h	S		mi/h
D = v_p / S	*21.7*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*C*		Required Number of Lanes, N		

Glossary / Factor Location

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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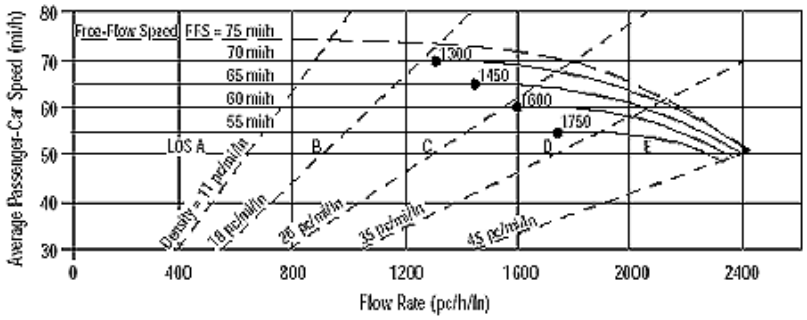

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Avd Pico*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6030*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*4*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*	
Peak-Hr Direction Prop, D			General Terrain:	*Grade*	
DDHV = AADT x K x D		veh/h	Grade -3.50% Length	*0.70mi*	
Driver type adjustment	*1.00*		Up/Down %	*-3.50*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*5*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1369*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*70.0*	mi/h	S	mi/h
D = v_p / S	*19.6*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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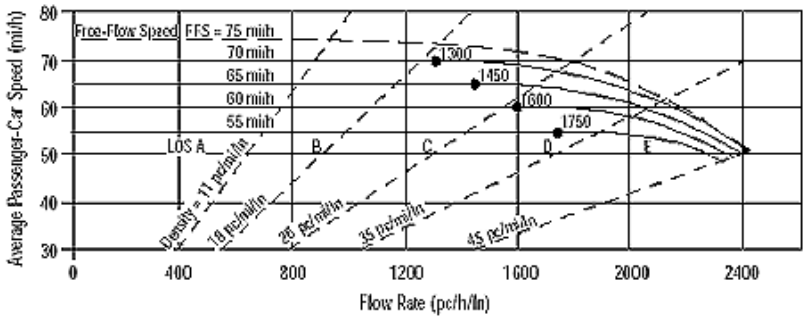

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Vista Hermosa*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6640*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*5*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1508*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*69.8*	mi/h	S	mi/h
D = v_p / S	*21.6*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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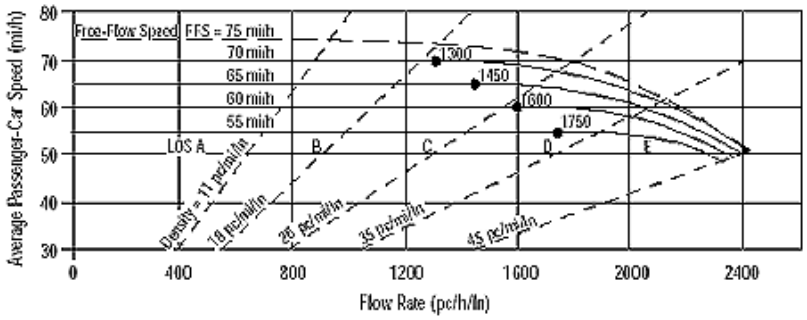

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Cm De Los Mares*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7130*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*4*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*	
Peak-Hr Direction Prop, D			General Terrain:	*Grade*	
DDHV = AADT x K x D		veh/h	Grade 2.50% Length	*0.75mi*	
Driver type adjustment	*1.00*		Up/Down %	*2.50*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*3.0*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs / Calc Speed Adj and FFS

Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2060*	pc/h/ln	Design LOS	
S	*63.6*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*32.4*	pc/mi/ln	S	mi/h
LOS	*D*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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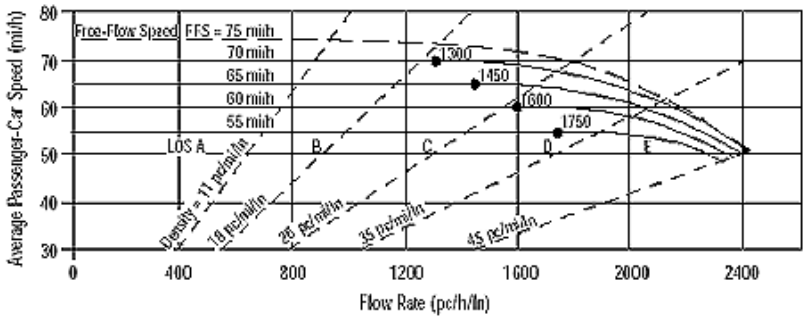

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

General Information		Site Information	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o SR-1*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7700*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Speed Inputs			Calc Speed Adj and FFS		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*6*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1457*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*69.9*	mi/h	S	mi/h
D = v_p / S	*20.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary / Factor Location

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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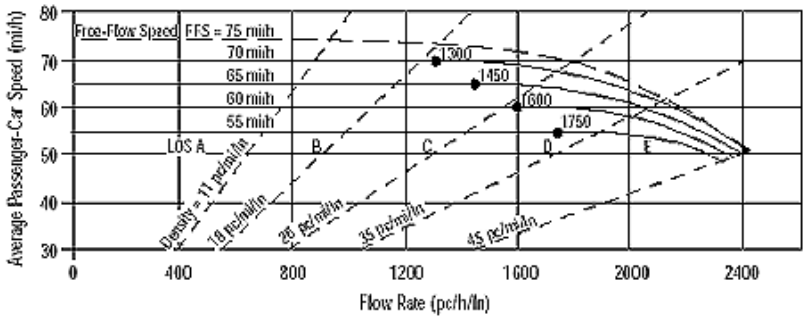

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Camino Capistrano*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5820*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1652*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*69.1*	mi/h	S		mi/h
D = v_p / S	*23.9*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*C*		Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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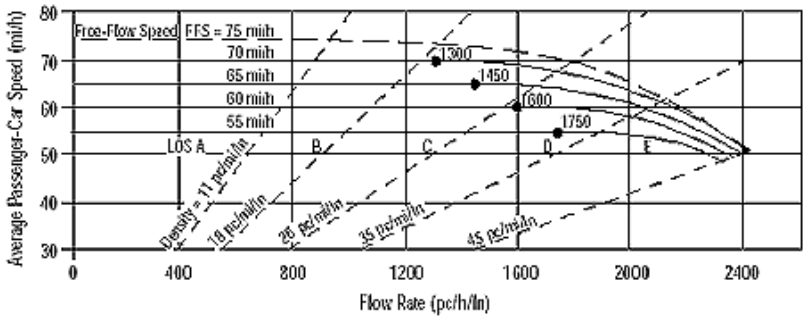

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o San Juan Creek*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*6860*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1947*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*65.8*	mi/h	S	mi/h
D = v_p / S	*29.6*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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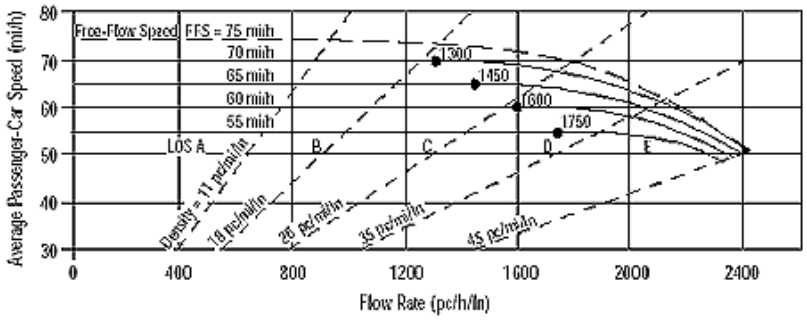

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Ortega Highway*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*6860*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1947*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*65.8*	mi/h	S	mi/h
D = v_p / S	*29.6*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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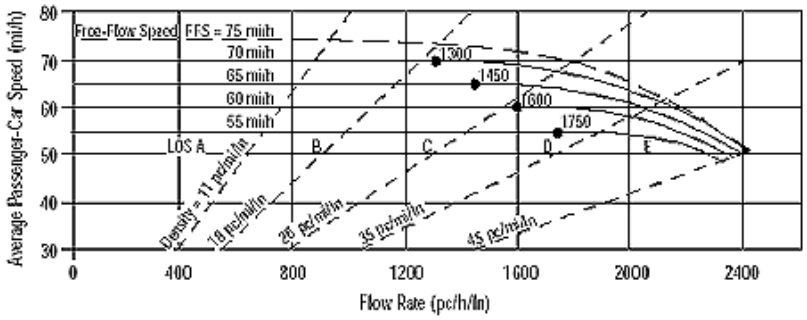
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

General Information		Site Information	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Junipero Serra*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7420*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*4*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*	
Peak-Hr Direction Prop, D			General Terrain:	*Grade*	
DDHV = AADT x K x D		veh/h	Grade 3.00% Length	*0.35mi*	
Driver type adjustment	*1.00*		Up/Down %	*3.00*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Speed Inputs			Calc Speed Adj and FFS		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*5*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1685*	pc/h/ln	Design LOS		
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*68.9*	mi/h	S		mi/h
D = v_p / S	*24.5*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*C*		Required Number of Lanes, N		

Glossary / Factor Location

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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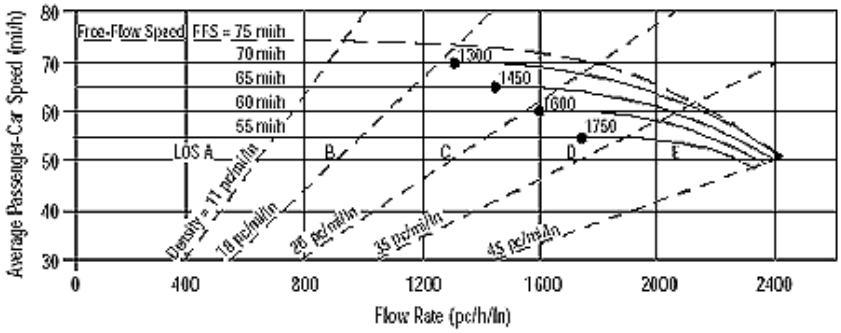

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o SR-73 Junction*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*7750*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*6*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1467*	pc/h/ln	Design LOS	
S	*69.9*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*21.0*	pc/mi/ln	S	mi/h
LOS	*C*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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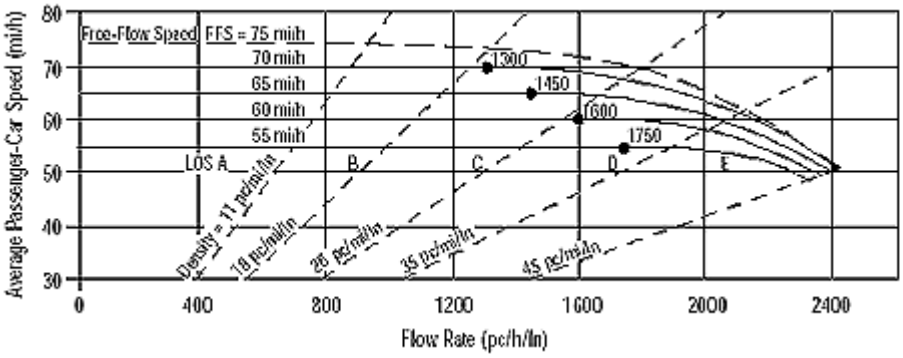

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Cristianitos*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4830*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1371*	pc/h/ln
S	*70.0*	mi/h
D = v_p / S	*19.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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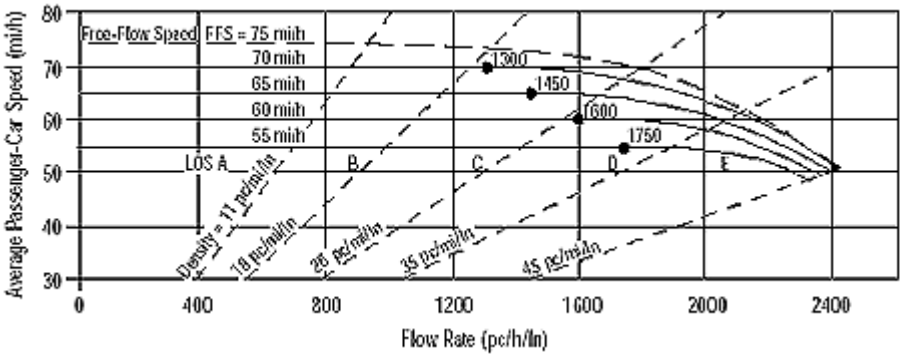

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Calafia*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*4700*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1334*	pc/h/ln
S	*70.0*	mi/h
D = v_p / S	*19.1*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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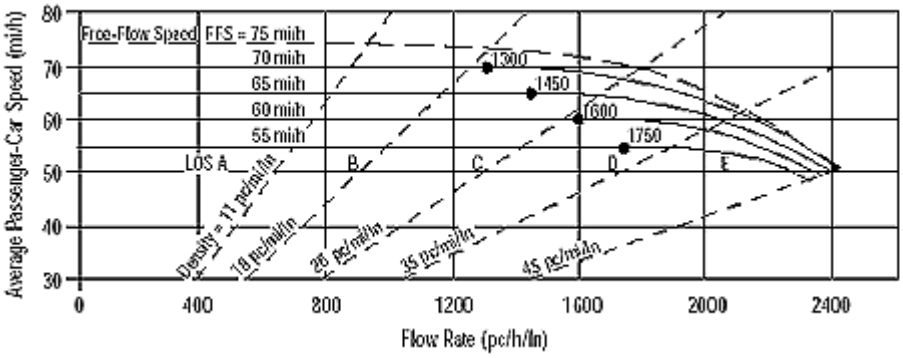

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o El Camino Real*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5150*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade -2.50% Length	*0.65mi*
Driver type adjustment	*1.00*		Up/Down %	*-2.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1170*	pc/h/ln
S	*70.0*	mi/h
D = v_p / S	*16.7*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
S - Speed
V - Hourly volume
D - Density
v_p - Flow rate
FFS - Free-flow speed
LOS - Level of service
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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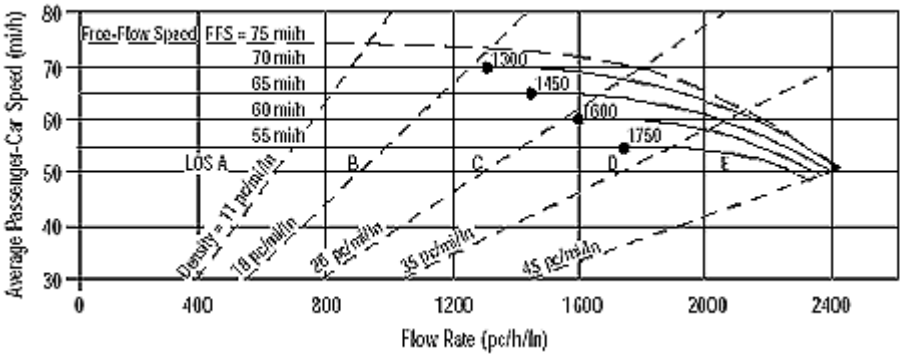

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Presidio*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5830*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1324*	pc/h/ln
S	*70.0*	mi/h
D = v_p / S	*18.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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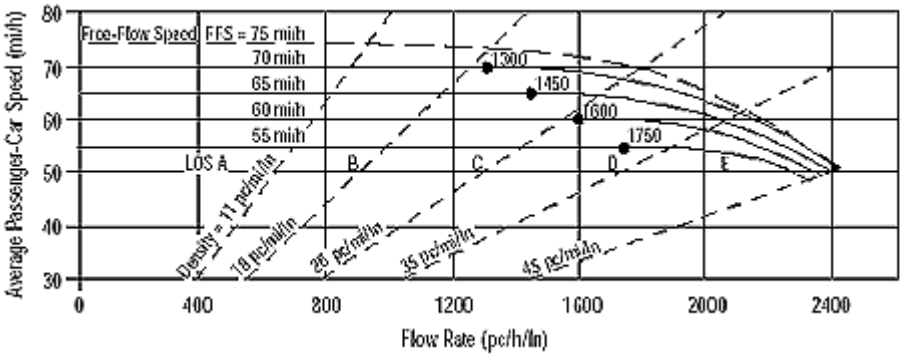

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Palizada*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*5610*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1274*	pc/h/ln
S	*70.0*	mi/h
D = v_p / S	*18.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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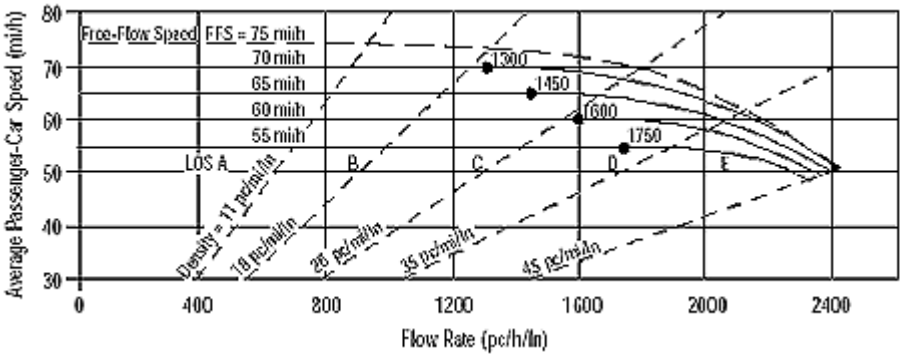
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Pico*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6820*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade 3.50% Length	*0.70mi*
Driver type adjustment	*1.00*		Up/Down %	*3.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*3.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.926*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*6*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1364*	pc/h/ln
S	*70.0*	mi/h
D = v_p / S	*19.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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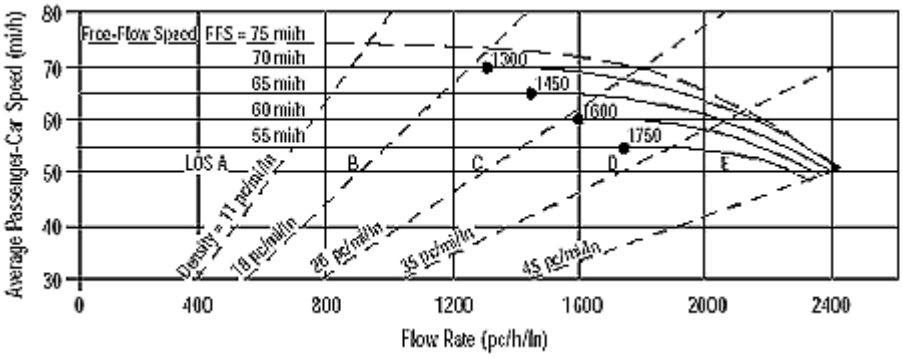

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Vista Hermosa*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7050*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1601*	pc/h/ln
S	*69.4*	mi/h
D = v_p / S	*23.1*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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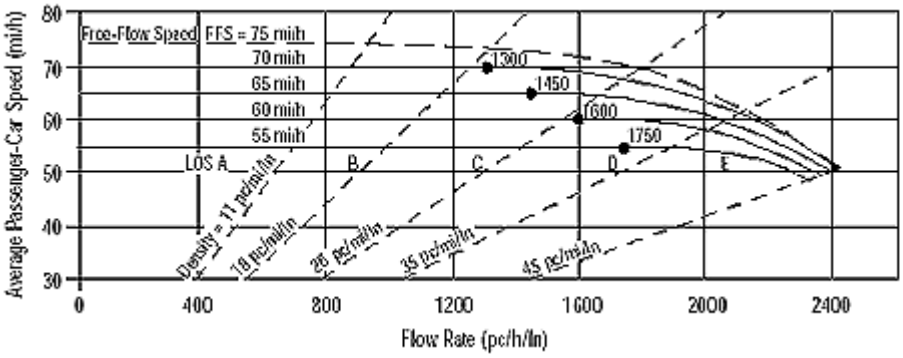

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Cm De Estrella*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7860*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade -2.50% Length	*0.75mi*
Driver type adjustment	*1.00*		Up/Down %	*-2.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2231*	pc/h/ln
S	*59.2*	mi/h
D = v_p / S	*37.7*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
S - Speed
V - Hourly volume
D - Density
v_p - Flow rate
FFS - Free-flow speed
LOS - Level of service
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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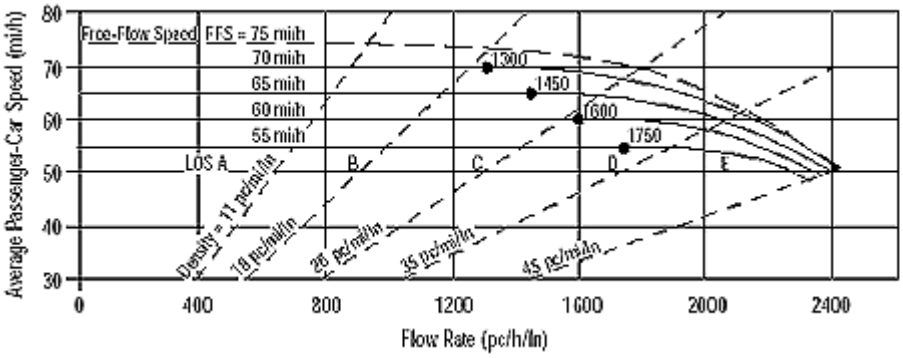

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o SR-1*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8760*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1989*	pc/h/ln
S	*65.1*	mi/h
D = v_p / S	*30.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
S - Speed
V - Hourly volume
D - Density
v_p - Flow rate
FFS - Free-flow speed
LOS - Level of service
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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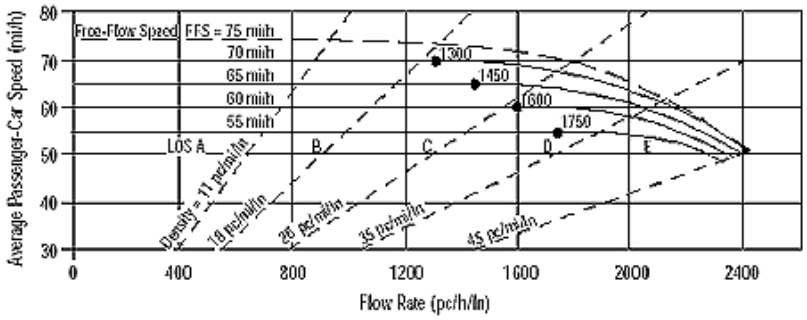

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

General Information		Site Information	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Southbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Camino Capistrano*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8870*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Speed Inputs			Calc Speed Adj and FFS		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*6*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1679*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*69.0*	mi/h	S		mi/h
D = v_p / S	*24.3*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*C*		Required Number of Lanes, N		

Glossary / Factor Location

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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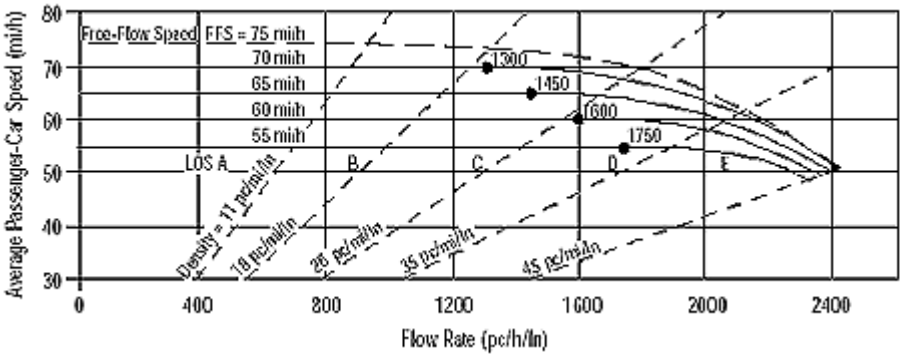

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o San Juan Creek*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8870*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2014*	pc/h/ln
S	*64.6*	mi/h
D = v_p / S	*31.2*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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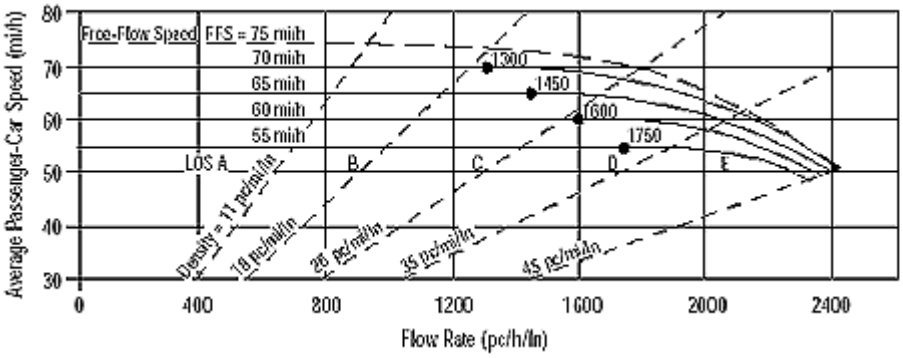
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Ortega Highway*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8190*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2325*	pc/h/ln
S	*56.1*	mi/h
D = v_p / S	*41.4*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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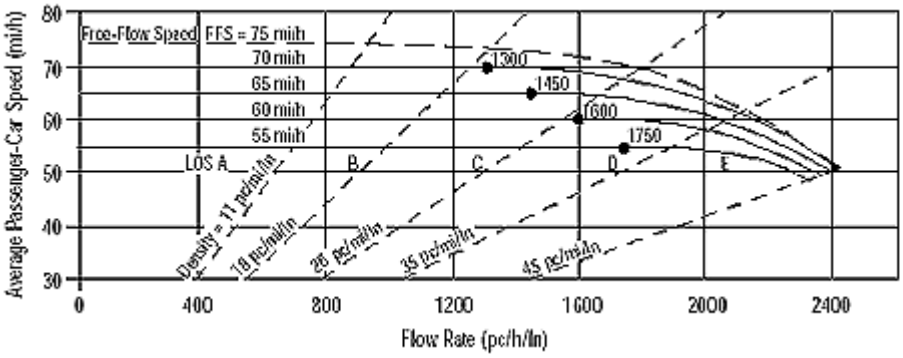
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Junipero Serra*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*9310*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade -3.00% Length	*0.35mi*
Driver type adjustment	*1.00*		Up/Down %	*-3.00*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2114*	pc/h/ln
S	*62.4*	mi/h
D = v_p / S	*33.9*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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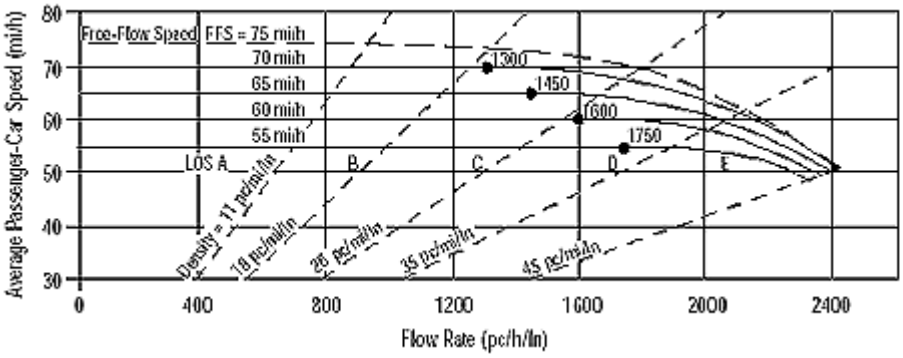

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o SR-73 Junction*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*Existing (2009)*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*9700*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*6*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1836*	pc/h/ln
S	*67.4*	mi/h
D = v_p / S	*27.2*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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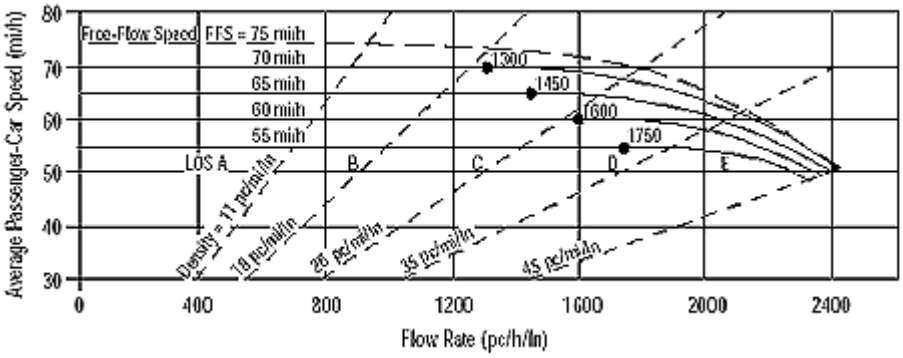

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Cristianitos*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6010*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1706*	pc/h/ln
S	*68.8*	mi/h
D = v_p / S	*24.8*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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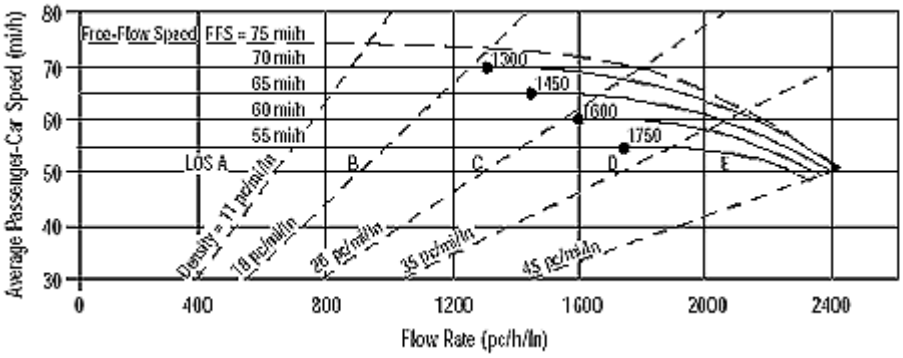
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Avd Magdalena*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6170*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1752*	pc/h/ln
S	*68.3*	mi/h
D = v_p / S	*25.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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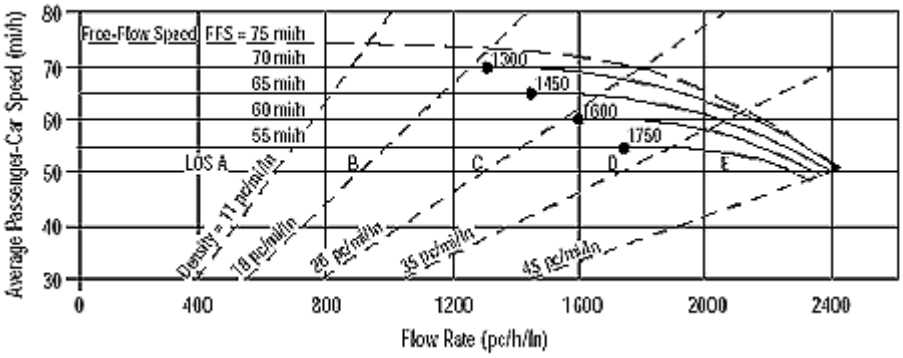

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o El Camino Real*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6700*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade 2.50% Length	*0.65mi*
Driver type adjustment	*1.00*		Up/Down %	*2.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*3.0*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1548*	pc/h/ln
S	*69.7*	mi/h
D = v_p / S	*22.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
S - Speed
V - Hourly volume
D - Density
v_p - Flow rate
FFS - Free-flow speed
LOS - Level of service
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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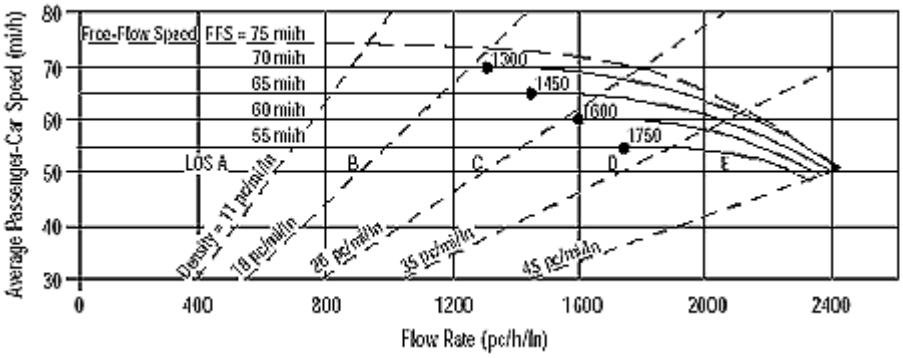

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Avd Presidio*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7160*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1626*	pc/h/ln
S	*69.3*	mi/h
D = v_p / S	*23.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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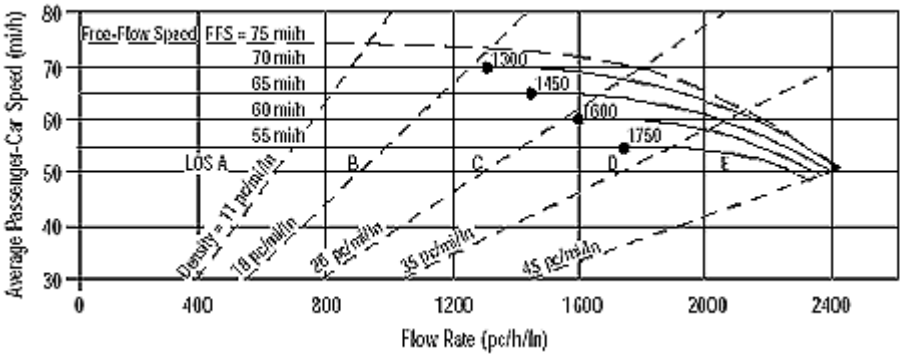
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Avd de la Paz*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7220*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2050*	pc/h/ln
S	*63.8*	mi/h
D = v_p / S	*32.1*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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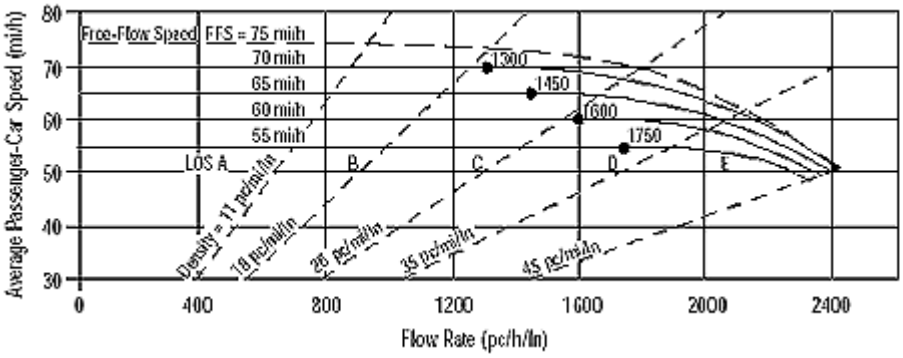

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Avd Pico*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8120*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade -3.50% Length	*0.70mi*
Driver type adjustment	*1.00*		Up/Down %	*-3.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1844*	pc/h/ln
S	*67.3*	mi/h
D = v_p / S	*27.4*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10
E_T - Exhibits 23-8, 23-10, 23-11
f_p - Page 23-12
LOS, S, FFS, v_p - Exhibits 23-2, 23-3
f_{LW} - Exhibit 23-4
f_{LC} - Exhibit 23-5
f_N - Exhibit 23-6
f_{ID} - Exhibit 23-7

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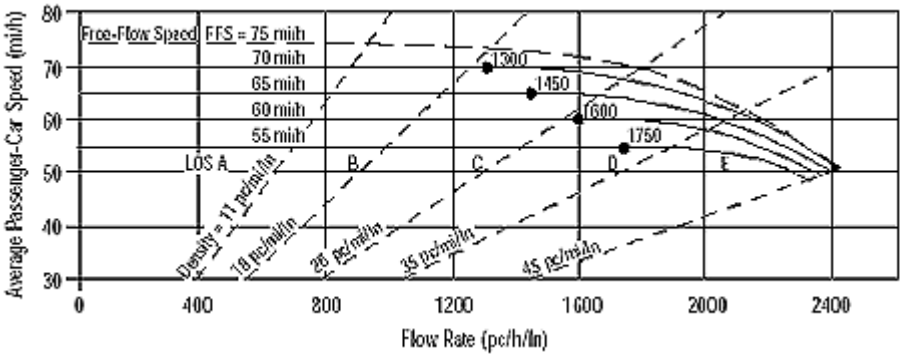

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Vista Hermosa*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8570*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1946*	pc/h/ln
S	*65.8*	mi/h
D = v_p / S	*29.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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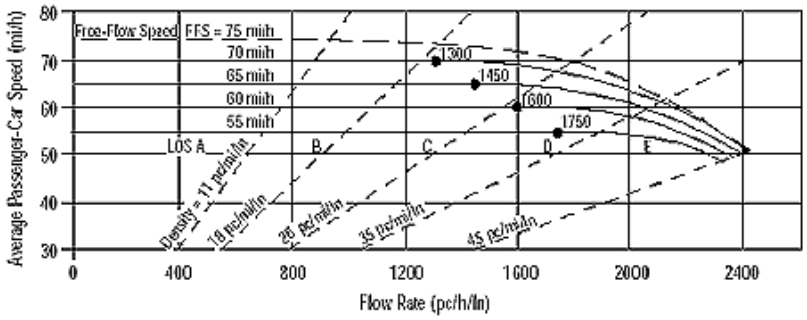

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Cm De Los Mares*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*9760*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade 2.50% Length	*0.75mi*
Driver type adjustment	*1.00*		Up/Down %	*2.50*

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*3.0*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2820*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S		mi/h	S	mi/h
D = v_p / S		pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*F*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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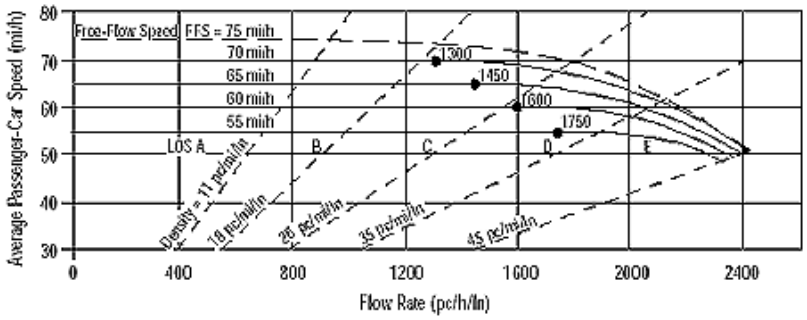

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o SR-1*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*11140*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*6*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2108*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*62.5*	mi/h	S	mi/h
D = v_p / S	*33.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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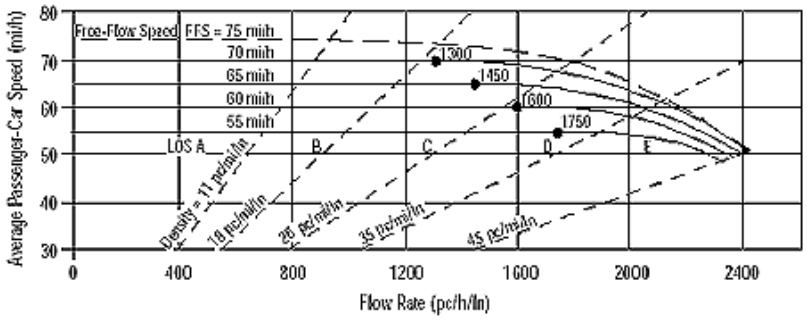

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Camino Capistrano*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*9390*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2666*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h	S		mi/h
D = v_p / S		pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*F*		Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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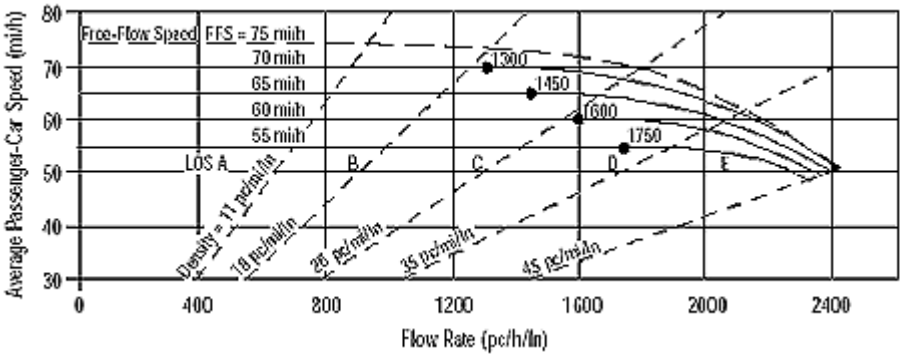

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o San Juan Creek*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*10920*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*3100*	pc/h/ln
S		mi/h
D = v_p / S		pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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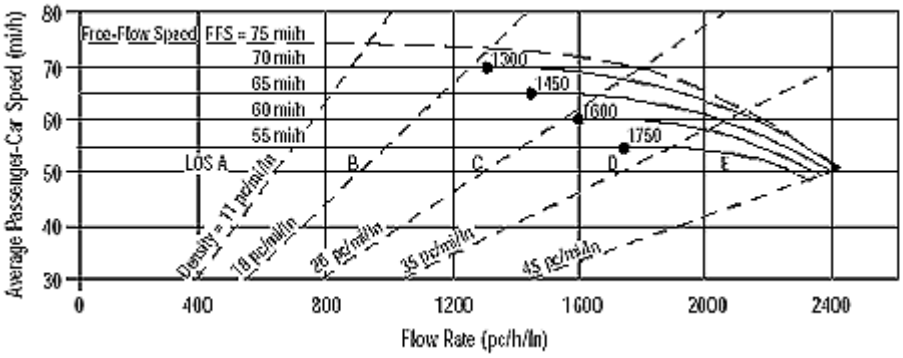
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Ortega Highway*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*10930*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*3103*	pc/h/ln
S		mi/h
D = v_p / S		pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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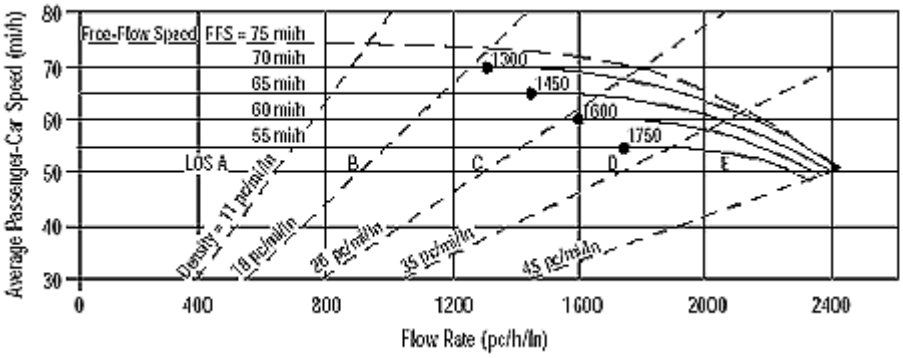

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Junipero Serra*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*11580*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade 3.00% Length	*0.35mi*
Driver type adjustment	*1.00*		Up/Down %	*3.00*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2630*	pc/h/ln
S		mi/h
D = v_p / S		pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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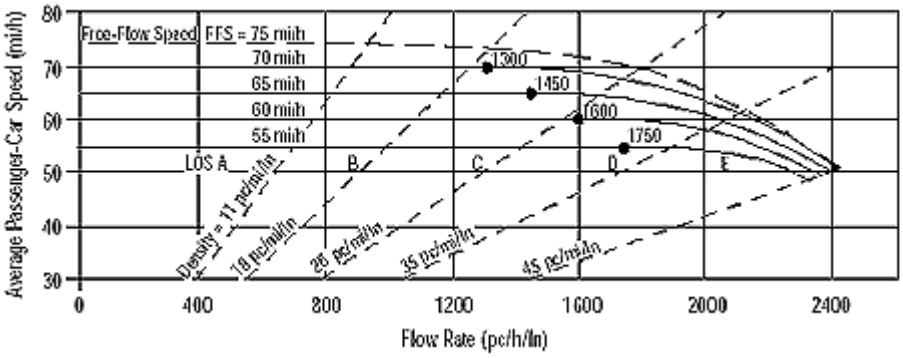

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o SR-73 Junction*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*12070*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*6*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2284*	pc/h/ln
S	*57.5*	mi/h
D = v_p / S	*39.7*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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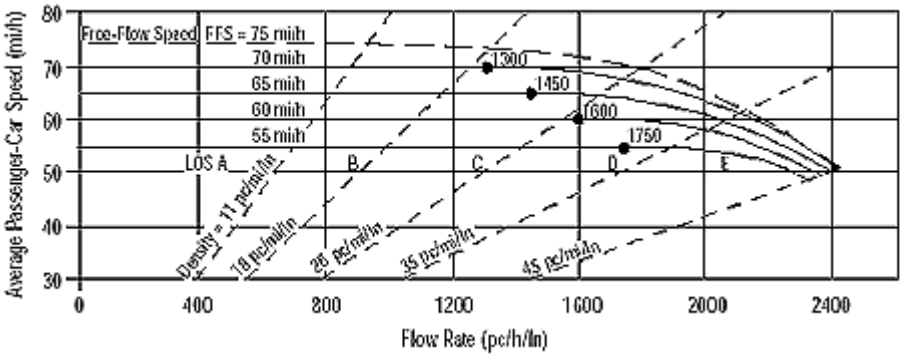

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Cristianitos*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6360*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1806*	pc/h/ln
S	*67.8*	mi/h
D = v_p / S	*26.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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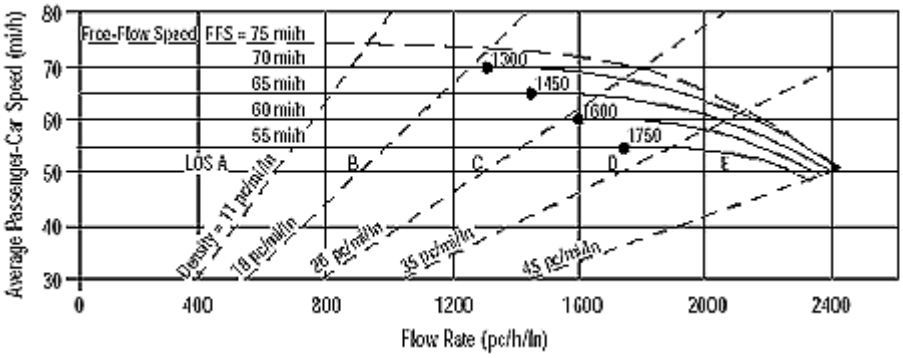

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Calafia*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6680*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1896*	pc/h/ln
S	*66.6*	mi/h
D = v_p / S	*28.5*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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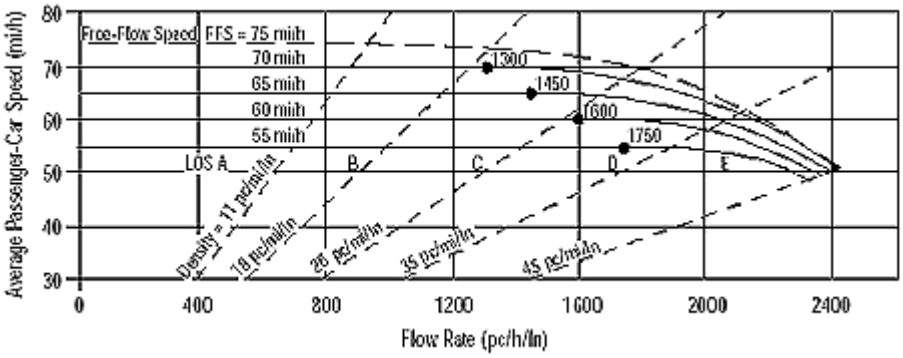

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o El Camino Real*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6880*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade -2.50% Length	*0.65mi*
Driver type adjustment	*1.00*		Up/Down %	*-2.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1563*	pc/h/ln
S	*69.6*	mi/h
D = v_p / S	*22.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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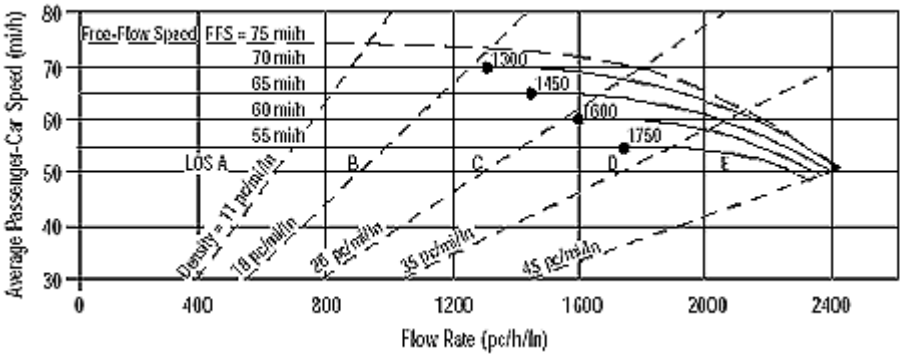
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Presidio*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7190*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1633*	pc/h/ln
S	*69.3*	mi/h
D = v_p / S	*23.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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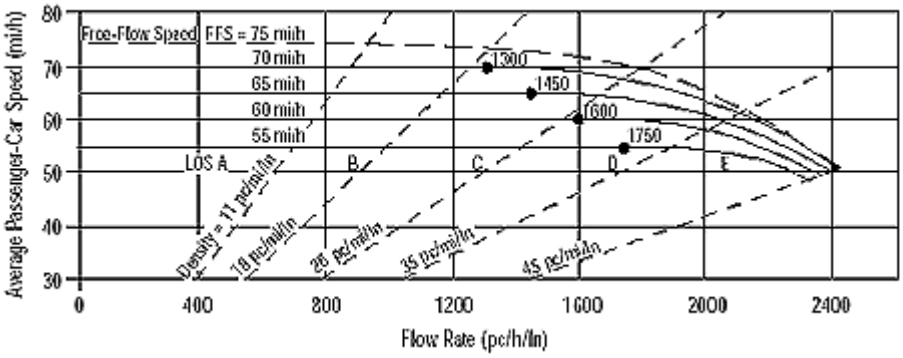

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Palizada*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6690*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1519*	pc/h/ln
S	*69.7*	mi/h
D = v_p / S	*21.8*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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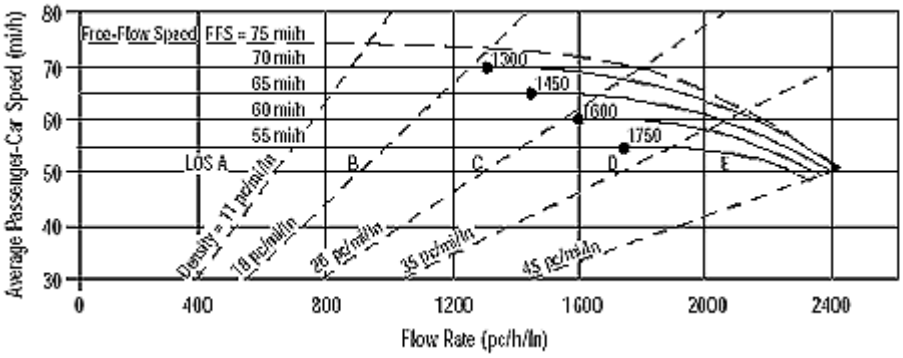

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Pico*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7690*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade 3.50% Length	*0.70mi*
Driver type adjustment	*1.00*		Up/Down %	*3.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*3.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.926*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*6*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1538*	pc/h/ln
S	*69.7*	mi/h
D = v_p / S	*22.1*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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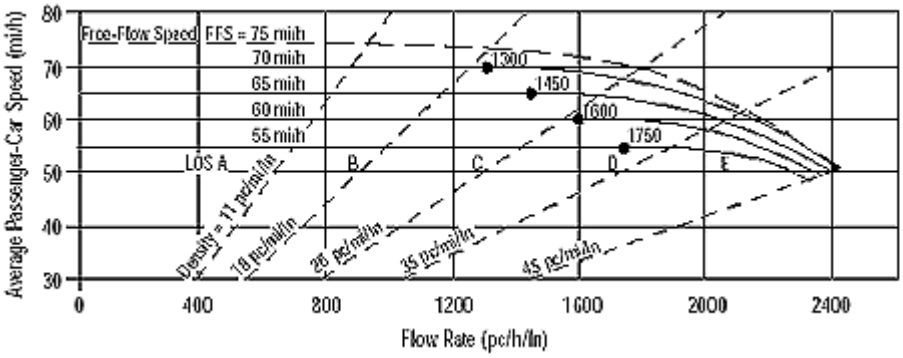

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Vista Hermosa*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8200*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1862*	pc/h/ln
S	*67.1*	mi/h
D = v_p / S	*27.8*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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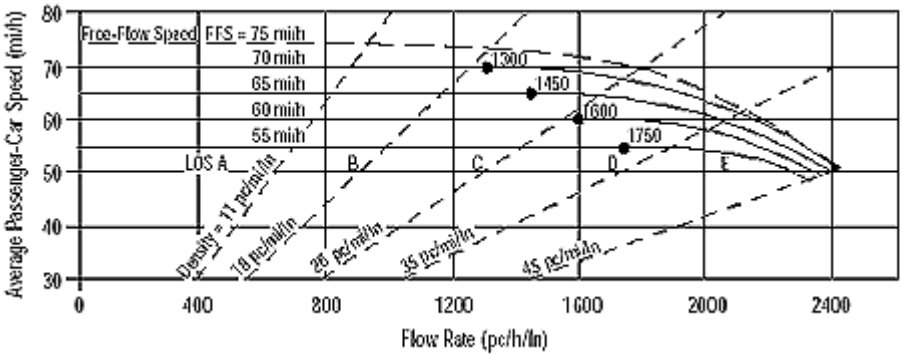

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Cm De Estrella*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8980*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade -2.50% Length	*0.75mi*
Driver type adjustment	*1.00*		Up/Down %	*-2.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2549*	pc/h/ln
S		mi/h
D = v_p / S		pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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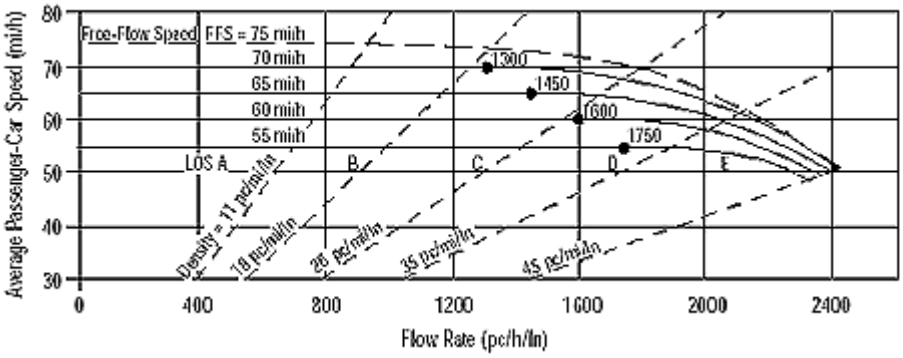

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o SR-1*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*9220*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2094*	pc/h/ln
S	*62.9*	mi/h
D = v_p / S	*33.3*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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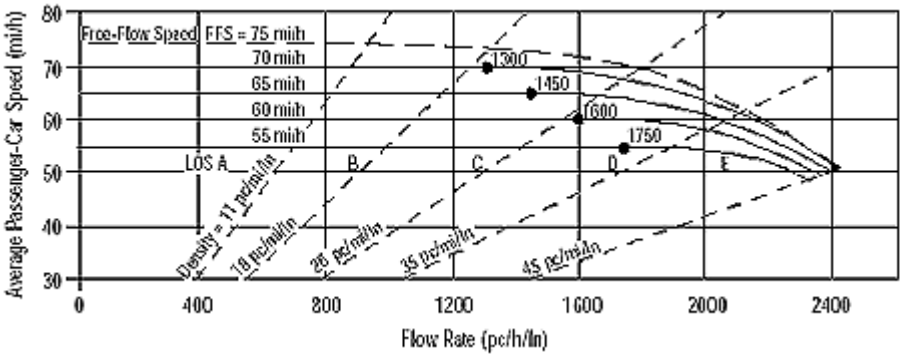

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Southbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Camino Capistrano*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8640*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*6*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1635*	pc/h/ln
S	*69.2*	mi/h
D = v_p / S	*23.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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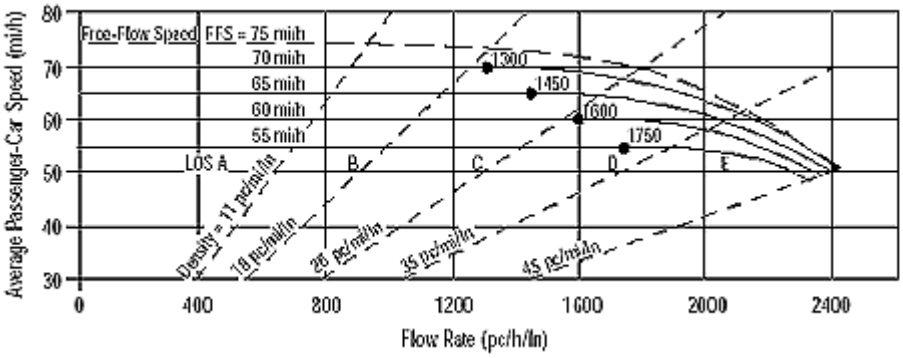
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o San Juan Creek*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8640*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1962*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*29.9*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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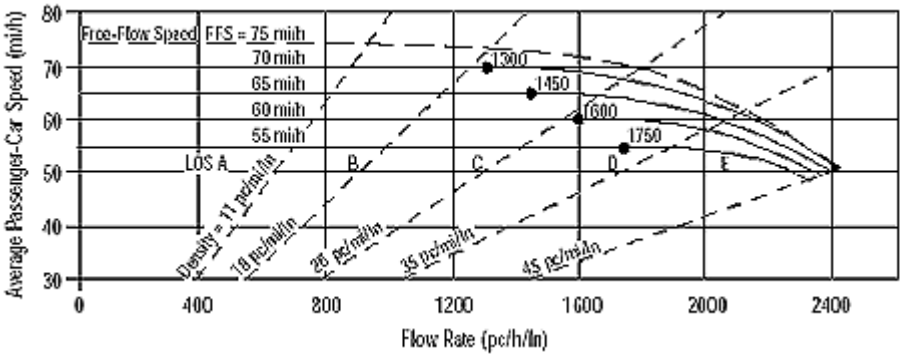

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Ortega Highway*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7520*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2135*	pc/h/ln
S	*61.9*	mi/h
D = v_p / S	*34.5*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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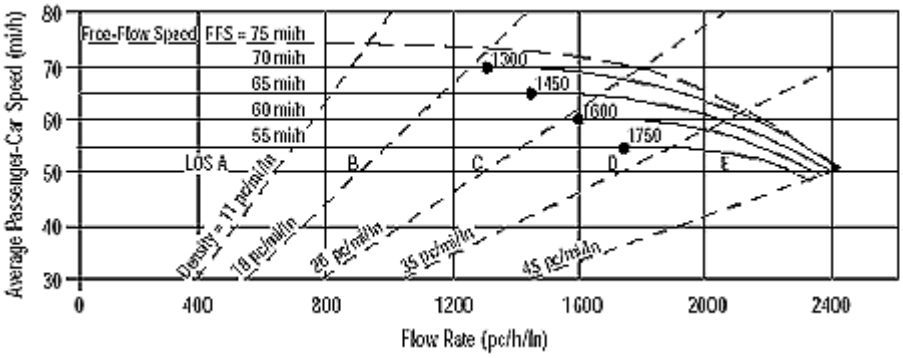

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Junipero Serra*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8570*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade -3.00% Length	*0.35mi*
Driver type adjustment	*1.00*		Up/Down %	*-3.00*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1946*	pc/h/ln
S	*65.8*	mi/h
D = v_p / S	*29.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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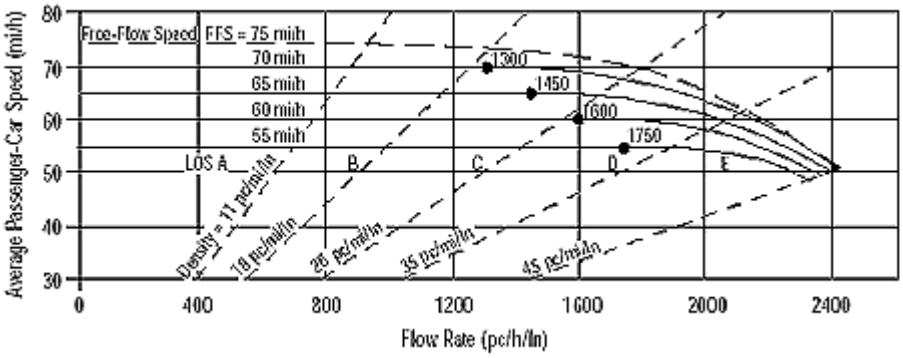

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o SR-73 Junction*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8880*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*6*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1681*	pc/h/ln
S	*68.9*	mi/h
D = v_p / S	*24.4*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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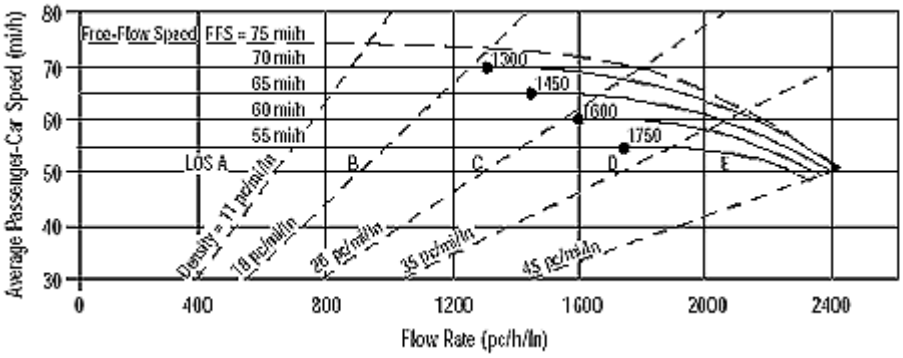

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Cristianitos*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6290*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1786*	pc/h/ln
S	*68.0*	mi/h
D = v_p / S	*26.3*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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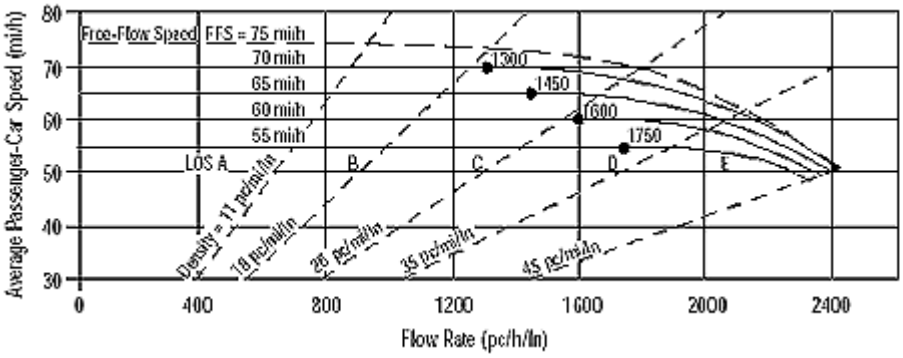

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Avd Magdalena*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6340*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1800*	pc/h/ln
S	*67.9*	mi/h
D = v_p / S	*26.5*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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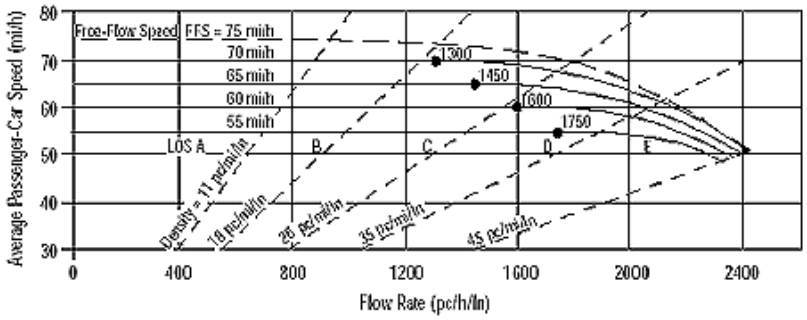

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o El Camino Real*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs					
Volume, V	*6550*	veh/h	Peak-Hour Factor, PHF		*0.90*
AADT		veh/day	%Trucks and Buses, P_T		*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R		*1*
Peak-Hr Direction Prop, D			General Terrain:		*Grade*
DDHV = AADT x K x D		veh/h	Grade 2.50%	Length	*0.65mi*
Driver type adjustment	*1.00*		Up/Down %		*2.50*

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*3.0*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*5*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1514*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*69.8*	mi/h	S	mi/h
D = v_p / S	*21.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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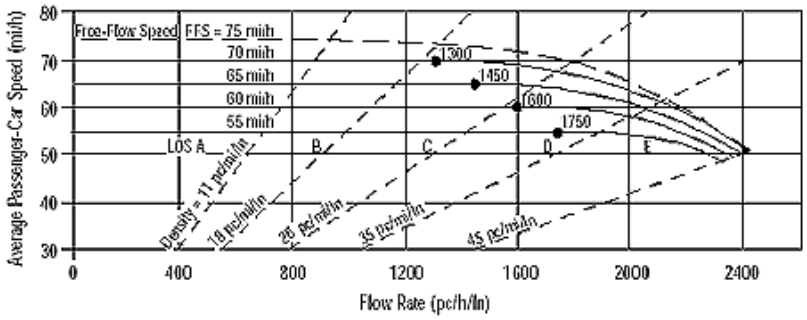

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

General Information		Site Information	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Avd Presidio*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6810*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*4*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*	
Driver type adjustment	*1.00*		Up/Down %		

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Speed Inputs			Calc Speed Adj and FFS		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*5*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1547*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*69.7*	mi/h	S	mi/h
D = v_p / S	*22.2*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary / Factor Location

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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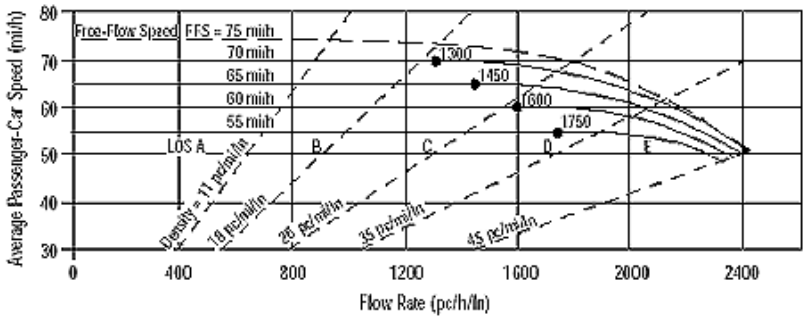

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

General Information		Site Information	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Avd de la Paz*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6700*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Speed Inputs			Calc Speed Adj and FFS		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1902*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*66.5*	mi/h	S		mi/h
D = v_p / S	*28.6*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*D*		Required Number of Lanes, N		

Glossary / Factor Location

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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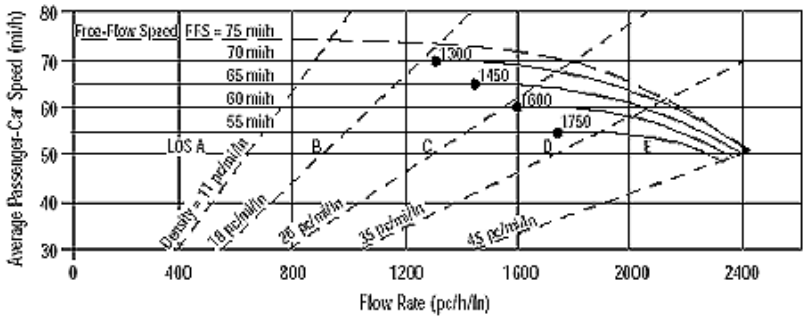

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Avd Pico*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*7410*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade -3.50% Length	*0.70mi*
Driver type adjustment	*1.00*		Up/Down %	*-3.50*

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*5*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1683*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*68.9*	mi/h	S	mi/h
D = v_p / S	*24.4*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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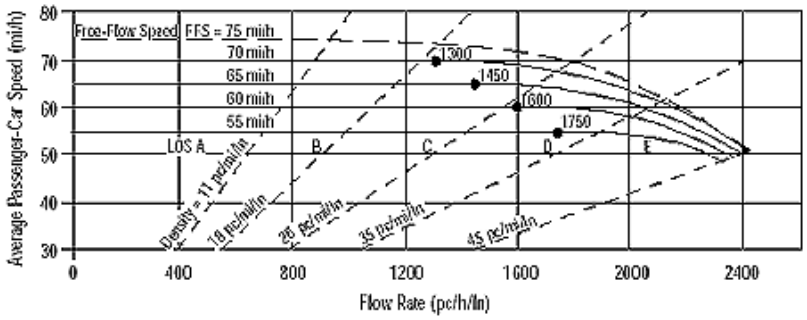

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Vista Hermosa*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*8090*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*5*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1837*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*67.4*	mi/h	S	mi/h
D = v_p / S	*27.2*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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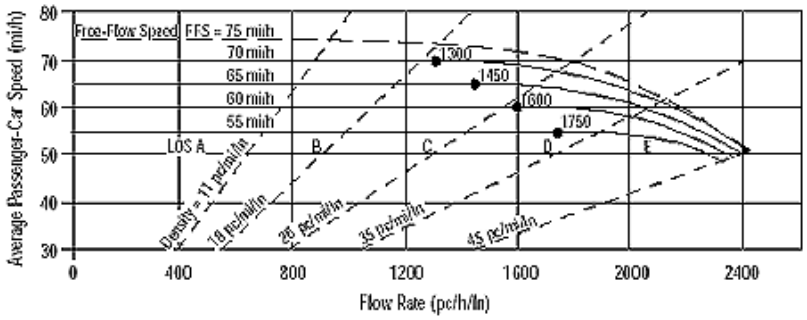

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Cm De Los Mares*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs					
Volume, V	*8840*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*4*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*	
Peak-Hr Direction Prop, D			General Terrain:	*Grade*	
DDHV = AADT x K x D		veh/h	Grade 2.50% Length	*0.75mi*	
Driver type adjustment	*1.00*		Up/Down %	*2.50*	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*3.0*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2554*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S		mi/h	S	mi/h
D = v_p / S		pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*F*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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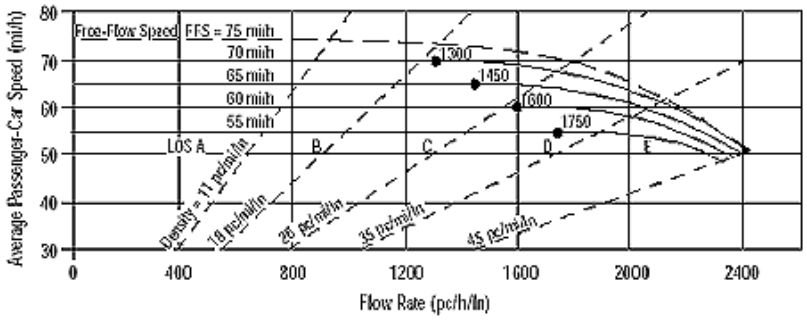

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o SR-1*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*9170*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*6*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1736*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*68.5*	mi/h	S	mi/h
D = v_p / S	*25.3*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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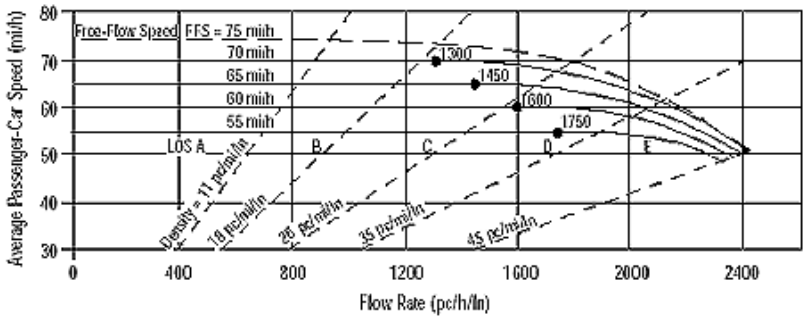

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Camino Capistrano*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7210*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2047*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*63.9*	mi/h	S		mi/h
D = v_p / S	*32.0*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*D*		Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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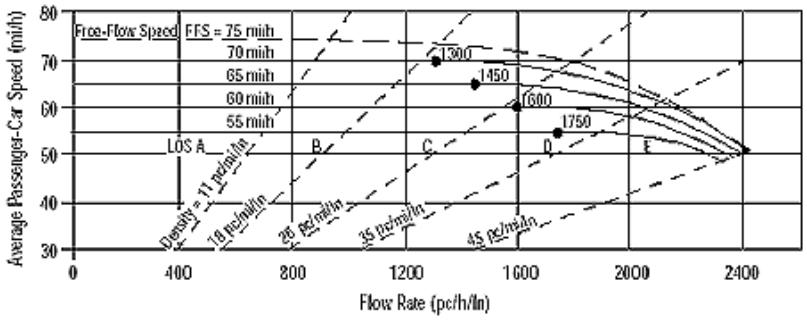

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o San Juan Creek*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8890*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2524*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S		mi/h	S	mi/h
D = v_p / S		pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*F*		Required Number of Lanes, N	

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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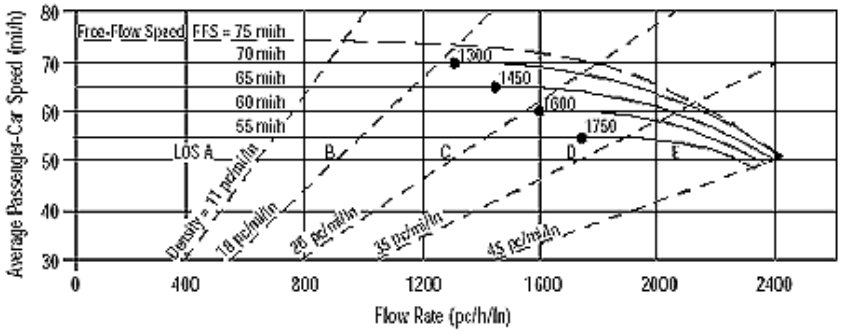

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Ortega Highway*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*8630*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p) *2450*		pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	*F*		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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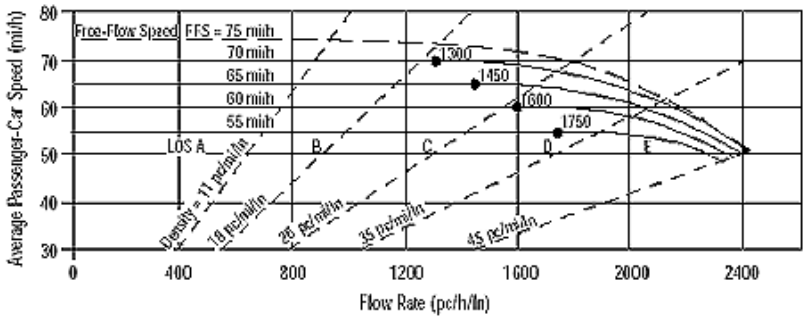

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Junipero Serra*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*9530*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*4*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*	
Peak-Hr Direction Prop, D			General Terrain:	*Grade*	
DDHV = AADT x K x D		veh/h	Grade 3.00% Length	*0.35mi*	
Driver type adjustment	*1.00*		Up/Down %	*3.00*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2164*	pc/h/ln
S	*61.1*	mi/h
D = v_p / S	*35.4*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	mi/h
D = v_p / S	pc/mi/ln
Required Number of Lanes, N	

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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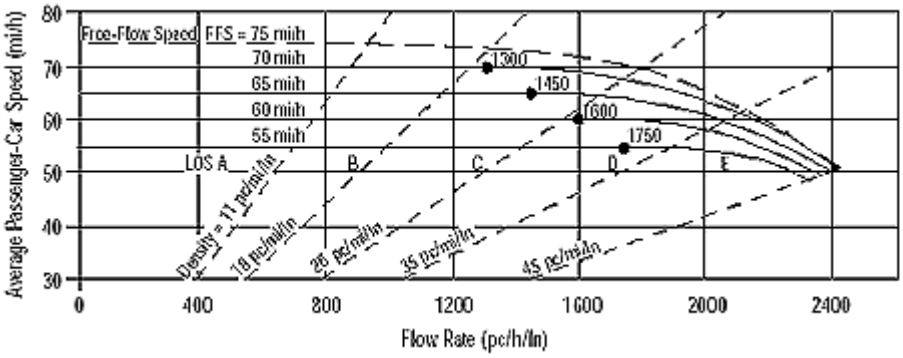

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o SR-73 Junction*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*10030*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*6*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1898*	pc/h/ln
S	*66.6*	mi/h
D = v_p / S	*28.5*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
S - Speed
V - Hourly volume
D - Density
v_p - Flow rate
FFS - Free-flow speed
LOS - Level of service
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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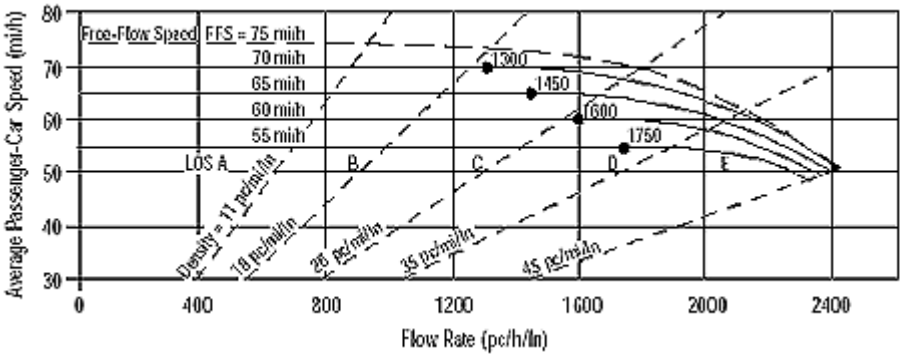

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Cristianitos*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6910*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1962*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*29.9*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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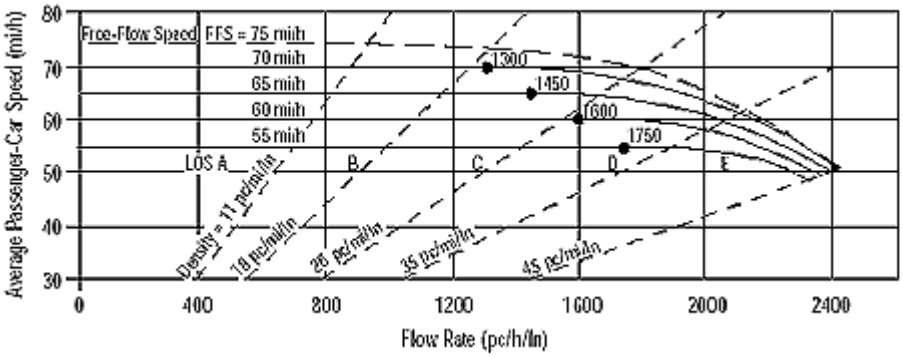

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Calafia*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7020*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1993*	pc/h/ln
S	*65.0*	mi/h
D = v_p / S	*30.7*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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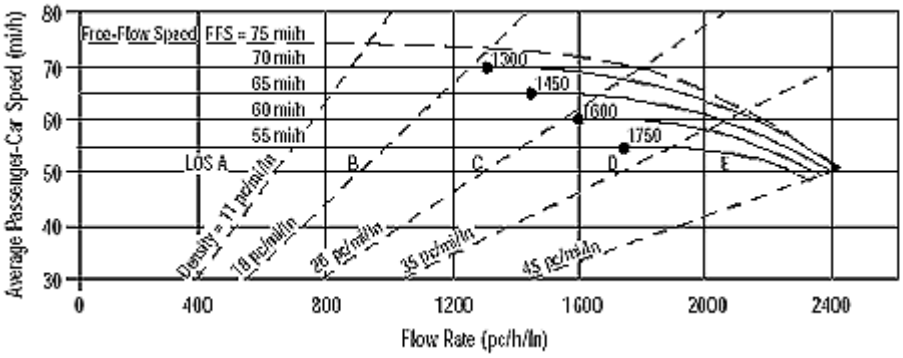
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o El Camino Real*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7700*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade -2.50% Length	*0.65mi*
Driver type adjustment	*1.00*		Up/Down %	*-2.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1749*	pc/h/ln
S	*68.4*	mi/h
D = v_p / S	*25.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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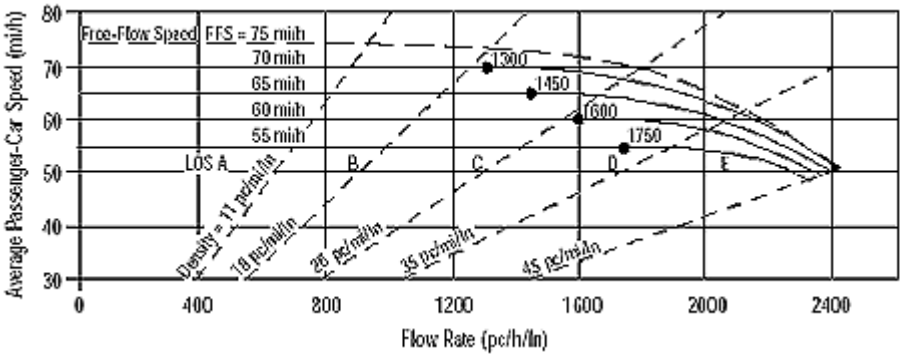

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Presidio*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8270*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1878*	pc/h/ln
S	*66.9*	mi/h
D = v_p / S	*28.1*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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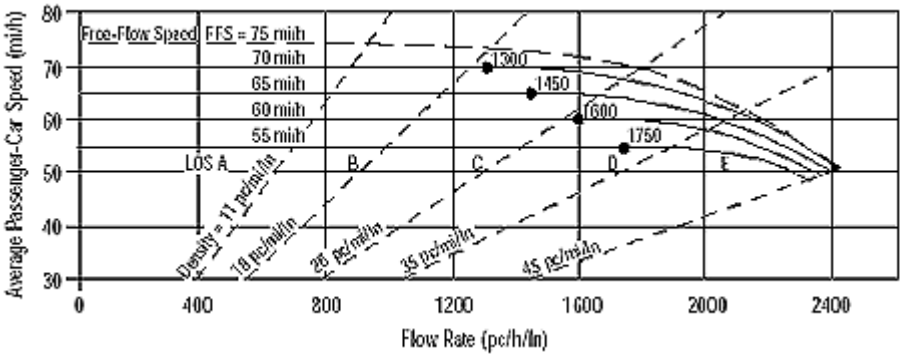

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Palizada*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7980*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1812*	pc/h/ln
S	*67.7*	mi/h
D = v_p / S	*26.8*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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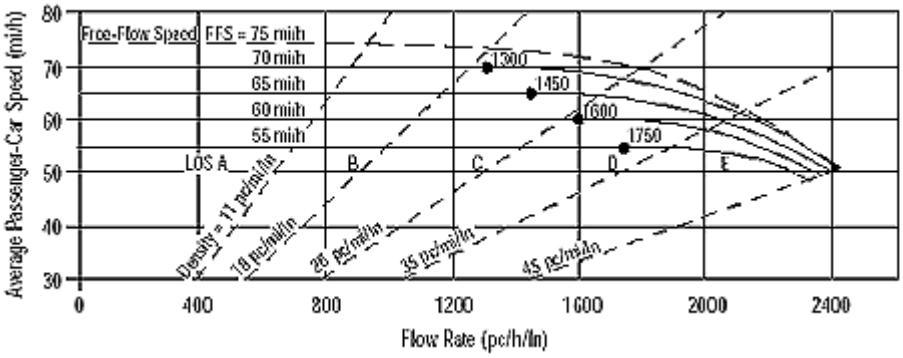

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Pico*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*9220*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade 3.50% Length	*0.70mi*
Driver type adjustment	*1.00*		Up/Down %	*3.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*3.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.926*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*6*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1844*	pc/h/ln
S	*67.3*	mi/h
D = v_p / S	*27.4*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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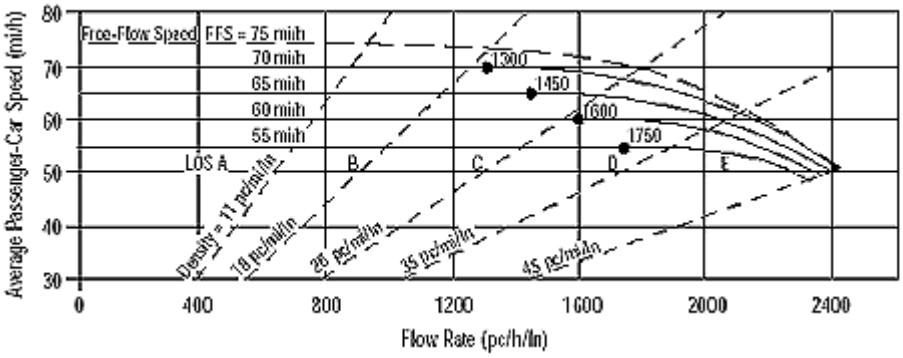

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Vista Hermosa*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*9360*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2126*	pc/h/ln
S	*62.1*	mi/h
D = v_p / S	*34.2*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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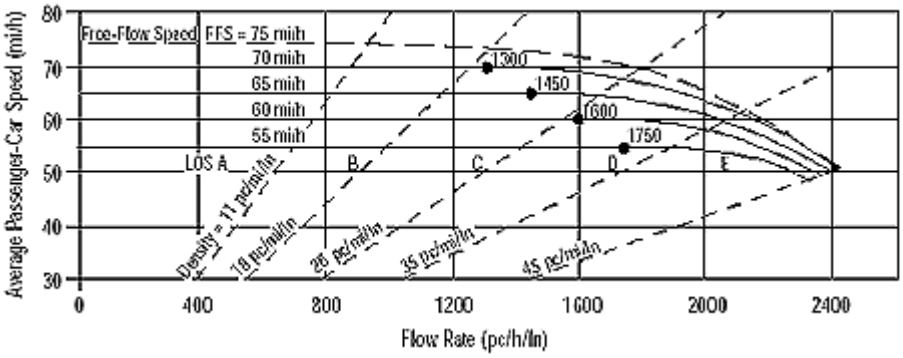

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Cm De Estrella*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*10620*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade -2.50% Length	*0.75mi*
Driver type adjustment	*1.00*		Up/Down %	*-2.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*3015*	pc/h/ln
S		mi/h
D = v_p / S		pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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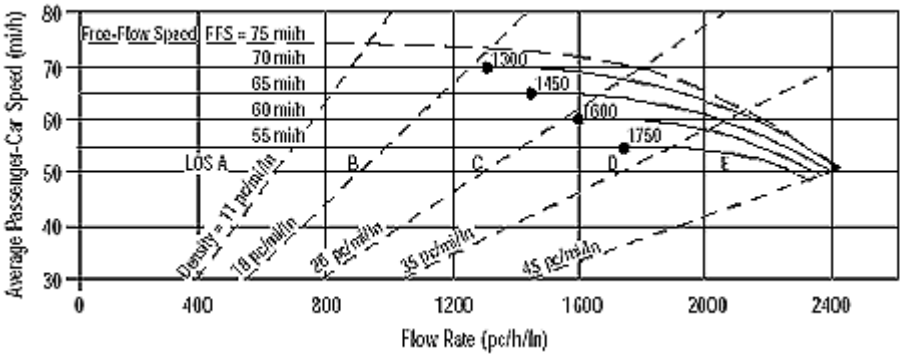
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o SR-1*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*11340*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2575*	pc/h/ln
S		mi/h
D = v_p / S		pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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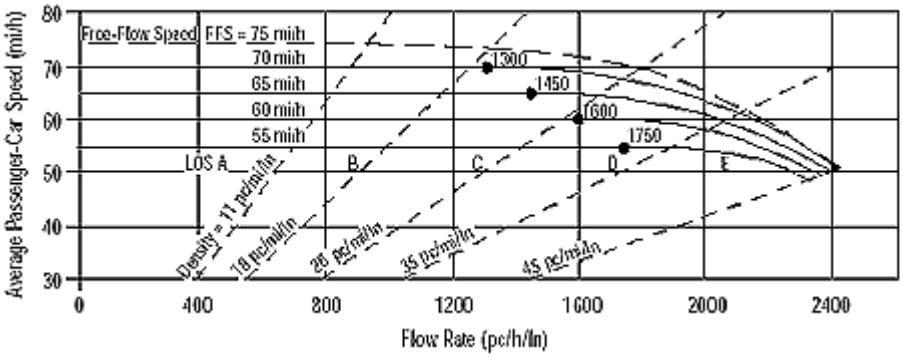

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

General Information		Site Information	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Southbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Camino Capistrano*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*11050*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Speed Inputs			Calc Speed Adj and FFS		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*6*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2091*	pc/h/ln	Design LOS		
S	*62.9*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S	*33.2*	pc/mi/ln	S		mi/h
LOS	*D*		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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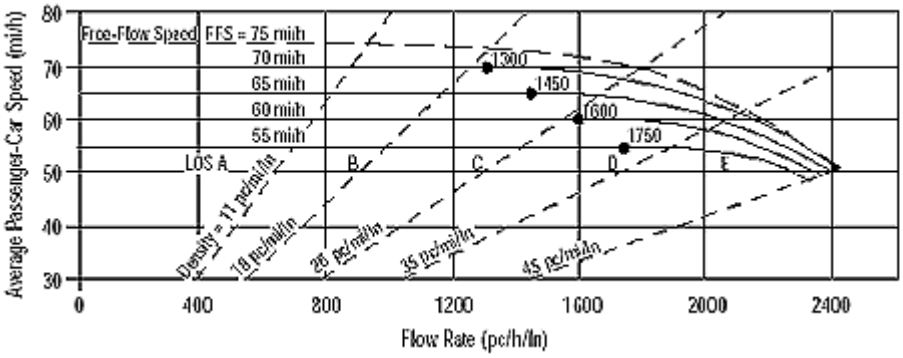
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o San Juan Creek*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*11050*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2510*	pc/h/ln
S		mi/h
D = v_p / S		pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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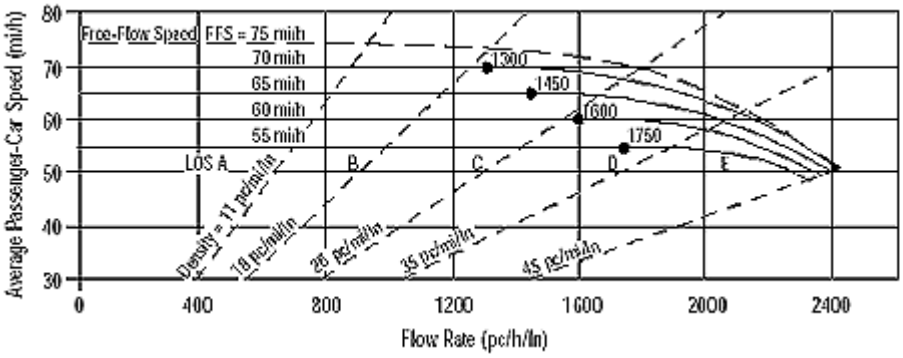

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Ortega Highway*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*10310*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2927*	pc/h/ln
S		mi/h
D = v_p / S		pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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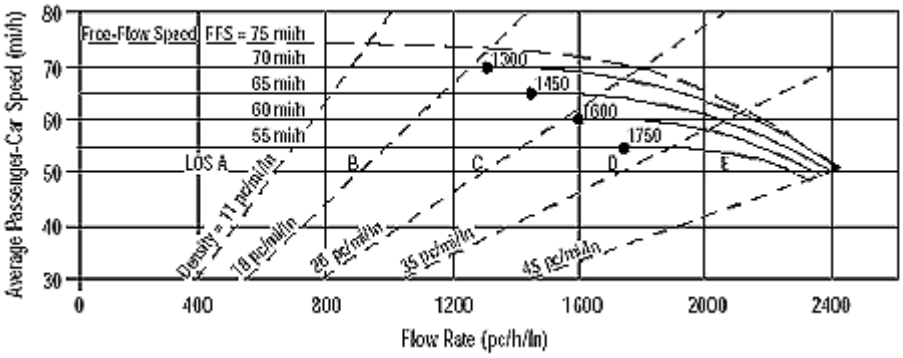
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Junipero Serra*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*11650*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade -3.00% Length	*0.35mi*
Driver type adjustment	*1.00*		Up/Down %	*-3.00*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2646*	pc/h/ln
S		mi/h
D = v_p / S		pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
S - Speed
V - Hourly volume
D - Density
v_p - Flow rate
FFS - Free-flow speed
LOS - Level of service
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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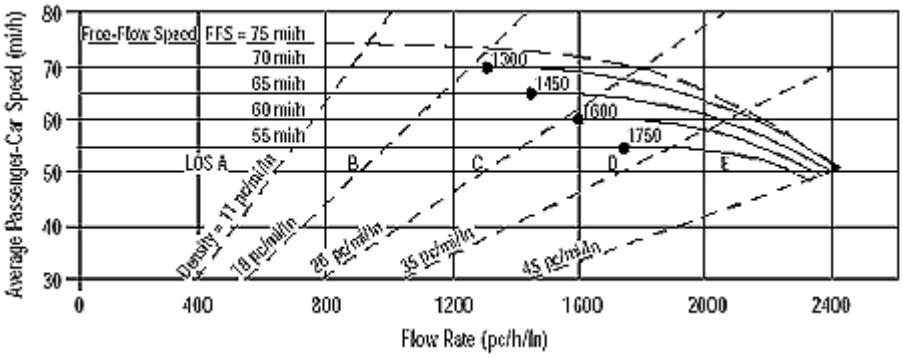
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o SR-73 Junction*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 No Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*12650*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*6*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2394*	pc/h/ln
S	*53.6*	mi/h
D = v_p / S	*44.7*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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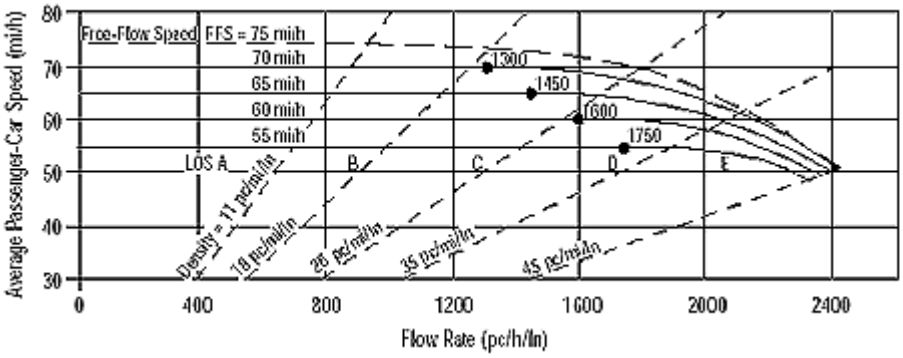
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Cristianitos*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6010*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1706*	pc/h/ln
S	*68.8*	mi/h
D = v_p / S	*24.8*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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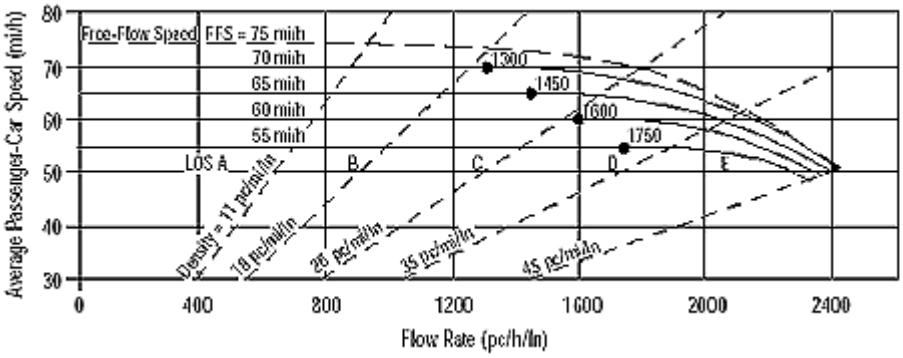
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Avd Magdalena*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6170*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1752*	pc/h/ln
S	*68.3*	mi/h
D = v_p / S	*25.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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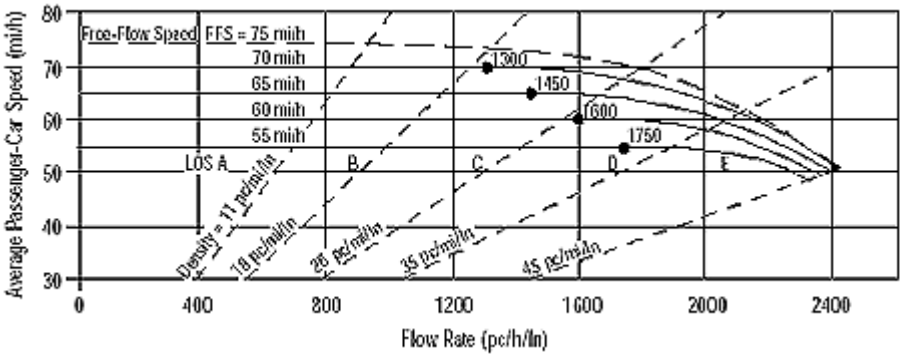

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o El Camino Real*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6700*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade 2.50% Length	*0.65mi*
Driver type adjustment	*1.00*		Up/Down %	*2.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*3.0*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1548*	pc/h/ln
S	*69.7*	mi/h
D = v_p / S	*22.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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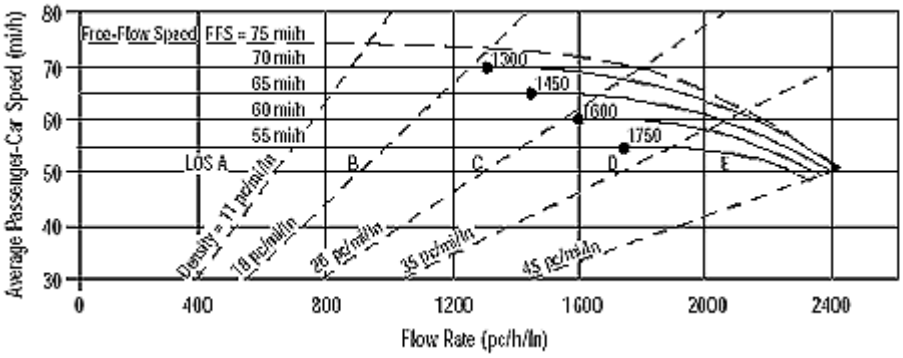

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Avd Presidio*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7170*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1628*	pc/h/ln
S	*69.3*	mi/h
D = v_p / S	*23.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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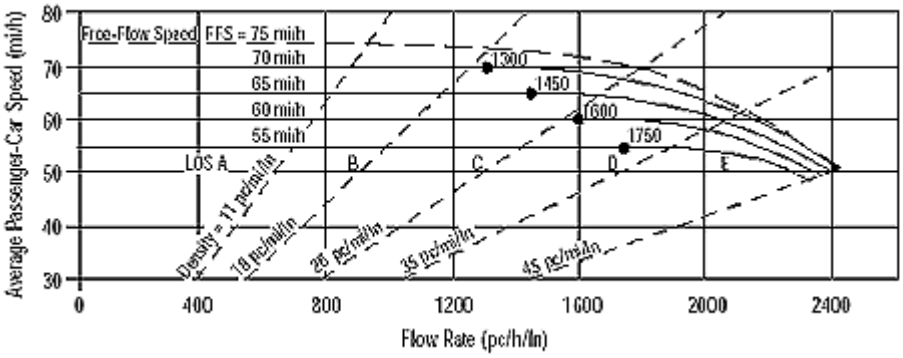

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Avd de la Paz*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7250*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2058*	pc/h/ln
S	*63.7*	mi/h
D = v_p / S	*32.3*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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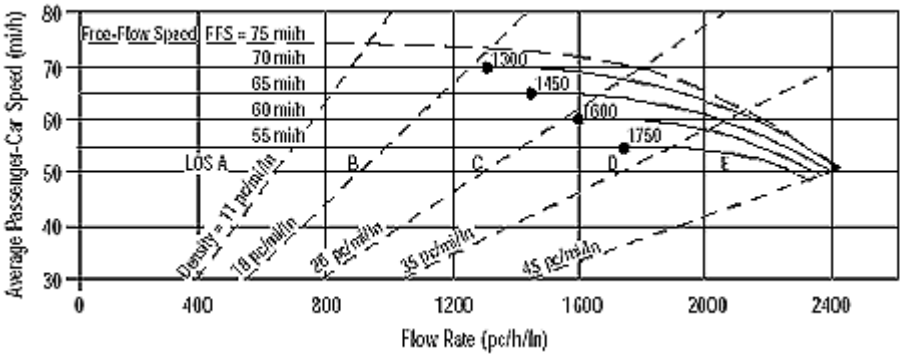

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Avd Pico*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8180*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade -3.50% Length	*0.70mi*
Driver type adjustment	*1.00*		Up/Down %	*-3.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1858*	pc/h/ln
S	*67.1*	mi/h
D = v_p / S	*27.7*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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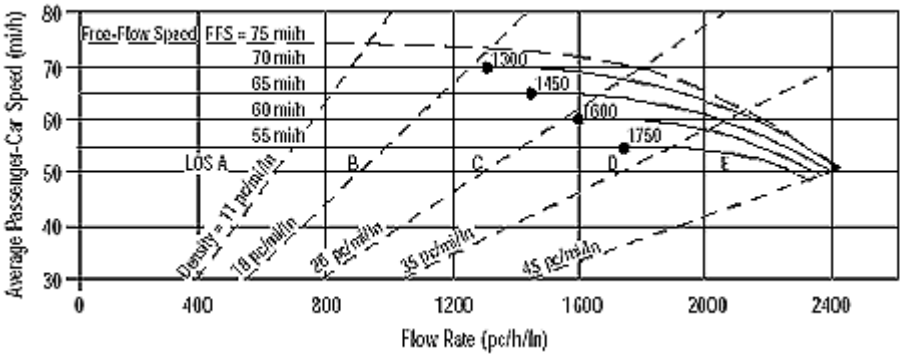

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Vista Hermosa*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7640*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1735*	pc/h/ln
S	*68.5*	mi/h
D = v_p / S	*25.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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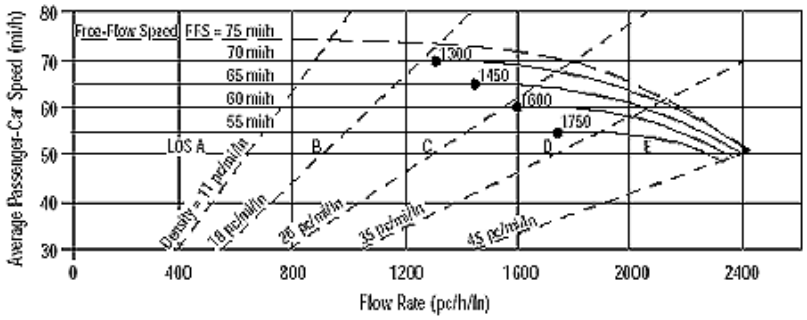

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Cm De Los Mares*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs					
Volume, V	*8750*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*4*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*	
Peak-Hr Direction Prop, D			General Terrain:	*Grade*	
DDHV = AADT x K x D		veh/h	Grade 2.50% Length	*0.75mi*	
Driver type adjustment	*1.00*		Up/Down %	*2.50*	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*3.0*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2528*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S		mi/h	S	mi/h
D = v_p / S		pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*F*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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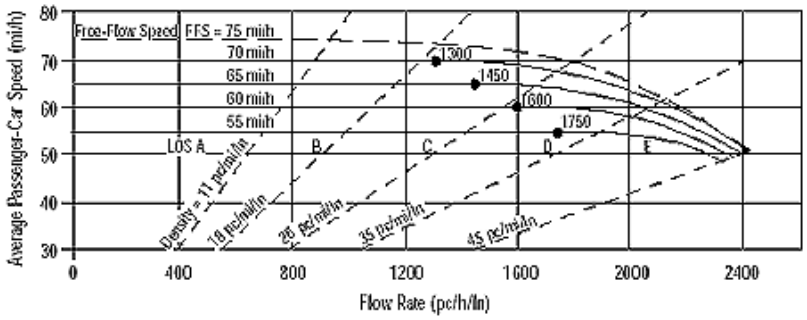
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o SR-1*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*10090*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*5*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2292*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*57.3*	mi/h	S	mi/h
D = v_p / S	*40.0*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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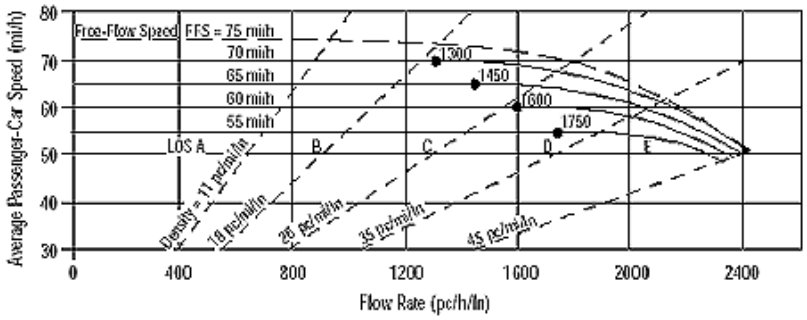

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

General Information		Site Information	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Camino Capistrano*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*9340*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Speed Inputs			Calc Speed Adj and FFS		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2652*	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	*F*		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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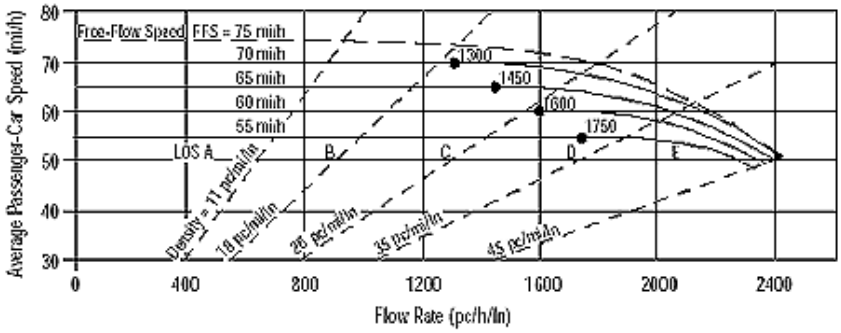

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o San Juan Creek*
Date Performed	*12/2/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*10860*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*3083*	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	*F*		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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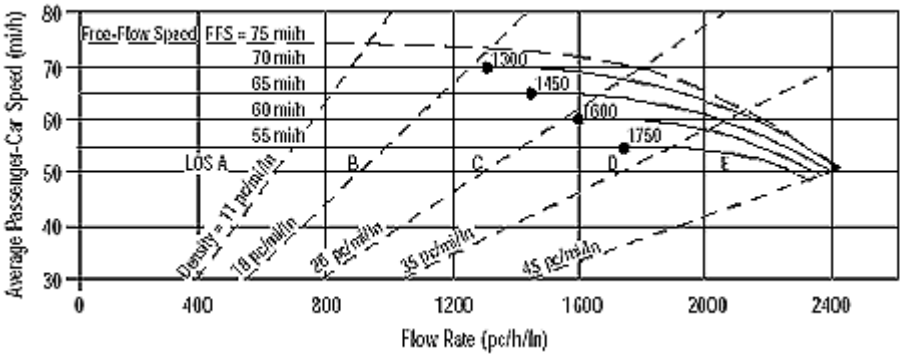

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Ortega Highway*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*10870*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*3086*	pc/h/ln
S		mi/h
D = v_p / S		pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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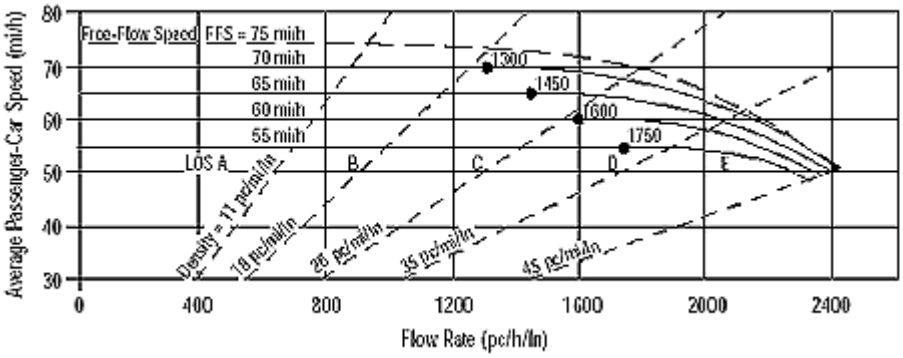

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Junipero Serra*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*11540*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade 3.00% Length	*0.35mi*
Driver type adjustment	*1.00*		Up/Down %	*3.00*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2621*	pc/h/ln
S		mi/h
D = v_p / S		pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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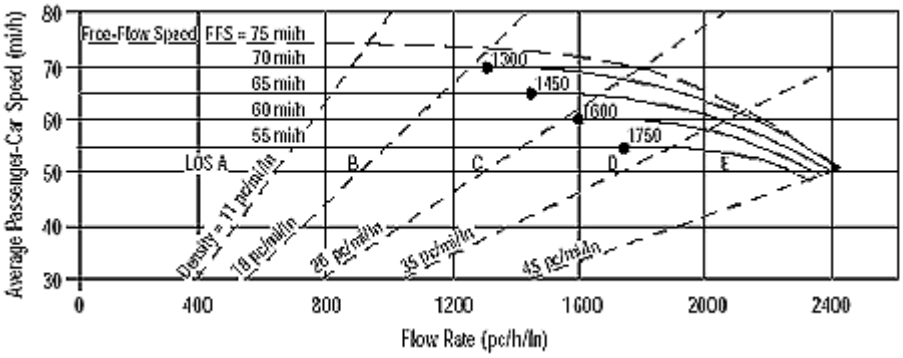
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o SR-73 Junction*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*12030*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*6*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2277*	pc/h/ln
S	*57.8*	mi/h
D = v_p / S	*39.4*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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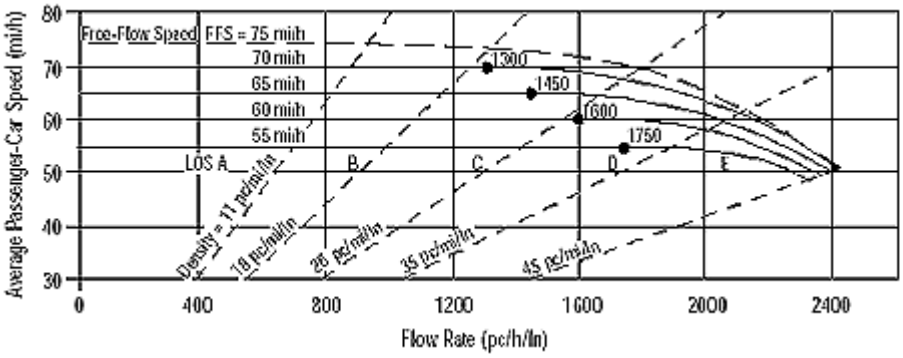
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Cristianitos*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6360*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1806*	pc/h/ln
S	*67.8*	mi/h
D = v_p / S	*26.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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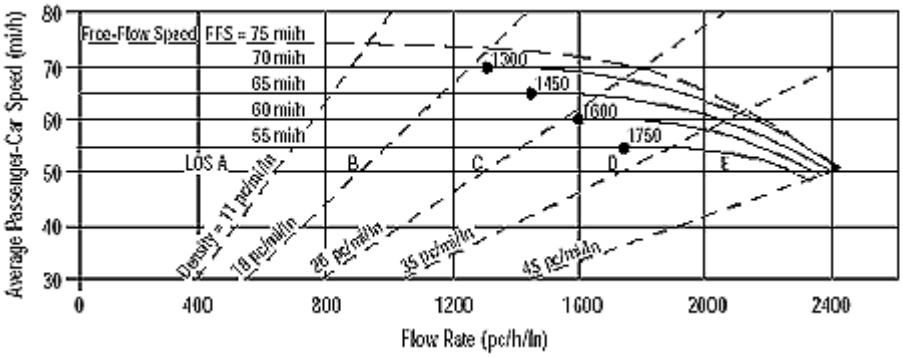

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Calafia*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6680*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1896*	pc/h/ln
S	*66.6*	mi/h
D = v_p / S	*28.5*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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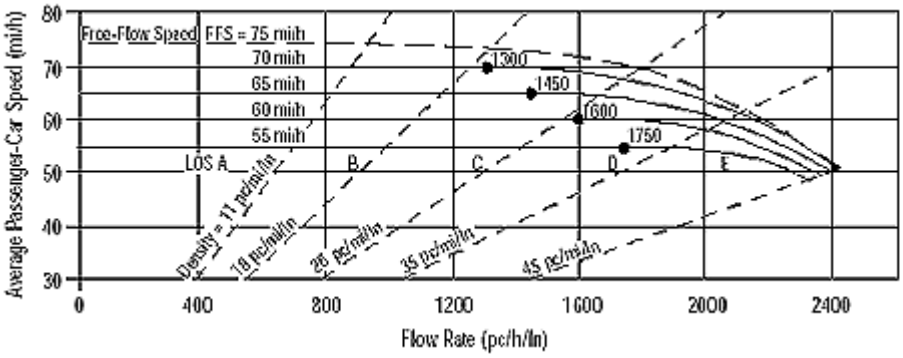

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o El Camino Real*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6890*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade -2.50% Length	*0.65mi*
Driver type adjustment	*1.00*		Up/Down %	*-2.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1565*	pc/h/ln
S	*69.6*	mi/h
D = v_p / S	*22.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
S - Speed
V - Hourly volume
D - Density
v_p - Flow rate
FFS - Free-flow speed
LOS - Level of service
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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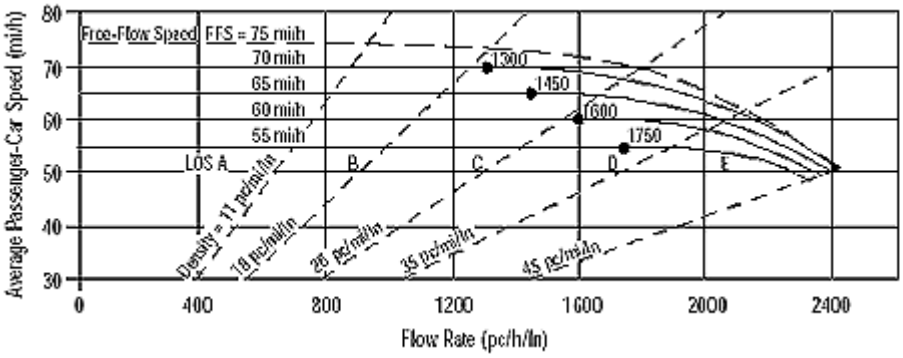

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Presidio*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7210*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1637*	pc/h/ln
S	*69.2*	mi/h
D = v_p / S	*23.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
S - Speed
V - Hourly volume
D - Density
v_p - Flow rate
FFS - Free-flow speed
LOS - Level of service
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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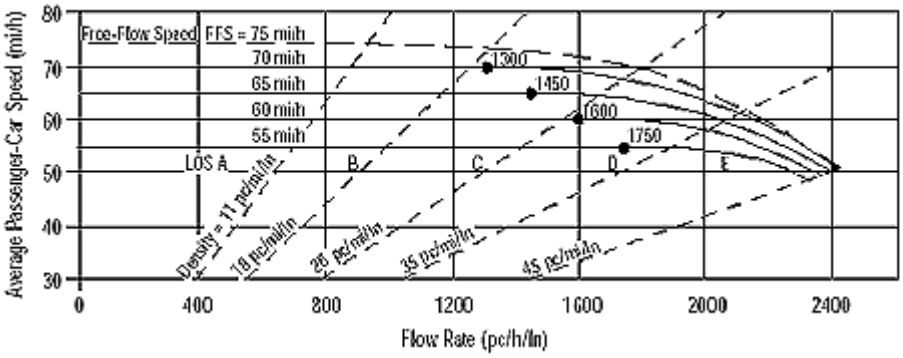

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Palizada*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6710*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1524*	pc/h/ln
S	*69.7*	mi/h
D = v_p / S	*21.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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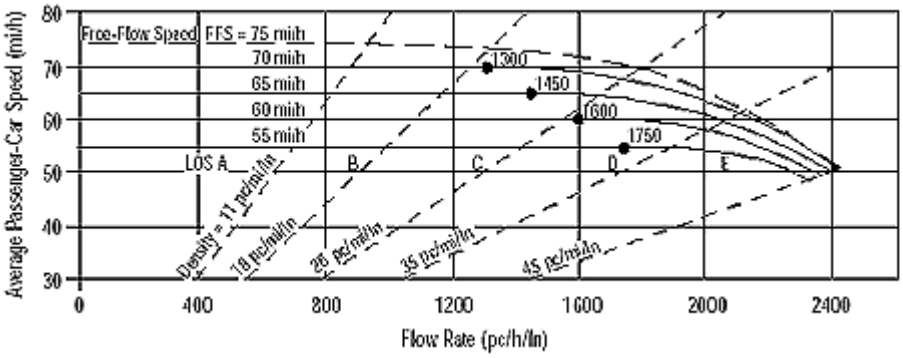

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Pico*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7700*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade 3.50% Length	*0.70mi*
Driver type adjustment	*1.00*		Up/Down %	*3.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*3.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.926*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*6*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1540*	pc/h/ln
S	*69.7*	mi/h
D = v_p / S	*22.1*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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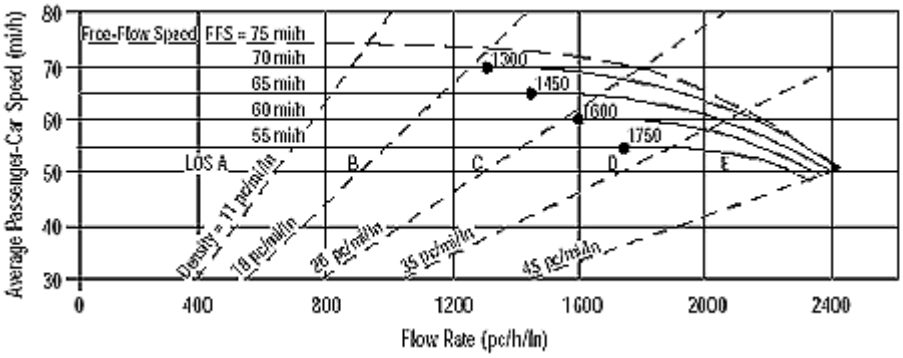
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Vista Hermosa*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7510*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1706*	pc/h/ln
S	*68.8*	mi/h
D = v_p / S	*24.8*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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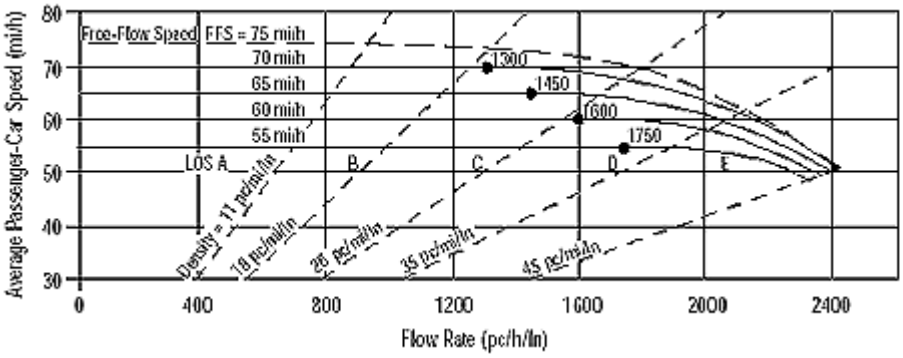
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Cm De Estrella*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8060*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade -2.50% Length	*0.75mi*
Driver type adjustment	*1.00*		Up/Down %	*-2.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2288*	pc/h/ln
S	*57.4*	mi/h
D = v_p / S	*39.9*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
S - Speed
V - Hourly volume
D - Density
v_p - Flow rate
FFS - Free-flow speed
LOS - Level of service
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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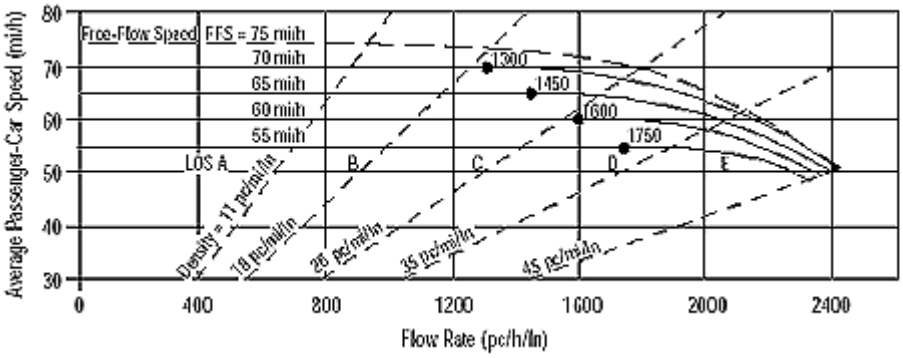

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o SR-1*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8090*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1837*	pc/h/ln
S	*67.4*	mi/h
D = v_p / S	*27.2*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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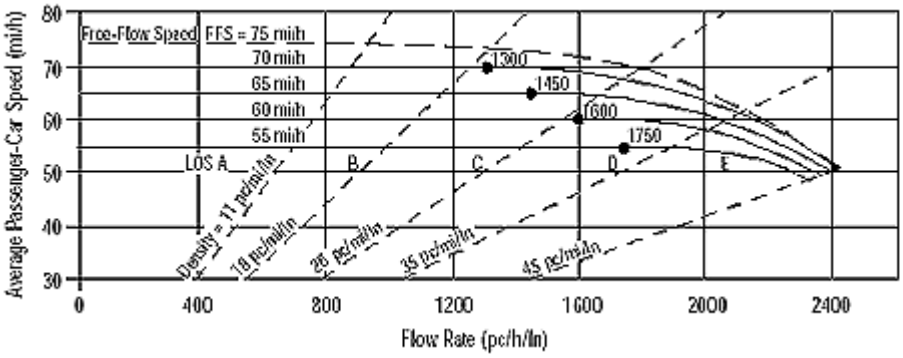

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Southbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Camino Capistrano*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*AM Peak Hour*	Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7300*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*5*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1658*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*69.1*	mi/h	S		mi/h
D = v_p / S	*24.0*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*C*		Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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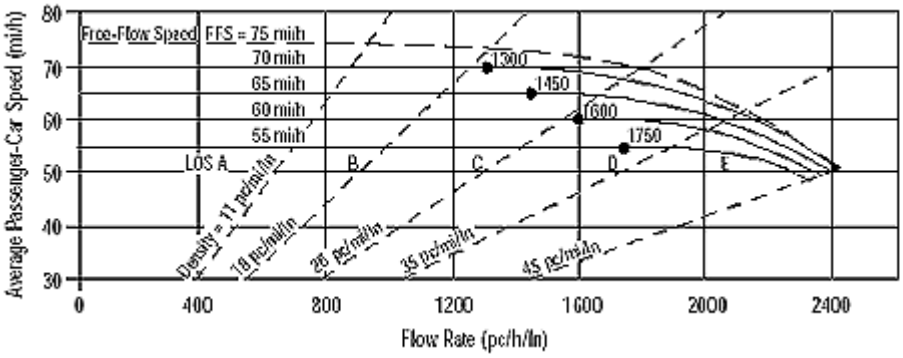

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o San Juan Creek*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7300*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2072*	pc/h/ln
S	*63.4*	mi/h
D = v_p / S	*32.7*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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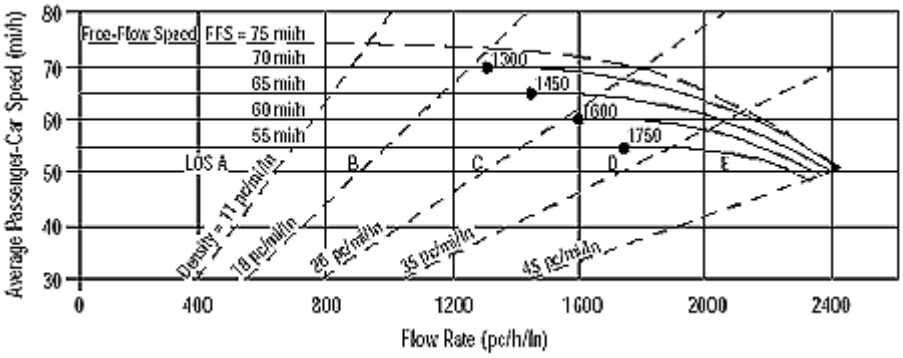

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Ortega Highway*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7490*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2126*	pc/h/ln
S	*62.1*	mi/h
D = v_p / S	*34.2*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed
DDHV - Directional design hour volume

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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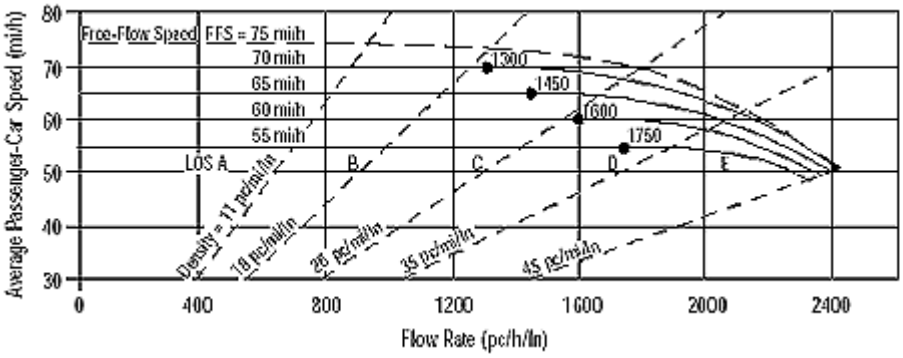

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Junipero Serra*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8560*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade -3.00% Length	*0.35mi*
Driver type adjustment	*1.00*		Up/Down %	*-3.00*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1944*	pc/h/ln
S	*65.9*	mi/h
D = v_p / S	*29.5*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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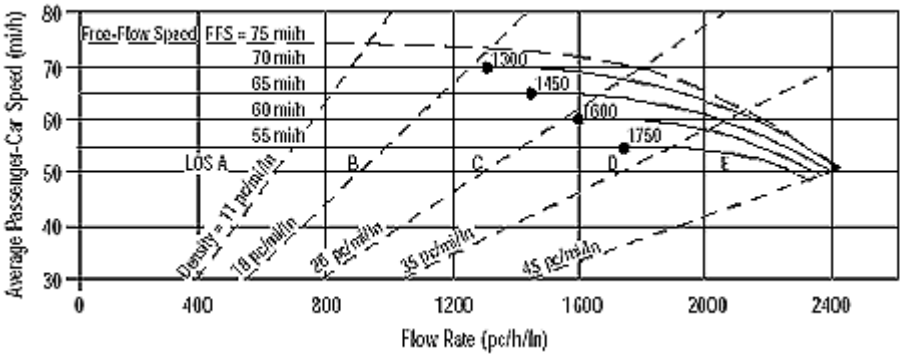

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*AM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o SR-73 Junction*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8860*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*6*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1677*	pc/h/ln
S	*69.0*	mi/h
D = v_p / S	*24.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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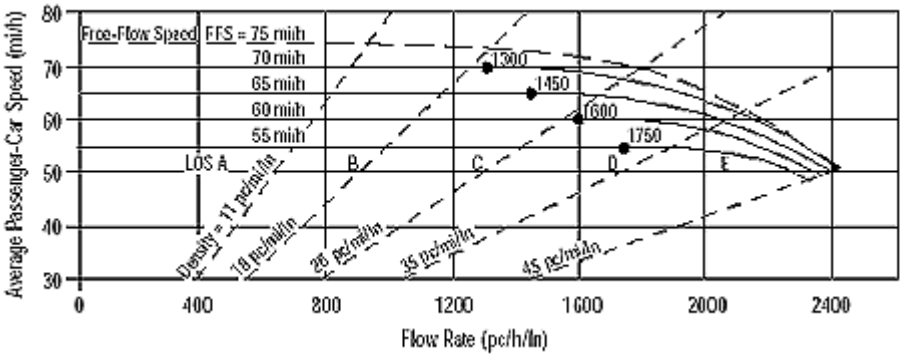
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Cristianitos*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6290*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1786*	pc/h/ln
S	*68.0*	mi/h
D = v_p / S	*26.3*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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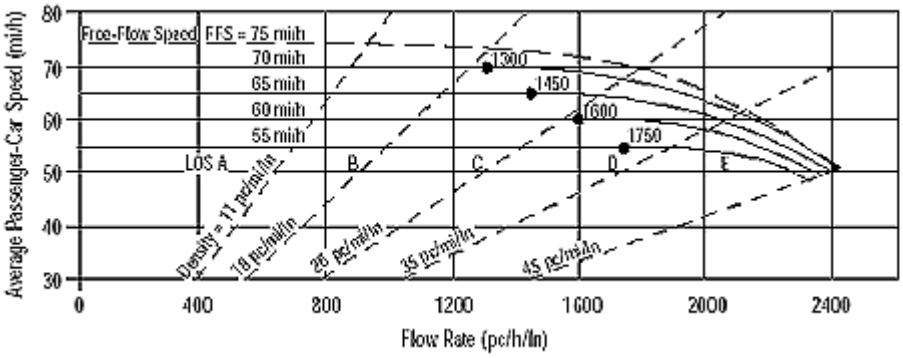

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Avd Magdalena*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6340*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1800*	pc/h/ln
S	*67.9*	mi/h
D = v_p / S	*26.5*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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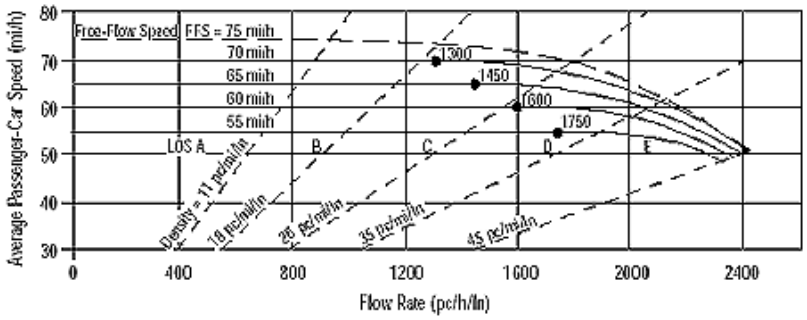

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o El Camino Real*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*6550*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade 2.50% Length	*0.65mi*
Driver type adjustment	*1.00*		Up/Down %	*2.50*

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*3.0*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*5*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1514*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*69.8*	mi/h	S	mi/h
D = v_p / S	*21.7*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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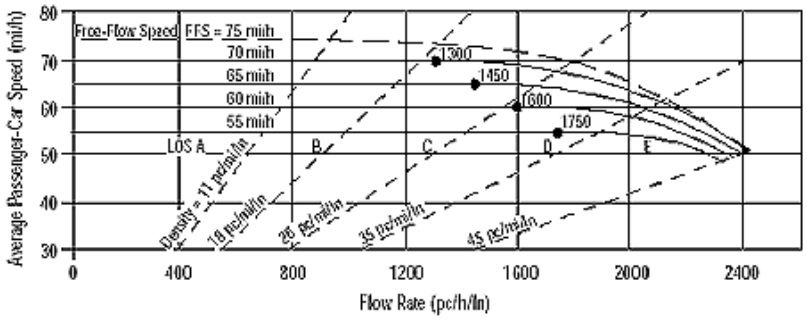

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Avd Presidio*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*6820*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*5*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1549*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*69.6*	mi/h	S	mi/h
D = v_p / S	*22.2*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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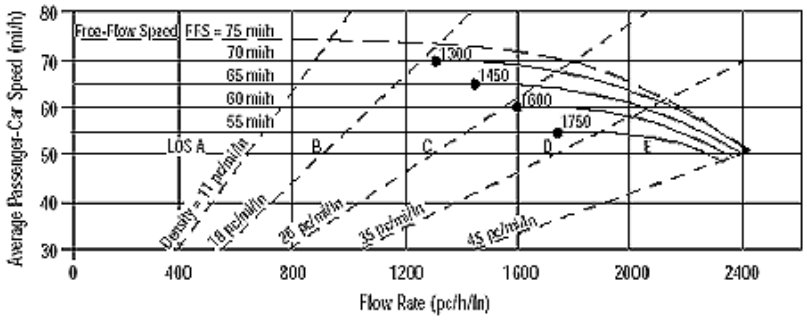

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Avd de la Paz*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6730*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*4*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*	
Driver type adjustment	*1.00*		Up/Down %		

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1911*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*66.4*	mi/h	S	mi/h
D = v_p / S	*28.8*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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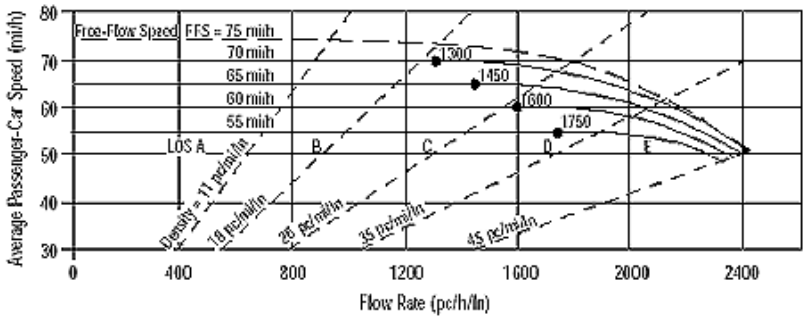

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o Avd Pico*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7440*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*4*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*	
Peak-Hr Direction Prop, D			General Terrain:	*Grade*	
DDHV = AADT x K x D		veh/h	Grade -3.50% Length	*0.70mi*	
Driver type adjustment	*1.00*		Up/Down %	*-3.50*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1690*	pc/h/ln
S	*68.9*	mi/h
D = v_p / S	*24.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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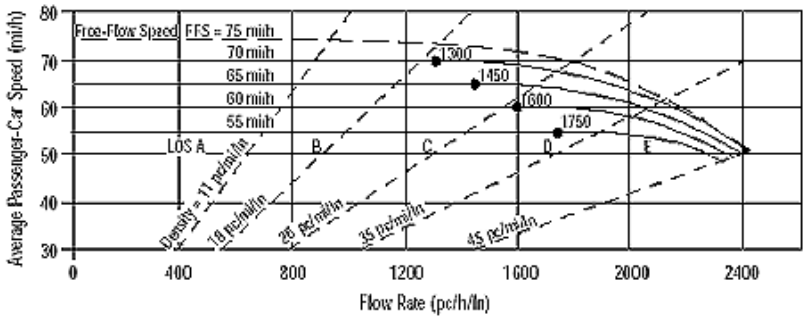

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Vista Hermosa*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*7420*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*5*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1685*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*68.9*	mi/h	S	mi/h
D = v_p / S	*24.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*C*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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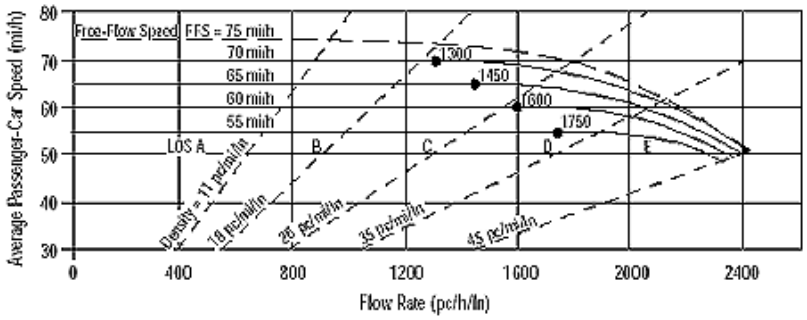

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Cm De Los Mares*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8090*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*4*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*	
Peak-Hr Direction Prop, D			General Terrain:	*Grade*	
DDHV = AADT x K x D		veh/h	Grade 2.50% Length	*0.75mi*	
Driver type adjustment	*1.00*		Up/Down %	*2.50*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*3.0*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.962*

Speed Inputs / Calc Speed Adj and FFS

Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2337*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*55.7*	mi/h	S	mi/h
D = v_p / S	*42.0*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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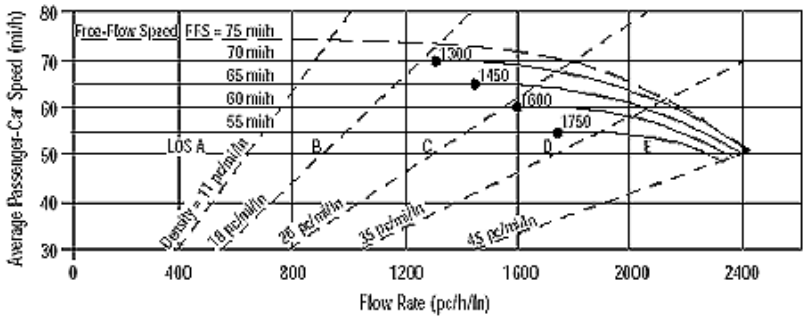

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o SR-1*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*8350*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*5*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1896*	pc/h/ln	Design LOS	
			v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*66.6*	mi/h	S	mi/h
D = v_p / S	*28.5*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*D*		Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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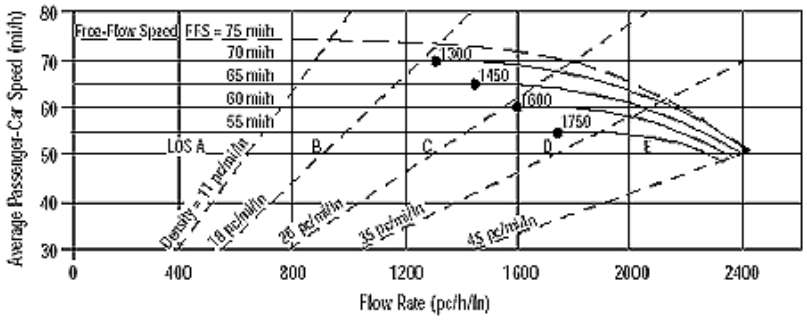

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Camino Capistrano*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7180*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)		
			Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2038*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S	*64.1*	mi/h	S		mi/h
D = v_p / S	*31.8*	pc/mi/ln	D = v_p / S		pc/mi/ln
LOS	*D*		Required Number of Lanes, N		

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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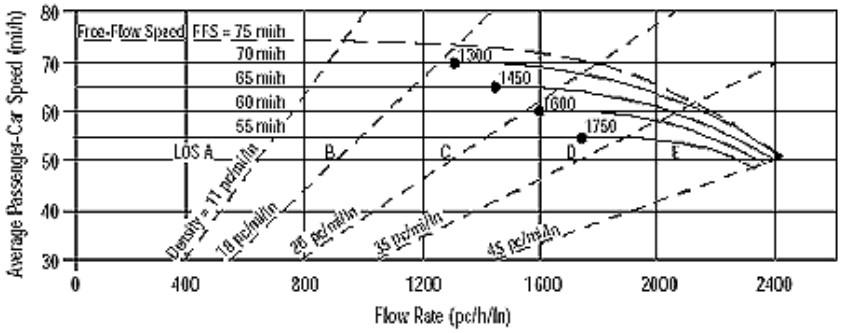

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

General Information		Site Information	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o San Juan Creek*
Date Performed	*12/2/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8850*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Speed Inputs			Calc Speed Adj and FFS		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2512*	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	*F*		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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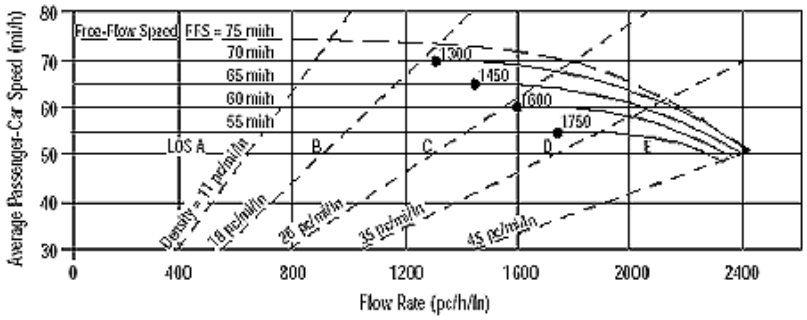

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

General Information		Site Information	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Ortega Highway*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8580*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Speed Inputs			Calc Speed Adj and FFS		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*4*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

LOS and Performance Measures			Design (N)		
Operational (LOS)			Design (N)		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2436*	pc/h/ln	Design LOS		
S		mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
D = v_p / S		pc/mi/ln	S		mi/h
LOS	*F*		D = v_p / S		pc/mi/ln
			Required Number of Lanes, N		

Glossary / Factor Location

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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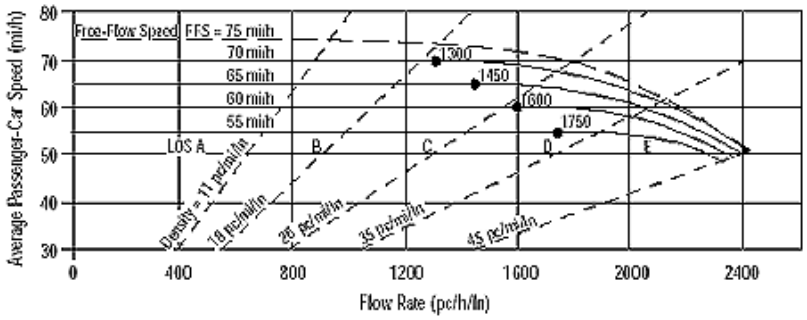

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information / Site Information

Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Northbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Junipero Serra*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*9500*	veh/h	Peak-Hour Factor, PHF	*0.90*	
AADT		veh/day	%Trucks and Buses, P_T	*4*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*	
Peak-Hr Direction Prop, D			General Terrain:	*Grade*	
DDHV = AADT x K x D		veh/h	Grade 3.00% Length	*0.35mi*	
Driver type adjustment	*1.00*		Up/Down %	*3.00*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs / Calc Speed Adj and FFS

Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*5*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures / Design (N)

Operational (LOS)			Design (N)	
			Design LOS	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2158*	pc/h/ln	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
S	*61.3*	mi/h	S	mi/h
D = v_p / S	*35.2*	pc/mi/ln	D = v_p / S	pc/mi/ln
LOS	*E*		Required Number of Lanes, N	

Glossary / Factor Location

N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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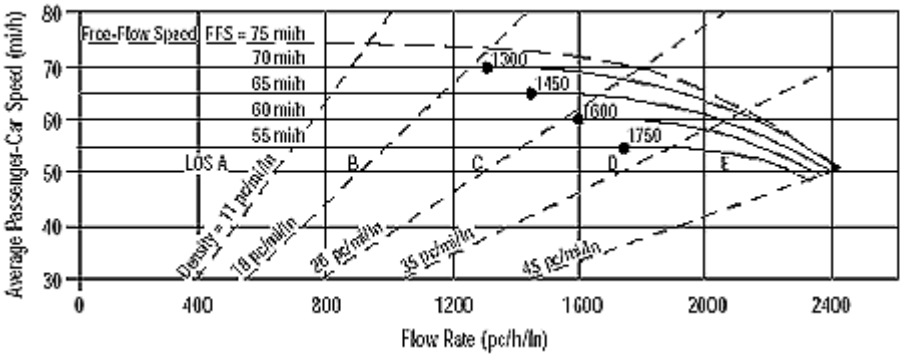

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Northbound*
From/To	*Mainline s/o SR-73 Junction*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*10000*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*6*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1893*	pc/h/ln
S	*66.7*	mi/h
D = v_p / S	*28.4*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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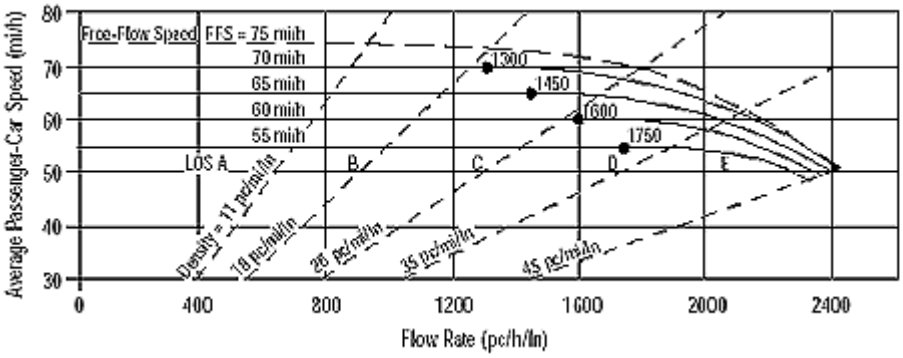

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Cristianitos*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*6910*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1962*	pc/h/ln
S	*65.5*	mi/h
D = v_p / S	*29.9*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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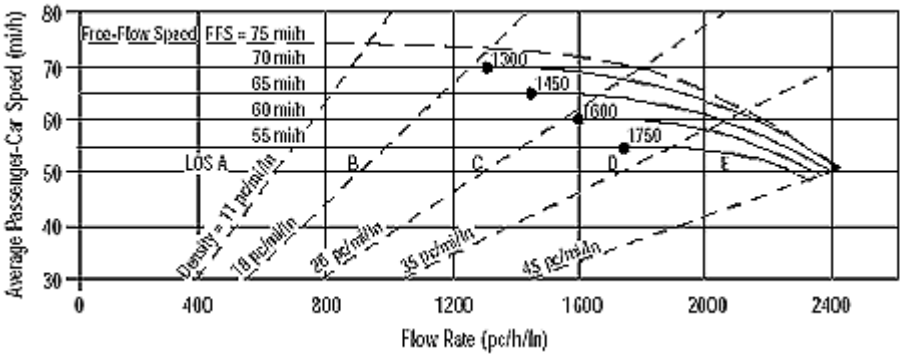

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Calafia*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7020*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1993*	pc/h/ln
S	*65.0*	mi/h
D = v_p / S	*30.7*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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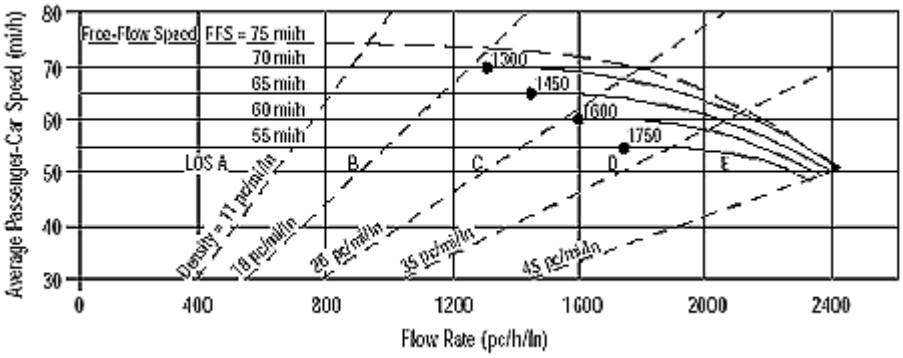

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o El Camino Real*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*7710*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade -2.50% Length	*0.65mi*
Driver type adjustment	*1.00*		Up/Down %	*-2.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1751*	pc/h/ln
S	*68.4*	mi/h
D = v_p / S	*25.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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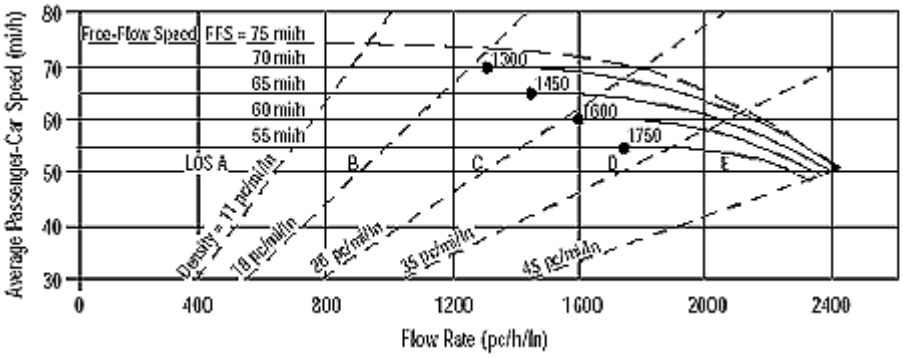

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Presidio*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8300*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1885*	pc/h/ln
S	*66.8*	mi/h
D = v_p / S	*28.2*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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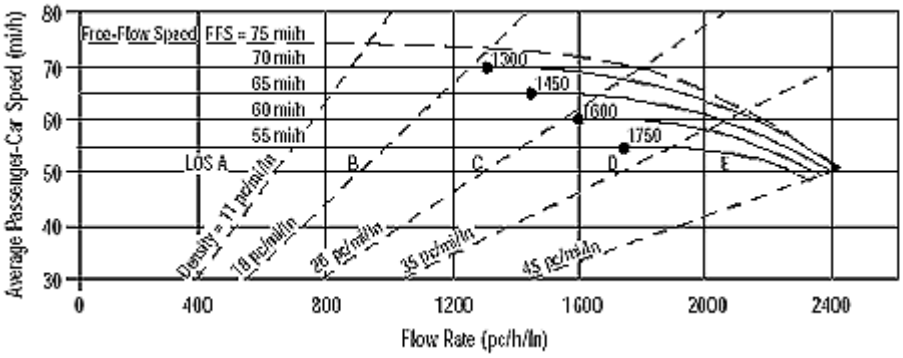

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Palizada*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8010*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1819*	pc/h/ln
S	*67.6*	mi/h
D = v_p / S	*26.9*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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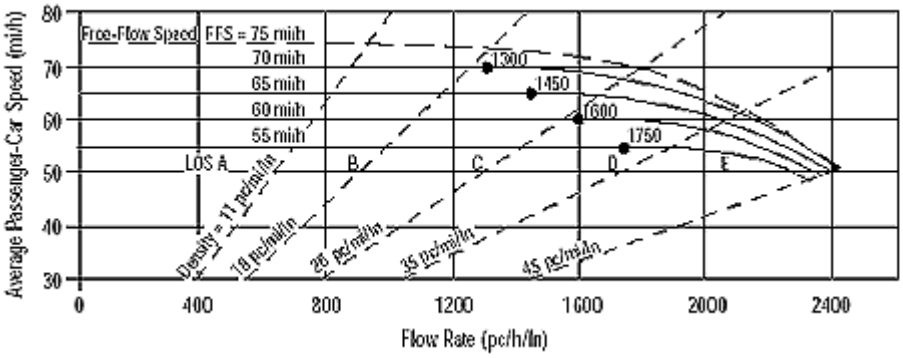
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Avd Pico*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*9270*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade 3.50% Length	*0.70mi*
Driver type adjustment	*1.00*		Up/Down %	*3.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*3.0*
E_T	*2.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.926*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*6*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1854*	pc/h/ln
S	*67.2*	mi/h
D = v_p / S	*27.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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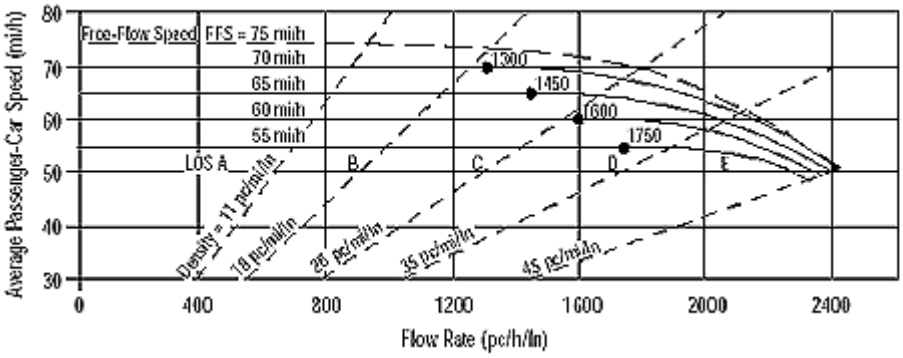

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Vista Hermosa*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*8030*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1824*	pc/h/ln
S	*67.6*	mi/h
D = v_p / S	*27.0*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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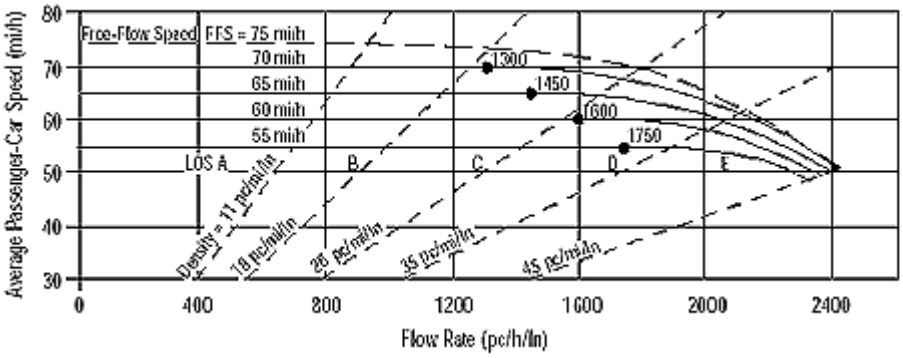
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Cm De Estrella*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*9210*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade -2.50% Length	*0.75mi*
Driver type adjustment	*1.00*		Up/Down %	*-2.50*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2615*	pc/h/ln
S		mi/h
D = v_p / S		pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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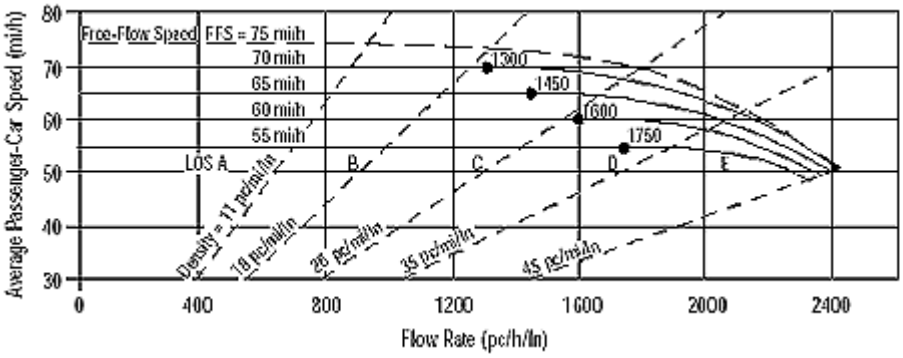

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o SR-1*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*9870*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2242*	pc/h/ln
S	*58.9*	mi/h
D = v_p / S	*38.1*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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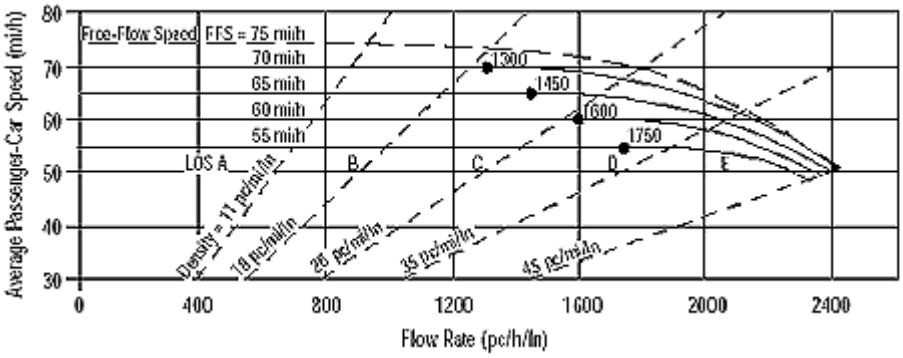
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information		***Site Information***	
Analyst	*Julio Perucho*	Highway/Direction of Travel	*Interstate 5 - Southbound*
Agency or Company	*Austin-Foust Associates, Inc.*	From/To	*Mainline s/o Camino Capistrano*
Date Performed	*9/9/2009*	Jurisdiction	*Caltrans - District 12*
Analysis Time Period	*PM Peak Hour*	Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs				
Volume, V	*9480*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments			
f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs			**Calc Speed Adj and FFS**		
Lane Width	*12.0*	ft	f_{LW}		mi/h
Rt-Shoulder Lat. Clearance	*6.0*	ft	f_{LC}		mi/h
Interchange Density	*0.50*	I/mi	f_{ID}		mi/h
Number of Lanes, N	*5*		f_N		mi/h
FFS (measured)	*70.0*	mi/h	FFS	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h			

LOS and Performance Measures			**Design (N)**	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2153*	pc/h/ln	Design LOS	
S	*61.4*	mi/h	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h
D = v_p / S	*35.1*	pc/mi/ln	S	mi/h
LOS	*E*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		**Factor Location**	
N - Number of lanes	S - Speed	E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
V - Hourly volume	D - Density	E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 23-12	f_N - Exhibit 23-6
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7
DDHV - Directional design hour volume			

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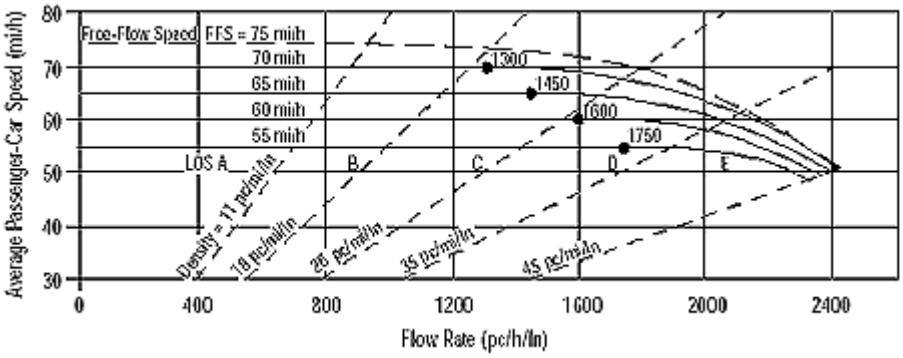

Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o San Juan Creek*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*9480*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2691*	pc/h/ln
S		mi/h
D = v_p / S		pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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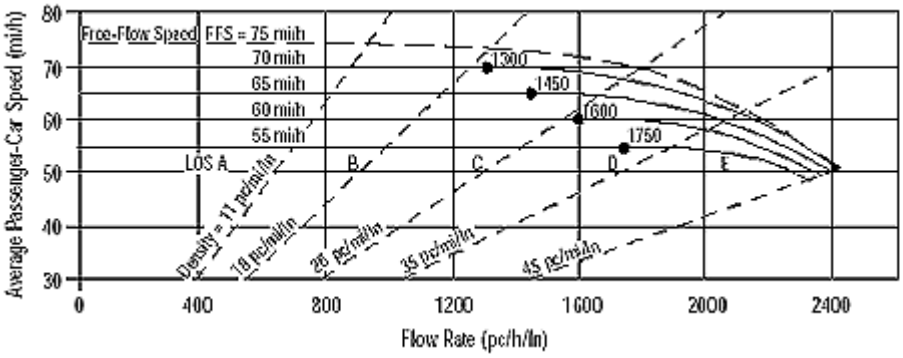
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Ortega Highway*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*10240*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*4*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2907*	pc/h/ln
S		mi/h
D = v_p / S		pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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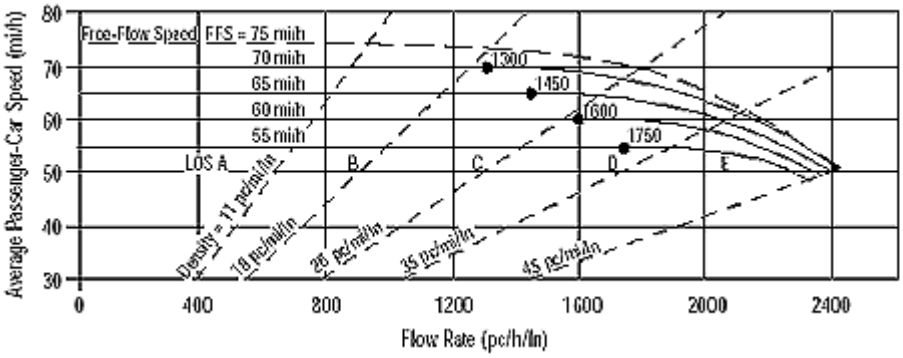
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o Junipero Serra*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*11640*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade -3.00% Length	*0.35mi*
Driver type adjustment	*1.00*		Up/Down %	*-3.00*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*5*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2644*	pc/h/ln
S		mi/h
D = v_p / S		pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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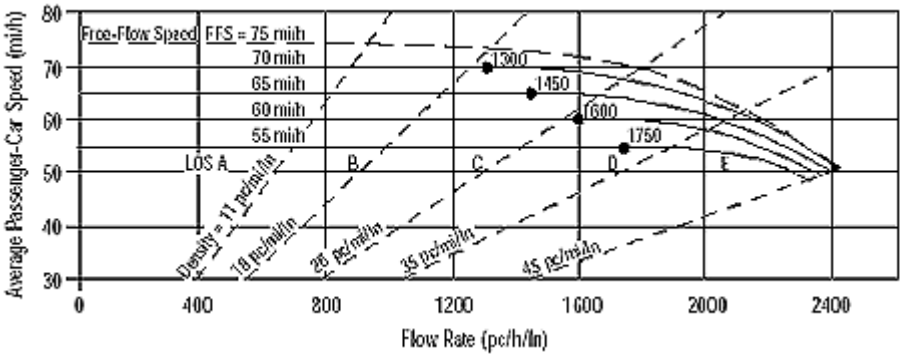
BASIC FREEWAY SEGMENTS WORKSHEET



Application	Input	Output
Operational (LOS)	FFS, N, v_p	LOS, S, D
Design (N)	FFS, LOS, v_p	N, S, D
Design (v_p)	FFS, LOS, N	v_p, S, D
Planning (LOS)	FFS, N, AADT	LOS, S, D
Planning (N)	FFS, LOS, AADT	N, S, D
Planning (v_p)	FFS, LOS, N	v_p, S, D

General Information

Analyst	*Julio Perucho*
Agency or Company	*Austin-Foust Associates, Inc.*
Date Performed	*9/9/2009*
Analysis Time Period	*PM Peak Hour*

Site Information

Highway/Direction of Travel	*Interstate 5 - Southbound*
From/To	*Mainline s/o SR-73 Junction*
Jurisdiction	*Caltrans - District 12*
Analysis Year	*2040 Build*

Project Description I-5 HOV Lane Extension PA/ED

☑ Oper.(LOS) ☐ Des.(N) ☐ Planning Data

Flow Inputs

Volume, V	*12620*	veh/h	Peak-Hour Factor, PHF	*0.90*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*1*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
Driver type adjustment	*1.00*		Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.978*

Speed Inputs

Lane Width	*12.0*	ft
Rt-Shoulder Lat. Clearance	*6.0*	ft
Interchange Density	*0.50*	I/mi
Number of Lanes, N	*6*	
FFS (measured)	*70.0*	mi/h
Base free-flow Speed, BFFS		mi/h

Calc Speed Adj and FFS

f_{LW}		mi/h
f_{LC}		mi/h
f_{ID}		mi/h
f_N		mi/h
FFS	*70.0*	mi/h

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2388*	pc/h/ln
S	*53.8*	mi/h
D = v_p / S	*44.4*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

Design LOS		
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)		pc/h
S		mi/h
D = v_p / S		pc/mi/ln
Required Number of Lanes, N		

Glossary

N - Number of lanes
V - Hourly volume
v_p - Flow rate
LOS - Level of service
DDHV - Directional design hour volume
S - Speed
D - Density
FFS - Free-flow speed
BFFS - Base free-flow speed

Factor Location

E_R - Exhibits23-8, 23-10	f_{LW} - Exhibit 23-4
E_T - Exhibits 23-8, 23-10, 23-11	f_{LC} - Exhibit 23-5
f_p - Page 23-12	f_N - Exhibit 23-6
LOS, S, FFS, v_p - Exhibits 23-2, 23-3	f_{ID} - Exhibit 23-7

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APPENDIX E

WEAVING LOS WORKSHEETS

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Magdalena-El Camino Real
Jurisdiction:	
Analysis Year:	Existing
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	800	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.13	
Weaving ratio, R	0.22	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4010	15	450	130	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1114	4	125	36	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	4553	17	511	147	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	0.79	0.31
Weaving and non-weaving speeds, Si	48.59	60.64
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	0.99
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	58.80	mph
Weaving segment density, D	17.78	pc/mi/ln
Level of service, LOS	B	
Capacity of base condition, cb	10179	pc/h
Capacity as a 15-minute flow rate, c	9960	pc/h
Capacity as a full-hour volume, ch	8964	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	658	2800	a
Average flow rate (pcphpl)	1045	2400	b
Volume ratio, VR	0.13	0.20	c
Weaving ratio, R	0.22	N/A	d
Weaving length (ft)	800	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).

g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.

h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.

i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	El Camino Real-Avd. Presidio
Jurisdiction:	
Analysis Year:	Existing
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1450	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.15	
Weaving ratio, R	0.24	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4280	15	580	180	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1189	4	161	50	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	4860	17	658	204	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	0.56	0.25
Weaving and non-weaving speeds, Si	53.44	63.09
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.21
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	61.42	mph
Weaving segment density, D	18.69	pc/mi/ln
Level of service, LOS	B	
Capacity of base condition, cb	11090	pc/h
Capacity as a 15-minute flow rate, c	10851	pc/h
Capacity as a full-hour volume, ch	9766	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	862	2800	a
Average flow rate (pcphpl)	1147	2400	b
Volume ratio, VR	0.15	0.20	c
Weaving ratio, R	0.24	N/A	d
Weaving length (ft)	1450	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin-Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Camino De Los Mares-Route 1
Jurisdiction:	
Analysis Year:	Existing
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1750	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	B	
Volume ratio, VR	0.29	
Weaving ratio, R	0.40	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4832	15	1220	800	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1342	4	339	222	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5487	17	1385	908	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.08	0.0020
b (Exhibit 24-6)	2.20	6.00
c (Exhibit 24-6)	0.70	1.00
d (Exhibit 24-6)	0.50	0.50
Weaving intensity factor, Wi	0.58	0.35
Weaving and non-weaving speeds, Si	52.99	59.44
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.55
Maximum number of lanes, Nw (max) (Exhibit 24-7)	3.50
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	57.39	mph
Weaving segment density, D	27.17	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	11569	pc/h
Capacity as a 15-minute flow rate, c	11320	pc/h
Capacity as a full-hour volume, ch	10188	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2293	4000	a
Average flow rate (pcphpl)	1559	2400	b
Volume ratio, VR	0.29	0.80	c
Weaving ratio, R	0.40	N/A	d
Weaving length (ft)	1750	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Magdalena-El Camino Real
Jurisdiction:	
Analysis Year:	Existing
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	2000	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.09	
Weaving ratio, R	0.35	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4270	15	260	140	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1186	4	72	39	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	4848	17	295	158	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	0.35	0.14
Weaving and non-weaving speeds, Si	59.30	67.65
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	0.90
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	66.85	mph
Weaving segment density, D	15.91	pc/mi/ln
Level of service, LOS	B	
Capacity of base condition, cb	11745	pc/h
Capacity as a 15-minute flow rate, c	11492	pc/h
Capacity as a full-hour volume, ch	10343	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	453	2800	a
Average flow rate (pcphpl)	1063	2400	b
Volume ratio, VR	0.09	0.20	c
Weaving ratio, R	0.35	N/A	d
Weaving length (ft)	2000	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	El Camino Real-Avd. Presidio
Jurisdiction:	
Analysis Year:	Existing
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	600	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.15	
Weaving ratio, R	0.31	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4300	15	510	230	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1194	4	142	64	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	4882	17	579	261	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.13	0.47
Weaving and non-weaving speeds, Si	43.20	55.71

Number of lanes required for

unconstrained operation, Nw (Exhibit 24-7)	1.06
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	53.45	mph
Weaving segment density, D	21.48	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	9508	pc/h
Capacity as a 15-minute flow rate, c	9303	pc/h
Capacity as a full-hour volume, ch	8373	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	840	2800	a
Average flow rate (pcphpl)	1147	2400	b
Volume ratio, VR	0.15	0.20	c
Weaving ratio, R	0.31	N/A	d
Weaving length (ft)	600	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Magdalena-El Camino Real
Jurisdiction:	
Analysis Year:	Existing
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	800	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.12	
Weaving ratio, R	0.23	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4160	15	430	130	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1156	4	119	36	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	4723	17	488	147	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	0.80	0.32
Weaving and non-weaving speeds, Si	48.41	60.55
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	0.95
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	58.80	mph
Weaving segment density, D	18.28	pc/mi/ln
Level of service, LOS	B	
Capacity of base condition, cb	10241	pc/h
Capacity as a 15-minute flow rate, c	10021	pc/h
Capacity as a full-hour volume, ch	9019	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	635	2800	a
Average flow rate (pcphpl)	1075	2400	b
Volume ratio, VR	0.12	0.20	c
Weaving ratio, R	0.23	N/A	d
Weaving length (ft)	800	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	El Camino Real-Avd. Presidio
Jurisdiction:	
Analysis Year:	Existing
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1450	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.15	
Weaving ratio, R	0.29	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4360	15	550	230	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1211	4	153	64	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	4951	17	624	261	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	0.57	0.26
Weaving and non-weaving speeds, Si	53.15	62.81

Number of lanes required for

unconstrained operation, Nw (Exhibit 24-7)	1.21
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	61.13	mph
Weaving segment density, D	19.15	pc/mi/ln
Level of service, LOS	B	
Capacity of base condition, cb	11082	pc/h
Capacity as a 15-minute flow rate, c	10843	pc/h
Capacity as a full-hour volume, ch	9759	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	885	2800	a
Average flow rate (pcphpl)	1170	2400	b
Volume ratio, VR	0.15	0.20	c
Weaving ratio, R	0.29	N/A	d
Weaving length (ft)	1450	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).

g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.

h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.

i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin-Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Camino De Los Mares-Route 1
Jurisdiction:	
Analysis Year:	Existing
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1750	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	B	
Volume ratio, VR	0.36	
Weaving ratio, R	0.33	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4216	15	1630	800	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1171	4	453	222	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	4787	17	1850	908	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.08	0.0020
b (Exhibit 24-6)	2.20	6.00
c (Exhibit 24-6)	0.70	1.00
d (Exhibit 24-6)	0.50	0.50
Weaving intensity factor, Wi	0.64	0.47
Weaving and non-weaving speeds, Si	51.64	55.90

Number of lanes required for

unconstrained operation, Nw (Exhibit 24-7)	2.00
Maximum number of lanes, Nw (max) (Exhibit 24-7)	3.50
Type of operation is	Unconstrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	54.27	mph
Weaving segment density, D	27.87	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	10514	pc/h
Capacity as a 15-minute flow rate, c	10288	pc/h
Capacity as a full-hour volume, ch	9259	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2758	4000	a
Average flow rate (pcphpl)	1512	2400	b
Volume ratio, VR	0.36	0.80	c
Weaving ratio, R	0.33	N/A	d
Weaving length (ft)	1750	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Magdalena-El Camino Real
Jurisdiction:	
Analysis Year:	Existing
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	2000	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.14	
Weaving ratio, R	0.28	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4430	15	520	200	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1231	4	144	56	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5030	17	590	227	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	0.43	0.19
Weaving and non-weaving speeds, Si	56.85	65.31
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.21
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	63.98	mph
Weaving segment density, D	18.33	pc/mi/ln
Level of service, LOS	B	
Capacity of base condition, cb	11560	pc/h
Capacity as a 15-minute flow rate, c	11311	pc/h
Capacity as a full-hour volume, ch	10180	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	817	2800	a
Average flow rate (pcphpl)	1172	2400	b
Volume ratio, VR	0.14	0.20	c
Weaving ratio, R	0.28	N/A	d
Weaving length (ft)	2000	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	El Camino Real-Avd. Presidio
Jurisdiction:	
Analysis Year:	Existing
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	600	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.19	
Weaving ratio, R	0.20	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4730	15	880	220	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1314	4	244	61	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5371	17	999	249	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.40	0.66
Weaving and non-weaving speeds, Si	39.96	51.14
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.27
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	48.58	mph
Weaving segment density, D	27.32	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	9147	pc/h
Capacity as a 15-minute flow rate, c	8950	pc/h
Capacity as a full-hour volume, ch	8055	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1248	2800	a
Average flow rate (pcphpl)	1327	2400	b
Volume ratio, VR	0.19	0.20	c
Weaving ratio, R	0.20	N/A	d
Weaving length (ft)	600	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Magdalena-El Camino Real
Jurisdiction:	
Analysis Year:	2040 No Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	800	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.14	
Weaving ratio, R	0.20	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5770	15	740	190	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1603	4	206	53	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6552	17	840	215	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.16	0.54
Weaving and non-weaving speeds, Si	42.75	54.03
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.10
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	52.13	mph
Weaving segment density, D	29.25	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	10078	pc/h
Capacity as a 15-minute flow rate, c	9861	pc/h
Capacity as a full-hour volume, ch	8875	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1055	2800	a
Average flow rate (pcphpl)	1524	2400	b
Volume ratio, VR	0.14	0.20	c
Weaving ratio, R	0.20	N/A	d
Weaving length (ft)	800	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	El Camino Real-Avd. Presidio
Jurisdiction:	
Analysis Year:	2040 No Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1450	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.16	
Weaving ratio, R	0.42	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	6040	15	650	470	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1678	4	181	131	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6858	17	738	533	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	0.80	0.40
Weaving and non-weaving speeds, Si	48.40	57.90

Number of lanes required for

unconstrained operation, Nw (Exhibit 24-7)	1.29
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	56.18	mph
Weaving segment density, D	29.00	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	11047	pc/h
Capacity as a 15-minute flow rate, c	10809	pc/h
Capacity as a full-hour volume, ch	9728	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1271	2800	a
Average flow rate (pcphpl)	1629	2400	b
Volume ratio, VR	0.16	0.20	c
Weaving ratio, R	0.42	N/A	d
Weaving length (ft)	1450	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin-Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Camino De Los Mares-Route 1
Jurisdiction:	
Analysis Year:	2040 No Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1750	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	B	
Volume ratio, VR	0.29	
Weaving ratio, R	0.49	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	6824	15	1410	1380	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1896	4	392	383	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	7749	17	1601	1567	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.08	0.0020
b (Exhibit 24-6)	2.20	6.00
c (Exhibit 24-6)	0.70	1.00
d (Exhibit 24-6)	0.50	0.50
Weaving intensity factor, Wi	0.73	0.48
Weaving and non-weaving speeds, Si	49.71	55.51

Number of lanes required for

unconstrained operation, Nw (Exhibit 24-7)	1.59
Maximum number of lanes, Nw (max) (Exhibit 24-7)	3.50
Type of operation is	Unconstrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	53.69	mph
Weaving segment density, D	40.73	pc/mi/ln
Level of service, LOS	E	
Capacity of base condition, cb	11580	pc/h
Capacity as a 15-minute flow rate, c	11331	pc/h
Capacity as a full-hour volume, ch	10198	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	3168	4000	a
Average flow rate (pcphpl)	2186	2400	b
Volume ratio, VR	0.29	0.80	c
Weaving ratio, R	0.49	N/A	d
Weaving length (ft)	1750	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Magdalena-El Camino Real
Jurisdiction:	
Analysis Year:	2040 No Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	2000	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.08	
Weaving ratio, R	0.38	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	6350	15	330	200	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1764	4	92	56	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	7210	17	374	227	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	0.51	0.22
Weaving and non-weaving speeds, Si	54.82	64.03
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	0.88
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	63.21	mph
Weaving segment density, D	24.77	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	11745	pc/h
Capacity as a 15-minute flow rate, c	11492	pc/h
Capacity as a full-hour volume, ch	10343	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	601	2800	a
Average flow rate (pcphpl)	1565	2400	b
Volume ratio, VR	0.08	0.20	c
Weaving ratio, R	0.38	N/A	d
Weaving length (ft)	2000	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	El Camino Real-Avd. Presidio
Jurisdiction:	
Analysis Year:	2040 No Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	600	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.14	
Weaving ratio, R	0.49	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	6180	15	510	500	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1717	4	142	139	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	7017	17	579	567	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.57	0.73
Weaving and non-weaving speeds, Si	38.34	49.59
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.09
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	47.63	mph
Weaving segment density, D	34.35	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	9562	pc/h
Capacity as a 15-minute flow rate, c	9356	pc/h
Capacity as a full-hour volume, ch	8420	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1146	2800	a
Average flow rate (pcphpl)	1636	2400	b
Volume ratio, VR	0.14	0.20	c
Weaving ratio, R	0.49	N/A	d
Weaving length (ft)	600	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Magdalena-El Camino Real
Jurisdiction:	
Analysis Year:	2040 No Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	800	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.11	
Weaving ratio, R	0.40	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5800	15	450	300	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1611	4	125	83	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6586	17	511	340	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.08	0.48
Weaving and non-weaving speeds, Si	43.79	55.58
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	0.98
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	53.92	mph
Weaving segment density, D	27.65	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	10273	pc/h
Capacity as a 15-minute flow rate, c	10052	pc/h
Capacity as a full-hour volume, ch	9047	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	851	2800	a
Average flow rate (pcphpl)	1490	2400	b
Volume ratio, VR	0.11	0.20	c
Weaving ratio, R	0.40	N/A	d
Weaving length (ft)	800	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	El Camino Real-Avd. Presidio
Jurisdiction:	
Analysis Year:	2040 No Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1450	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.16	
Weaving ratio, R	0.49	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5710	15	560	540	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1586	4	156	150	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6484	17	635	613	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	0.77	0.38
Weaving and non-weaving speeds, Si	48.97	58.48
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.30
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	56.71	mph
Weaving segment density, D	27.33	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	11011	pc/h
Capacity as a 15-minute flow rate, c	10774	pc/h
Capacity as a full-hour volume, ch	9697	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1248	2800	a
Average flow rate (pcphpl)	1549	2400	b
Volume ratio, VR	0.16	0.20	c
Weaving ratio, R	0.49	N/A	d
Weaving length (ft)	1450	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin-Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Camino De Los Mares-Route 1
Jurisdiction:	
Analysis Year:	2040 No Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1750	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	B	
Volume ratio, VR	0.31	
Weaving ratio, R	0.33	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5368	15	1640	820	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1491	4	456	228	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6095	17	1862	931	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.08	0.0020
b (Exhibit 24-6)	2.20	6.00
c (Exhibit 24-6)	0.70	1.00
d (Exhibit 24-6)	0.50	0.50
Weaving intensity factor, Wi	0.66	0.44
Weaving and non-weaving speeds, Si	51.21	56.74

Number of lanes required for

unconstrained operation, Nw (Exhibit 24-7)	1.70
Maximum number of lanes, Nw (max) (Exhibit 24-7)	3.50
Type of operation is	Unconstrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	54.88	mph
Weaving segment density, D	32.45	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	11334	pc/h
Capacity as a 15-minute flow rate, c	11090	pc/h
Capacity as a full-hour volume, ch	9981	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2793	4000	a
Average flow rate (pcphpl)	1781	2400	b
Volume ratio, VR	0.31	0.80	c
Weaving ratio, R	0.33	N/A	d
Weaving length (ft)	1750	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Magdalena-El Camino Real
Jurisdiction:	
Analysis Year:	2040 No Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	2000	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.14	
Weaving ratio, R	0.29	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	6620	15	770	310	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1839	4	214	86	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	7517	17	874	352	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	0.64	0.33
Weaving and non-weaving speeds, Si	51.57	60.27
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.27
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	58.88	mph
Weaving segment density, D	29.76	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	11557	pc/h
Capacity as a 15-minute flow rate, c	11308	pc/h
Capacity as a full-hour volume, ch	10177	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1226	2800	a
Average flow rate (pcphpl)	1752	2400	b
Volume ratio, VR	0.14	0.20	c
Weaving ratio, R	0.29	N/A	d
Weaving length (ft)	2000	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	El Camino Real-Avd. Presidio
Jurisdiction:	
Analysis Year:	2040 No Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	600	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.14	
Weaving ratio, R	0.25	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	7100	15	880	290	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1972	4	244	81	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	8062	17	999	329	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.80	0.88
Weaving and non-weaving speeds, Si	36.41	46.84
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.12
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	45.02	mph
Weaving segment density, D	41.79	pc/mi/ln
Level of service, LOS	E	
Capacity of base condition, cb	9553	pc/h
Capacity as a 15-minute flow rate, c	9347	pc/h
Capacity as a full-hour volume, ch	8412	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1328	2800	a
Average flow rate (pcphpl)	1881	2400	b
Volume ratio, VR	0.14	0.20	c
Weaving ratio, R	0.25	N/A	d
Weaving length (ft)	600	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Magdalena-El Camino Real
Jurisdiction:	
Analysis Year:	2040 Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	800	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.14	
Weaving ratio, R	0.21	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5780	15	730	190	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1606	4	203	53	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6563	17	828	215	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.16	0.53
Weaving and non-weaving speeds, Si	42.80	54.11
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.10
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	52.22	mph
Weaving segment density, D	29.19	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	10091	pc/h
Capacity as a 15-minute flow rate, c	9874	pc/h
Capacity as a full-hour volume, ch	8887	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1043	2800	a
Average flow rate (pcphpl)	1524	2400	b
Volume ratio, VR	0.14	0.20	c
Weaving ratio, R	0.21	N/A	d
Weaving length (ft)	800	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
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Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	El Camino Real-Avd. Presidio
Jurisdiction:	
Analysis Year:	2040 Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1450	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.16	
Weaving ratio, R	0.42	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	6040	15	660	470	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1678	4	183	131	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6858	17	749	533	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	0.80	0.40
Weaving and non-weaving speeds, Si	48.35	57.83
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.29
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	56.10	mph
Weaving segment density, D	29.08	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	11039	pc/h
Capacity as a 15-minute flow rate, c	10801	pc/h
Capacity as a full-hour volume, ch	9721	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1282	2800	a
Average flow rate (pcphpl)	1631	2400	b
Volume ratio, VR	0.16	0.20	c
Weaving ratio, R	0.42	N/A	d
Weaving length (ft)	1450	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin-Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Camino De Los Mares-Route 1
Jurisdiction:	
Analysis Year:	2040 Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1750	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	B	
Volume ratio, VR	0.32	
Weaving ratio, R	0.49	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5864	15	1420	1370	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1629	4	394	381	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6658	17	1612	1555	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.08	0.0020
b (Exhibit 24-6)	2.20	6.00
c (Exhibit 24-6)	0.70	1.00
d (Exhibit 24-6)	0.50	0.50
Weaving intensity factor, Wi	0.71	0.50
Weaving and non-weaving speeds, Si	50.00	54.95
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.78
Maximum number of lanes, Nw (max) (Exhibit 24-7)	3.50
Type of operation is	Unconstrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	53.25	mph
Weaving segment density, D	36.96	pc/mi/ln
Level of service, LOS	E	
Capacity of base condition, cb	11203	pc/h
Capacity as a 15-minute flow rate, c	10962	pc/h
Capacity as a full-hour volume, ch	9866	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	3167	4000	a
Average flow rate (pcphpl)	1968	2400	b
Volume ratio, VR	0.32	0.80	c
Weaving ratio, R	0.49	N/A	d
Weaving length (ft)	1750	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Magdalena-El Camino Real
Jurisdiction:	
Analysis Year:	2040 Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	2000	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.08	
Weaving ratio, R	0.37	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	6350	15	340	200	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1764	4	94	56	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	7210	17	386	227	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	0.51	0.23
Weaving and non-weaving speeds, Si	54.76	63.96
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	0.89
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	63.13	mph
Weaving segment density, D	24.84	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	11745	pc/h
Capacity as a 15-minute flow rate, c	11492	pc/h
Capacity as a full-hour volume, ch	10343	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	613	2800	a
Average flow rate (pcphpl)	1568	2400	b
Volume ratio, VR	0.08	0.20	c
Weaving ratio, R	0.37	N/A	d
Weaving length (ft)	2000	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	El Camino Real-Avd. Presidio
Jurisdiction:	
Analysis Year:	2040 Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	600	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.14	
Weaving ratio, R	0.49	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	6190	15	520	500	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1719	4	144	139	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	7029	17	590	567	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.58	0.74
Weaving and non-weaving speeds, Si	38.27	49.48
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.09
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	47.52	mph
Weaving segment density, D	34.52	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	9554	pc/h
Capacity as a 15-minute flow rate, c	9348	pc/h
Capacity as a full-hour volume, ch	8413	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1157	2800	a
Average flow rate (pcphpl)	1640	2400	b
Volume ratio, VR	0.14	0.20	c
Weaving ratio, R	0.49	N/A	d
Weaving length (ft)	600	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Magdalena-El Camino Real
Jurisdiction:	
Analysis Year:	2040 Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	800	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.11	
Weaving ratio, R	0.41	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5800	15	440	300	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1611	4	122	83	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6586	17	499	340	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.08	0.48
Weaving and non-weaving speeds, Si	43.85	55.67
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	0.97
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	54.03	mph
Weaving segment density, D	27.55	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	10284	pc/h
Capacity as a 15-minute flow rate, c	10063	pc/h
Capacity as a full-hour volume, ch	9057	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	839	2800	a
Average flow rate (pcphpl)	1488	2400	b
Volume ratio, VR	0.11	0.20	c
Weaving ratio, R	0.41	N/A	d
Weaving length (ft)	800	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	El Camino Real-Avd. Presidio
Jurisdiction:	
Analysis Year:	2040 Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1450	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.16	
Weaving ratio, R	0.49	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5710	15	570	540	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1586	4	158	150	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6484	17	647	613	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	0.77	0.38
Weaving and non-weaving speeds, Si	48.92	58.40
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.31
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	56.62	mph
Weaving segment density, D	27.42	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	11001	pc/h
Capacity as a 15-minute flow rate, c	10764	pc/h
Capacity as a full-hour volume, ch	9688	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1260	2800	a
Average flow rate (pcphpl)	1552	2400	b
Volume ratio, VR	0.16	0.20	c
Weaving ratio, R	0.49	N/A	d
Weaving length (ft)	1450	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin-Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Camino De Los Mares-Route 1
Jurisdiction:	
Analysis Year:	2040 Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1750	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	B	
Volume ratio, VR	0.34	
Weaving ratio, R	0.33	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4752	15	1650	810	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1320	4	458	225	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5	1.5	1.5	1.5	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5396	17	1873	919	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.08	0.0020
b (Exhibit 24-6)	2.20	6.00
c (Exhibit 24-6)	0.70	1.00
d (Exhibit 24-6)	0.50	0.50
Weaving intensity factor, Wi	0.65	0.45
Weaving and non-weaving speeds, Si	51.39	56.24

Number of lanes required for

unconstrained operation, Nw (Exhibit 24-7)	1.86
Maximum number of lanes, Nw (max) (Exhibit 24-7)	3.50
Type of operation is	Unconstrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	54.49	mph
Weaving segment density, D	30.11	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	10906	pc/h
Capacity as a 15-minute flow rate, c	10671	pc/h
Capacity as a full-hour volume, ch	9604	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2792	4000	a
Average flow rate (pcphpl)	1641	2400	b
Volume ratio, VR	0.34	0.80	c
Weaving ratio, R	0.33	N/A	d
Weaving length (ft)	1750	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Magdalena-El Camino Real
Jurisdiction:	
Analysis Year:	2040 Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	2000	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.14	
Weaving ratio, R	0.28	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	6620	15	780	310	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1839	4	217	86	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	7517	17	885	352	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	0.64	0.33
Weaving and non-weaving speeds, Si	51.52	60.21
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.27
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	58.81	mph
Weaving segment density, D	29.83	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	11552	pc/h
Capacity as a 15-minute flow rate, c	11303	pc/h
Capacity as a full-hour volume, ch	10173	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1237	2800	a
Average flow rate (pcphpl)	1754	2400	b
Volume ratio, VR	0.14	0.20	c
Weaving ratio, R	0.28	N/A	d
Weaving length (ft)	2000	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	El Camino Real-Avd. Presidio
Jurisdiction:	
Analysis Year:	2040 Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	600	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.14	
Weaving ratio, R	0.24	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	7110	15	900	290	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1975	4	250	81	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	8073	17	1022	329	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.0035
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.82	0.89
Weaving and non-weaving speeds, Si	36.31	46.67
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.13
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Unconstrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	44.84	mph
Weaving segment density, D	42.11	pc/mi/ln
Level of service, LOS	E	
Capacity of base condition, cb	9536	pc/h
Capacity as a 15-minute flow rate, c	9331	pc/h
Capacity as a full-hour volume, ch	8398	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1351	2800	a
Average flow rate (pcphpl)	1888	2400	b
Volume ratio, VR	0.14	0.20	c
Weaving ratio, R	0.24	N/A	d
Weaving length (ft)	600	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

APPENDIX F

INTERSECTION LOS WORKSHEETS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	1.00					1.00	1.00	
Frt		1.00	0.85	1.00	1.00					1.00	0.85	
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (prot)		3539	1583	1770	1863					1770	1583	
Flt Permitted		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (perm)		3539	1583	1770	1863					1770	1583	
Volume (vph)	0	540	130	270	480	0	0	0	0	220	0	360
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	540	130	270	480	0	0	0	0	220	0	360
RTOR Reduction (vph)	0	0	95	0	0	0	0	0	0	0	262	0
Lane Group Flow (vph)	0	540	35	270	480	0	0	0	0	220	98	0
Turn Type			Perm	Prot						Perm		
Protected Phases		4		3	8						6	
Permitted Phases			4							6		
Actuated Green, G (s)		19.0	19.0	20.0	43.0					19.0	19.0	
Effective Green, g (s)		19.0	19.0	20.0	43.0					19.0	19.0	
Actuated g/C Ratio		0.27	0.27	0.29	0.61					0.27	0.27	
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	
Lane Grp Cap (vph)		961	430	506	1144					480	430	
v/s Ratio Prot		c0.15		c0.15	0.26						0.06	
v/s Ratio Perm			0.02							c0.12		
v/c Ratio		0.56	0.08	0.53	0.42					0.46	0.23	
Uniform Delay, d1		21.9	19.0	21.1	7.0					21.2	19.8	
Progression Factor		0.32	0.02	1.34	1.85					1.00	1.00	
Incremental Delay, d2		2.2	0.3	0.8	0.9					3.1	1.2	
Delay (s)		9.1	0.6	29.1	13.8					24.4	21.0	
Level of Service		A	A	C	B					C	C	
Approach Delay (s)		7.5			19.3			0.0			22.3	
Approach LOS		A			B			A			C	

Intersection Summary

HCM Average Control Delay	16.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Util. Factor	1.00	1.00			0.95		1.00	1.00				
Frt	1.00	1.00			0.95		1.00	0.85				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1770	1863			3355		1770	1583				
Flt Permitted	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	1770	1863			3355		1770	1583				
Volume (vph)	350	410	0	0	490	260	260	0	200	0	0	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	350	410	0	0	490	260	260	0	200	0	0	0
RTOR Reduction (vph)	0	0	0	0	96	0	0	151	0	0	0	0
Lane Group Flow (vph)	350	410	0	0	654	0	260	49	0	0	0	0
Turn Type	Prot						Perm					
Protected Phases	7	4			8			2				
Permitted Phases							2					
Actuated Green, G (s)	19.3	45.0			21.7		17.0	17.0				
Effective Green, g (s)	19.3	45.0			21.7		17.0	17.0				
Actuated g/C Ratio	0.28	0.64			0.31		0.24	0.24				
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0				
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	488	1198			1040		430	384				
v/s Ratio Prot	c0.20	0.22			c0.19			0.03				
v/s Ratio Perm							c0.15					
v/c Ratio	0.72	0.34			0.63		0.60	0.13				
Uniform Delay, d1	22.9	5.7			20.7		23.5	20.7				
Progression Factor	0.30	0.85			0.74		1.00	1.00				
Incremental Delay, d2	4.3	0.7			2.6		6.2	0.7				
Delay (s)	11.1	5.5			17.8		29.7	21.4				
Level of Service	B	A			B		C	C				
Approach Delay (s)		8.1			17.8			26.1			0.0	
Approach LOS		A			B			C			A	

Intersection Summary

HCM Average Control Delay	16.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91		1.00	0.95					0.95	0.91	0.95
Frt		0.98		1.00	1.00					1.00	0.95	0.85
Flt Protected		1.00		0.95	1.00					0.95	0.97	1.00
Satd. Flow (prot)		4997		1752	3539					1665	1548	1504
Flt Permitted		1.00		0.95	1.00					0.95	0.97	1.00
Satd. Flow (perm)		4997		1752	3539					1665	1548	1504
Volume (vph)	0	1230	160	450	730	0	0	0	0	720	0	700
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	1230	160	450	730	0	0	0	0	720	0	700
RTOR Reduction (vph)	0	18	0	0	0	0	0	0	0	0	20	176
Lane Group Flow (vph)	0	1372	0	450	730	0	0	0	0	420	433	372
Heavy Vehicles (%)	2%	2%	2%	3%	2%	2%	2%	2%	2%	3%	2%	2%
Turn Type				Prot						Prot		Prot
Protected Phases		2		1	6					7	4	4
Permitted Phases												
Actuated Green, G (s)		28.5		24.5	57.0					25.0	25.0	25.0
Effective Green, g (s)		28.5		24.5	57.0					25.0	25.0	25.0
Actuated g/C Ratio		0.32		0.27	0.63					0.28	0.28	0.28
Clearance Time (s)		4.0		4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1582		477	2241					463	430	418
v/s Ratio Prot		c0.27		c0.26	0.21					0.25	c0.28	0.25
v/s Ratio Perm												
v/c Ratio		0.87		0.94	0.33					0.91	1.01	0.89
Uniform Delay, d1		29.0		32.1	7.6					31.4	32.5	31.2
Progression Factor		0.86		0.52	0.89					1.00	1.00	1.00
Incremental Delay, d2		5.0		21.3	0.3					21.2	45.0	19.9
Delay (s)		30.0		38.0	7.1					52.6	77.5	51.1
Level of Service		C		D	A					D	E	D
Approach Delay (s)		30.0			18.9			0.0			59.9	
Approach LOS		C			B			A			E	

Intersection Summary

HCM Average Control Delay	37.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	145.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0		4.0	4.0			
Lane Util. Factor	0.97	0.95			0.95	1.00		0.95	0.95			
Frt	1.00	1.00			1.00	0.85		0.91	0.85			
Flt Protected	0.95	1.00			1.00	1.00		0.98	1.00			
Satd. Flow (prot)	3433	3505			3505	1568		1569	1490			
Flt Permitted	0.95	1.00			1.00	1.00		0.98	1.00			
Satd. Flow (perm)	3433	3505			3505	1568		1569	1490			
Volume (vph)	720	1230	0	0	1020	990	160	0	620	0	0	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	720	1230	0	0	1020	990	160	0	620	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	320	0	60	79	0	0	0
Lane Group Flow (vph)	720	1230	0	0	1020	670	0	341	300	0	0	0
Heavy Vehicles (%)	2%	3%	2%	2%	3%	3%	2%	2%	3%	2%	2%	2%
Turn Type	Prot					Perm	Perm		Perm			
Protected Phases	5	2			6			8				
Permitted Phases						6	8		8			
Actuated Green, G (s)	19.0	62.0			39.0	39.0		20.0	20.0			
Effective Green, g (s)	19.0	62.0			39.0	39.0		20.0	20.0			
Actuated g/C Ratio	0.21	0.69			0.43	0.43		0.22	0.22			
Clearance Time (s)	4.0	4.0			4.0	4.0		4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0	3.0			
Lane Grp Cap (vph)	725	2415			1519	679		349	331			
v/s Ratio Prot	c0.21	0.35			0.29							
v/s Ratio Perm						c0.43		0.22	0.20			
v/c Ratio	0.99	0.51			0.67	0.99		0.98	0.91			
Uniform Delay, d1	35.4	6.7			20.4	25.3		34.8	34.1			
Progression Factor	0.79	0.59			0.30	1.32		1.00	1.00			
Incremental Delay, d2	19.9	0.3			1.6	24.9		41.7	26.8			
Delay (s)	47.8	4.3			7.7	58.1		76.4	60.9			
Level of Service	D	A			A	E		E	E			
Approach Delay (s)		20.3			32.6			68.9			0.0	
Approach LOS		C			C			E			A	

Intersection Summary

HCM Average Control Delay	33.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	145.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		0.97	1.00
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3511		3433	1863
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3511		3433	1863
Volume (vph)	550	260	350	20	420	430
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	550	260	350	20	420	430
RTOR Reduction (vph)	0	158	8	0	0	0
Lane Group Flow (vph)	550	102	362	0	420	430
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	23.5	23.5	14.7		9.8	28.5
Effective Green, g (s)	23.5	23.5	14.7		9.8	28.5
Actuated g/C Ratio	0.39	0.39	0.24		0.16	0.48
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	693	620	860		561	885
v/s Ratio Prot	c0.31		0.10		c0.12	c0.23
v/s Ratio Perm		0.06				
v/c Ratio	0.79	0.16	0.42		0.75	0.49
Uniform Delay, d1	16.1	11.9	19.1		23.9	10.7
Progression Factor	1.00	1.00	1.00		0.82	0.84
Incremental Delay, d2	6.2	0.1	1.5		5.0	1.8
Delay (s)	22.3	12.0	20.6		24.5	10.8
Level of Service	C	B	C		C	B
Approach Delay (s)	19.0		20.6			17.6
Approach LOS	B		C			B

Intersection Summary

HCM Average Control Delay	18.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Volume (vph)	330	60	40	70	130	210
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	330	60	40	70	130	210

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	330	60	40	70	130	210
Volume Left (vph)	330	0	40	0	0	0
Volume Right (vph)	0	60	0	0	0	210
Hadj (s)	0.53	-0.67	0.53	0.03	0.03	-0.67
Departure Headway (s)	6.2	5.0	6.7	6.2	5.9	5.2
Degree Utilization, x	0.57	0.08	0.07	0.12	0.21	0.30
Capacity (veh/h)	563	684	502	542	577	657
Control Delay (s)	15.8	7.2	9.1	8.9	9.3	9.3
Approach Delay (s)	14.5		8.9		9.3	
Approach LOS	B		A		A	

Intersection Summary			
Delay	11.6		
HCM Level of Service	B		
Intersection Capacity Utilization	38.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0		4.0			
Lane Util. Factor		0.95	1.00		1.00	1.00	0.97		1.00			
Frt		1.00	0.85		1.00	0.85	1.00		0.85			
Flt Protected		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (prot)		3539	1583		1863	1583	3433		1583			
Flt Permitted		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (perm)		3539	1583		1863	1583	3433		1583			
Volume (vph)	0	460	930	0	200	140	130	0	560	0	0	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	460	930	0	200	140	130	0	560	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	460	930	0	200	140	130	0	560	0	0	0
Turn Type			Free			Free	custom		Free			
Protected Phases		2			6							
Permitted Phases			Free			Free	4		Free			
Actuated Green, G (s)		8.2	22.5		8.2	22.5	6.3		22.5			
Effective Green, g (s)		8.2	22.5		8.2	22.5	6.3		22.5			
Actuated g/C Ratio		0.36	1.00		0.36	1.00	0.28		1.00			
Clearance Time (s)		4.0			4.0		4.0					
Vehicle Extension (s)		3.0			3.0		3.0					
Lane Grp Cap (vph)		1290	1583		679	1583	961		1583			
v/s Ratio Prot		0.13			0.11							
v/s Ratio Perm			c0.59			0.09	0.04		0.35			
v/c Ratio		0.36	0.59		0.29	0.09	0.14		0.35			
Uniform Delay, d1		5.2	0.0		5.1	0.0	6.1		0.0			
Progression Factor		1.00	1.00		1.00	1.00	1.00		1.00			
Incremental Delay, d2		0.2	1.6		0.2	0.1	0.1		0.6			
Delay (s)		5.4	1.6		5.3	0.1	6.1		0.6			
Level of Service		A	A		A	A	A		A			
Approach Delay (s)		2.9			3.2			1.7			0.0	
Approach LOS		A			A			A			A	

Intersection Summary

HCM Average Control Delay	2.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	22.5	Sum of lost time (s)	0.0
Intersection Capacity Utilization	23.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0			4.0	4.0	4.0		4.0
Lane Util. Factor	1.00	0.95	1.00		0.91			1.00	1.00	1.00		1.00
Frt	1.00	1.00	0.85		1.00			1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00	1.00		1.00			0.98	1.00	0.95		1.00
Satd. Flow (prot)	1770	3539	1583		5085			1832	1583	1770		1583
Flt Permitted	0.47	1.00	1.00		1.00			0.98	1.00	0.74		1.00
Satd. Flow (perm)	866	3539	1583		5085			1832	1583	1374		1583
Volume (vph)	20	180	390	0	630	0	10	20	70	10	0	90
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	20	180	390	0	630	0	10	20	70	10	0	90
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	51	0	0	66
Lane Group Flow (vph)	20	180	390	0	630	0	0	30	19	10	0	24
Turn Type	Perm		Free				Perm		Perm	custom		custom
Protected Phases		4			8			2				
Permitted Phases	4		Free				2		2	6		6
Actuated Green, G (s)	8.6	8.6	22.6		8.6			6.0	6.0	6.0		6.0
Effective Green, g (s)	8.6	8.6	22.6		8.6			6.0	6.0	6.0		6.0
Actuated g/C Ratio	0.38	0.38	1.00		0.38			0.27	0.27	0.27		0.27
Clearance Time (s)	4.0	4.0			4.0			4.0	4.0	4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0			3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	330	1347	1583		1935			486	420	365		420
v/s Ratio Prot		0.05			0.12							
v/s Ratio Perm	0.02		c0.25					0.02	0.01	0.01		0.02
v/c Ratio	0.06	0.13	0.25		0.33			0.06	0.04	0.03		0.06
Uniform Delay, d1	4.4	4.6	0.0		4.9			6.2	6.2	6.1		6.2
Progression Factor	1.00	1.00	1.00		1.00			1.00	1.00	1.00		1.00
Incremental Delay, d2	0.1	0.0	0.4		0.1			0.1	0.0	0.0		0.1
Delay (s)	4.5	4.6	0.4		5.0			6.3	6.2	6.2		6.2
Level of Service	A	A	A		A			A	A	A		A
Approach Delay (s)		1.8			5.0			6.2			6.2	
Approach LOS		A			A			A			A	

Intersection Summary

HCM Average Control Delay	3.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.25		
Actuated Cycle Length (s)	22.6	Sum of lost time (s)	0.0
Intersection Capacity Utilization	31.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0					4.0	4.0	4.0	4.0	
Lane Util. Factor	0.95	0.95	1.00					0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1681	1681	1583					3539	1583	1770	3539	
Flt Permitted	0.95	0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1681	1681	1583					3539	1583	1770	3539	
Volume (vph)	570	0	260	0	0	0	0	570	180	180	280	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	570	0	260	0	0	0	0	570	180	180	280	0
RTOR Reduction (vph)	0	0	196	0	0	0	0	0	106	0	0	0
Lane Group Flow (vph)	285	285	64	0	0	0	0	570	74	180	280	0
Turn Type	Perm		Perm						Perm	Prot		
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)	14.8	14.8	14.8					24.6	24.6	8.6	37.2	
Effective Green, g (s)	14.8	14.8	14.8					24.6	24.6	8.6	37.2	
Actuated g/C Ratio	0.25	0.25	0.25					0.41	0.41	0.14	0.62	
Clearance Time (s)	4.0	4.0	4.0					4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	415	415	390					1451	649	254	2194	
v/s Ratio Prot								c0.16		c0.10	0.08	
v/s Ratio Perm	c0.17	0.17	0.04						0.05			
v/c Ratio	0.69	0.69	0.16					0.39	0.11	0.71	0.13	
Uniform Delay, d1	20.5	20.5	17.7					12.4	11.0	24.5	4.7	
Progression Factor	1.00	1.00	1.00					1.00	1.00	0.73	0.23	
Incremental Delay, d2	4.7	4.7	0.2					0.8	0.4	7.4	0.1	
Delay (s)	25.2	25.2	17.9					13.2	11.3	25.3	1.2	
Level of Service	C	C	B					B	B	C	A	
Approach Delay (s)		22.9			0.0			12.8			10.6	
Approach LOS		C			A			B			B	

Intersection Summary

HCM Average Control Delay	16.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	51.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0		4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00		1.00		0.95	0.95		0.91	1.00		0.91	
Frt	1.00		0.85		0.95	0.85		1.00	0.85		1.00	
Flt Protected	0.95		1.00		0.97	1.00		1.00	1.00		1.00	
Satd. Flow (prot)	1770		1583		1626	1504		5085	1583		5085	
Flt Permitted	0.95		1.00		0.97	1.00		1.00	1.00		1.00	
Satd. Flow (perm)	1770		1583		1626	1504		5085	1583		5085	
Volume (vph)	80	0	170	120	0	270	0	640	440	0	1420	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	80	0	170	120	0	270	0	640	440	0	1420	0
RTOR Reduction (vph)	0	0	147	0	35	172	0	0	0	0	0	0
Lane Group Flow (vph)	80	0	23	0	146	37	0	640	440	0	1420	0
Turn Type	Prot		custom	Split		Perm			Free			
Protected Phases	6		6	2	2			4			8	
Permitted Phases						2		4	Free			
Actuated Green, G (s)	8.0		8.0		10.5	10.5		29.5	60.0		29.5	
Effective Green, g (s)	8.0		8.0		10.5	10.5		29.5	60.0		29.5	
Actuated g/C Ratio	0.13		0.13		0.18	0.18		0.49	1.00		0.49	
Clearance Time (s)	4.0		4.0		4.0	4.0		4.0			4.0	
Vehicle Extension (s)	3.0		3.0		3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	236		211		285	263		2500	1583		2500	
v/s Ratio Prot	0.05		0.01		c0.09			0.13			c0.28	
v/s Ratio Perm						0.02			c0.28			
v/c Ratio	0.34		0.11		0.51	0.14		0.26	0.28		0.57	
Uniform Delay, d1	23.6		22.9		22.4	20.9		8.9	0.0		10.8	
Progression Factor	1.00		1.00		1.00	1.00		0.59	1.00		1.00	
Incremental Delay, d2	0.9		0.2		1.6	0.2		0.2	0.4		0.9	
Delay (s)	24.5		23.1		24.0	21.2		5.4	0.4		11.7	
Level of Service	C		C		C	C		A	A		B	
Approach Delay (s)		23.5			22.5			3.4			11.7	
Approach LOS		C			C			A			B	

Intersection Summary

HCM Average Control Delay	11.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	60.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.91	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1441	1770	5085	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1441	1770	5085	3539	1583
Volume (vph)	1230	30	30	180	140	370
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1230	30	30	180	140	370
RTOR Reduction (vph)	0	13	0	0	0	0
Lane Group Flow (vph)	1230	17	30	180	140	370
Turn Type		Perm	Prot			Free
Protected Phases	4		5	2	6	
Permitted Phases		4				Free
Actuated Green, G (s)	33.6	33.6	1.6	18.4	12.8	60.0
Effective Green, g (s)	33.6	33.6	1.6	18.4	12.8	60.0
Actuated g/C Ratio	0.56	0.56	0.03	0.31	0.21	1.00
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	1922	807	47	1559	755	1583
v/s Ratio Prot	c0.36		0.02	0.04	0.04	
v/s Ratio Perm		0.01				c0.23
v/c Ratio	0.64	0.02	0.64	0.12	0.19	0.23
Uniform Delay, d1	9.1	5.9	28.9	15.0	19.3	0.0
Progression Factor	1.00	1.00	1.00	1.00	0.87	1.00
Incremental Delay, d2	0.7	0.0	25.1	0.2	0.5	0.3
Delay (s)	9.8	5.9	54.0	15.1	17.4	0.3
Level of Service	A	A	D	B	B	A
Approach Delay (s)	9.7			20.7	5.0	
Approach LOS	A			C	A	

Intersection Summary

HCM Average Control Delay	9.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	52.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.91	0.95		0.95	1.00		0.91	0.91
Frt				1.00	0.85	0.85		1.00	0.85		0.92	0.85
Flt Protected				0.95	1.00	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1441	1504		3539	1583		3103	1441
Flt Permitted				0.95	1.00	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1441	1504		3539	1583		3103	1441
Volume (vph)	0	0	0	30	0	430	0	1200	20	0	540	1400
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	0	0	30	0	430	0	1200	20	0	540	1400
RTOR Reduction (vph)	0	0	0	0	62	62	0	0	0	0	220	220
Lane Group Flow (vph)	0	0	0	30	153	153	0	1200	20	0	1020	480
Turn Type				Perm		Perm			Free			Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			Free			6
Actuated Green, G (s)				10.9	10.9	10.9		41.1	60.0		41.1	41.1
Effective Green, g (s)				10.9	10.9	10.9		41.1	60.0		41.1	41.1
Actuated g/C Ratio				0.18	0.18	0.18		0.69	1.00		0.69	0.69
Clearance Time (s)				4.0	4.0	4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0	3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				305	262	273		2424	1583		2126	987
v/s Ratio Prot								c0.34			0.33	
v/s Ratio Perm				0.02	0.11	0.10			0.01			0.33
v/c Ratio				0.10	0.58	0.56		0.50	0.01		0.48	0.49
Uniform Delay, d1				20.5	22.5	22.4		4.5	0.0		4.4	4.5
Progression Factor				1.00	1.00	1.00		0.23	1.00		1.00	1.00
Incremental Delay, d2				0.1	3.3	2.5		0.6	0.0		0.8	1.7
Delay (s)				20.6	25.8	24.8		1.6	0.0		5.2	6.2
Level of Service				C	C	C		A	A		A	A
Approach Delay (s)		0.0			25.0			1.6			5.6	
Approach LOS		A			C			A			A	

Intersection Summary

HCM Average Control Delay	6.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		0.95	0.95	
Frt	0.95	0.85		1.00	1.00	
Flt Protected	0.97	1.00		1.00	1.00	
Satd. Flow (prot)	1718	1504		3539	3539	
Flt Permitted	0.97	1.00		1.00	1.00	
Satd. Flow (perm)	1718	1504		3539	3539	
Volume (vph)	300	660	0	700	140	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	300	660	0	700	140	0
RTOR Reduction (vph)	41	327	0	0	0	0
Lane Group Flow (vph)	390	202	0	700	140	0
Turn Type		Perm				
Protected Phases	6			4	8	
Permitted Phases		6				
Actuated Green, G (s)	12.4	12.4		12.0	12.0	
Effective Green, g (s)	12.4	12.4		12.0	12.0	
Actuated g/C Ratio	0.38	0.38		0.37	0.37	
Clearance Time (s)	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	658	576		1311	1311	
v/s Ratio Prot	c0.23			c0.20	0.04	
v/s Ratio Perm		0.13				
v/c Ratio	0.59	0.35		0.53	0.11	
Uniform Delay, d1	8.0	7.1		8.0	6.7	
Progression Factor	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.4	0.4		0.4	0.0	
Delay (s)	9.4	7.5		8.4	6.7	
Level of Service	A	A		A	A	
Approach Delay (s)	8.4			8.4	6.7	
Approach LOS	A			A	A	

Intersection Summary

HCM Average Control Delay	8.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	32.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Sign Control	Yield			Yield	Yield	
Volume (vph)	0	0	730	360	140	160
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	730	360	140	160

Direction, Lane #	NE 1	NE 2	SW 1
Volume Total (vph)	730	360	300
Volume Left (vph)	730	0	0
Volume Right (vph)	0	0	160
Hadj (s)	0.53	0.03	-0.29
Departure Headway (s)	5.2	4.7	4.5
Degree Utilization, x	1.06	0.47	0.37
Capacity (veh/h)	698	755	795
Control Delay (s)	72.6	10.7	10.1
Approach Delay (s)	52.2		10.1
Approach LOS	F		B

Intersection Summary			
Delay	43.1		
HCM Level of Service	E		
Intersection Capacity Utilization	76.6%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	50	120	170	0	0	0	50	370	70	40	120	110
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	50	120	170	0	0	0	50	370	70	40	120	110
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			3									
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								182			337	
pX, platoon unblocked												
vC, conflicting volume	485	740	120	765	815	220	230			440		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	485	740	120	765	815	220	230			440		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	89	62	81	100	100	100	96			96		
cM capacity (veh/h)	439	318	909	159	288	784	1335			1116		

Direction, Lane #	SE 1	NE 1	NE 2	SW 1	SW 2	SW 3
Volume Total	340	235	255	40	120	110
Volume Left	50	50	0	40	0	0
Volume Right	170	0	70	0	0	110
cSH	708	1335	1700	1116	1700	1700
Volume to Capacity	0.48	0.04	0.15	0.04	0.07	0.06
Queue Length 95th (ft)	66	3	0	3	0	0
Control Delay (s)	17.0	1.9	0.0	8.3	0.0	0.0
Lane LOS	C	A		A		
Approach Delay (s)	17.0	0.9		1.2		
Approach LOS	C					

Intersection Summary				
Average Delay	6.0			
Intersection Capacity Utilization	39.3%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor				1.00	1.00		1.00	0.95			1.00	1.00
Frt				1.00	0.85		1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (prot)				1770	1583		1770	3539			1863	1583
Flt Permitted				0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (perm)				1770	1583		1770	3539			1863	1583
Volume (vph)	0	0	0	140	0	140	410	110	0	0	160	140
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	0	0	140	0	140	410	110	0	0	160	140
RTOR Reduction (vph)	0	0	0	0	107	0	0	0	0	0	0	116
Lane Group Flow (vph)	0	0	0	140	33	0	410	110	0	0	160	24
Turn Type				Perm			Prot					Perm
Protected Phases					2		7	4			8	
Permitted Phases				2								8
Actuated Green, G (s)				10.6	10.6		14.4	25.9			7.5	7.5
Effective Green, g (s)				10.6	10.6		14.4	25.9			7.5	7.5
Actuated g/C Ratio				0.24	0.24		0.32	0.58			0.17	0.17
Clearance Time (s)				4.0	4.0		4.0	4.0			4.0	4.0
Vehicle Extension (s)				3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)				422	377		573	2060			314	267
v/s Ratio Prot					0.02		c0.23	0.03			c0.09	
v/s Ratio Perm				c0.08								0.01
v/c Ratio				0.33	0.09		0.72	0.05			0.51	0.09
Uniform Delay, d1				14.0	13.2		13.2	4.0			16.8	15.6
Progression Factor				1.00	1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2				0.5	0.1		4.2	0.0			1.3	0.1
Delay (s)				14.5	13.3		17.5	4.0			18.1	15.8
Level of Service				B	B		B	A			B	B
Approach Delay (s)		0.0			13.9			14.6			17.0	
Approach LOS		A			B			B			B	

Intersection Summary

HCM Average Control Delay	15.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	44.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	50.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0		4.0		4.0	4.0	4.0	4.0
Lane Util. Factor		0.95		1.00	0.95		1.00		1.00	1.00	1.00	1.00
Frt		0.99		1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		3501		1770	3539		1770		1583	1770	1863	1583
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)		3501		1770	3539		1770		1583	1770	1863	1583
Volume (vph)	0	260	20	10	330	0	70	0	340	180	70	120
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	260	20	10	330	0	70	0	340	180	70	120
RTOR Reduction (vph)	0	8	0	0	0	0	0	0	277	0	0	93
Lane Group Flow (vph)	0	272	0	10	330	0	70	0	63	180	70	27
Turn Type				Prot			Prot		custom	Split		Perm
Protected Phases		4		3	8		2		2	6	6	
Permitted Phases												6
Actuated Green, G (s)		9.2		0.5	13.7		8.1		8.1	9.6	9.6	9.6
Effective Green, g (s)		9.2		0.5	13.7		8.1		8.1	9.6	9.6	9.6
Actuated g/C Ratio		0.21		0.01	0.32		0.19		0.19	0.22	0.22	0.22
Clearance Time (s)		4.0		4.0	4.0		4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0		3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		742		20	1117		330		295	392	412	350
v/s Ratio Prot		0.08		0.01	c0.09		0.04		c0.04	c0.10	0.04	
v/s Ratio Perm												0.02
v/c Ratio		0.37		0.50	0.30		0.21		0.22	0.46	0.17	0.08
Uniform Delay, d1		14.6		21.3	11.2		14.9		15.0	14.6	13.7	13.4
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		0.3		18.3	0.1		0.3		0.4	0.9	0.2	0.1
Delay (s)		14.9		39.6	11.4		15.3		15.3	15.5	13.9	13.5
Level of Service		B		D	B		B		B	B	B	B
Approach Delay (s)		14.9			12.2			15.3			14.5	
Approach LOS		B			B			B			B	

Intersection Summary

HCM Average Control Delay	14.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	43.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	48.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	
Lane Util. Factor	0.95			0.95	0.97	
Frt	1.00			1.00	0.98	
Flt Protected	1.00			1.00	0.96	
Satd. Flow (prot)	3539			3539	3391	
Flt Permitted	1.00			1.00	0.96	
Satd. Flow (perm)	3539			3539	3391	
Volume (vph)	550	0	0	610	60	10
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	550	0	0	610	60	10
RTOR Reduction (vph)	0	0	0	0	8	0
Lane Group Flow (vph)	550	0	0	610	63	0
Turn Type						
Protected Phases	4			8	2	
Permitted Phases						
Actuated Green, G (s)	9.7			9.7	5.9	
Effective Green, g (s)	9.7			9.7	5.9	
Actuated g/C Ratio	0.41			0.41	0.25	
Clearance Time (s)	4.0			4.0	4.0	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	1455			1455	848	
v/s Ratio Prot	0.16			c0.17	c0.02	
v/s Ratio Perm						
v/c Ratio	0.38			0.42	0.07	
Uniform Delay, d1	4.8			4.9	6.8	
Progression Factor	1.00			1.00	1.00	
Incremental Delay, d2	0.2			0.2	0.0	
Delay (s)	5.0			5.1	6.8	
Level of Service	A			A	A	
Approach Delay (s)	5.0			5.1	6.8	
Approach LOS	A			A	A	

Intersection Summary

HCM Average Control Delay	5.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.29		
Actuated Cycle Length (s)	23.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	26.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	50	50	410	290	280	60
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	50	50	410	290	280	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		17				
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1275	170	340			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1275	170	340			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	52	94	66			
cM capacity (veh/h)	105	844	1216			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	100	410	145	145	187	153
Volume Left	50	410	0	0	0	0
Volume Right	50	0	0	0	0	60
cSH	210	1216	1700	1700	1700	1700
Volume to Capacity	0.48	0.34	0.09	0.09	0.11	0.09
Queue Length 95th (ft)	58	38	0	0	0	0
Control Delay (s)	38.2	9.5	0.0	0.0	0.0	0.0
Lane LOS	E	A				
Approach Delay (s)	38.2	5.5			0.0	
Approach LOS	E					

Intersection Summary			
Average Delay	6.8		
Intersection Capacity Utilization	45.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	100	30	50	160	60	90	50	90	0	60	70	20
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	100	30	50	160	60	90	50	90	0	60	70	20

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	180	160	150	50	90	60	90
Volume Left (vph)	100	160	0	50	0	60	0
Volume Right (vph)	50	0	90	0	0	0	20
Hadj (s)	-0.02	0.53	-0.39	0.53	0.03	0.53	-0.12
Departure Headway (s)	5.7	6.1	5.2	6.6	6.1	6.6	5.9
Degree Utilization, x	0.29	0.27	0.22	0.09	0.15	0.11	0.15
Capacity (veh/h)	596	563	660	508	548	508	564
Control Delay (s)	11.0	10.2	8.4	9.1	9.0	9.2	8.8
Approach Delay (s)	11.0	9.3		9.0		8.9	
Approach LOS	B	A		A		A	

Intersection Summary			
Delay	9.6		
HCM Level of Service	A		
Intersection Capacity Utilization	39.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	190	110	0	0	90	60	0	0	0	30	0	150
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	190	110	0	0	90	60	0	0	0	30	0	150
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	150			110			760	610	120	610	640	110
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	150			110			760	610	120	610	640	110
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	87			100			100	100	100	92	100	84
cM capacity (veh/h)	1431			1480			244	355	931	365	341	943

Direction, Lane #	EB 1	EB 2	WB 1	NW 1	NW 2
Volume Total	190	110	150	30	150
Volume Left	190	0	0	30	0
Volume Right	0	0	60	0	150
cSH	1431	1700	1700	365	943
Volume to Capacity	0.13	0.06	0.09	0.08	0.16
Queue Length 95th (ft)	11	0	0	7	14
Control Delay (s)	7.9	0.0	0.0	15.7	9.5
Lane LOS	A			C	A
Approach Delay (s)	5.0		0.0	10.6	
Approach LOS				B	

Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	38.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	210	40	80	60	0	70	0	100	0	0	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	210	40	80	60	0	70	0	100	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									22			
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	60			250			450	470	60	500	450	230
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	60			250			450	470	60	500	450	230
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			94			86	100	90	100	100	100
cM capacity (veh/h)	1544			1316			495	462	1005	413	474	809

Direction, Lane #	EB 1	WB 1	WB 2	SE 1
Volume Total	250	80	60	170
Volume Left	0	80	0	70
Volume Right	40	0	0	100
cSH	1700	1316	1700	1203
Volume to Capacity	0.15	0.06	0.04	0.14
Queue Length 95th (ft)	0	5	0	12
Control Delay (s)	0.0	7.9	0.0	10.8
Lane LOS		A		B
Approach Delay (s)	0.0	4.5		10.8
Approach LOS				B

Intersection Summary			
Average Delay	4.4		
Intersection Capacity Utilization	38.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	1.00					1.00	1.00	
Frt		1.00	0.85	1.00	1.00					1.00	0.85	
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (prot)		3539	1583	1770	1863					1770	1589	
Flt Permitted		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (perm)		3539	1583	1770	1863					1770	1589	
Volume (vph)	0	560	170	290	350	0	0	0	0	330	10	460
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	560	170	290	350	0	0	0	0	330	10	460
RTOR Reduction (vph)	0	0	113	0	0	0	0	0	0	0	312	0
Lane Group Flow (vph)	0	560	57	290	350	0	0	0	0	330	158	0
Turn Type			Perm	Prot						Perm		
Protected Phases		4		3	8						6	
Permitted Phases			4							6		
Actuated Green, G (s)		30.2	30.2	18.8	53.0					29.0	29.0	
Effective Green, g (s)		30.2	30.2	18.8	53.0					29.0	29.0	
Actuated g/C Ratio		0.34	0.34	0.21	0.59					0.32	0.32	
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	
Lane Grp Cap (vph)		1188	531	370	1097					570	512	
v/s Ratio Prot		c0.16		c0.16	0.19						0.10	
v/s Ratio Perm			0.04							c0.19		
v/c Ratio		0.47	0.11	0.78	0.32					0.58	0.31	
Uniform Delay, d1		23.6	20.6	33.7	9.4					25.4	23.0	
Progression Factor		0.50	0.11	0.74	1.03					1.00	1.00	
Incremental Delay, d2		1.3	0.4	9.1	0.7					4.2	1.6	
Delay (s)		13.1	2.7	33.9	10.3					29.7	24.5	
Level of Service		B	A	C	B					C	C	
Approach Delay (s)		10.7			21.0			0.0			26.6	
Approach LOS		B			C			A			C	

Intersection Summary

HCM Average Control Delay	19.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	70.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Util. Factor	1.00	1.00			0.95		1.00	1.00				
Frt	1.00	1.00			0.94		1.00	0.85				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1770	1863			3328		1770	1583				
Flt Permitted	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	1770	1863			3328		1770	1583				
Volume (vph)	330	560	0	0	500	330	140	0	230	0	0	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	330	560	0	0	500	330	140	0	230	0	0	0
RTOR Reduction (vph)	0	0	0	0	108	0	0	181	0	0	0	0
Lane Group Flow (vph)	330	560	0	0	722	0	140	49	0	0	0	0
Turn Type	Prot						Perm					
Protected Phases	7	4			8			2				
Permitted Phases							2					
Actuated Green, G (s)	21.7	63.0			37.3		19.0	19.0				
Effective Green, g (s)	21.7	63.0			37.3		19.0	19.0				
Actuated g/C Ratio	0.24	0.70			0.41		0.21	0.21				
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0				
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	427	1304			1379		374	334				
v/s Ratio Prot	c0.19	0.30			c0.22			0.03				
v/s Ratio Perm							c0.08					
v/c Ratio	0.77	0.43			0.52		0.37	0.15				
Uniform Delay, d1	31.9	5.8			19.7		30.4	28.9				
Progression Factor	0.75	0.26			0.63		1.00	1.00				
Incremental Delay, d2	7.4	0.9			1.2		2.9	0.9				
Delay (s)	31.4	2.4			13.6		33.3	29.8				
Level of Service	C	A			B		C	C				
Approach Delay (s)		13.1			13.6			31.1			0.0	
Approach LOS		B			B			C			A	

Intersection Summary

HCM Average Control Delay	16.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	70.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91		1.00	0.95					0.95	0.91	0.95
Frt		0.98		1.00	1.00					1.00	0.95	0.85
Flt Protected		1.00		0.95	1.00					0.95	0.97	1.00
Satd. Flow (prot)		4971		1752	3539					1665	1546	1504
Flt Permitted		1.00		0.95	1.00					0.95	0.97	1.00
Satd. Flow (perm)		4971		1752	3539					1665	1546	1504
Volume (vph)	0	1130	200	480	730	0	0	0	0	960	0	870
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	1130	200	480	730	0	0	0	0	960	0	870
RTOR Reduction (vph)	0	25	0	0	0	0	0	0	0	0	19	139
Lane Group Flow (vph)	0	1305	0	480	730	0	0	0	0	566	585	521
Heavy Vehicles (%)	2%	2%	2%	3%	2%	2%	2%	2%	2%	3%	2%	2%
Turn Type				Prot						Prot		Prot
Protected Phases		2		1	6					7	4	4
Permitted Phases												
Actuated Green, G (s)		27.0		27.0	58.0					34.0	34.0	34.0
Effective Green, g (s)		27.0		27.0	58.0					34.0	34.0	34.0
Actuated g/C Ratio		0.27		0.27	0.58					0.34	0.34	0.34
Clearance Time (s)		4.0		4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1342		473	2053					566	526	511
v/s Ratio Prot		c0.26		c0.27	0.21					0.34	c0.38	0.35
v/s Ratio Perm												
v/c Ratio		0.97		1.01	0.36					1.00	1.11	1.02
Uniform Delay, d1		36.1		36.5	11.1					33.0	33.0	33.0
Progression Factor		0.84		0.72	1.47					1.00	1.00	1.00
Incremental Delay, d2		15.1		35.6	0.3					37.8	73.6	44.7
Delay (s)		45.6		62.1	16.6					70.8	106.6	77.7
Level of Service		D		E	B					E	F	E
Approach Delay (s)		45.6			34.7			0.0			85.1	
Approach LOS		D			C			A			F	

Intersection Summary

HCM Average Control Delay	59.1	HCM Level of Service	E
HCM Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	137.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0		4.0	4.0			
Lane Util. Factor	0.97	0.95			0.95	1.00		0.95	0.95			
Frt	1.00	1.00			1.00	0.85		0.92	0.85			
Flt Protected	0.95	1.00			1.00	1.00		0.98	1.00			
Satd. Flow (prot)	3433	3505			3505	1568		1585	1490			
Flt Permitted	0.95	1.00			1.00	1.00		0.98	1.00			
Satd. Flow (perm)	3433	3505			3505	1568		1585	1490			
Volume (vph)	600	1490	0	0	990	750	220	0	650	0	0	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	600	1490	0	0	990	750	220	0	650	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	423	0	25	25	0	0	0
Lane Group Flow (vph)	600	1490	0	0	990	327	0	435	385	0	0	0
Heavy Vehicles (%)	2%	3%	2%	2%	3%	3%	2%	2%	3%	2%	2%	2%
Turn Type	Prot					Perm	Perm		Perm			
Protected Phases	5	2			6			8				
Permitted Phases						6	8		8			
Actuated Green, G (s)	20.6	61.9			37.3	37.3		30.1	30.1			
Effective Green, g (s)	20.6	61.9			37.3	37.3		30.1	30.1			
Actuated g/C Ratio	0.21	0.62			0.37	0.37		0.30	0.30			
Clearance Time (s)	4.0	4.0			4.0	4.0		4.0	4.0			
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0	3.0			
Lane Grp Cap (vph)	707	2170			1307	585		477	448			
v/s Ratio Prot	c0.17	0.43			c0.28							
v/s Ratio Perm						0.21		0.27	0.26			
v/c Ratio	0.85	0.69			0.76	0.56		0.91	0.86			
Uniform Delay, d1	38.2	12.6			27.4	24.8		33.7	32.9			
Progression Factor	0.88	0.17			0.56	1.70		1.00	1.00			
Incremental Delay, d2	0.9	0.2			3.0	2.8		21.6	15.0			
Delay (s)	34.7	2.3			18.4	45.0		55.3	48.0			
Level of Service	C	A			B	D		E	D			
Approach Delay (s)		11.6			29.9			51.8			0.0	
Approach LOS		B			C			D			A	

Intersection Summary

HCM Average Control Delay	25.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	137.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		0.97	1.00
Frt	1.00	0.85	0.98		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3486		3433	1863
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3486		3433	1863
Volume (vph)	730	250	450	50	470	520
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	730	250	450	50	470	520
RTOR Reduction (vph)	0	138	12	0	0	0
Lane Group Flow (vph)	730	112	488	0	470	520
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	30.7	30.7	14.2		11.6	29.8
Effective Green, g (s)	30.7	30.7	14.2		11.6	29.8
Actuated g/C Ratio	0.45	0.45	0.21		0.17	0.44
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	793	709	723		581	810
v/s Ratio Prot	c0.41		0.14		c0.14	c0.28
v/s Ratio Perm		0.07				
v/c Ratio	0.92	0.16	0.68		0.81	0.64
Uniform Delay, d1	17.8	11.2	25.0		27.4	15.2
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	15.9	0.1	2.5		8.1	1.8
Delay (s)	33.6	11.3	27.5		35.5	16.9
Level of Service	C	B	C		D	B
Approach Delay (s)	27.9		27.5			25.8
Approach LOS	C		C			C

Intersection Summary

HCM Average Control Delay	27.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	68.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	77.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Volume (vph)	400	100	90	150	180	230
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	400	100	90	150	180	230

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	400	100	90	150	180	230
Volume Left (vph)	400	0	90	0	0	0
Volume Right (vph)	0	100	0	0	0	230
Hadj (s)	0.53	-0.67	0.53	0.03	0.03	-0.67
Departure Headway (s)	6.8	5.6	7.3	6.8	6.6	5.9
Degree Utilization, x	0.76	0.16	0.18	0.28	0.33	0.38
Capacity (veh/h)	518	615	463	498	517	581
Control Delay (s)	26.7	8.4	10.8	11.3	11.7	11.2
Approach Delay (s)	23.0		11.1		11.4	
Approach LOS	C		B		B	

Intersection Summary			
Delay	16.4		
HCM Level of Service	C		
Intersection Capacity Utilization	46.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0		4.0			
Lane Util. Factor		0.95	1.00		1.00	1.00	0.97		1.00			
Frt		1.00	0.85		1.00	0.85	1.00		0.85			
Flt Protected		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (prot)		3539	1583		1863	1583	3433		1583			
Flt Permitted		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (perm)		3539	1583		1863	1583	3433		1583			
Volume (vph)	0	540	1140	0	140	100	280	0	690	0	0	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	540	1140	0	140	100	280	0	690	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	540	1140	0	140	100	280	0	690	0	0	0
Turn Type			Free			Free	custom		Free			
Protected Phases		2			6							
Permitted Phases			Free			Free	4		Free			
Actuated Green, G (s)		9.2	24.6		9.2	24.6	7.4		24.6			
Effective Green, g (s)		9.2	24.6		9.2	24.6	7.4		24.6			
Actuated g/C Ratio		0.37	1.00		0.37	1.00	0.30		1.00			
Clearance Time (s)		4.0			4.0		4.0					
Vehicle Extension (s)		3.0			3.0		3.0					
Lane Grp Cap (vph)		1324	1583		697	1583	1033		1583			
v/s Ratio Prot		0.15			0.08							
v/s Ratio Perm			c0.72			0.06	0.08		0.44			
v/c Ratio		0.41	0.72		0.20	0.06	0.27		0.44			
Uniform Delay, d1		5.7	0.0		5.2	0.0	6.5		0.0			
Progression Factor		1.00	1.00		1.00	1.00	1.00		1.00			
Incremental Delay, d2		0.2	2.9		0.1	0.1	0.1		0.9			
Delay (s)		5.9	2.9		5.4	0.1	6.7		0.9			
Level of Service		A	A		A	A	A		A			
Approach Delay (s)		3.8			3.2			2.6			0.0	
Approach LOS		A			A			A			A	

Intersection Summary

HCM Average Control Delay	3.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	24.6	Sum of lost time (s)	0.0
Intersection Capacity Utilization	29.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0			4.0	4.0	4.0		4.0
Lane Util. Factor	1.00	0.95	1.00		0.91			1.00	1.00	1.00		1.00
Frt	1.00	1.00	0.85		1.00			1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00	1.00		1.00			0.99	1.00	0.95		1.00
Satd. Flow (prot)	1770	3539	1583		5085			1840	1583	1770		1583
Flt Permitted	0.56	1.00	1.00		1.00			0.99	1.00	0.73		1.00
Satd. Flow (perm)	1046	3539	1583		5085			1840	1583	1362		1583
Volume (vph)	50	420	350	0	300	0	10	30	110	10	0	60
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	50	420	350	0	300	0	10	30	110	10	0	60
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	79	0	0	43
Lane Group Flow (vph)	50	420	350	0	300	0	0	40	31	10	0	17
Turn Type	Perm		Free				Perm		Perm	custom		custom
Protected Phases		4			8			2				
Permitted Phases	4		Free				2		2	6		6
Actuated Green, G (s)	8.1	8.1	22.3		8.1			6.2	6.2	6.2		6.2
Effective Green, g (s)	8.1	8.1	22.3		8.1			6.2	6.2	6.2		6.2
Actuated g/C Ratio	0.36	0.36	1.00		0.36			0.28	0.28	0.28		0.28
Clearance Time (s)	4.0	4.0			4.0			4.0	4.0	4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0			3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	380	1285	1583		1847			512	440	379		440
v/s Ratio Prot		0.12			0.06							
v/s Ratio Perm	0.05		c0.22					0.02	0.02	0.01		0.01
v/c Ratio	0.13	0.33	0.22		0.16			0.08	0.07	0.03		0.04
Uniform Delay, d1	4.7	5.1	0.0		4.8			5.9	5.9	5.9		5.9
Progression Factor	1.00	1.00	1.00		1.00			1.00	1.00	1.00		1.00
Incremental Delay, d2	0.2	0.1	0.3		0.0			0.1	0.1	0.0		0.0
Delay (s)	4.9	5.3	0.3		4.8			6.0	6.0	5.9		5.9
Level of Service	A	A	A		A			A	A	A		A
Approach Delay (s)		3.1			4.8			6.0			5.9	
Approach LOS		A			A			A			A	

Intersection Summary

HCM Average Control Delay	4.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.22		
Actuated Cycle Length (s)	22.3	Sum of lost time (s)	0.0
Intersection Capacity Utilization	31.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0					4.0	4.0	4.0	4.0	
Lane Util. Factor	0.95	0.95	1.00					0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1681	1681	1583					3539	1583	1770	3539	
Flt Permitted	0.95	0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1681	1681	1583					3539	1583	1770	3539	
Volume (vph)	1000	0	520	0	0	0	0	570	210	350	440	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1000	0	520	0	0	0	0	570	210	350	440	0
RTOR Reduction (vph)	0	0	256	0	0	0	0	0	159	0	0	0
Lane Group Flow (vph)	500	500	264	0	0	0	0	570	51	350	440	0
Turn Type	Perm		Perm						Perm	Prot		
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)	20.4	20.4	20.4					14.6	14.6	13.0	31.6	
Effective Green, g (s)	20.4	20.4	20.4					14.6	14.6	13.0	31.6	
Actuated g/C Ratio	0.34	0.34	0.34					0.24	0.24	0.22	0.53	
Clearance Time (s)	4.0	4.0	4.0					4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	572	572	538					861	385	384	1864	
v/s Ratio Prot								c0.16		c0.20	0.12	
v/s Ratio Perm	c0.30	0.30	0.17						0.03			
v/c Ratio	0.87	0.87	0.49					0.66	0.13	0.91	0.24	
Uniform Delay, d1	18.6	18.6	15.7					20.5	17.7	22.9	7.7	
Progression Factor	1.00	1.00	1.00					1.00	1.00	1.00	1.00	
Incremental Delay, d2	13.9	13.9	0.7					4.0	0.7	25.3	0.3	
Delay (s)	32.5	32.5	16.4					24.5	18.5	48.2	7.9	
Level of Service	C	C	B					C	B	D	A	
Approach Delay (s)		27.0			0.0			22.8			25.8	
Approach LOS		C			A			C			C	

Intersection Summary

HCM Average Control Delay	25.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0		4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00		1.00		0.95	0.95		0.91	1.00		0.91	
Frt	1.00		0.85		0.98	0.85		1.00	0.85		1.00	
Flt Protected	0.95		1.00		0.96	1.00		1.00	1.00		1.00	
Satd. Flow (prot)	1770		1583		1659	1504		5085	1583		5085	
Flt Permitted	0.95		1.00		0.96	1.00		1.00	1.00		1.00	
Satd. Flow (perm)	1770		1583		1659	1504		5085	1583		5085	
Volume (vph)	80	0	110	190	0	340	0	1150	370	0	1290	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	80	0	110	190	0	340	0	1150	370	0	1290	0
RTOR Reduction (vph)	0	0	95	0	12	243	0	0	0	0	0	0
Lane Group Flow (vph)	80	0	15	0	212	63	0	1150	370	0	1290	0
Turn Type	Prot		custom	Split		Perm			Free			
Protected Phases	6		6	2	2			4			8	
Permitted Phases						2		4	Free			
Actuated Green, G (s)	8.0		8.0		12.3	12.3		27.7	60.0		27.7	
Effective Green, g (s)	8.0		8.0		12.3	12.3		27.7	60.0		27.7	
Actuated g/C Ratio	0.13		0.13		0.21	0.21		0.46	1.00		0.46	
Clearance Time (s)	4.0		4.0		4.0	4.0		4.0			4.0	
Vehicle Extension (s)	3.0		3.0		3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	236		211		340	308		2348	1583		2348	
v/s Ratio Prot	0.05		0.01		c0.13			0.23			c0.25	
v/s Ratio Perm						0.04			c0.23			
v/c Ratio	0.34		0.07		0.62	0.20		0.49	0.23		0.55	
Uniform Delay, d1	23.6		22.7		21.7	19.8		11.2	0.0		11.6	
Progression Factor	1.00		1.00		1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	0.9		0.1		3.5	0.3		0.7	0.3		0.9	
Delay (s)	24.5		22.9		25.3	20.1		11.9	0.3		12.6	
Level of Service	C		C		C	C		B	A		B	
Approach Delay (s)		23.5			22.3			9.1			12.6	
Approach LOS		C			C			A			B	

Intersection Summary

HCM Average Control Delay	13.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	59.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.91	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1441	1770	5085	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1441	1770	5085	3539	1583
Volume (vph)	1050	10	10	220	10	270
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1050	10	10	220	10	270
RTOR Reduction (vph)	0	4	0	0	0	0
Lane Group Flow (vph)	1050	6	10	220	10	270
Turn Type		Perm	Prot			Free
Protected Phases	4		5	2	6	
Permitted Phases		4				Free
Actuated Green, G (s)	33.4	33.4	1.3	18.6	13.3	60.0
Effective Green, g (s)	33.4	33.4	1.3	18.6	13.3	60.0
Actuated g/C Ratio	0.56	0.56	0.02	0.31	0.22	1.00
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	1911	802	38	1576	784	1583
v/s Ratio Prot	c0.31		0.01	0.04	0.00	
v/s Ratio Perm		0.00				c0.17
v/c Ratio	0.55	0.01	0.26	0.14	0.01	0.17
Uniform Delay, d1	8.5	5.9	28.9	14.9	18.2	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.01	1.00
Incremental Delay, d2	0.3	0.0	3.7	0.2	0.0	0.2
Delay (s)	8.8	5.9	32.6	15.1	18.4	0.2
Level of Service	A	A	C	B	B	A
Approach Delay (s)	8.8			15.9	0.9	
Approach LOS	A			B	A	

Intersection Summary

HCM Average Control Delay	8.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	43.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.91	0.95		0.95	1.00		0.91	0.91
Frt				1.00	0.85	0.85		1.00	0.85		0.88	0.85
Flt Protected				0.95	1.00	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1441	1504		3539	1583		2998	1441
Flt Permitted				0.95	1.00	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1441	1504		3539	1583		2998	1441
Volume (vph)	0	0	0	100	0	350	0	1130	140	0	170	1150
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	0	0	100	0	350	0	1130	140	0	170	1150
RTOR Reduction (vph)	0	0	0	0	53	53	0	0	0	0	173	173
Lane Group Flow (vph)	0	0	0	100	122	122	0	1130	140	0	572	402
Turn Type				Perm		Perm			Free			Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			Free			6
Actuated Green, G (s)				10.1	10.1	10.1		41.9	60.0		41.9	41.9
Effective Green, g (s)				10.1	10.1	10.1		41.9	60.0		41.9	41.9
Actuated g/C Ratio				0.17	0.17	0.17		0.70	1.00		0.70	0.70
Clearance Time (s)				4.0	4.0	4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0	3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				283	243	253		2471	1583		2094	1006
v/s Ratio Prot								c0.32			0.19	
v/s Ratio Perm				0.06	0.08	0.08			0.09			0.28
v/c Ratio				0.35	0.50	0.48		0.46	0.09		0.27	0.40
Uniform Delay, d1				22.1	22.7	22.6		4.0	0.0		3.4	3.8
Progression Factor				1.00	1.00	1.00		0.22	1.00		1.00	1.00
Incremental Delay, d2				0.8	1.6	1.4		0.5	0.1		0.3	1.2
Delay (s)				22.8	24.3	24.0		1.4	0.1		3.7	5.0
Level of Service				C	C	C		A	A		A	A
Approach Delay (s)		0.0			23.9			1.3			4.2	
Approach LOS		A			C			A			A	

Intersection Summary

HCM Average Control Delay	5.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	60.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		0.95	0.95	
Frt	0.90	0.85		1.00	1.00	
Flt Protected	0.98	1.00		1.00	1.00	
Satd. Flow (prot)	1647	1504		3539	3539	
Flt Permitted	0.98	1.00		1.00	1.00	
Satd. Flow (perm)	1647	1504		3539	3539	
Volume (vph)	190	1040	0	670	80	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	190	1040	0	670	80	0
RTOR Reduction (vph)	189	393	0	0	0	0
Lane Group Flow (vph)	395	253	0	670	80	0
Turn Type		Perm				
Protected Phases	6			4	8	
Permitted Phases		6				
Actuated Green, G (s)	12.7	12.7		11.7	11.7	
Effective Green, g (s)	12.7	12.7		11.7	11.7	
Actuated g/C Ratio	0.39	0.39		0.36	0.36	
Clearance Time (s)	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	646	590		1278	1278	
v/s Ratio Prot	c0.24			c0.19	0.02	
v/s Ratio Perm		0.17				
v/c Ratio	0.61	0.43		0.52	0.06	
Uniform Delay, d1	7.9	7.2		8.2	6.8	
Progression Factor	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.7	0.5		0.4	0.0	
Delay (s)	9.6	7.7		8.5	6.8	
Level of Service	A	A		A	A	
Approach Delay (s)	8.6			8.5	6.8	
Approach LOS	A			A	A	

Intersection Summary

HCM Average Control Delay	8.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	32.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	82.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Sign Control	Yield			Yield	Yield	
Volume (vph)	0	0	660	270	120	70
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	660	270	120	70

Direction, Lane #	NE 1	NE 2	SW 1
Volume Total (vph)	660	270	190
Volume Left (vph)	660	0	0
Volume Right (vph)	0	0	70
Hadj (s)	0.53	0.03	-0.19
Departure Headway (s)	5.2	4.7	4.6
Degree Utilization, x	0.95	0.35	0.24
Capacity (veh/h)	688	764	775
Control Delay (s)	43.3	8.9	9.0
Approach Delay (s)	33.3		9.0
Approach LOS	D		A

Intersection Summary			
Delay	29.2		
HCM Level of Service	D		
Intersection Capacity Utilization	82.0%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	30	60	90	0	0	0	30	510	50	90	130	100
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	30	60	90	0	0	0	30	510	50	90	130	100
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			3									
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								184			337	
pX, platoon unblocked												
vC, conflicting volume	625	930	130	935	1005	280	230			560		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	625	930	130	935	1005	280	230			560		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	91	75	90	100	100	100	98			91		
cM capacity (veh/h)	338	237	896	146	214	717	1335			1007		

Direction, Lane #	SE 1	NE 1	NE 2	SW 1	SW 2	SW 3
Volume Total	180	285	305	90	130	100
Volume Left	30	30	0	90	0	0
Volume Right	90	0	50	0	0	100
cSH	541	1335	1700	1007	1700	1700
Volume to Capacity	0.33	0.02	0.18	0.09	0.08	0.06
Queue Length 95th (ft)	36	2	0	7	0	0
Control Delay (s)	17.1	1.0	0.0	8.9	0.0	0.0
Lane LOS	C	A		A		
Approach Delay (s)	17.1	0.5		2.5		
Approach LOS	C					

Intersection Summary			
Average Delay	3.8		
Intersection Capacity Utilization	38.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor				1.00	1.00		1.00	0.95			1.00	1.00
Frt				1.00	0.85		1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (prot)				1770	1583		1770	3539			1863	1583
Flt Permitted				0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (perm)				1770	1583		1770	3539			1863	1583
Volume (vph)	0	0	0	180	0	40	310	120	0	0	120	80
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	0	0	180	0	40	310	120	0	0	120	80
RTOR Reduction (vph)	0	0	0	0	26	0	0	0	0	0	0	68
Lane Group Flow (vph)	0	0	0	180	14	0	310	120	0	0	120	12
Turn Type				Perm			Prot					Perm
Protected Phases					2		7	4			8	
Permitted Phases				2								8
Actuated Green, G (s)				15.4	15.4		10.0	20.7			6.7	6.7
Effective Green, g (s)				15.4	15.4		10.0	20.7			6.7	6.7
Actuated g/C Ratio				0.35	0.35		0.23	0.47			0.15	0.15
Clearance Time (s)				4.0	4.0		4.0	4.0			4.0	4.0
Vehicle Extension (s)				3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)				618	553		401	1661			283	241
v/s Ratio Prot					0.01		c0.18	0.03			c0.06	
v/s Ratio Perm				c0.10								0.01
v/c Ratio				0.29	0.03		0.77	0.07			0.42	0.05
Uniform Delay, d1				10.4	9.4		16.0	6.4			17.0	16.0
Progression Factor				1.00	1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2				0.3	0.0		9.0	0.0			1.0	0.1
Delay (s)				10.7	9.4		25.0	6.4			18.0	16.1
Level of Service				B	A		C	A			B	B
Approach Delay (s)		0.0			10.4			19.8			17.2	
Approach LOS		A			B			B			B	

Intersection Summary

HCM Average Control Delay	16.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	44.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	40.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0		4.0		4.0	4.0	4.0	4.0
Lane Util. Factor		0.95		1.00	0.95		1.00		1.00	1.00	1.00	1.00
Frt		0.95		1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		3369		1770	3539		1770		1583	1770	1863	1583
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)		3369		1770	3539		1770		1583	1770	1863	1583
Volume (vph)	0	340	160	30	450	0	130	0	310	400	190	170
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	340	160	30	450	0	130	0	310	400	190	170
RTOR Reduction (vph)	0	82	0	0	0	0	0	0	203	0	0	114
Lane Group Flow (vph)	0	418	0	30	450	0	130	0	107	400	190	56
Turn Type				Prot			Prot		custom	Split		Perm
Protected Phases		4		3	8		2		2	6	6	
Permitted Phases												6
Actuated Green, G (s)		11.6		1.3	16.9		9.6		9.6	16.0	16.0	16.0
Effective Green, g (s)		11.6		1.3	16.9		9.6		9.6	16.0	16.0	16.0
Actuated g/C Ratio		0.21		0.02	0.31		0.18		0.18	0.29	0.29	0.29
Clearance Time (s)		4.0		4.0	4.0		4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0		3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		717		42	1097		312		279	520	547	465
v/s Ratio Prot		c0.12		0.02	c0.13		c0.07		0.07	c0.23	0.10	
v/s Ratio Perm												0.04
v/c Ratio		0.58		0.71	0.41		0.42		0.38	0.77	0.35	0.12
Uniform Delay, d1		19.3		26.4	14.9		20.0		19.8	17.6	15.1	14.1
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		1.2		44.2	0.3		0.9		0.9	6.8	0.4	0.1
Delay (s)		20.5		70.6	15.1		20.9		20.7	24.3	15.5	14.2
Level of Service		C		E	B		C		C	C	B	B
Approach Delay (s)		20.5			18.6			20.8			19.9	
Approach LOS		C			B			C			B	

Intersection Summary

HCM Average Control Delay	19.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	54.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	65.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	
Lane Util. Factor	0.95			0.95	0.97	
Frt	1.00			1.00	0.97	
Flt Protected	1.00			1.00	0.96	
Satd. Flow (prot)	3539			3539	3370	
Flt Permitted	1.00			1.00	0.96	
Satd. Flow (perm)	3539			3539	3370	
Volume (vph)	840	0	0	710	80	20
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	840	0	0	710	80	20
RTOR Reduction (vph)	0	0	0	0	15	0
Lane Group Flow (vph)	840	0	0	710	85	0
Turn Type						
Protected Phases	4			8	2	
Permitted Phases						
Actuated Green, G (s)	12.0			12.0	6.2	
Effective Green, g (s)	12.0			12.0	6.2	
Actuated g/C Ratio	0.46			0.46	0.24	
Clearance Time (s)	4.0			4.0	4.0	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	1621			1621	797	
v/s Ratio Prot	c0.24			0.20	c0.03	
v/s Ratio Perm						
v/c Ratio	0.52			0.44	0.11	
Uniform Delay, d1	5.0			4.8	7.8	
Progression Factor	1.00			1.00	1.00	
Incremental Delay, d2	0.3			0.2	0.1	
Delay (s)	5.3			5.0	7.9	
Level of Service	A			A	A	
Approach Delay (s)	5.3			5.0	7.9	
Approach LOS	A			A	A	

Intersection Summary

HCM Average Control Delay	5.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	26.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	33.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	80	80	340	330	310	50
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	80	80	340	330	310	50
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		17				
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1180	180	360			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1180	180	360			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	39	90	72			
cM capacity (veh/h)	131	832	1195			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	160	340	165	165	207	153
Volume Left	80	340	0	0	0	0
Volume Right	80	0	0	0	0	50
cSH	262	1195	1700	1700	1700	1700
Volume to Capacity	0.61	0.28	0.10	0.10	0.12	0.09
Queue Length 95th (ft)	91	29	0	0	0	0
Control Delay (s)	39.0	9.2	0.0	0.0	0.0	0.0
Lane LOS	E	A				
Approach Delay (s)	39.0	4.7			0.0	
Approach LOS	E					

Intersection Summary			
Average Delay	7.9		
Intersection Capacity Utilization	43.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	130	20	40	250	140	130	40	50	0	60	40	80
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	130	20	40	250	140	130	40	50	0	60	40	80

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	190	250	270	40	50	60	120
Volume Left (vph)	130	250	0	40	0	60	0
Volume Right (vph)	40	0	130	0	0	0	80
Hadj (s)	0.04	0.53	-0.30	0.53	0.03	0.53	-0.43
Departure Headway (s)	6.0	6.1	5.3	7.2	6.7	7.0	6.1
Degree Utilization, x	0.32	0.43	0.40	0.08	0.09	0.12	0.20
Capacity (veh/h)	571	569	660	460	491	474	550
Control Delay (s)	11.7	12.4	10.5	9.6	9.2	9.8	9.4
Approach Delay (s)	11.7	11.4		9.4		9.5	
Approach LOS	B	B		A		A	

Intersection Summary			
Delay	11.0		
HCM Level of Service	B		
Intersection Capacity Utilization	46.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	80	110	0	0	320	120	0	0	0	40	0	110
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	80	110	0	0	320	120	0	0	0	40	0	110
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	440			110			760	650	380	650	710	110
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	440			110			760	650	380	650	710	110
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	93			100			100	100	100	89	100	88
cM capacity (veh/h)	1120			1480			269	360	667	361	333	943

Direction, Lane #	EB 1	EB 2	WB 1	NW 1	NW 2
Volume Total	80	110	440	40	110
Volume Left	80	0	0	40	0
Volume Right	0	0	120	0	110
cSH	1120	1700	1700	361	943
Volume to Capacity	0.07	0.06	0.26	0.11	0.12
Queue Length 95th (ft)	6	0	0	9	10
Control Delay (s)	8.5	0.0	0.0	16.2	9.3
Lane LOS	A			C	A
Approach Delay (s)	3.6		0.0	11.2	
Approach LOS				B	

Intersection Summary			
Average Delay	3.0		
Intersection Capacity Utilization	45.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	100	20	290	70	0	90	0	90	0	0	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	100	20	290	70	0	90	0	90	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									22			
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	70			120			760	770	70	805	760	110
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	70			120			760	770	70	805	760	110
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			80			67	100	91	100	100	100
cM capacity (veh/h)	1531			1468			273	266	993	232	269	943

Direction, Lane #	EB 1	WB 1	WB 2	SE 1
Volume Total	120	290	70	180
Volume Left	0	290	0	90
Volume Right	20	0	0	90
cSH	1700	1468	1700	547
Volume to Capacity	0.07	0.20	0.04	0.33
Queue Length 95th (ft)	0	18	0	36
Control Delay (s)	0.0	8.1	0.0	16.7
Lane LOS		A		C
Approach Delay (s)	0.0	6.5		16.7
Approach LOS				C

Intersection Summary			
Average Delay	8.1		
Intersection Capacity Utilization	45.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	1.00					1.00	1.00	
Frt		1.00	0.85	1.00	1.00					1.00	0.85	
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (prot)		3539	1583	1770	1863					1770	1583	
Flt Permitted		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (perm)		3539	1583	1770	1863					1770	1583	
Volume (vph)	0	1100	140	280	570	0	0	0	0	270	0	590
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	1100	140	280	570	0	0	0	0	270	0	590
RTOR Reduction (vph)	0	0	71	0	0	0	0	0	0	0	223	0
Lane Group Flow (vph)	0	1100	69	280	570	0	0	0	0	270	367	0
Turn Type			Perm	Prot						Perm		
Protected Phases		4		3	8						6	
Permitted Phases			4							6		
Actuated Green, G (s)		29.4	29.4	14.6	48.0					24.0	24.0	
Effective Green, g (s)		29.4	29.4	14.6	48.0					24.0	24.0	
Actuated g/C Ratio		0.37	0.37	0.18	0.60					0.30	0.30	
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	
Lane Grp Cap (vph)		1301	582	323	1118					531	475	
v/s Ratio Prot		c0.31		c0.16	0.31						c0.23	
v/s Ratio Perm			0.04							0.15		
v/c Ratio		0.85	0.12	0.87	0.51					0.51	0.77	
Uniform Delay, d1		23.2	16.7	31.8	9.2					23.1	25.5	
Progression Factor		0.41	0.08	0.94	0.55					1.00	1.00	
Incremental Delay, d2		5.4	0.3	14.7	1.1					3.5	11.6	
Delay (s)		15.0	1.7	44.5	6.2					26.6	37.1	
Level of Service		B	A	D	A					C	D	
Approach Delay (s)		13.5			18.8			0.0			33.8	
Approach LOS		B			B			A			C	

Intersection Summary

HCM Average Control Delay	20.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	92.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Util. Factor	0.97	1.00			0.95		1.00	1.00				
Frt	1.00	1.00			0.93		1.00	0.85				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	3433	1863			3286		1770	1583				
Flt Permitted	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	3433	1863			3286		1770	1583				
Volume (vph)	700	660	0	0	580	530	270	0	260	0	0	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	700	660	0	0	580	530	270	0	260	0	0	0
RTOR Reduction (vph)	0	0	0	0	201	0	0	202	0	0	0	0
Lane Group Flow (vph)	700	660	0	0	909	0	270	59	0	0	0	0
Turn Type	Prot						Perm					
Protected Phases	7	4			8			2				
Permitted Phases							2					
Actuated Green, G (s)	19.9	54.0			30.1		18.0	18.0				
Effective Green, g (s)	19.9	54.0			30.1		18.0	18.0				
Actuated g/C Ratio	0.25	0.68			0.38		0.22	0.22				
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0				
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	854	1258			1236		398	356				
v/s Ratio Prot	c0.20	0.35			c0.28			0.04				
v/s Ratio Perm							c0.15					
v/c Ratio	0.82	0.52			0.74		0.68	0.16				
Uniform Delay, d1	28.4	6.5			21.5		28.4	24.9				
Progression Factor	0.53	0.65			0.33		1.00	1.00				
Incremental Delay, d2	3.8	0.9			2.0		9.0	1.0				
Delay (s)	18.9	5.2			9.1		37.3	25.9				
Level of Service	B	A			A		D	C				
Approach Delay (s)		12.2			9.1			31.7			0.0	
Approach LOS		B			A			C			A	

Intersection Summary

HCM Average Control Delay	14.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	92.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.97	0.95					0.91	0.86	0.95
Frt		1.00	0.85	1.00	1.00					1.00	0.89	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.99	1.00
Satd. Flow (prot)		5085	1583	3400	3539					3189	1404	1504
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.99	1.00
Satd. Flow (perm)		5085	1583	3400	3539					3189	1404	1504
Volume (vph)	0	1460	180	450	1000	0	0	0	0	1090	0	910
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	1460	180	450	1000	0	0	0	0	1090	0	910
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	58	58
Lane Group Flow (vph)	0	1460	180	450	1000	0	0	0	0	944	485	455
Heavy Vehicles (%)	2%	2%	2%	3%	2%	2%	2%	2%	2%	3%	2%	2%
Turn Type			Free	Prot						Prot		Prot
Protected Phases		2		1	6					7	4	4
Permitted Phases			Free									
Actuated Green, G (s)		34.0	100.0	16.0	54.0					38.0	38.0	38.0
Effective Green, g (s)		34.0	100.0	16.0	54.0					38.0	38.0	38.0
Actuated g/C Ratio		0.34	1.00	0.16	0.54					0.38	0.38	0.38
Clearance Time (s)		4.0		4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1729	1583	544	1911					1212	534	572
v/s Ratio Prot		c0.29		c0.13	0.28					0.30	c0.35	0.30
v/s Ratio Perm			0.11									
v/c Ratio		0.84	0.11	0.83	0.52					0.78	0.91	0.80
Uniform Delay, d1		30.6	0.0	40.7	14.7					27.3	29.4	27.6
Progression Factor		0.87	1.00	0.55	0.22					1.00	1.00	1.00
Incremental Delay, d2		4.9	0.1	3.5	0.3					3.2	19.2	7.6
Delay (s)		31.5	0.1	25.9	3.6					30.5	48.6	35.1
Level of Service		C	A	C	A					C	D	D
Approach Delay (s)		28.0			10.5			0.0			36.6	
Approach LOS		C			B			A			D	

Intersection Summary

HCM Average Control Delay	26.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	86.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.91	1.00		0.91			0.95	0.95		1.00	
Frt	1.00	1.00	0.85		1.00			0.97	0.85		0.93	
Flt Protected	0.95	1.00	1.00		1.00			0.96	1.00		0.98	
Satd. Flow (prot)	1770	5036	1583		5033			1646	1490		1695	
Flt Permitted	0.95	1.00	1.00		1.00			0.96	1.00		0.98	
Satd. Flow (perm)	1770	5036	1583		5033			1646	1490		1695	
Volume (vph)	10	1790	810	0	2510	10	280	10	630	10	0	10
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	10	1790	810	0	2510	10	280	10	630	10	0	10
RTOR Reduction (vph)	0	0	0	0	1	0	0	9	183	0	9	0
Lane Group Flow (vph)	10	1790	810	0	2519	0	0	361	367	0	11	0
Heavy Vehicles (%)	2%	3%	2%	2%	3%	3%	2%	2%	3%	2%	2%	2%
Turn Type	Prot		Free				Split		Perm	Split		
Protected Phases	5	2			6		8	8		4	4	
Permitted Phases			Free						8			
Actuated Green, G (s)	0.8	53.0	100.0		48.2			28.7	28.7		6.3	
Effective Green, g (s)	0.8	53.0	100.0		48.2			28.7	28.7		6.3	
Actuated g/C Ratio	0.01	0.53	1.00		0.48			0.29	0.29		0.06	
Clearance Time (s)	4.0	4.0			4.0			4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0			3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	14	2669	1583		2426			472	428		107	
v/s Ratio Prot	0.01	0.36			c0.50			0.22			0.01	
v/s Ratio Perm			c0.51						c0.25			
v/c Ratio	0.71	0.67	0.51		1.04			0.77	0.86		0.10	
Uniform Delay, d1	49.5	17.1	0.0		25.9			32.6	33.7		44.2	
Progression Factor	0.80	0.49	1.00		0.42			1.00	1.00		1.00	
Incremental Delay, d2	66.4	0.8	0.7		25.8			7.3	15.6		0.4	
Delay (s)	105.7	9.2	0.7		36.7			39.9	49.3		44.6	
Level of Service	F	A	A		D			D	D		D	
Approach Delay (s)		6.9			36.7			45.5			44.6	
Approach LOS		A			D			D			D	

Intersection Summary

HCM Average Control Delay	25.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	90.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		0.97	1.00
Frt	1.00	0.85	1.00		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3530		3433	1863
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3530		3433	1863
Volume (vph)	800	260	1160	20	620	960
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	800	260	1160	20	620	960
RTOR Reduction (vph)	0	99	1	0	0	0
Lane Group Flow (vph)	800	161	1179	0	620	960
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	54.0	54.0	42.0		22.0	68.0
Effective Green, g (s)	54.0	54.0	42.0		22.0	68.0
Actuated g/C Ratio	0.42	0.42	0.32		0.17	0.52
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	735	658	1140		581	974
v/s Ratio Prot	c0.45		0.33		c0.18	c0.52
v/s Ratio Perm		0.10				
v/c Ratio	1.09	0.24	1.03		1.07	0.99
Uniform Delay, d1	38.0	24.7	44.0		54.0	30.5
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	59.8	0.2	36.0		56.5	25.1
Delay (s)	97.8	24.9	80.0		110.5	55.6
Level of Service	F	C	E		F	E
Approach Delay (s)	80.0		80.0			77.2
Approach LOS	E		E			E

Intersection Summary

HCM Average Control Delay	78.8	HCM Level of Service	E
HCM Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	104.7%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Volume (vph)	410	70	280	130	200	290
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	410	70	280	130	200	290

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	410	70	280	130	200	290
Volume Left (vph)	410	0	280	0	0	0
Volume Right (vph)	0	70	0	0	0	290
Hadj (s)	0.53	-0.67	0.53	0.03	0.03	-0.67
Departure Headway (s)	7.5	6.3	7.7	7.2	7.2	6.4
Degree Utilization, x	0.86	0.12	0.60	0.26	0.40	0.52
Capacity (veh/h)	467	548	449	480	484	540
Control Delay (s)	39.6	9.0	20.3	11.5	13.6	15.0
Approach Delay (s)	35.1		17.5		14.4	
Approach LOS	E		C		B	

Intersection Summary			
Delay	22.5		
HCM Level of Service	C		
Intersection Capacity Utilization	58.8%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0		4.0			
Lane Util. Factor		0.95	1.00		1.00	1.00	0.97		1.00			
Frt		1.00	0.85		1.00	0.85	1.00		0.85			
Flt Protected		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (prot)		3539	1583		1863	1583	3433		1583			
Flt Permitted		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (perm)		3539	1583		1863	1583	3433		1583			
Volume (vph)	0	940	1070	0	250	200	190	0	640	0	0	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	940	1070	0	250	200	190	0	640	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	940	1070	0	250	200	190	0	640	0	0	0
Turn Type			Free			Free	custom		Free			
Protected Phases		2			6							
Permitted Phases			Free			Free	4		Free			
Actuated Green, G (s)		24.7	40.0		24.7	40.0	7.3		40.0			
Effective Green, g (s)		24.7	40.0		24.7	40.0	7.3		40.0			
Actuated g/C Ratio		0.62	1.00		0.62	1.00	0.18		1.00			
Clearance Time (s)		4.0			4.0		4.0					
Vehicle Extension (s)		3.0			3.0		3.0					
Lane Grp Cap (vph)		2185	1583		1150	1583	627		1583			
v/s Ratio Prot		0.27			0.13							
v/s Ratio Perm			c0.68			0.13	0.06		0.40			
v/c Ratio		0.43	0.68		0.22	0.13	0.30		0.40			
Uniform Delay, d1		4.0	0.0		3.4	0.0	14.1		0.0			
Progression Factor		1.00	1.00		0.42	1.00	1.00		1.00			
Incremental Delay, d2		0.6	2.3		0.4	0.2	0.3		0.8			
Delay (s)		4.6	2.3		1.8	0.2	14.4		0.8			
Level of Service		A	A		A	A	B		A			
Approach Delay (s)		3.4			1.1			3.9			0.0	
Approach LOS		A			A			A			A	

Intersection Summary

HCM Average Control Delay	3.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	38.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0			4.0	4.0	4.0		4.0
Lane Util. Factor	1.00	0.95	1.00		0.91			1.00	1.00	1.00		1.00
Frt	1.00	1.00	0.85		1.00			1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00	1.00		1.00			0.98	1.00	0.95		1.00
Satd. Flow (prot)	1770	3539	1583		5074			1826	1583	1770		1583
Flt Permitted	0.36	1.00	1.00		1.00			0.98	1.00	0.66		1.00
Satd. Flow (perm)	661	3539	1583		5074			1826	1583	1232		1583
Volume (vph)	20	420	630	0	690	10	60	90	150	20	0	90
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	20	420	630	0	690	10	60	90	150	20	0	90
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	76	0	0	45
Lane Group Flow (vph)	20	420	630	0	696	0	0	150	74	20	0	45
Turn Type	Perm		Free				Perm		Perm	custom		custom
Protected Phases		4			8			2				
Permitted Phases	4		Free				2		2	6		6
Actuated Green, G (s)	12.2	12.2	40.0		12.2			19.8	19.8	19.8		19.8
Effective Green, g (s)	12.2	12.2	40.0		12.2			19.8	19.8	19.8		19.8
Actuated g/C Ratio	0.30	0.30	1.00		0.30			0.50	0.50	0.50		0.50
Clearance Time (s)	4.0	4.0			4.0			4.0	4.0	4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0			3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	202	1079	1583		1548			904	784	610		784
v/s Ratio Prot		0.12			0.14							
v/s Ratio Perm	0.03		c0.40					0.08	0.05	0.02		0.03
v/c Ratio	0.10	0.39	0.40		0.45			0.17	0.09	0.03		0.06
Uniform Delay, d1	10.0	11.0	0.0		11.2			5.6	5.4	5.2		5.2
Progression Factor	0.67	0.70	1.00		1.00			1.00	1.00	1.00		1.00
Incremental Delay, d2	0.2	0.2	0.7		0.2			0.4	0.2	0.1		0.1
Delay (s)	6.8	7.9	0.7		11.4			6.0	5.6	5.3		5.4
Level of Service	A	A	A		B			A	A	A		A
Approach Delay (s)		3.6			11.4			5.8			5.4	
Approach LOS		A			B			A			A	

Intersection Summary

HCM Average Control Delay	6.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	38.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0					4.0	4.0	4.0	4.0	
Lane Util. Factor	0.95	0.95	1.00					0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1681	1681	1583					3539	1583	1770	3539	
Flt Permitted	0.95	0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1681	1681	1583					3539	1583	1770	3539	
Volume (vph)	560	0	270	0	0	0	0	570	220	280	340	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	560	0	270	0	0	0	0	570	220	280	340	0
RTOR Reduction (vph)	0	0	206	0	0	0	0	0	144	0	0	0
Lane Group Flow (vph)	280	280	64	0	0	0	0	570	76	280	340	0
Turn Type	Perm		Perm						Perm	Prot		
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)	14.3	14.3	14.3					20.7	20.7	13.0	37.7	
Effective Green, g (s)	14.3	14.3	14.3					20.7	20.7	13.0	37.7	
Actuated g/C Ratio	0.24	0.24	0.24					0.34	0.34	0.22	0.63	
Clearance Time (s)	4.0	4.0	4.0					4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	401	401	377					1221	546	384	2224	
v/s Ratio Prot								c0.16		c0.16	0.10	
v/s Ratio Perm	c0.17	0.17	0.04						0.05			
v/c Ratio	0.70	0.70	0.17					0.47	0.14	0.73	0.15	
Uniform Delay, d1	20.9	20.9	18.1					15.3	13.5	21.9	4.6	
Progression Factor	1.00	1.00	1.00					1.00	1.00	1.00	0.99	
Incremental Delay, d2	5.2	5.2	0.2					1.3	0.5	6.8	0.1	
Delay (s)	26.1	26.1	18.4					16.6	14.1	28.6	4.7	
Level of Service	C	C	B					B	B	C	A	
Approach Delay (s)		23.6			0.0			15.9			15.5	
Approach LOS		C			A			B			B	

Intersection Summary

HCM Average Control Delay	18.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	45.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0		4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00		1.00		0.95	0.95		0.91	1.00		0.91	
Frt	1.00		0.85		0.96	0.85		1.00	0.85		1.00	
Flt Protected	0.95		1.00		0.97	1.00		1.00	1.00		1.00	
Satd. Flow (prot)	1770		1583		1637	1504		5085	1583		5085	
Flt Permitted	0.95		1.00		0.97	1.00		1.00	1.00		1.00	
Satd. Flow (perm)	1770		1583		1637	1504		5085	1583		5085	
Volume (vph)	110	0	240	150	0	320	0	620	470	0	1590	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	110	0	240	150	0	320	0	620	470	0	1590	0
RTOR Reduction (vph)	0	0	204	0	26	212	0	0	0	0	0	0
Lane Group Flow (vph)	110	0	36	0	182	50	0	620	470	0	1590	0
Turn Type	Prot		custom	Split		Perm			Free			
Protected Phases	6		6	2	2			4			8	
Permitted Phases						2		4	Free			
Actuated Green, G (s)	9.0		9.0		11.4	11.4		27.6	60.0		27.6	
Effective Green, g (s)	9.0		9.0		11.4	11.4		27.6	60.0		27.6	
Actuated g/C Ratio	0.15		0.15		0.19	0.19		0.46	1.00		0.46	
Clearance Time (s)	4.0		4.0		4.0	4.0		4.0			4.0	
Vehicle Extension (s)	3.0		3.0		3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	266		237		311	286		2339	1583		2339	
v/s Ratio Prot	0.06		0.02		c0.11			0.12			c0.31	
v/s Ratio Perm						0.03			c0.30			
v/c Ratio	0.41		0.15		0.59	0.17		0.27	0.30		0.68	
Uniform Delay, d1	23.1		22.2		22.1	20.4		10.0	0.0		12.7	
Progression Factor	1.00		1.00		1.00	1.00		0.99	1.00		1.00	
Incremental Delay, d2	1.0		0.3		2.8	0.3		0.3	0.5		1.6	
Delay (s)	24.2		22.5		24.9	20.6		10.2	0.5		14.3	
Level of Service	C		C		C	C		B	A		B	
Approach Delay (s)		23.0			22.6			6.0			14.3	
Approach LOS		C			C			A			B	

Intersection Summary

HCM Average Control Delay	13.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	70.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.91	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1441	1770	5085	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1441	1770	5085	3539	1583
Volume (vph)	1250	200	50	630	400	380
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1250	200	50	630	400	380
RTOR Reduction (vph)	0	116	0	0	0	0
Lane Group Flow (vph)	1250	84	50	630	400	380
Turn Type		Perm	Prot			Free
Protected Phases	4		5	2	6	
Permitted Phases		4				Free
Actuated Green, G (s)	33.7	33.7	5.2	38.3	29.1	80.0
Effective Green, g (s)	33.7	33.7	5.2	38.3	29.1	80.0
Actuated g/C Ratio	0.42	0.42	0.07	0.48	0.36	1.00
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	1446	607	115	2434	1287	1583
v/s Ratio Prot	c0.36		c0.03	0.12	c0.11	
v/s Ratio Perm		0.06				0.24
v/c Ratio	0.86	0.14	0.43	0.26	0.31	0.24
Uniform Delay, d1	21.1	14.2	36.0	12.4	18.3	0.0
Progression Factor	1.00	1.00	1.00	1.00	0.80	1.00
Incremental Delay, d2	5.6	0.1	2.6	0.3	0.5	0.3
Delay (s)	26.7	14.3	38.6	12.7	15.1	0.3
Level of Service	C	B	D	B	B	A
Approach Delay (s)	25.0			14.6	7.9	
Approach LOS	C			B	A	

Intersection Summary

HCM Average Control Delay	18.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	62.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.91	0.95		0.95	1.00		0.91	0.91
Frt				1.00	0.85	0.85		1.00	0.85		0.93	0.85
Flt Protected				0.95	1.00	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1441	1504		3539	1583		3147	1441
Flt Permitted				0.95	1.00	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1441	1504		3539	1583		3147	1441
Volume (vph)	0	0	0	40	0	480	0	1580	300	0	760	1470
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	0	0	40	0	480	0	1580	300	0	760	1470
RTOR Reduction (vph)	0	0	0	0	23	23	0	0	0	0	156	241
Lane Group Flow (vph)	0	0	0	40	217	217	0	1580	300	0	1301	532
Turn Type				Perm		Perm			Free			Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			Free			6
Actuated Green, G (s)				16.9	16.9	16.9		55.1	80.0		55.1	55.1
Effective Green, g (s)				16.9	16.9	16.9		55.1	80.0		55.1	55.1
Actuated g/C Ratio				0.21	0.21	0.21		0.69	1.00		0.69	0.69
Clearance Time (s)				4.0	4.0	4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0	3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				355	304	318		2437	1583		2167	992
v/s Ratio Prot								c0.45			0.41	
v/s Ratio Perm				0.02	0.15	0.14			0.19			0.37
v/c Ratio				0.11	0.71	0.68		0.65	0.19		0.60	0.54
Uniform Delay, d1				25.5	29.3	29.1		7.0	0.0		6.6	6.1
Progression Factor				1.00	1.00	1.00		0.31	1.00		1.00	1.00
Incremental Delay, d2				0.1	7.7	5.9		1.0	0.2		1.2	2.1
Delay (s)				25.6	37.0	35.0		3.2	0.2		7.8	8.2
Level of Service				C	D	D		A	A		A	A
Approach Delay (s)		0.0			35.2			2.7			8.0	
Approach LOS		A			D			A			A	

Intersection Summary

HCM Average Control Delay	8.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		0.95	0.95	
Frt	0.95	0.85		1.00	1.00	
Flt Protected	0.97	1.00		1.00	1.00	
Satd. Flow (prot)	1714	1504		3539	3539	
Flt Permitted	0.97	1.00		1.00	1.00	
Satd. Flow (perm)	1714	1504		3539	3539	
Volume (vph)	300	700	0	840	170	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	300	700	0	840	170	0
RTOR Reduction (vph)	46	348	0	0	0	0
Lane Group Flow (vph)	400	206	0	840	170	0
Turn Type		Perm				
Protected Phases	6			4	8	
Permitted Phases		6				
Actuated Green, G (s)	12.7	12.7		13.4	13.4	
Effective Green, g (s)	12.7	12.7		13.4	13.4	
Actuated g/C Ratio	0.37	0.37		0.39	0.39	
Clearance Time (s)	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	638	560		1391	1391	
v/s Ratio Prot	c0.23			c0.24	0.05	
v/s Ratio Perm		0.14				
v/c Ratio	0.63	0.37		0.60	0.12	
Uniform Delay, d1	8.8	7.8		8.2	6.6	
Progression Factor	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.9	0.4		0.7	0.0	
Delay (s)	10.7	8.2		9.0	6.6	
Level of Service	B	A		A	A	
Approach Delay (s)	9.3			9.0	6.6	
Approach LOS	A			A	A	

Intersection Summary

HCM Average Control Delay	8.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	34.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	83.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Sign Control	Yield			Yield	Yield	
Volume (vph)	0	0	770	370	180	160
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	770	370	180	160

Direction, Lane #	NE 1	NE 2	SW 1
Volume Total (vph)	770	370	340
Volume Left (vph)	770	0	0
Volume Right (vph)	0	0	160
Hadj (s)	0.53	0.03	-0.25
Departure Headway (s)	5.3	4.8	4.5
Degree Utilization, x	1.13	0.49	0.43
Capacity (veh/h)	690	751	789
Control Delay (s)	94.1	11.0	10.8
Approach Delay (s)	67.1		10.8
Approach LOS	F		B

Intersection Summary			
Delay	54.2		
HCM Level of Service	F		
Intersection Capacity Utilization	83.4%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	60	190	170	0	0	0	50	360	170	60	160	130
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	60	190	170	0	0	0	50	360	170	60	160	130
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			3									
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								189			337	
pX, platoon unblocked												
vC, conflicting volume	560	910	160	920	955	265	290			530		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	560	910	160	920	955	265	290			530		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	84	23	80	100	100	100	96			94		
cM capacity (veh/h)	381	247	857	62	232	733	1269			1033		

Direction, Lane #	SE 1	NE 1	NE 2	SW 1	SW 2	SW 3
Volume Total	420	230	350	60	160	130
Volume Left	60	50	0	60	0	0
Volume Right	170	0	170	0	0	130
cSH	421	1269	1700	1033	1700	1700
Volume to Capacity	1.00	0.04	0.21	0.06	0.09	0.08
Queue Length 95th (ft)	312	3	0	5	0	0
Control Delay (s)	74.8	2.0	0.0	8.7	0.0	0.0
Lane LOS	F	A		A		
Approach Delay (s)	74.8	0.8		1.5		
Approach LOS	F					

Intersection Summary			
Average Delay	24.0		
Intersection Capacity Utilization	48.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor				1.00	1.00		1.00	0.95			1.00	1.00
Frt				1.00	0.85		1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (prot)				1770	1583		1770	3539			1863	1583
Flt Permitted				0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (perm)				1770	1583		1770	3539			1863	1583
Volume (vph)	0	0	0	180	0	170	390	150	0	0	200	150
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	0	0	180	0	170	390	150	0	0	200	150
RTOR Reduction (vph)	0	0	0	0	126	0	0	0	0	0	0	123
Lane Group Flow (vph)	0	0	0	180	44	0	390	150	0	0	200	27
Turn Type				Perm			Prot					Perm
Protected Phases					2		7	4			8	
Permitted Phases				2								8
Actuated Green, G (s)				11.9	11.9		14.2	26.6			8.4	8.4
Effective Green, g (s)				11.9	11.9		14.2	26.6			8.4	8.4
Actuated g/C Ratio				0.26	0.26		0.31	0.57			0.18	0.18
Clearance Time (s)				4.0	4.0		4.0	4.0			4.0	4.0
Vehicle Extension (s)				3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)				453	405		541	2024			337	286
v/s Ratio Prot					0.03		c0.22	0.04			c0.11	
v/s Ratio Perm				c0.10								0.02
v/c Ratio				0.40	0.11		0.72	0.07			0.59	0.09
Uniform Delay, d1				14.3	13.2		14.4	4.4			17.5	15.9
Progression Factor				1.00	1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2				0.6	0.1		4.7	0.0			2.8	0.1
Delay (s)				14.9	13.4		19.1	4.5			20.3	16.0
Level of Service				B	B		B	A			C	B
Approach Delay (s)		0.0			14.2			15.0			18.5	
Approach LOS		A			B			B			B	

Intersection Summary

HCM Average Control Delay	15.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	46.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	52.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0		4.0		4.0	4.0	4.0	4.0
Lane Util. Factor		0.95		1.00	0.95		1.00		1.00	1.00	1.00	1.00
Frt		0.99		1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		3505		1770	3539		1770		1583	1770	1863	1583
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)		3505		1770	3539		1770		1583	1770	1863	1583
Volume (vph)	0	290	20	10	340	0	90	0	320	170	70	120
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	290	20	10	340	0	90	0	320	170	70	120
RTOR Reduction (vph)	0	7	0	0	0	0	0	0	260	0	0	94
Lane Group Flow (vph)	0	303	0	10	340	0	90	0	60	170	70	26
Turn Type				Prot			Prot		custom	Split		Perm
Protected Phases		4		3	8		2		2	6	6	
Permitted Phases												6
Actuated Green, G (s)		9.3		0.5	13.8		8.2		8.2	9.5	9.5	9.5
Effective Green, g (s)		9.3		0.5	13.8		8.2		8.2	9.5	9.5	9.5
Actuated g/C Ratio		0.21		0.01	0.32		0.19		0.19	0.22	0.22	0.22
Clearance Time (s)		4.0		4.0	4.0		4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0		3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		749		20	1123		334		298	387	407	346
v/s Ratio Prot		c0.09		0.01	c0.10		c0.05		0.04	c0.10	0.04	
v/s Ratio Perm												0.02
v/c Ratio		0.40		0.50	0.30		0.27		0.20	0.44	0.17	0.08
Uniform Delay, d1		14.7		21.4	11.2		15.1		14.9	14.7	13.8	13.5
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		0.4		18.3	0.2		0.4		0.3	0.8	0.2	0.1
Delay (s)		15.1		39.7	11.4		15.5		15.2	15.5	14.0	13.6
Level of Service		B		D	B		B		B	B	B	B
Approach Delay (s)		15.1			12.2			15.3			14.6	
Approach LOS		B			B			B			B	

Intersection Summary

HCM Average Control Delay	14.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	43.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	47.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	
Lane Util. Factor	0.95			0.95	0.97	
Frt	1.00			1.00	0.98	
Flt Protected	1.00			1.00	0.96	
Satd. Flow (prot)	3539			3539	3397	
Flt Permitted	1.00			1.00	0.96	
Satd. Flow (perm)	3539			3539	3397	
Volume (vph)	510	0	0	710	70	10
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	510	0	0	710	70	10
RTOR Reduction (vph)	0	0	0	0	8	0
Lane Group Flow (vph)	510	0	0	710	72	0
Turn Type						
Protected Phases	4			8	2	
Permitted Phases						
Actuated Green, G (s)	10.8			10.8	6.1	
Effective Green, g (s)	10.8			10.8	6.1	
Actuated g/C Ratio	0.43			0.43	0.24	
Clearance Time (s)	4.0			4.0	4.0	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	1535			1535	832	
v/s Ratio Prot	0.14			c0.20	c0.02	
v/s Ratio Perm						
v/c Ratio	0.33			0.46	0.09	
Uniform Delay, d1	4.7			5.0	7.3	
Progression Factor	1.00			1.00	1.00	
Incremental Delay, d2	0.1			0.2	0.0	
Delay (s)	4.8			5.2	7.3	
Level of Service	A			A	A	
Approach Delay (s)	4.8			5.2	7.3	
Approach LOS	A			A	A	

Intersection Summary

HCM Average Control Delay	5.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	24.9	Sum of lost time (s)	8.0
Intersection Capacity Utilization	29.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	100	90	640	290	280	190
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	100	90	640	290	280	190
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		17				
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1800	235	470			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1800	235	470			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	88	41			
cM capacity (veh/h)	29	767	1088			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	190	640	145	145	187	283
Volume Left	100	640	0	0	0	0
Volume Right	90	0	0	0	0	190
cSH	55	1088	1700	1700	1700	1700
Volume to Capacity	3.48	0.59	0.09	0.09	0.11	0.17
Queue Length 95th (ft)	Err	100	0	0	0	0
Control Delay (s)	Err	12.9	0.0	0.0	0.0	0.0
Lane LOS	F	B				
Approach Delay (s)	Err	8.9			0.0	
Approach LOS	F					

Intersection Summary			
Average Delay	1200.0		
Intersection Capacity Utilization	64.8%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	190	40	110	160	120	60	70	90	20	70	70	60
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	190	40	110	160	120	60	70	90	20	70	70	60

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	340	160	180	70	110	70	130
Volume Left (vph)	190	160	0	70	0	70	0
Volume Right (vph)	110	0	60	0	20	0	60
Hadj (s)	-0.05	0.53	-0.20	0.53	-0.09	0.53	-0.29
Departure Headway (s)	6.1	6.8	6.1	7.4	6.8	7.4	6.6
Degree Utilization, x	0.58	0.30	0.30	0.14	0.21	0.14	0.24
Capacity (veh/h)	563	503	563	447	485	449	505
Control Delay (s)	17.3	11.5	10.5	10.5	10.3	10.4	10.4
Approach Delay (s)	17.3	11.0		10.4		10.4	
Approach LOS	C	B		B		B	

Intersection Summary			
Delay	12.8		
HCM Level of Service	B		
Intersection Capacity Utilization	53.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	180	470	0	0	90	260	0	0	0	30	0	150
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	180	470	0	0	90	260	0	0	0	30	0	150
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	350			470			1200	1050	220	1050	1180	470
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	350			470			1200	1050	220	1050	1180	470
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	85			100			100	100	100	83	100	75
cM capacity (veh/h)	1209			1092			107	193	820	182	162	594

Direction, Lane #	EB 1	EB 2	WB 1	NW 1	NW 2
Volume Total	180	470	350	30	150
Volume Left	180	0	0	30	0
Volume Right	0	0	260	0	150
cSH	1209	1700	1700	182	594
Volume to Capacity	0.15	0.28	0.21	0.17	0.25
Queue Length 95th (ft)	13	0	0	14	25
Control Delay (s)	8.5	0.0	0.0	28.7	13.1
Lane LOS	A			D	B
Approach Delay (s)	2.4		0.0	15.7	
Approach LOS				C	

Intersection Summary			
Average Delay	3.7		
Intersection Capacity Utilization	67.3%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	260	40	80	60	0	370	0	100	0	0	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	260	40	80	60	0	370	0	100	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									22			
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	60			300			500	520	60	550	500	280
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	60			300			500	520	60	550	500	280
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			94			19	100	90	100	100	100
cM capacity (veh/h)	1544			1261			458	431	1005	382	443	759

Direction, Lane #	EB 1	WB 1	WB 2	SE 1
Volume Total	300	80	60	470
Volume Left	0	80	0	370
Volume Right	40	0	0	100
cSH	1700	1261	1700	582
Volume to Capacity	0.18	0.06	0.04	0.81
Queue Length 95th (ft)	0	5	0	201
Control Delay (s)	0.0	8.0	0.0	32.1
Lane LOS		A		D
Approach Delay (s)	0.0	4.6		32.1
Approach LOS				D

Intersection Summary			
Average Delay	17.3		
Intersection Capacity Utilization	67.3%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	1.00					1.00	1.00	
Frt		1.00	0.85	1.00	1.00					1.00	0.85	
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (prot)		3539	1583	1770	1863					1770	1590	
Flt Permitted		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (perm)		3539	1583	1770	1863					1770	1590	
Volume (vph)	0	860	180	360	620	0	0	0	0	350	20	780
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	860	180	360	620	0	0	0	0	350	20	780
RTOR Reduction (vph)	0	0	105	0	0	0	0	0	0	0	127	0
Lane Group Flow (vph)	0	860	75	360	620	0	0	0	0	350	673	0
Turn Type			Perm	Prot						Perm		
Protected Phases		4		3	8						6	
Permitted Phases			4							6		
Actuated Green, G (s)		23.0	23.0	18.0	45.0					37.0	37.0	
Effective Green, g (s)		23.0	23.0	18.0	45.0					37.0	37.0	
Actuated g/C Ratio		0.26	0.26	0.20	0.50					0.41	0.41	
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	
Lane Grp Cap (vph)		904	405	354	932					728	654	
v/s Ratio Prot		c0.24		c0.20	0.33						c0.42	
v/s Ratio Perm			0.05							0.20		
v/c Ratio		0.95	0.19	1.02	0.67					0.48	1.03	
Uniform Delay, d1		32.9	26.2	36.0	16.9					19.4	26.5	
Progression Factor		0.63	0.89	0.74	0.45					1.00	1.00	
Incremental Delay, d2		18.5	0.9	44.9	2.7					2.3	42.7	
Delay (s)		39.2	24.2	71.4	10.3					21.7	69.2	
Level of Service		D	C	E	B					C	E	
Approach Delay (s)		36.6			32.8			0.0			54.8	
Approach LOS		D			C			A			D	

Intersection Summary

HCM Average Control Delay	42.0	HCM Level of Service	D
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	103.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Util. Factor	0.97	1.00			0.95		1.00	1.00				
Frt	1.00	1.00			0.96		1.00	0.85				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	3433	1863			3386		1770	1583				
Flt Permitted	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	3433	1863			3386		1770	1583				
Volume (vph)	630	570	0	0	840	340	140	0	230	0	0	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	630	570	0	0	840	340	140	0	230	0	0	0
RTOR Reduction (vph)	0	0	0	0	45	0	0	189	0	0	0	0
Lane Group Flow (vph)	630	570	0	0	1135	0	140	41	0	0	0	0
Turn Type	Prot						Perm					
Protected Phases	7	4			8			2				
Permitted Phases							2					
Actuated Green, G (s)	19.9	66.0			42.1		16.0	16.0				
Effective Green, g (s)	19.9	66.0			42.1		16.0	16.0				
Actuated g/C Ratio	0.22	0.73			0.47		0.18	0.18				
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0				
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	759	1366			1584		315	281				
v/s Ratio Prot	c0.18	0.31			c0.34			0.03				
v/s Ratio Perm							c0.08					
v/c Ratio	0.83	0.42			0.72		0.44	0.15				
Uniform Delay, d1	33.4	4.6			19.2		33.0	31.2				
Progression Factor	0.61	2.23			0.78		1.00	1.00				
Incremental Delay, d2	4.4	0.5			1.7		4.5	1.1				
Delay (s)	24.6	10.8			16.7		37.5	32.3				
Level of Service	C	B			B		D	C				
Approach Delay (s)		18.1			16.7			34.3			0.0	
Approach LOS		B			B			C			A	

Intersection Summary

HCM Average Control Delay	19.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	103.0%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.97	0.95					0.91	0.86	0.95
Frt		1.00	0.85	1.00	1.00					1.00	0.92	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.98	1.00
Satd. Flow (prot)		5085	1583	3400	3539					3189	1434	1504
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.98	1.00
Satd. Flow (perm)		5085	1583	3400	3539					3189	1434	1504
Volume (vph)	0	1590	250	490	950	0	0	0	0	1400	0	930
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	1590	250	490	950	0	0	0	0	1400	0	930
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	37	63
Lane Group Flow (vph)	0	1590	250	490	950	0	0	0	0	1113	577	540
Heavy Vehicles (%)	2%	2%	2%	3%	2%	2%	2%	2%	2%	3%	2%	2%
Turn Type			Free	Prot						Prot		Prot
Protected Phases		2		1	6					7	4	4
Permitted Phases			Free									
Actuated Green, G (s)		38.0	110.0	17.0	59.0					43.0	43.0	43.0
Effective Green, g (s)		38.0	110.0	17.0	59.0					43.0	43.0	43.0
Actuated g/C Ratio		0.35	1.00	0.15	0.54					0.39	0.39	0.39
Clearance Time (s)		4.0		4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1757	1583	525	1898					1247	561	588
v/s Ratio Prot		c0.31		c0.14	0.27					0.35	c0.40	0.36
v/s Ratio Perm			0.16									
v/c Ratio		0.90	0.16	0.93	0.50					0.89	1.03	0.92
Uniform Delay, d1		34.3	0.0	45.9	16.2					31.3	33.5	31.8
Progression Factor		0.82	1.00	0.61	0.18					1.00	1.00	1.00
Incremental Delay, d2		7.3	0.2	12.7	0.4					8.4	45.4	19.2
Delay (s)		35.5	0.2	40.8	3.3					39.8	78.9	51.1
Level of Service		D	A	D	A					D	E	D
Approach Delay (s)		30.7			16.0			0.0			53.0	
Approach LOS		C			B			A			D	

Intersection Summary

HCM Average Control Delay	36.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	150.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.91	1.00		0.91			0.95	0.95		1.00	
Frt	1.00	1.00	0.85		1.00			0.96	0.85		0.93	
Flt Protected	0.95	1.00	1.00		1.00			0.97	1.00		0.98	
Satd. Flow (prot)	1770	5036	1583		5033			1631	1490		1695	
Flt Permitted	0.95	1.00	1.00		1.00			0.97	1.00		0.98	
Satd. Flow (perm)	1770	5036	1583		5033			1631	1490		1695	
Volume (vph)	10	2120	830	0	2300	10	280	10	660	10	0	10
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	10	2120	830	0	2300	10	280	10	660	10	0	10
RTOR Reduction (vph)	0	0	0	0	1	0	0	12	161	0	9	0
Lane Group Flow (vph)	10	2120	830	0	2309	0	0	400	377	0	11	0
Heavy Vehicles (%)	2%	3%	2%	2%	3%	3%	2%	2%	3%	2%	2%	2%
Turn Type	Prot		Free				Split		Perm	Split		
Protected Phases	5	2			6		8	8		4	4	
Permitted Phases			Free						8			
Actuated Green, G (s)	0.8	57.0	110.0		52.2			34.6	34.6		6.4	
Effective Green, g (s)	0.8	57.0	110.0		52.2			34.6	34.6		6.4	
Actuated g/C Ratio	0.01	0.52	1.00		0.47			0.31	0.31		0.06	
Clearance Time (s)	4.0	4.0			4.0			4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0			3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	13	2610	1583		2388			513	469		99	
v/s Ratio Prot	0.01	0.42			c0.46			0.25			0.01	
v/s Ratio Perm			c0.52						c0.25			
v/c Ratio	0.77	0.81	0.52		0.97			0.78	0.80		0.11	
Uniform Delay, d1	54.5	22.0	0.0		28.1			34.2	34.6		49.1	
Progression Factor	1.06	0.42	1.00		0.50			1.00	1.00		1.00	
Incremental Delay, d2	68.3	1.2	0.5		9.6			7.4	9.6		0.5	
Delay (s)	125.9	10.3	0.5		23.6			41.6	44.2		49.6	
Level of Service	F	B	A		C			D	D		D	
Approach Delay (s)		8.0			23.6			43.1			49.6	
Approach LOS		A			C			D			D	

Intersection Summary

HCM Average Control Delay	19.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	87.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		0.97	1.00
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3507		3433	1863
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3507		3433	1863
Volume (vph)	1090	410	940	60	530	1340
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1090	410	940	60	530	1340
RTOR Reduction (vph)	0	124	4	0	0	0
Lane Group Flow (vph)	1090	286	996	0	530	1340
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	51.0	51.0	37.0		20.0	61.0
Effective Green, g (s)	51.0	51.0	37.0		20.0	61.0
Actuated g/C Ratio	0.42	0.42	0.31		0.17	0.51
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	752	673	1081		572	947
v/s Ratio Prot	c0.62		0.28		0.15	c0.72
v/s Ratio Perm		0.18				
v/c Ratio	1.45	0.42	0.92		0.93	1.41
Uniform Delay, d1	34.5	24.2	40.1		49.3	29.5
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	209.7	0.4	12.5		21.1	193.0
Delay (s)	244.2	24.6	52.6		70.4	222.5
Level of Service	F	C	D		E	F
Approach Delay (s)	184.2		52.6			179.4
Approach LOS	F		D			F

Intersection Summary

HCM Average Control Delay	152.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.43		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	137.6%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Volume (vph)	530	110	130	160	240	270
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	530	110	130	160	240	270

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	530	110	130	160	240	270
Volume Left (vph)	530	0	130	0	0	0
Volume Right (vph)	0	110	0	0	0	270
Hadj (s)	0.53	-0.67	0.53	0.03	0.03	-0.67
Departure Headway (s)	7.3	6.1	7.9	7.4	7.1	6.4
Degree Utilization, x	1.07	0.19	0.28	0.33	0.47	0.48
Capacity (veh/h)	490	577	448	478	498	554
Control Delay (s)	85.8	9.2	12.8	12.7	15.1	14.0
Approach Delay (s)	72.7		12.8		14.5	
Approach LOS	F		B		B	

Intersection Summary			
Delay	40.0		
HCM Level of Service	E		
Intersection Capacity Utilization	59.2%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0		4.0			
Lane Util. Factor		0.95	1.00		1.00	1.00	0.97		1.00			
Frt		1.00	0.85		1.00	0.85	1.00		0.85			
Flt Protected		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (prot)		3539	1583		1863	1583	3433		1583			
Flt Permitted		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (perm)		3539	1583		1863	1583	3433		1583			
Volume (vph)	0	700	1350	0	340	200	430	0	880	0	0	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	700	1350	0	340	200	430	0	880	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	700	1350	0	340	200	430	0	880	0	0	0
Turn Type			Free			Free	custom		Free			
Protected Phases		2			6							
Permitted Phases			Free			Free	4		Free			
Actuated Green, G (s)		22.1	40.0		22.1	40.0	9.9		40.0			
Effective Green, g (s)		22.1	40.0		22.1	40.0	9.9		40.0			
Actuated g/C Ratio		0.55	1.00		0.55	1.00	0.25		1.00			
Clearance Time (s)		4.0			4.0		4.0					
Vehicle Extension (s)		3.0			3.0		3.0					
Lane Grp Cap (vph)		1955	1583		1029	1583	850		1583			
v/s Ratio Prot		0.20			0.18							
v/s Ratio Perm			c0.85			0.13	0.13		0.56			
v/c Ratio		0.36	0.85		0.33	0.13	0.51		0.56			
Uniform Delay, d1		5.0	0.0		4.9	0.0	12.9		0.0			
Progression Factor		1.00	1.00		0.55	1.00	1.00		1.00			
Incremental Delay, d2		0.5	6.0		0.8	0.2	0.5		1.4			
Delay (s)		5.5	6.0		3.5	0.2	13.4		1.4			
Level of Service		A	A		A	A	B		A			
Approach Delay (s)		5.9			2.3			5.4			0.0	
Approach LOS		A			A			A			A	

Intersection Summary

HCM Average Control Delay	5.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	38.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0			4.0	4.0	4.0		4.0
Lane Util. Factor	1.00	0.95	1.00		0.91			1.00	1.00	1.00		1.00
Frt	1.00	1.00	0.85		1.00			1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00	1.00		1.00			0.96	1.00	0.95		1.00
Satd. Flow (prot)	1770	3539	1583		5073			1781	1583	1770		1583
Flt Permitted	0.41	1.00	1.00		1.00			0.96	1.00	0.67		1.00
Satd. Flow (perm)	764	3539	1583		5073			1781	1583	1255		1583
Volume (vph)	90	630	390	0	600	10	120	10	230	10	0	40
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	90	630	390	0	600	10	120	10	230	10	0	40
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	77	0	0	23
Lane Group Flow (vph)	90	630	390	0	606	0	0	130	153	10	0	18
Turn Type	Perm		Free				Perm		Perm	custom		custom
Protected Phases		4			8			2				
Permitted Phases	4		Free				2		2	6		6
Actuated Green, G (s)	14.5	14.5	40.0		14.5			17.5	17.5	17.5		17.5
Effective Green, g (s)	14.5	14.5	40.0		14.5			17.5	17.5	17.5		17.5
Actuated g/C Ratio	0.36	0.36	1.00		0.36			0.44	0.44	0.44		0.44
Clearance Time (s)	4.0	4.0			4.0			4.0	4.0	4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0			3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	277	1283	1583		1839			779	693	549		693
v/s Ratio Prot		c0.18			0.12							
v/s Ratio Perm	0.12		c0.25					0.07	0.10	0.01		0.01
v/c Ratio	0.32	0.49	0.25		0.33			0.17	0.22	0.02		0.03
Uniform Delay, d1	9.2	9.9	0.0		9.2			6.8	7.0	6.4		6.4
Progression Factor	0.76	0.79	1.00		1.00			1.00	1.00	1.00		1.00
Incremental Delay, d2	0.6	0.3	0.3		0.1			0.5	0.7	0.1		0.1
Delay (s)	7.7	8.0	0.3		9.3			7.3	7.7	6.4		6.5
Level of Service	A	A	A		A			A	A	A		A
Approach Delay (s)		5.3			9.3			7.6			6.5	
Approach LOS		A			A			A			A	

Intersection Summary

HCM Average Control Delay	6.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	45.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0					4.0	4.0	4.0	4.0	
Lane Util. Factor	0.95	0.95	1.00					0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1681	1681	1583					3539	1583	1770	3539	
Flt Permitted	0.95	0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1681	1681	1583					3539	1583	1770	3539	
Volume (vph)	960	0	530	0	0	0	0	610	260	480	450	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	960	0	530	0	0	0	0	610	260	480	450	0
RTOR Reduction (vph)	0	0	281	0	0	0	0	0	199	0	0	0
Lane Group Flow (vph)	480	480	249	0	0	0	0	610	61	480	450	0
Turn Type	Perm		Perm						Perm	Prot		
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)	21.4	21.4	21.4					16.4	16.4	20.2	40.6	
Effective Green, g (s)	21.4	21.4	21.4					16.4	16.4	20.2	40.6	
Actuated g/C Ratio	0.31	0.31	0.31					0.23	0.23	0.29	0.58	
Clearance Time (s)	4.0	4.0	4.0					4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	514	514	484					829	371	511	2053	
v/s Ratio Prot								c0.17		c0.27	0.13	
v/s Ratio Perm	c0.29	0.29	0.16						0.04			
v/c Ratio	0.93	0.93	0.51					0.74	0.16	0.94	0.22	
Uniform Delay, d1	23.6	23.6	20.0					24.8	21.3	24.3	7.1	
Progression Factor	1.00	1.00	1.00					1.00	1.00	1.00	1.00	
Incremental Delay, d2	24.2	24.2	0.9					5.8	1.0	25.2	0.2	
Delay (s)	47.8	47.8	20.9					30.6	22.3	49.4	7.3	
Level of Service	D	D	C					C	C	D	A	
Approach Delay (s)		38.3			0.0			28.1			29.1	
Approach LOS		D			A			C			C	

Intersection Summary

HCM Average Control Delay	33.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	63.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0		4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00		1.00		0.95	0.95		0.91	1.00		0.91	
Frt	1.00		0.85		0.96	0.85		1.00	0.85		1.00	
Flt Protected	0.95		1.00		0.96	1.00		1.00	1.00		1.00	
Satd. Flow (prot)	1770		1583		1642	1504		5085	1583		5085	
Flt Permitted	0.95		1.00		0.96	1.00		1.00	1.00		1.00	
Satd. Flow (perm)	1770		1583		1642	1504		5085	1583		5085	
Volume (vph)	80	0	150	220	0	460	0	1170	370	0	1360	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	80	0	150	220	0	460	0	1170	370	0	1360	0
RTOR Reduction (vph)	0	0	132	0	18	222	0	0	0	0	0	0
Lane Group Flow (vph)	80	0	18	0	274	166	0	1170	370	0	1360	0
Turn Type	Prot		custom	Split		Perm			Free			
Protected Phases	6		6	2	2			4			8	
Permitted Phases						2		4	Free			
Actuated Green, G (s)	8.4		8.4		15.4	15.4		34.2	70.0		34.2	
Effective Green, g (s)	8.4		8.4		15.4	15.4		34.2	70.0		34.2	
Actuated g/C Ratio	0.12		0.12		0.22	0.22		0.49	1.00		0.49	
Clearance Time (s)	4.0		4.0		4.0	4.0		4.0			4.0	
Vehicle Extension (s)	3.0		3.0		3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	212		190		361	331		2484	1583		2484	
v/s Ratio Prot	c0.05		0.01		c0.17			0.23			c0.27	
v/s Ratio Perm						0.11			0.23			
v/c Ratio	0.38		0.09		0.76	0.50		0.47	0.23		0.55	
Uniform Delay, d1	28.4		27.4		25.6	23.9		11.9	0.0		12.5	
Progression Factor	1.00		1.00		1.00	1.00		0.99	1.00		1.00	
Incremental Delay, d2	1.1		0.2		8.9	1.2		0.6	0.3		0.9	
Delay (s)	29.5		27.6		34.4	25.1		12.5	0.3		13.4	
Level of Service	C		C		C	C		B	A		B	
Approach Delay (s)		28.3			29.1			9.6			13.4	
Approach LOS		C			C			A			B	

Intersection Summary

HCM Average Control Delay	15.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	67.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.91	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1441	1770	5085	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1441	1770	5085	3539	1583
Volume (vph)	1050	730	50	730	530	280
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1050	730	50	730	530	280
RTOR Reduction (vph)	0	363	0	0	0	0
Lane Group Flow (vph)	1050	367	50	730	530	280
Turn Type		Perm	Prot			Free
Protected Phases	4		5	2	6	
Permitted Phases		4				Free
Actuated Green, G (s)	25.4	25.4	5.0	36.6	27.6	70.0
Effective Green, g (s)	25.4	25.4	5.0	36.6	27.6	70.0
Actuated g/C Ratio	0.36	0.36	0.07	0.52	0.39	1.00
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	1246	523	126	2659	1395	1583
v/s Ratio Prot	c0.31		c0.03	0.14	c0.15	
v/s Ratio Perm		0.25				0.18
v/c Ratio	0.84	0.70	0.40	0.27	0.38	0.18
Uniform Delay, d1	20.5	19.1	31.1	9.3	15.1	0.0
Progression Factor	1.00	1.00	1.00	1.00	0.78	1.00
Incremental Delay, d2	5.4	4.2	2.1	0.3	0.7	0.2
Delay (s)	25.8	23.3	33.1	9.6	12.4	0.2
Level of Service	C	C	C	A	B	A
Approach Delay (s)	24.8			11.1	8.2	
Approach LOS	C			B	A	

Intersection Summary

HCM Average Control Delay	17.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	65.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.91	0.95		0.95	1.00		0.91	0.91
Frt				1.00	0.85	0.85		1.00	0.85		0.94	0.85
Flt Protected				0.95	1.00	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1441	1504		3539	1583		3204	1441
Flt Permitted				0.95	1.00	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1441	1504		3539	1583		3204	1441
Volume (vph)	0	0	0	60	0	430	0	1430	350	0	790	1140
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	0	0	60	0	430	0	1430	350	0	790	1140
RTOR Reduction (vph)	0	0	0	0	30	30	0	0	0	0	75	212
Lane Group Flow (vph)	0	0	0	60	183	187	0	1430	350	0	1173	470
Turn Type				Perm		Perm			Free			Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			Free			6
Actuated Green, G (s)				13.8	13.8	13.8		48.2	70.0		48.2	48.2
Effective Green, g (s)				13.8	13.8	13.8		48.2	70.0		48.2	48.2
Actuated g/C Ratio				0.20	0.20	0.20		0.69	1.00		0.69	0.69
Clearance Time (s)				4.0	4.0	4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0	3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				331	284	297		2437	1583		2206	992
v/s Ratio Prot								c0.40			0.37	
v/s Ratio Perm				0.04	0.13	0.12			0.22			0.33
v/c Ratio				0.18	0.65	0.63		0.59	0.22		0.53	0.47
Uniform Delay, d1				23.4	25.8	25.8		5.7	0.0		5.4	5.0
Progression Factor				1.00	1.00	1.00		0.31	1.00		1.00	1.00
Incremental Delay, d2				0.3	5.0	4.3		0.8	0.3		0.9	1.6
Delay (s)				23.7	30.8	30.1		2.6	0.3		6.3	6.7
Level of Service				C	C	C		A	A		A	A
Approach Delay (s)		0.0			29.6			2.2			6.4	
Approach LOS		A			C			A			A	

Intersection Summary

HCM Average Control Delay	7.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	63.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		0.95	0.95	
Frt	0.90	0.85		1.00	1.00	
Flt Protected	0.98	1.00		1.00	1.00	
Satd. Flow (prot)	1646	1504		3539	3539	
Flt Permitted	0.98	1.00		1.00	1.00	
Satd. Flow (perm)	1646	1504		3539	3539	
Volume (vph)	190	1060	0	790	160	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	190	1060	0	790	160	0
RTOR Reduction (vph)	198	406	0	0	0	0
Lane Group Flow (vph)	396	250	0	790	160	0
Turn Type		Perm				
Protected Phases	6			4	8	
Permitted Phases		6				
Actuated Green, G (s)	12.8	12.8		12.9	12.9	
Effective Green, g (s)	12.8	12.8		12.9	12.9	
Actuated g/C Ratio	0.38	0.38		0.38	0.38	
Clearance Time (s)	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	625	571		1355	1355	
v/s Ratio Prot	c0.24			c0.22	0.05	
v/s Ratio Perm		0.17				
v/c Ratio	0.63	0.44		0.58	0.12	
Uniform Delay, d1	8.5	7.8		8.3	6.7	
Progression Factor	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.1	0.5		0.6	0.0	
Delay (s)	10.6	8.3		8.9	6.8	
Level of Service	B	A		A	A	
Approach Delay (s)	9.4			8.9	6.8	
Approach LOS	A			A	A	

Intersection Summary

HCM Average Control Delay	9.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	33.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	88.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Sign Control	Yield			Yield	Yield	
Volume (vph)	0	0	690	310	160	80
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	690	310	160	80

Direction, Lane #	NE 1	NE 2	SW 1
Volume Total (vph)	690	310	240
Volume Left (vph)	690	0	0
Volume Right (vph)	0	0	80
Hadj (s)	0.53	0.03	-0.17
Departure Headway (s)	5.2	4.7	4.6
Degree Utilization, x	1.00	0.40	0.31
Capacity (veh/h)	690	759	773
Control Delay (s)	54.4	9.6	9.7
Approach Delay (s)	40.6		9.7
Approach LOS	E		A

Intersection Summary			
Delay	34.6		
HCM Level of Service	D		
Intersection Capacity Utilization	88.9%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	40	100	90	0	0	0	20	560	80	100	240	180
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	40	100	90	0	0	0	20	560	80	100	240	180
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			3									
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								189			337	
pX, platoon unblocked												
vC, conflicting volume	760	1120	240	1130	1260	320	420			640		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	760	1120	240	1130	1260	320	420			640		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	85	44	88	100	100	100	98			89		
cM capacity (veh/h)	267	180	761	72	148	676	1136			940		

Direction, Lane #	SE 1	NE 1	NE 2	SW 1	SW 2	SW 3
Volume Total	230	300	360	100	240	180
Volume Left	40	20	0	100	0	0
Volume Right	90	0	80	0	0	180
cSH	337	1136	1700	940	1700	1700
Volume to Capacity	0.68	0.02	0.21	0.11	0.14	0.11
Queue Length 95th (ft)	119	1	0	9	0	0
Control Delay (s)	36.7	0.7	0.0	9.3	0.0	0.0
Lane LOS	E	A		A		
Approach Delay (s)	36.7	0.3		1.8		
Approach LOS	E					

Intersection Summary				
Average Delay	6.8			
Intersection Capacity Utilization	48.7%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor				1.00	1.00		1.00	0.95			1.00	1.00
Frt				1.00	0.85		1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (prot)				1770	1583		1770	3539			1863	1583
Flt Permitted				0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (perm)				1770	1583		1770	3539			1863	1583
Volume (vph)	0	0	0	360	0	90	320	160	0	0	170	90
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	0	0	360	0	90	320	160	0	0	170	90
RTOR Reduction (vph)	0	0	0	0	59	0	0	0	0	0	0	75
Lane Group Flow (vph)	0	0	0	360	31	0	320	160	0	0	170	15
Turn Type				Perm			Prot					Perm
Protected Phases					2		7	4			8	
Permitted Phases				2								8
Actuated Green, G (s)				17.1	17.1		12.6	24.7			8.1	8.1
Effective Green, g (s)				17.1	17.1		12.6	24.7			8.1	8.1
Actuated g/C Ratio				0.34	0.34		0.25	0.50			0.16	0.16
Clearance Time (s)				4.0	4.0		4.0	4.0			4.0	4.0
Vehicle Extension (s)				3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)				608	544		448	1755			303	257
v/s Ratio Prot					0.02		c0.18	0.05			c0.09	
v/s Ratio Perm				c0.20								0.01
v/c Ratio				0.59	0.06		0.71	0.09			0.56	0.06
Uniform Delay, d1				13.5	10.9		17.0	6.6			19.2	17.6
Progression Factor				1.00	1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2				1.6	0.0		5.3	0.0			2.4	0.1
Delay (s)				15.0	11.0		22.3	6.6			21.6	17.7
Level of Service				B	B		C	A			C	B
Approach Delay (s)		0.0			14.2			17.1			20.2	
Approach LOS		A			B			B			C	

Intersection Summary

HCM Average Control Delay	16.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	49.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0		4.0		4.0	4.0	4.0	4.0
Lane Util. Factor		0.95		1.00	0.95		1.00		1.00	1.00	1.00	1.00
Frt		0.95		1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		3359		1770	3539		1770		1583	1770	1863	1583
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)		3359		1770	3539		1770		1583	1770	1863	1583
Volume (vph)	0	350	180	50	540	0	150	0	310	310	160	190
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	350	180	50	540	0	150	0	310	310	160	190
RTOR Reduction (vph)	0	93	0	0	0	0	0	0	224	0	0	142
Lane Group Flow (vph)	0	437	0	50	540	0	150	0	86	310	160	48
Turn Type				Prot			Prot		custom	Split		Perm
Protected Phases		4		3	8		2		2	6	6	
Permitted Phases												6
Actuated Green, G (s)		12.5		2.0	18.5		10.1		10.1	13.6	13.6	13.6
Effective Green, g (s)		12.5		2.0	18.5		10.1		10.1	13.6	13.6	13.6
Actuated g/C Ratio		0.23		0.04	0.34		0.19		0.19	0.25	0.25	0.25
Clearance Time (s)		4.0		4.0	4.0		4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0		3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		775		65	1208		330		295	444	467	397
v/s Ratio Prot		c0.13		0.03	c0.15		c0.08		0.05	c0.18	0.09	
v/s Ratio Perm												0.03
v/c Ratio		0.56		0.77	0.45		0.45		0.29	0.70	0.34	0.12
Uniform Delay, d1		18.4		25.9	13.9		19.6		19.0	18.4	16.6	15.7
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		0.9		41.2	0.3		1.0		0.6	4.7	0.4	0.1
Delay (s)		19.4		67.1	14.1		20.6		19.5	23.2	17.1	15.8
Level of Service		B		E	B		C		B	C	B	B
Approach Delay (s)		19.4			18.6			19.9			19.6	
Approach LOS		B			B			B			B	

Intersection Summary

HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	54.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	61.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	
Lane Util. Factor	0.95			0.95	0.97	
Frt	1.00			1.00	0.99	
Flt Protected	1.00			1.00	0.95	
Satd. Flow (prot)	3539			3539	3428	
Flt Permitted	1.00			1.00	0.95	
Satd. Flow (perm)	3539			3539	3428	
Volume (vph)	490	0	0	740	240	10
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	490	0	0	740	240	10
RTOR Reduction (vph)	0	0	0	0	7	0
Lane Group Flow (vph)	490	0	0	740	243	0
Turn Type						
Protected Phases	4			8	2	
Permitted Phases						
Actuated Green, G (s)	11.3			11.3	7.3	
Effective Green, g (s)	11.3			11.3	7.3	
Actuated g/C Ratio	0.42			0.42	0.27	
Clearance Time (s)	4.0			4.0	4.0	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	1503			1503	941	
v/s Ratio Prot	0.14			c0.21	c0.07	
v/s Ratio Perm						
v/c Ratio	0.33			0.49	0.26	
Uniform Delay, d1	5.1			5.6	7.5	
Progression Factor	1.00			1.00	1.00	
Incremental Delay, d2	0.1			0.3	0.1	
Delay (s)	5.2			5.8	7.7	
Level of Service	A			A	A	
Approach Delay (s)	5.2			5.8	7.7	
Approach LOS	A			A	A	

Intersection Summary

HCM Average Control Delay	5.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	26.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	34.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	160	150	370	430	320	60
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	160	150	370	430	320	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		17				
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1305	190	380			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1305	190	380			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	82	69			
cM capacity (veh/h)	104	820	1175			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	310	370	215	215	213	167
Volume Left	160	370	0	0	0	0
Volume Right	150	0	0	0	0	60
cSH	201	1175	1700	1700	1700	1700
Volume to Capacity	1.54	0.31	0.13	0.13	0.13	0.10
Queue Length 95th (ft)	488	34	0	0	0	0
Control Delay (s)	189.7	9.5	0.0	0.0	0.0	0.0
Lane LOS	F	A				
Approach Delay (s)	189.7	4.4			0.0	
Approach LOS	F					

Intersection Summary			
Average Delay	41.8		
Intersection Capacity Utilization	50.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	240	20	100	270	320	220	140	50	10	60	40	100
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	240	20	100	270	320	220	140	50	10	60	40	100

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	360	270	540	140	60	60	140
Volume Left (vph)	240	270	0	140	0	60	0
Volume Right (vph)	100	0	220	0	10	0	100
Hadj (s)	0.00	0.53	-0.25	0.53	-0.08	0.53	-0.47
Departure Headway (s)	7.1	7.3	6.5	8.7	8.1	8.8	7.7
Degree Utilization, x	0.71	0.55	0.97	0.34	0.13	0.15	0.30
Capacity (veh/h)	499	487	540	405	433	400	453
Control Delay (s)	25.4	17.5	56.2	14.9	11.1	12.0	12.8
Approach Delay (s)	25.4	43.3		13.8		12.6	
Approach LOS	D	E		B		B	

Intersection Summary			
Delay	31.5		
HCM Level of Service	D		
Intersection Capacity Utilization	80.1%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	80	400	0	0	390	610	0	0	0	40	0	110
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	80	400	0	0	390	610	0	0	0	40	0	110
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1000			400			1365	1255	695	1255	1560	400
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1000			400			1365	1255	695	1255	1560	400
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	88			100			100	100	100	70	100	83
cM capacity (veh/h)	692			1159			94	152	442	135	99	650

Direction, Lane #	EB 1	EB 2	WB 1	NW 1	NW 2
Volume Total	80	400	1000	40	110
Volume Left	80	0	0	40	0
Volume Right	0	0	610	0	110
cSH	692	1700	1700	135	650
Volume to Capacity	0.12	0.24	0.59	0.30	0.17
Queue Length 95th (ft)	10	0	0	29	15
Control Delay (s)	10.9	0.0	0.0	42.4	11.7
Lane LOS	B			E	B
Approach Delay (s)	1.8		0.0	19.9	
Approach LOS				C	

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	95.4%	ICU Level of Service	F
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	110	20	290	130	0	370	0	90	0	0	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	110	20	290	130	0	370	0	90	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									22			
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	130			130			830	840	130	875	830	120
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	130			130			830	840	130	875	830	120
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			80			0	100	90	100	100	100
cM capacity (veh/h)	1455			1455			245	241	920	206	245	931

Direction, Lane #	EB 1	WB 1	WB 2	SE 1
Volume Total	130	290	130	460
Volume Left	0	290	0	370
Volume Right	20	0	0	90
cSH	1700	1455	1700	300
Volume to Capacity	0.08	0.20	0.08	1.54
Queue Length 95th (ft)	0	19	0	664
Control Delay (s)	0.0	8.1	0.0	288.5
Lane LOS		A		F
Approach Delay (s)	0.0	5.6		288.5
Approach LOS				F

Intersection Summary			
Average Delay	133.7		
Intersection Capacity Utilization	95.4%	ICU Level of Service	F
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	1.00					1.00	1.00	
Frt		1.00	0.85	1.00	1.00					1.00	0.85	
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (prot)		3539	1583	1770	1863					1770	1583	
Flt Permitted		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (perm)		3539	1583	1770	1863					1770	1583	
Volume (vph)	0	1100	140	280	570	0	0	0	0	260	0	580
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	1100	140	280	570	0	0	0	0	260	0	580
RTOR Reduction (vph)	0	0	63	0	0	0	0	0	0	0	228	0
Lane Group Flow (vph)	0	1100	77	280	570	0	0	0	0	260	352	0
Turn Type			Perm	Prot						Perm		
Protected Phases		4		3	8						6	
Permitted Phases			4							6		
Actuated Green, G (s)		34.1	34.1	16.9	55.0					27.0	27.0	
Effective Green, g (s)		34.1	34.1	16.9	55.0					27.0	27.0	
Actuated g/C Ratio		0.38	0.38	0.19	0.61					0.30	0.30	
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	
Lane Grp Cap (vph)		1341	600	332	1139					531	475	
v/s Ratio Prot		c0.31		c0.16	0.31						c0.22	
v/s Ratio Perm			0.05							0.15		
v/c Ratio		0.82	0.13	0.84	0.50					0.49	0.74	
Uniform Delay, d1		25.2	18.3	35.3	9.8					25.8	28.3	
Progression Factor		0.34	0.05	1.00	0.89					1.00	1.00	
Incremental Delay, d2		4.4	0.3	12.2	1.0					3.2	10.0	
Delay (s)		13.1	1.3	47.4	9.7					29.1	38.3	
Level of Service		B	A	D	A					C	D	
Approach Delay (s)		11.7			22.1			0.0			35.5	
Approach LOS		B			C			A			D	

Intersection Summary

HCM Average Control Delay	21.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	91.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Util. Factor	0.97	1.00			0.95		1.00	1.00				
Frt	1.00	1.00			0.93		1.00	0.85				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	3433	1863			3286		1770	1583				
Flt Permitted	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	3433	1863			3286		1770	1583				
Volume (vph)	700	660	0	0	580	530	270	0	260	0	0	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	700	660	0	0	580	530	270	0	260	0	0	0
RTOR Reduction (vph)	0	0	0	0	178	0	0	202	0	0	0	0
Lane Group Flow (vph)	700	660	0	0	932	0	270	58	0	0	0	0
Turn Type	Prot						Perm					
Protected Phases	7	4			8			2				
Permitted Phases							2					
Actuated Green, G (s)	22.6	62.0			35.4		20.0	20.0				
Effective Green, g (s)	22.6	62.0			35.4		20.0	20.0				
Actuated g/C Ratio	0.25	0.69			0.39		0.22	0.22				
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0				
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	862	1283			1292		393	352				
v/s Ratio Prot	c0.20	0.35			c0.28			0.04				
v/s Ratio Perm							c0.15					
v/c Ratio	0.81	0.51			0.72		0.69	0.16				
Uniform Delay, d1	31.7	6.7			23.1		32.1	28.3				
Progression Factor	0.59	0.33			0.61		1.00	1.00				
Incremental Delay, d2	3.8	0.9			2.3		9.4	1.0				
Delay (s)	22.5	3.2			16.3		41.6	29.3				
Level of Service	C	A			B		D	C				
Approach Delay (s)		13.1			16.3			35.5			0.0	
Approach LOS		B			B			D			A	

Intersection Summary

HCM Average Control Delay	18.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	91.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.97	0.95					0.91	0.86	0.95
Frt		1.00	0.85	1.00	1.00					1.00	0.89	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.99	1.00
Satd. Flow (prot)		5085	1583	3400	3539					3189	1403	1504
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.99	1.00
Satd. Flow (perm)		5085	1583	3400	3539					3189	1403	1504
Volume (vph)	0	1460	180	460	990	0	0	0	0	1140	0	950
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	1460	180	460	990	0	0	0	0	1140	0	950
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	56	56
Lane Group Flow (vph)	0	1460	180	460	990	0	0	0	0	989	510	479
Heavy Vehicles (%)	2%	2%	2%	3%	2%	2%	2%	2%	2%	3%	2%	2%
Turn Type			Free	Prot						Prot		Prot
Protected Phases		2		1	6					7	4	4
Permitted Phases			Free									
Actuated Green, G (s)		33.0	100.0	16.0	53.0					39.0	39.0	39.0
Effective Green, g (s)		33.0	100.0	16.0	53.0					39.0	39.0	39.0
Actuated g/C Ratio		0.33	1.00	0.16	0.53					0.39	0.39	0.39
Clearance Time (s)		4.0		4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1678	1583	544	1876					1244	547	587
v/s Ratio Prot		c0.29		c0.14	0.28					0.31	c0.36	0.32
v/s Ratio Perm			0.11									
v/c Ratio		0.87	0.11	0.85	0.53					0.80	0.93	0.82
Uniform Delay, d1		31.5	0.0	40.8	15.3					27.0	29.3	27.3
Progression Factor		0.87	1.00	0.54	0.17					1.00	1.00	1.00
Incremental Delay, d2		6.0	0.1	4.2	0.4					3.6	23.1	8.6
Delay (s)		33.4	0.1	26.4	2.9					30.6	52.3	35.9
Level of Service		C	A	C	A					C	D	D
Approach Delay (s)		29.7			10.4			0.0			37.8	
Approach LOS		C			B			A			D	

Intersection Summary

HCM Average Control Delay	27.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	86.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.91	1.00		0.91			0.95	0.95		1.00	
Frt	1.00	1.00	0.85		1.00			0.97	0.85		0.93	
Flt Protected	0.95	1.00	1.00		1.00			0.96	1.00		0.98	
Satd. Flow (prot)	1770	5036	1583		5033			1646	1490		1695	
Flt Permitted	0.95	1.00	1.00		1.00			0.96	1.00		0.98	
Satd. Flow (perm)	1770	5036	1583		5033			1646	1490		1695	
Volume (vph)	10	1790	810	0	2500	10	280	10	630	10	0	10
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	10	1790	810	0	2500	10	280	10	630	10	0	10
RTOR Reduction (vph)	0	0	0	0	1	0	0	9	183	0	9	0
Lane Group Flow (vph)	10	1790	810	0	2509	0	0	361	367	0	11	0
Heavy Vehicles (%)	2%	3%	2%	2%	3%	3%	2%	2%	3%	2%	2%	2%
Turn Type	Prot		Free				Split		Perm	Split		
Protected Phases	5	2			6		8	8		4	4	
Permitted Phases			Free						8			
Actuated Green, G (s)	0.8	53.0	100.0		48.2			28.7	28.7		6.3	
Effective Green, g (s)	0.8	53.0	100.0		48.2			28.7	28.7		6.3	
Actuated g/C Ratio	0.01	0.53	1.00		0.48			0.29	0.29		0.06	
Clearance Time (s)	4.0	4.0			4.0			4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0			3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	14	2669	1583		2426			472	428		107	
v/s Ratio Prot	0.01	0.36			c0.50			0.22			0.01	
v/s Ratio Perm			c0.51						c0.25			
v/c Ratio	0.71	0.67	0.51		1.03			0.77	0.86		0.10	
Uniform Delay, d1	49.5	17.1	0.0		25.9			32.6	33.7		44.2	
Progression Factor	1.07	0.37	1.00		0.37			1.00	1.00		1.00	
Incremental Delay, d2	61.4	0.7	0.6		24.3			7.3	15.6		0.4	
Delay (s)	114.2	7.0	0.6		33.9			39.9	49.3		44.6	
Level of Service	F	A	A		C			D	D		D	
Approach Delay (s)		5.4			33.9			45.5			44.6	
Approach LOS		A			C			D			D	

Intersection Summary

HCM Average Control Delay	23.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	90.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		0.97	1.00
Frt	1.00	0.85	1.00		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3530		3433	1863
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3530		3433	1863
Volume (vph)	810	270	1150	20	630	940
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	810	270	1150	20	630	940
RTOR Reduction (vph)	0	102	1	0	0	0
Lane Group Flow (vph)	810	168	1169	0	630	940
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	54.0	54.0	42.0		22.0	68.0
Effective Green, g (s)	54.0	54.0	42.0		22.0	68.0
Actuated g/C Ratio	0.42	0.42	0.32		0.17	0.52
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	735	658	1140		581	974
v/s Ratio Prot	c0.46		c0.33		c0.18	0.50
v/s Ratio Perm		0.11				
v/c Ratio	1.10	0.26	1.03		1.08	0.97
Uniform Delay, d1	38.0	24.9	44.0		54.0	29.9
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	64.7	0.2	33.4		62.2	20.7
Delay (s)	102.7	25.1	77.4		116.2	50.5
Level of Service	F	C	E		F	D
Approach Delay (s)	83.3		77.4			76.9
Approach LOS	F		E			E

Intersection Summary

HCM Average Control Delay	78.9	HCM Level of Service	E
HCM Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	105.3%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Volume (vph)	400	70	280	130	200	280
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	400	70	280	130	200	280

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	400	70	280	130	200	280
Volume Left (vph)	400	0	280	0	0	0
Volume Right (vph)	0	70	0	0	0	280
Hadj (s)	0.53	-0.67	0.53	0.03	0.03	-0.67
Departure Headway (s)	7.5	6.3	7.6	7.1	7.1	6.4
Degree Utilization, x	0.83	0.12	0.59	0.26	0.39	0.50
Capacity (veh/h)	468	550	454	485	488	545
Control Delay (s)	36.3	8.9	19.9	11.3	13.4	14.3
Approach Delay (s)	32.2		17.2		13.9	
Approach LOS	D		C		B	

Intersection Summary			
Delay	21.2		
HCM Level of Service	C		
Intersection Capacity Utilization	58.2%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0		4.0			
Lane Util. Factor		0.95	1.00		1.00	1.00	0.97		1.00			
Frt		1.00	0.85		1.00	0.85	1.00		0.85			
Flt Protected		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (prot)		3539	1583		1863	1583	3433		1583			
Flt Permitted		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (perm)		3539	1583		1863	1583	3433		1583			
Volume (vph)	0	860	1160	0	260	190	220	0	600	0	0	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	860	1160	0	260	190	220	0	600	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	860	1160	0	260	190	220	0	600	0	0	0
Turn Type			Free			Free	custom		Free			
Protected Phases		2			6							
Permitted Phases			Free			Free	4		Free			
Actuated Green, G (s)		12.4	27.6		12.4	27.6	7.2		27.6			
Effective Green, g (s)		12.4	27.6		12.4	27.6	7.2		27.6			
Actuated g/C Ratio		0.45	1.00		0.45	1.00	0.26		1.00			
Clearance Time (s)		4.0			4.0		4.0					
Vehicle Extension (s)		3.0			3.0		3.0					
Lane Grp Cap (vph)		1590	1583		837	1583	896		1583			
v/s Ratio Prot		0.24			0.14							
v/s Ratio Perm			c0.73			0.12	0.06		0.38			
v/c Ratio		0.54	0.73		0.31	0.12	0.25		0.38			
Uniform Delay, d1		5.5	0.0		4.9	0.0	8.1		0.0			
Progression Factor		1.00	1.00		1.00	1.00	1.00		1.00			
Incremental Delay, d2		0.4	3.0		0.2	0.2	0.1		0.7			
Delay (s)		5.9	3.0		5.1	0.2	8.2		0.7			
Level of Service		A	A		A	A	A		A			
Approach Delay (s)		4.3			3.0			2.7			0.0	
Approach LOS		A			A			A			A	

Intersection Summary

HCM Average Control Delay	3.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	27.6	Sum of lost time (s)	0.0
Intersection Capacity Utilization	36.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0			4.0	4.0	4.0		4.0
Lane Util. Factor	1.00	0.95	1.00		0.91			1.00	1.00	1.00		1.00
Frt	1.00	1.00	0.85		1.00			1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00	1.00		1.00			0.98	1.00	0.95		1.00
Satd. Flow (prot)	1770	3539	1583		5074			1820	1583	1770		1583
Flt Permitted	0.42	1.00	1.00		1.00			0.98	1.00	0.66		1.00
Satd. Flow (perm)	784	3539	1583		5074			1820	1583	1232		1583
Volume (vph)	20	420	640	0	690	10	70	80	150	20	0	80
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	20	420	640	0	690	10	70	80	150	20	0	80
RTOR Reduction (vph)	0	0	0	0	4	0	0	0	105	0	0	56
Lane Group Flow (vph)	20	420	640	0	696	0	0	150	45	20	0	24
Turn Type	Perm		Free				Perm		Perm	custom		custom
Protected Phases		4			8			2				
Permitted Phases	4		Free				2		2	6		6
Actuated Green, G (s)	9.5	9.5	25.0		9.5			7.5	7.5	7.5		7.5
Effective Green, g (s)	9.5	9.5	25.0		9.5			7.5	7.5	7.5		7.5
Actuated g/C Ratio	0.38	0.38	1.00		0.38			0.30	0.30	0.30		0.30
Clearance Time (s)	4.0	4.0			4.0			4.0	4.0	4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0			3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	298	1345	1583		1928			546	475	370		475
v/s Ratio Prot		0.12			0.14							
v/s Ratio Perm	0.03		c0.40					0.08	0.03	0.02		0.02
v/c Ratio	0.07	0.31	0.40		0.36			0.27	0.09	0.05		0.05
Uniform Delay, d1	4.9	5.5	0.0		5.6			6.7	6.3	6.2		6.2
Progression Factor	1.00	1.00	1.00		1.00			1.00	1.00	1.00		1.00
Incremental Delay, d2	0.1	0.1	0.8		0.1			0.3	0.1	0.1		0.0
Delay (s)	5.0	5.6	0.8		5.7			6.9	6.4	6.3		6.3
Level of Service	A	A	A		A			A	A	A		A
Approach Delay (s)		2.7			5.7			6.7			6.3	
Approach LOS		A			A			A			A	

Intersection Summary

HCM Average Control Delay	4.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	25.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	38.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0					4.0	4.0	4.0	4.0	
Lane Util. Factor	0.95	0.95	1.00					0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1681	1681	1583					3539	1583	1770	3539	
Flt Permitted	0.95	0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1681	1681	1583					3539	1583	1770	3539	
Volume (vph)	560	0	260	0	0	0	0	570	210	280	340	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	560	0	260	0	0	0	0	570	210	280	340	0
RTOR Reduction (vph)	0	0	198	0	0	0	0	0	138	0	0	0
Lane Group Flow (vph)	280	280	62	0	0	0	0	570	72	280	340	0
Turn Type	Perm		Perm						Perm	Prot		
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)	14.3	14.3	14.3					20.7	20.7	13.0	37.7	
Effective Green, g (s)	14.3	14.3	14.3					20.7	20.7	13.0	37.7	
Actuated g/C Ratio	0.24	0.24	0.24					0.34	0.34	0.22	0.63	
Clearance Time (s)	4.0	4.0	4.0					4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	401	401	377					1221	546	384	2224	
v/s Ratio Prot								c0.16		c0.16	0.10	
v/s Ratio Perm	c0.17	0.17	0.04						0.05			
v/c Ratio	0.70	0.70	0.16					0.47	0.13	0.73	0.15	
Uniform Delay, d1	20.9	20.9	18.1					15.3	13.5	21.9	4.6	
Progression Factor	1.00	1.00	1.00					1.00	1.00	1.00	0.99	
Incremental Delay, d2	5.2	5.2	0.2					1.3	0.5	6.8	0.1	
Delay (s)	26.1	26.1	18.3					16.6	14.0	28.6	4.7	
Level of Service	C	C	B					B	B	C	A	
Approach Delay (s)		23.6			0.0			15.9			15.5	
Approach LOS		C			A			B			B	

Intersection Summary

HCM Average Control Delay	18.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	45.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0		4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00		1.00		0.95	0.95		0.91	1.00		0.91	
Frt	1.00		0.85		0.97	0.85		1.00	0.85		1.00	
Flt Protected	0.95		1.00		0.96	1.00		1.00	1.00		1.00	
Satd. Flow (prot)	1770		1583		1646	1504		5085	1583		5085	
Flt Permitted	0.95		1.00		0.96	1.00		1.00	1.00		1.00	
Satd. Flow (perm)	1770		1583		1646	1504		5085	1583		5085	
Volume (vph)	100	0	240	160	0	310	0	630	470	0	1590	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	100	0	240	160	0	310	0	630	470	0	1590	0
RTOR Reduction (vph)	0	0	206	0	19	213	0	0	0	0	0	0
Lane Group Flow (vph)	100	0	34	0	187	51	0	630	470	0	1590	0
Turn Type	Prot		custom	Split		Perm			Free			
Protected Phases	6		6	2	2			4			8	
Permitted Phases						2		4	Free			
Actuated Green, G (s)	8.6		8.6		11.5	11.5		27.9	60.0		27.9	
Effective Green, g (s)	8.6		8.6		11.5	11.5		27.9	60.0		27.9	
Actuated g/C Ratio	0.14		0.14		0.19	0.19		0.46	1.00		0.46	
Clearance Time (s)	4.0		4.0		4.0	4.0		4.0			4.0	
Vehicle Extension (s)	3.0		3.0		3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	254		227		315	288		2365	1583		2365	
v/s Ratio Prot	0.06		0.02		c0.11			0.12			c0.31	
v/s Ratio Perm						0.03			c0.30			
v/c Ratio	0.39		0.15		0.59	0.18		0.27	0.30		0.67	
Uniform Delay, d1	23.3		22.5		22.1	20.3		9.8	0.0		12.5	
Progression Factor	1.00		1.00		1.00	1.00		0.99	1.00		1.00	
Incremental Delay, d2	1.0		0.3		3.0	0.3		0.3	0.5		1.5	
Delay (s)	24.3		22.8		25.1	20.6		10.0	0.5		14.0	
Level of Service	C		C		C	C		B	A		B	
Approach Delay (s)		23.3			22.6			5.9			14.0	
Approach LOS		C			C			A			B	

Intersection Summary

HCM Average Control Delay	13.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.91	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1441	1770	5085	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1441	1770	5085	3539	1583
Volume (vph)	1260	200	50	630	400	380
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1260	200	50	630	400	380
RTOR Reduction (vph)	0	116	0	0	0	0
Lane Group Flow (vph)	1260	85	50	630	400	380
Turn Type		Perm	Prot			Free
Protected Phases	4		5	2	6	
Permitted Phases		4				Free
Actuated Green, G (s)	33.8	33.8	5.2	38.2	29.0	80.0
Effective Green, g (s)	33.8	33.8	5.2	38.2	29.0	80.0
Actuated g/C Ratio	0.42	0.42	0.06	0.48	0.36	1.00
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	1450	609	115	2428	1283	1583
v/s Ratio Prot	c0.37		c0.03	0.12	c0.11	
v/s Ratio Perm		0.06				0.24
v/c Ratio	0.87	0.14	0.43	0.26	0.31	0.24
Uniform Delay, d1	21.1	14.2	36.0	12.5	18.3	0.0
Progression Factor	1.00	1.00	1.00	1.00	0.91	1.00
Incremental Delay, d2	5.8	0.1	2.6	0.3	0.5	0.3
Delay (s)	26.9	14.3	38.6	12.7	17.1	0.3
Level of Service	C	B	D	B	B	A
Approach Delay (s)	25.2			14.6	8.9	
Approach LOS	C			B	A	

Intersection Summary

HCM Average Control Delay	18.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	62.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.91	0.95		0.95	1.00		0.91	0.91
Frt				1.00	0.85	0.85		1.00	0.85		0.93	0.85
Flt Protected				0.95	1.00	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1441	1504		3539	1583		3138	1441
Flt Permitted				0.95	1.00	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1441	1504		3539	1583		3138	1441
Volume (vph)	0	0	0	70	0	440	0	1590	300	0	710	1420
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	0	0	70	0	440	0	1590	300	0	710	1420
RTOR Reduction (vph)	0	0	0	0	24	24	0	0	0	0	165	214
Lane Group Flow (vph)	0	0	0	70	192	200	0	1590	300	0	1245	506
Turn Type				Perm		Perm			Free			Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			Free			6
Actuated Green, G (s)				15.8	15.8	15.8		56.2	80.0		56.2	56.2
Effective Green, g (s)				15.8	15.8	15.8		56.2	80.0		56.2	56.2
Actuated g/C Ratio				0.20	0.20	0.20		0.70	1.00		0.70	0.70
Clearance Time (s)				4.0	4.0	4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0	3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				332	285	297		2486	1583		2204	1012
v/s Ratio Prot								c0.45			0.40	
v/s Ratio Perm				0.04	0.13	0.13			0.19			0.35
v/c Ratio				0.21	0.67	0.67		0.64	0.19		0.56	0.50
Uniform Delay, d1				26.9	29.7	29.7		6.4	0.0		5.9	5.5
Progression Factor				1.00	1.00	1.00		0.28	1.00		1.00	1.00
Incremental Delay, d2				0.3	6.2	5.9		0.9	0.2		1.1	1.8
Delay (s)				27.2	35.9	35.6		2.7	0.2		6.9	7.2
Level of Service				C	D	D		A	A		A	A
Approach Delay (s)		0.0			34.6			2.3			7.0	
Approach LOS		A			C			A			A	

Intersection Summary

HCM Average Control Delay	8.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	71.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		0.95	0.95	
Frt	0.95	0.85		1.00	1.00	
Flt Protected	0.97	1.00		1.00	1.00	
Satd. Flow (prot)	1715	1504		3539	3539	
Flt Permitted	0.97	1.00		1.00	1.00	
Satd. Flow (perm)	1715	1504		3539	3539	
Volume (vph)	300	690	0	820	170	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	300	690	0	820	170	0
RTOR Reduction (vph)	44	343	0	0	0	0
Lane Group Flow (vph)	398	206	0	820	170	0
Turn Type		Perm				
Protected Phases	6			4	8	
Permitted Phases		6				
Actuated Green, G (s)	12.6	12.6		13.0	13.0	
Effective Green, g (s)	12.6	12.6		13.0	13.0	
Actuated g/C Ratio	0.38	0.38		0.39	0.39	
Clearance Time (s)	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	643	564		1369	1369	
v/s Ratio Prot	c0.23			c0.23	0.05	
v/s Ratio Perm		0.14				
v/c Ratio	0.62	0.36		0.60	0.12	
Uniform Delay, d1	8.5	7.6		8.2	6.6	
Progression Factor	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.8	0.4		0.7	0.0	
Delay (s)	10.3	8.0		8.9	6.7	
Level of Service	B	A		A	A	
Approach Delay (s)	9.0			8.9	6.7	
Approach LOS	A			A	A	

Intersection Summary

HCM Average Control Delay	8.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	33.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	82.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Sign Control	Yield			Yield	Yield	
Volume (vph)	0	0	760	360	170	170
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	760	360	170	170

Direction, Lane #	NE 1	NE 2	SW 1
Volume Total (vph)	760	360	340
Volume Left (vph)	760	0	0
Volume Right (vph)	0	0	170
Hadj (s)	0.53	0.03	-0.27
Departure Headway (s)	5.3	4.8	4.5
Degree Utilization, x	1.11	0.48	0.43
Capacity (veh/h)	689	751	792
Control Delay (s)	88.9	10.8	10.8
Approach Delay (s)	63.8		10.8
Approach LOS	F		B

Intersection Summary			
Delay	51.5		
HCM Level of Service	F		
Intersection Capacity Utilization	82.7%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	60	190	170	0	0	0	50	360	170	60	160	130
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	60	190	170	0	0	0	50	360	170	60	160	130
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			3									
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								189			337	
pX, platoon unblocked												
vC, conflicting volume	560	910	160	920	955	265	290			530		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	560	910	160	920	955	265	290			530		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	84	23	80	100	100	100	96			94		
cM capacity (veh/h)	381	247	857	62	232	733	1269			1033		

Direction, Lane #	SE 1	NE 1	NE 2	SW 1	SW 2	SW 3
Volume Total	420	230	350	60	160	130
Volume Left	60	50	0	60	0	0
Volume Right	170	0	170	0	0	130
cSH	421	1269	1700	1033	1700	1700
Volume to Capacity	1.00	0.04	0.21	0.06	0.09	0.08
Queue Length 95th (ft)	312	3	0	5	0	0
Control Delay (s)	74.8	2.0	0.0	8.7	0.0	0.0
Lane LOS	F	A		A		
Approach Delay (s)	74.8	0.8		1.5		
Approach LOS	F					

Intersection Summary			
Average Delay	24.0		
Intersection Capacity Utilization	48.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor				1.00	1.00		1.00	0.95			1.00	1.00
Frt				1.00	0.85		1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (prot)				1770	1583		1770	3539			1863	1583
Flt Permitted				0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (perm)				1770	1583		1770	3539			1863	1583
Volume (vph)	0	0	0	180	0	170	400	140	0	0	200	150
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	0	0	180	0	170	400	140	0	0	200	150
RTOR Reduction (vph)	0	0	0	0	127	0	0	0	0	0	0	123
Lane Group Flow (vph)	0	0	0	180	43	0	400	140	0	0	200	27
Turn Type				Perm			Prot					Perm
Protected Phases					2		7	4			8	
Permitted Phases				2								8
Actuated Green, G (s)				11.8	11.8		14.4	26.8			8.4	8.4
Effective Green, g (s)				11.8	11.8		14.4	26.8			8.4	8.4
Actuated g/C Ratio				0.25	0.25		0.31	0.58			0.18	0.18
Clearance Time (s)				4.0	4.0		4.0	4.0			4.0	4.0
Vehicle Extension (s)				3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)				448	401		547	2035			336	285
v/s Ratio Prot					0.03		c0.23	0.04			c0.11	
v/s Ratio Perm				c0.10								0.02
v/c Ratio				0.40	0.11		0.73	0.07			0.60	0.09
Uniform Delay, d1				14.5	13.4		14.4	4.4			17.5	15.9
Progression Factor				1.00	1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2				0.6	0.1		5.0	0.0			2.8	0.1
Delay (s)				15.1	13.5		19.4	4.4			20.4	16.1
Level of Service				B	B		B	A			C	B
Approach Delay (s)		0.0			14.3			15.5			18.5	
Approach LOS		A			B			B			B	

Intersection Summary

HCM Average Control Delay	16.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	46.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	53.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0		4.0		4.0	4.0	4.0	4.0
Lane Util. Factor		0.95		1.00	0.95		1.00		1.00	1.00	1.00	1.00
Frt		0.99		1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		3505		1770	3539		1770		1583	1770	1863	1583
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)		3505		1770	3539		1770		1583	1770	1863	1583
Volume (vph)	0	290	20	10	340	0	90	0	320	170	70	120
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	290	20	10	340	0	90	0	320	170	70	120
RTOR Reduction (vph)	0	7	0	0	0	0	0	0	260	0	0	94
Lane Group Flow (vph)	0	303	0	10	340	0	90	0	60	170	70	26
Turn Type				Prot			Prot		custom	Split		Perm
Protected Phases		4		3	8		2		2	6	6	
Permitted Phases												6
Actuated Green, G (s)		9.3		0.5	13.8		8.2		8.2	9.5	9.5	9.5
Effective Green, g (s)		9.3		0.5	13.8		8.2		8.2	9.5	9.5	9.5
Actuated g/C Ratio		0.21		0.01	0.32		0.19		0.19	0.22	0.22	0.22
Clearance Time (s)		4.0		4.0	4.0		4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0		3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		749		20	1123		334		298	387	407	346
v/s Ratio Prot		c0.09		0.01	c0.10		c0.05		0.04	c0.10	0.04	
v/s Ratio Perm												0.02
v/c Ratio		0.40		0.50	0.30		0.27		0.20	0.44	0.17	0.08
Uniform Delay, d1		14.7		21.4	11.2		15.1		14.9	14.7	13.8	13.5
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		0.4		18.3	0.2		0.4		0.3	0.8	0.2	0.1
Delay (s)		15.1		39.7	11.4		15.5		15.2	15.5	14.0	13.6
Level of Service		B		D	B		B		B	B	B	B
Approach Delay (s)		15.1			12.2			15.3			14.6	
Approach LOS		B			B			B			B	

Intersection Summary

HCM Average Control Delay	14.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	43.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	47.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	
Lane Util. Factor	0.95			0.95	0.97	
Frt	1.00			1.00	0.98	
Flt Protected	1.00			1.00	0.96	
Satd. Flow (prot)	3539			3539	3397	
Flt Permitted	1.00			1.00	0.96	
Satd. Flow (perm)	3539			3539	3397	
Volume (vph)	510	0	0	710	70	10
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	510	0	0	710	70	10
RTOR Reduction (vph)	0	0	0	0	8	0
Lane Group Flow (vph)	510	0	0	710	72	0
Turn Type						
Protected Phases	4			8	2	
Permitted Phases						
Actuated Green, G (s)	10.8			10.8	6.1	
Effective Green, g (s)	10.8			10.8	6.1	
Actuated g/C Ratio	0.43			0.43	0.24	
Clearance Time (s)	4.0			4.0	4.0	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	1535			1535	832	
v/s Ratio Prot	0.14			c0.20	c0.02	
v/s Ratio Perm						
v/c Ratio	0.33			0.46	0.09	
Uniform Delay, d1	4.7			5.0	7.3	
Progression Factor	1.00			1.00	1.00	
Incremental Delay, d2	0.1			0.2	0.0	
Delay (s)	4.8			5.2	7.3	
Level of Service	A			A	A	
Approach Delay (s)	4.8			5.2	7.3	
Approach LOS	A			A	A	

Intersection Summary

HCM Average Control Delay	5.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	24.9	Sum of lost time (s)	8.0
Intersection Capacity Utilization	29.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	100	90	630	300	280	180
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	100	90	630	300	280	180
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		17				
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1780	230	460			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1780	230	460			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	88	43			
cM capacity (veh/h)	31	772	1097			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	190	630	150	150	187	273
Volume Left	100	630	0	0	0	0
Volume Right	90	0	0	0	0	180
cSH	58	1097	1700	1700	1700	1700
Volume to Capacity	3.26	0.57	0.09	0.09	0.11	0.16
Queue Length 95th (ft)	Err	95	0	0	0	0
Control Delay (s)	Err	12.6	0.0	0.0	0.0	0.0
Lane LOS	F	B				
Approach Delay (s)	Err	8.5			0.0	
Approach LOS	F					

Intersection Summary			
Average Delay	1207.4		
Intersection Capacity Utilization	64.0%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	190	40	110	160	120	60	70	90	20	70	70	60
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	190	40	110	160	120	60	70	90	20	70	70	60

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	340	160	180	70	110	70	130
Volume Left (vph)	190	160	0	70	0	70	0
Volume Right (vph)	110	0	60	0	20	0	60
Hadj (s)	-0.05	0.53	-0.20	0.53	-0.09	0.53	-0.29
Departure Headway (s)	6.1	6.8	6.1	7.4	6.8	7.4	6.6
Degree Utilization, x	0.58	0.30	0.30	0.14	0.21	0.14	0.24
Capacity (veh/h)	563	503	563	447	485	449	505
Control Delay (s)	17.3	11.5	10.5	10.5	10.3	10.4	10.4
Approach Delay (s)	17.3	11.0		10.4		10.4	
Approach LOS	C	B		B		B	

Intersection Summary			
Delay	12.8		
HCM Level of Service	B		
Intersection Capacity Utilization	53.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	180	470	0	0	90	260	0	0	0	30	0	150
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	180	470	0	0	90	260	0	0	0	30	0	150
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	350			470			1200	1050	220	1050	1180	470
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	350			470			1200	1050	220	1050	1180	470
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	85			100			100	100	100	83	100	75
cM capacity (veh/h)	1209			1092			107	193	820	182	162	594

Direction, Lane #	EB 1	EB 2	WB 1	NW 1	NW 2
Volume Total	180	470	350	30	150
Volume Left	180	0	0	30	0
Volume Right	0	0	260	0	150
cSH	1209	1700	1700	182	594
Volume to Capacity	0.15	0.28	0.21	0.17	0.25
Queue Length 95th (ft)	13	0	0	14	25
Control Delay (s)	8.5	0.0	0.0	28.7	13.1
Lane LOS	A			D	B
Approach Delay (s)	2.4		0.0	15.7	
Approach LOS				C	

Intersection Summary			
Average Delay	3.7		
Intersection Capacity Utilization	67.3%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	260	40	80	60	0	370	0	100	0	0	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	260	40	80	60	0	370	0	100	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									22			
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	60			300			500	520	60	550	500	280
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	60			300			500	520	60	550	500	280
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			94			19	100	90	100	100	100
cM capacity (veh/h)	1544			1261			458	431	1005	382	443	759

Direction, Lane #	EB 1	WB 1	WB 2	SE 1
Volume Total	300	80	60	470
Volume Left	0	80	0	370
Volume Right	40	0	0	100
cSH	1700	1261	1700	582
Volume to Capacity	0.18	0.06	0.04	0.81
Queue Length 95th (ft)	0	5	0	201
Control Delay (s)	0.0	8.0	0.0	32.1
Lane LOS		A		D
Approach Delay (s)	0.0	4.6		32.1
Approach LOS				D

Intersection Summary			
Average Delay	17.3		
Intersection Capacity Utilization	67.3%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Lane Util. Factor		0.95	1.00	1.00	1.00					1.00	1.00	
Frt		1.00	0.85	1.00	1.00					1.00	0.85	
Flt Protected		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (prot)		3539	1583	1770	1863					1770	1590	
Flt Permitted		1.00	1.00	0.95	1.00					0.95	1.00	
Satd. Flow (perm)		3539	1583	1770	1863					1770	1590	
Volume (vph)	0	860	180	360	620	0	0	0	0	340	20	770
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	860	180	360	620	0	0	0	0	340	20	770
RTOR Reduction (vph)	0	0	118	0	0	0	0	0	0	0	130	0
Lane Group Flow (vph)	0	860	62	360	620	0	0	0	0	340	660	0
Turn Type			Perm	Prot						Perm		
Protected Phases		4		3	8						6	
Permitted Phases			4							6		
Actuated Green, G (s)		20.0	20.0	16.0	40.0					32.0	32.0	
Effective Green, g (s)		20.0	20.0	16.0	40.0					32.0	32.0	
Actuated g/C Ratio		0.25	0.25	0.20	0.50					0.40	0.40	
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0					3.0	3.0	
Lane Grp Cap (vph)		885	396	354	932					708	636	
v/s Ratio Prot		c0.24		c0.20	0.33						c0.42	
v/s Ratio Perm			0.04							0.19		
v/c Ratio		0.97	0.16	1.02	0.67					0.48	1.04	
Uniform Delay, d1		29.7	23.4	32.0	15.0					17.8	24.0	
Progression Factor		0.58	0.86	0.62	0.85					1.00	1.00	
Incremental Delay, d2		21.9	0.7	42.7	2.4					2.3	46.0	
Delay (s)		39.2	20.8	62.6	15.2					20.1	70.0	
Level of Service		D	C	E	B					C	E	
Approach Delay (s)		36.0			32.6			0.0			55.0	
Approach LOS		D			C			A			E	

Intersection Summary

HCM Average Control Delay	41.8	HCM Level of Service	D
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	102.4%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Util. Factor	0.97	1.00			0.95		1.00	1.00				
Frt	1.00	1.00			0.96		1.00	0.85				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	3433	1863			3386		1770	1583				
Flt Permitted	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	3433	1863			3386		1770	1583				
Volume (vph)	630	570	0	0	840	340	140	0	230	0	0	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	630	570	0	0	840	340	140	0	230	0	0	0
RTOR Reduction (vph)	0	0	0	0	54	0	0	184	0	0	0	0
Lane Group Flow (vph)	630	570	0	0	1126	0	140	46	0	0	0	0
Turn Type	Prot						Perm					
Protected Phases	7	4			8			2				
Permitted Phases							2					
Actuated Green, G (s)	18.7	56.0			33.3		16.0	16.0				
Effective Green, g (s)	18.7	56.0			33.3		16.0	16.0				
Actuated g/C Ratio	0.23	0.70			0.42		0.20	0.20				
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0				
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	802	1304			1409		354	317				
v/s Ratio Prot	c0.18	0.31			c0.33			0.03				
v/s Ratio Perm							c0.08					
v/c Ratio	0.79	0.44			0.80		0.40	0.15				
Uniform Delay, d1	28.8	5.2			20.4		27.8	26.4				
Progression Factor	0.56	0.27			0.86		1.00	1.00				
Incremental Delay, d2	2.7	0.6			3.1		3.3	1.0				
Delay (s)	18.8	2.0			20.7		31.1	27.3				
Level of Service	B	A			C		C	C				
Approach Delay (s)		10.8			20.7			28.7			0.0	
Approach LOS		B			C			C			A	

Intersection Summary

HCM Average Control Delay	17.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	102.4%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.97	0.95					0.91	0.86	0.95
Frt		1.00	0.85	1.00	1.00					1.00	0.92	0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95	0.98	1.00
Satd. Flow (prot)		5085	1583	3400	3539					3189	1433	1504
Flt Permitted		1.00	1.00	0.95	1.00					0.95	0.98	1.00
Satd. Flow (perm)		5085	1583	3400	3539					3189	1433	1504
Volume (vph)	0	1590	250	490	950	0	0	0	0	1380	0	920
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	1590	250	490	950	0	0	0	0	1380	0	920
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	38	63
Lane Group Flow (vph)	0	1590	250	490	950	0	0	0	0	1099	568	532
Heavy Vehicles (%)	2%	2%	2%	3%	2%	2%	2%	2%	2%	3%	2%	2%
Turn Type			Free	Prot						Prot		Prot
Protected Phases		2		1	6					7	4	4
Permitted Phases			Free									
Actuated Green, G (s)		38.0	110.0	17.0	59.0					43.0	43.0	43.0
Effective Green, g (s)		38.0	110.0	17.0	59.0					43.0	43.0	43.0
Actuated g/C Ratio		0.35	1.00	0.15	0.54					0.39	0.39	0.39
Clearance Time (s)		4.0		4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0					3.0	3.0	3.0
Lane Grp Cap (vph)		1757	1583	525	1898					1247	560	588
v/s Ratio Prot		c0.31		c0.14	0.27					0.34	c0.40	0.35
v/s Ratio Perm			0.16									
v/c Ratio		0.90	0.16	0.93	0.50					0.88	1.01	0.90
Uniform Delay, d1		34.3	0.0	45.9	16.2					31.1	33.5	31.6
Progression Factor		0.80	1.00	0.55	0.17					1.00	1.00	1.00
Incremental Delay, d2		7.3	0.2	12.3	0.4					7.6	41.8	17.3
Delay (s)		34.9	0.2	37.5	3.1					38.7	75.3	48.9
Level of Service		C	A	D	A					D	E	D
Approach Delay (s)		30.2			14.8			0.0			51.0	
Approach LOS		C			B			A			D	

Intersection Summary

HCM Average Control Delay	34.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	149.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0			4.0	4.0		4.0	
Lane Util. Factor	1.00	0.91	1.00		0.91			0.95	0.95		1.00	
Frt	1.00	1.00	0.85		1.00			0.96	0.85		0.93	
Flt Protected	0.95	1.00	1.00		1.00			0.97	1.00		0.98	
Satd. Flow (prot)	1770	5036	1583		5033			1632	1490		1695	
Flt Permitted	0.95	1.00	1.00		1.00			0.97	1.00		0.98	
Satd. Flow (perm)	1770	5036	1583		5033			1632	1490		1695	
Volume (vph)	10	2120	830	0	2290	10	280	10	660	10	0	10
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	10	2120	830	0	2290	10	280	10	660	10	0	10
RTOR Reduction (vph)	0	0	0	0	1	0	0	12	161	0	9	0
Lane Group Flow (vph)	10	2120	830	0	2299	0	0	395	382	0	11	0
Heavy Vehicles (%)	2%	3%	2%	2%	3%	3%	2%	2%	3%	2%	2%	2%
Turn Type	Prot		Free				Split		Perm	Split		
Protected Phases	5	2			6		8	8		4	4	
Permitted Phases			Free						8			
Actuated Green, G (s)	0.8	57.0	110.0		52.2			34.6	34.6		6.4	
Effective Green, g (s)	0.8	57.0	110.0		52.2			34.6	34.6		6.4	
Actuated g/C Ratio	0.01	0.52	1.00		0.47			0.31	0.31		0.06	
Clearance Time (s)	4.0	4.0			4.0			4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0			3.0			3.0	3.0		3.0	
Lane Grp Cap (vph)	13	2610	1583		2388			513	469		99	
v/s Ratio Prot	0.01	0.42			c0.46			0.24			0.01	
v/s Ratio Perm			c0.52						c0.26			
v/c Ratio	0.77	0.81	0.52		0.96			0.77	0.81		0.11	
Uniform Delay, d1	54.5	22.0	0.0		28.0			34.1	34.7		49.1	
Progression Factor	1.06	0.44	1.00		0.48			1.00	1.00		1.00	
Incremental Delay, d2	69.5	1.2	0.5		9.1			7.0	10.4		0.5	
Delay (s)	127.3	10.8	0.5		22.6			41.2	45.2		49.6	
Level of Service	F	B	A		C			D	D		D	
Approach Delay (s)		8.3			22.6			43.4			49.6	
Approach LOS		A			C			D			D	

Intersection Summary

HCM Average Control Delay	19.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	87.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		0.97	1.00
Frt	1.00	0.85	0.99		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3507		3433	1863
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3507		3433	1863
Volume (vph)	1080	410	930	60	530	1340
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1080	410	930	60	530	1340
RTOR Reduction (vph)	0	107	3	0	0	0
Lane Group Flow (vph)	1080	303	987	0	530	1340
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	60.0	60.0	45.0		23.0	72.0
Effective Green, g (s)	60.0	60.0	45.0		23.0	72.0
Actuated g/C Ratio	0.43	0.43	0.32		0.16	0.51
Clearance Time (s)	4.0	4.0	4.0		4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	759	678	1127		564	958
v/s Ratio Prot	c0.61		0.28		0.15	c0.72
v/s Ratio Perm		0.19				
v/c Ratio	1.42	0.45	0.88		0.94	1.40
Uniform Delay, d1	40.0	28.3	44.9		57.8	34.0
Progression Factor	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	198.0	0.5	7.8		23.6	185.8
Delay (s)	238.0	28.7	52.7		81.4	219.8
Level of Service	F	C	D		F	F
Approach Delay (s)	180.4		52.7			180.6
Approach LOS	F		D			F

Intersection Summary

HCM Average Control Delay	151.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.41		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	137.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Stop	Stop	
Volume (vph)	530	110	130	160	240	270
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	530	110	130	160	240	270

Direction, Lane #	EB 1	EB 2	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	530	110	130	160	240	270
Volume Left (vph)	530	0	130	0	0	0
Volume Right (vph)	0	110	0	0	0	270
Hadj (s)	0.53	-0.67	0.53	0.03	0.03	-0.67
Departure Headway (s)	7.3	6.1	7.9	7.4	7.1	6.4
Degree Utilization, x	1.07	0.19	0.28	0.33	0.47	0.48
Capacity (veh/h)	490	577	448	478	498	554
Control Delay (s)	85.8	9.2	12.8	12.7	15.1	14.0
Approach Delay (s)	72.7		12.8		14.5	
Approach LOS	F		B		B	

Intersection Summary			
Delay	40.0		
HCM Level of Service	E		
Intersection Capacity Utilization	59.2%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	NBL	NBT	NBR	SBL	SBT	SBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0		4.0			
Lane Util. Factor		0.95	1.00		1.00	1.00	0.97		1.00			
Frt		1.00	0.85		1.00	0.85	1.00		0.85			
Flt Protected		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (prot)		3539	1583		1863	1583	3433		1583			
Flt Permitted		1.00	1.00		1.00	1.00	0.95		1.00			
Satd. Flow (perm)		3539	1583		1863	1583	3433		1583			
Volume (vph)	0	650	1400	0	350	200	460	0	850	0	0	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	650	1400	0	350	200	460	0	850	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	650	1400	0	350	200	460	0	850	0	0	0
Turn Type			Free			Free	custom		Free			
Protected Phases		2			6							
Permitted Phases			Free			Free	4		Free			
Actuated Green, G (s)		21.8	40.0		21.8	40.0	10.2		40.0			
Effective Green, g (s)		21.8	40.0		21.8	40.0	10.2		40.0			
Actuated g/C Ratio		0.55	1.00		0.55	1.00	0.25		1.00			
Clearance Time (s)		4.0			4.0		4.0					
Vehicle Extension (s)		3.0			3.0		3.0					
Lane Grp Cap (vph)		1929	1583		1015	1583	875		1583			
v/s Ratio Prot		0.18			0.19							
v/s Ratio Perm			c0.88			0.13	0.13		0.54			
v/c Ratio		0.34	0.88		0.34	0.13	0.53		0.54			
Uniform Delay, d1		5.1	0.0		5.1	0.0	12.8		0.0			
Progression Factor		1.00	1.00		1.00	1.00	1.00		1.00			
Incremental Delay, d2		0.5	7.6		0.9	0.2	0.6		1.3			
Delay (s)		5.5	7.6		6.0	0.2	13.4		1.3			
Level of Service		A	A		A	A	B		A			
Approach Delay (s)		6.9			3.9			5.6			0.0	
Approach LOS		A			A			A			A	

Intersection Summary

HCM Average Control Delay	6.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	38.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0			4.0	4.0	4.0		4.0
Lane Util. Factor	1.00	0.95	1.00		0.91			1.00	1.00	1.00		1.00
Frt	1.00	1.00	0.85		1.00			1.00	0.85	1.00		0.85
Flt Protected	0.95	1.00	1.00		1.00			0.96	1.00	0.95		1.00
Satd. Flow (prot)	1770	3539	1583		5073			1781	1583	1770		1583
Flt Permitted	0.41	1.00	1.00		1.00			0.96	1.00	0.67		1.00
Satd. Flow (perm)	764	3539	1583		5073			1781	1583	1255		1583
Volume (vph)	90	630	390	0	600	10	120	10	230	10	0	40
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	90	630	390	0	600	10	120	10	230	10	0	40
RTOR Reduction (vph)	0	0	0	0	5	0	0	0	71	0	0	21
Lane Group Flow (vph)	90	630	390	0	605	0	0	130	159	10	0	19
Turn Type	Perm		Free				Perm		Perm	custom		custom
Protected Phases		4			8			2				
Permitted Phases	4		Free				2		2	6		6
Actuated Green, G (s)	12.6	12.6	40.0		12.6			19.4	19.4	19.4		19.4
Effective Green, g (s)	12.6	12.6	40.0		12.6			19.4	19.4	19.4		19.4
Actuated g/C Ratio	0.31	0.31	1.00		0.31			0.48	0.48	0.48		0.48
Clearance Time (s)	4.0	4.0			4.0			4.0	4.0	4.0		4.0
Vehicle Extension (s)	3.0	3.0			3.0			3.0	3.0	3.0		3.0
Lane Grp Cap (vph)	241	1115	1583		1598			864	768	609		768
v/s Ratio Prot		c0.18			0.12							
v/s Ratio Perm	0.12		c0.25					0.07	0.10	0.01		0.01
v/c Ratio	0.37	0.57	0.25		0.38			0.15	0.21	0.02		0.03
Uniform Delay, d1	10.6	11.4	0.0		10.7			5.7	5.9	5.3		5.4
Progression Factor	1.00	1.00	1.00		1.00			1.00	1.00	1.00		1.00
Incremental Delay, d2	1.0	0.7	0.4		0.2			0.4	0.6	0.0		0.1
Delay (s)	11.6	12.0	0.4		10.8			6.1	6.5	5.4		5.4
Level of Service	B	B	A		B			A	A	A		A
Approach Delay (s)		7.9			10.8			6.4			5.4	
Approach LOS		A			B			A			A	

Intersection Summary

HCM Average Control Delay	8.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	45.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0					4.0	4.0	4.0	4.0	
Lane Util. Factor	0.95	0.95	1.00					0.95	1.00	1.00	0.95	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1681	1681	1583					3539	1583	1770	3539	
Flt Permitted	0.95	0.95	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1681	1681	1583					3539	1583	1770	3539	
Volume (vph)	980	0	520	0	0	0	0	610	250	480	460	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	980	0	520	0	0	0	0	610	250	480	460	0
RTOR Reduction (vph)	0	0	272	0	0	0	0	0	193	0	0	0
Lane Group Flow (vph)	490	490	248	0	0	0	0	610	57	480	460	0
Turn Type	Perm		Perm						Perm	Prot		
Protected Phases		4						2		1	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)	21.9	21.9	21.9					15.9	15.9	20.2	40.1	
Effective Green, g (s)	21.9	21.9	21.9					15.9	15.9	20.2	40.1	
Actuated g/C Ratio	0.31	0.31	0.31					0.23	0.23	0.29	0.57	
Clearance Time (s)	4.0	4.0	4.0					4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	526	526	495					804	360	511	2027	
v/s Ratio Prot								c0.17		c0.27	0.13	
v/s Ratio Perm	c0.29	0.29	0.16						0.04			
v/c Ratio	0.93	0.93	0.50					0.76	0.16	0.94	0.23	
Uniform Delay, d1	23.3	23.3	19.6					25.3	21.7	24.3	7.3	
Progression Factor	1.00	1.00	1.00					1.00	1.00	1.00	1.00	
Incremental Delay, d2	23.5	23.5	0.8					6.6	0.9	25.2	0.3	
Delay (s)	46.8	46.8	20.4					31.9	22.6	49.4	7.6	
Level of Service	D	D	C					C	C	D	A	
Approach Delay (s)		37.6			0.0			29.2			29.0	
Approach LOS		D			A			C			C	

Intersection Summary

HCM Average Control Delay	33.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	62.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0		4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00		1.00		0.95	0.95		0.91	1.00		0.91	
Frt	1.00		0.85		0.98	0.85		1.00	0.85		1.00	
Flt Protected	0.95		1.00		0.96	1.00		1.00	1.00		1.00	
Satd. Flow (prot)	1770		1583		1663	1504		5085	1583		5085	
Flt Permitted	0.95		1.00		0.96	1.00		1.00	1.00		1.00	
Satd. Flow (perm)	1770		1583		1663	1504		5085	1583		5085	
Volume (vph)	80	0	150	240	0	450	0	1180	370	0	1360	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	80	0	150	240	0	450	0	1180	370	0	1360	0
RTOR Reduction (vph)	0	0	125	0	8	223	0	0	0	0	0	0
Lane Group Flow (vph)	80	0	25	0	268	191	0	1180	370	0	1360	0
Turn Type	Prot		custom	Split		Perm			Free			
Protected Phases	6		6	2	2			4			8	
Permitted Phases						2		4	Free			
Actuated Green, G (s)	8.4		8.4		15.2	15.2		34.4	70.0		34.4	
Effective Green, g (s)	8.4		8.4		15.2	15.2		34.4	70.0		34.4	
Actuated g/C Ratio	0.12		0.12		0.22	0.22		0.49	1.00		0.49	
Clearance Time (s)	4.0		4.0		4.0	4.0		4.0			4.0	
Vehicle Extension (s)	3.0		3.0		3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	212		190		361	327		2499	1583		2499	
v/s Ratio Prot	c0.05		0.02		c0.16			0.23			c0.27	
v/s Ratio Perm						0.13			0.23			
v/c Ratio	0.38		0.13		0.74	0.58		0.47	0.23		0.54	
Uniform Delay, d1	28.4		27.5		25.6	24.6		11.8	0.0		12.4	
Progression Factor	1.00		1.00		1.00	1.00		0.99	1.00		1.00	
Incremental Delay, d2	1.1		0.3		8.0	2.6		0.6	0.3		0.9	
Delay (s)	29.5		27.9		33.6	27.2		12.4	0.3		13.2	
Level of Service	C		C		C	C		B	A		B	
Approach Delay (s)		28.4			29.8			9.5			13.2	
Approach LOS		C			C			A			B	

Intersection Summary

HCM Average Control Delay	15.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	68.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	1.00	0.91	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1441	1770	5085	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1441	1770	5085	3539	1583
Volume (vph)	1060	730	50	730	530	280
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1060	730	50	730	530	280
RTOR Reduction (vph)	0	318	0	0	0	0
Lane Group Flow (vph)	1060	412	50	730	530	280
Turn Type		Perm	Prot			Free
Protected Phases	4		5	2	6	
Permitted Phases		4				Free
Actuated Green, G (s)	30.9	30.9	5.0	31.1	22.1	70.0
Effective Green, g (s)	30.9	30.9	5.0	31.1	22.1	70.0
Actuated g/C Ratio	0.44	0.44	0.07	0.44	0.32	1.00
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	1515	636	126	2259	1117	1583
v/s Ratio Prot	c0.31		0.03	c0.14	c0.15	
v/s Ratio Perm		0.29				0.18
v/c Ratio	0.70	0.65	0.40	0.32	0.47	0.18
Uniform Delay, d1	15.8	15.3	31.1	12.6	19.3	0.0
Progression Factor	1.00	1.00	1.00	1.00	0.89	1.00
Incremental Delay, d2	1.4	2.3	2.1	0.4	1.3	0.2
Delay (s)	17.2	17.6	33.1	13.0	18.3	0.2
Level of Service	B	B	C	B	B	A
Approach Delay (s)	17.4			14.3	12.1	
Approach LOS	B			B	B	

Intersection Summary

HCM Average Control Delay	15.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	65.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor				0.95	0.91	0.95		0.95	1.00		0.91	0.91
Frt				1.00	0.85	0.85		1.00	0.85		0.93	0.85
Flt Protected				0.95	1.00	1.00		1.00	1.00		1.00	1.00
Satd. Flow (prot)				1681	1441	1504		3539	1583		3164	1441
Flt Permitted				0.95	1.00	1.00		1.00	1.00		1.00	1.00
Satd. Flow (perm)				1681	1441	1504		3539	1583		3164	1441
Volume (vph)	0	0	0	130	0	360	0	1440	350	0	680	1160
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	0	0	130	0	360	0	1440	350	0	680	1160
RTOR Reduction (vph)	0	0	0	0	33	33	0	0	0	0	145	179
Lane Group Flow (vph)	0	0	0	130	147	147	0	1440	350	0	1080	436
Turn Type				Perm		Perm			Free			Perm
Protected Phases					8			2			6	
Permitted Phases				8		8			Free			6
Actuated Green, G (s)				12.4	12.4	12.4		49.6	70.0		49.6	49.6
Effective Green, g (s)				12.4	12.4	12.4		49.6	70.0		49.6	49.6
Actuated g/C Ratio				0.18	0.18	0.18		0.71	1.00		0.71	0.71
Clearance Time (s)				4.0	4.0	4.0		4.0			4.0	4.0
Vehicle Extension (s)				3.0	3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)				298	255	266		2508	1583		2242	1021
v/s Ratio Prot								c0.41			0.34	
v/s Ratio Perm				0.08	0.10	0.10			0.22			0.30
v/c Ratio				0.44	0.58	0.55		0.57	0.22		0.48	0.43
Uniform Delay, d1				25.7	26.4	26.3		5.0	0.0		4.5	4.3
Progression Factor				1.00	1.00	1.00		0.56	1.00		1.00	1.00
Incremental Delay, d2				1.0	3.1	2.5		0.8	0.3		0.7	1.3
Delay (s)				26.7	29.5	28.8		3.6	0.3		5.3	5.6
Level of Service				C	C	C		A	A		A	A
Approach Delay (s)		0.0			28.5			3.0			5.4	
Approach LOS		A			C			A			A	

Intersection Summary

HCM Average Control Delay	7.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		0.95	0.95	
Frt	0.90	0.85		1.00	1.00	
Flt Protected	0.98	1.00		1.00	1.00	
Satd. Flow (prot)	1650	1504		3539	3539	
Flt Permitted	0.98	1.00		1.00	1.00	
Satd. Flow (perm)	1650	1504		3539	3539	
Volume (vph)	200	1060	0	770	160	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	200	1060	0	770	160	0
RTOR Reduction (vph)	182	403	0	0	0	0
Lane Group Flow (vph)	412	263	0	770	160	0
Turn Type		Perm				
Protected Phases	6			4	8	
Permitted Phases		6				
Actuated Green, G (s)	13.0	13.0		12.9	12.9	
Effective Green, g (s)	13.0	13.0		12.9	12.9	
Actuated g/C Ratio	0.38	0.38		0.38	0.38	
Clearance Time (s)	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	633	577		1347	1347	
v/s Ratio Prot	c0.25			c0.22	0.05	
v/s Ratio Perm		0.17				
v/c Ratio	0.65	0.46		0.57	0.12	
Uniform Delay, d1	8.6	7.8		8.3	6.8	
Progression Factor	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.4	0.6		0.6	0.0	
Delay (s)	11.0	8.4		8.9	6.9	
Level of Service	B	A		A	A	
Approach Delay (s)	9.6			8.9	6.9	
Approach LOS	A			A	A	

Intersection Summary

HCM Average Control Delay	9.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	33.9	Sum of lost time (s)	8.0
Intersection Capacity Utilization	88.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Sign Control	Yield			Yield	Yield	
Volume (vph)	0	0	670	300	160	80
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	0	670	300	160	80

Direction, Lane #	NE 1	NE 2	SW 1
Volume Total (vph)	670	300	240
Volume Left (vph)	670	0	0
Volume Right (vph)	0	0	80
Hadj (s)	0.53	0.03	-0.17
Departure Headway (s)	5.2	4.7	4.6
Degree Utilization, x	0.97	0.39	0.31
Capacity (veh/h)	687	759	773
Control Delay (s)	47.8	9.5	9.6
Approach Delay (s)	35.9		9.6
Approach LOS	E		A

Intersection Summary			
Delay	30.7		
HCM Level of Service	D		
Intersection Capacity Utilization	88.3%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	40	100	90	0	0	0	20	560	80	100	240	180
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	40	100	90	0	0	0	20	560	80	100	240	180
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			3									
Median type		None			None							
Median storage veh)												
Upstream signal (ft)								189			337	
pX, platoon unblocked												
vC, conflicting volume	760	1120	240	1130	1260	320	420			640		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	760	1120	240	1130	1260	320	420			640		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	85	44	88	100	100	100	98			89		
cM capacity (veh/h)	267	180	761	72	148	676	1136			940		

Direction, Lane #	SE 1	NE 1	NE 2	SW 1	SW 2	SW 3
Volume Total	230	300	360	100	240	180
Volume Left	40	20	0	100	0	0
Volume Right	90	0	80	0	0	180
cSH	337	1136	1700	940	1700	1700
Volume to Capacity	0.68	0.02	0.21	0.11	0.14	0.11
Queue Length 95th (ft)	119	1	0	9	0	0
Control Delay (s)	36.7	0.7	0.0	9.3	0.0	0.0
Lane LOS	E	A		A		
Approach Delay (s)	36.7	0.3		1.8		
Approach LOS	E					

Intersection Summary				
Average Delay	6.8			
Intersection Capacity Utilization	48.7%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)				4.0	4.0		4.0	4.0			4.0	4.0
Lane Util. Factor				1.00	1.00		1.00	0.95			1.00	1.00
Frt				1.00	0.85		1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (prot)				1770	1583		1770	3539			1863	1583
Flt Permitted				0.95	1.00		0.95	1.00			1.00	1.00
Satd. Flow (perm)				1770	1583		1770	3539			1863	1583
Volume (vph)	0	0	0	360	0	90	330	150	0	0	160	90
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	0	0	360	0	90	330	150	0	0	160	90
RTOR Reduction (vph)	0	0	0	0	59	0	0	0	0	0	0	76
Lane Group Flow (vph)	0	0	0	360	31	0	330	150	0	0	160	14
Turn Type				Perm			Prot					Perm
Protected Phases					2		7	4			8	
Permitted Phases				2								8
Actuated Green, G (s)				17.1	17.1		12.7	24.6			7.9	7.9
Effective Green, g (s)				17.1	17.1		12.7	24.6			7.9	7.9
Actuated g/C Ratio				0.34	0.34		0.26	0.49			0.16	0.16
Clearance Time (s)				4.0	4.0		4.0	4.0			4.0	4.0
Vehicle Extension (s)				3.0	3.0		3.0	3.0			3.0	3.0
Lane Grp Cap (vph)				609	545		452	1752			296	252
v/s Ratio Prot					0.02		c0.19	0.04			c0.09	
v/s Ratio Perm				c0.20								0.01
v/c Ratio				0.59	0.06		0.73	0.09			0.54	0.06
Uniform Delay, d1				13.4	10.9		16.9	6.6			19.2	17.7
Progression Factor				1.00	1.00		1.00	1.00			1.00	1.00
Incremental Delay, d2				1.5	0.0		6.0	0.0			2.0	0.1
Delay (s)				15.0	10.9		22.9	6.6			21.2	17.8
Level of Service				B	B		C	A			C	B
Approach Delay (s)		0.0			14.2			17.8			20.0	
Approach LOS		A			B			B			C	

Intersection Summary

HCM Average Control Delay	16.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	49.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0		4.0		4.0	4.0	4.0	4.0
Lane Util. Factor		0.95		1.00	0.95		1.00		1.00	1.00	1.00	1.00
Frt		0.95		1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		3359		1770	3539		1770		1583	1770	1863	1583
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)		3359		1770	3539		1770		1583	1770	1863	1583
Volume (vph)	0	350	180	50	540	0	150	0	300	310	160	190
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	350	180	50	540	0	150	0	300	310	160	190
RTOR Reduction (vph)	0	93	0	0	0	0	0	0	224	0	0	142
Lane Group Flow (vph)	0	437	0	50	540	0	150	0	76	310	160	48
Turn Type				Prot			Prot		custom	Split		Perm
Protected Phases		4		3	8		2		2	6	6	
Permitted Phases												6
Actuated Green, G (s)		12.5		2.0	18.5		10.1		10.1	13.6	13.6	13.6
Effective Green, g (s)		12.5		2.0	18.5		10.1		10.1	13.6	13.6	13.6
Actuated g/C Ratio		0.23		0.04	0.34		0.19		0.19	0.25	0.25	0.25
Clearance Time (s)		4.0		4.0	4.0		4.0		4.0	4.0	4.0	4.0
Vehicle Extension (s)		3.0		3.0	3.0		3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)		775		65	1208		330		295	444	467	397
v/s Ratio Prot		c0.13		0.03	c0.15		c0.08		0.05	c0.18	0.09	
v/s Ratio Perm												0.03
v/c Ratio		0.56		0.77	0.45		0.45		0.26	0.70	0.34	0.12
Uniform Delay, d1		18.4		25.9	13.9		19.6		18.8	18.4	16.6	15.7
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		0.9		41.2	0.3		1.0		0.5	4.7	0.4	0.1
Delay (s)		19.4		67.1	14.1		20.6		19.3	23.2	17.1	15.8
Level of Service		B		E	B		C		B	C	B	B
Approach Delay (s)		19.4			18.6			19.7			19.6	
Approach LOS		B			B			B			B	

Intersection Summary

HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	54.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	61.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NEL	NER
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	
Lane Util. Factor	0.95			0.95	0.97	
Frt	1.00			1.00	0.99	
Flt Protected	1.00			1.00	0.95	
Satd. Flow (prot)	3539			3539	3428	
Flt Permitted	1.00			1.00	0.95	
Satd. Flow (perm)	3539			3539	3428	
Volume (vph)	490	0	0	740	240	10
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	490	0	0	740	240	10
RTOR Reduction (vph)	0	0	0	0	7	0
Lane Group Flow (vph)	490	0	0	740	243	0
Turn Type						
Protected Phases	4			8	2	
Permitted Phases						
Actuated Green, G (s)	11.3			11.3	7.3	
Effective Green, g (s)	11.3			11.3	7.3	
Actuated g/C Ratio	0.42			0.42	0.27	
Clearance Time (s)	4.0			4.0	4.0	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	1503			1503	941	
v/s Ratio Prot	0.14			c0.21	c0.07	
v/s Ratio Perm						
v/c Ratio	0.33			0.49	0.26	
Uniform Delay, d1	5.1			5.6	7.5	
Progression Factor	1.00			1.00	1.00	
Incremental Delay, d2	0.1			0.3	0.1	
Delay (s)	5.2			5.8	7.7	
Level of Service	A			A	A	
Approach Delay (s)	5.2			5.8	7.7	
Approach LOS	A			A	A	

Intersection Summary

HCM Average Control Delay	5.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	26.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	34.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	150	150	360	440	320	60
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	150	150	360	440	320	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		17				
Median type	None					
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1290	190	380			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1290	190	380			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	0	82	69			
cM capacity (veh/h)	108	820	1175			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	300	360	220	220	213	167
Volume Left	150	360	0	0	0	0
Volume Right	150	0	0	0	0	60
cSH	215	1175	1700	1700	1700	1700
Volume to Capacity	1.39	0.31	0.13	0.13	0.13	0.10
Queue Length 95th (ft)	429	33	0	0	0	0
Control Delay (s)	153.6	9.4	0.0	0.0	0.0	0.0
Lane LOS	F	A				
Approach Delay (s)	153.6	4.2			0.0	
Approach LOS	F					

Intersection Summary			
Average Delay	33.4		
Intersection Capacity Utilization	49.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	240	20	100	270	330	220	140	50	10	60	40	100
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	240	20	100	270	330	220	140	50	10	60	40	100

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total (vph)	360	270	550	140	60	60	140
Volume Left (vph)	240	270	0	140	0	60	0
Volume Right (vph)	100	0	220	0	10	0	100
Hadj (s)	0.00	0.53	-0.25	0.53	-0.08	0.53	-0.47
Departure Headway (s)	7.1	7.3	6.5	8.7	8.1	8.8	7.7
Degree Utilization, x	0.71	0.55	0.99	0.34	0.13	0.15	0.30
Capacity (veh/h)	500	487	550	405	433	400	453
Control Delay (s)	25.6	17.6	60.9	15.0	11.2	12.1	12.8
Approach Delay (s)	25.6	46.7		13.8		12.6	
Approach LOS	D	E		B		B	

Intersection Summary			
Delay	33.4		
HCM Level of Service	D		
Intersection Capacity Utilization	80.6%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	80	400	0	0	390	610	0	0	0	40	0	110
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	80	400	0	0	390	610	0	0	0	40	0	110
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1000			400			1365	1255	695	1255	1560	400
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1000			400			1365	1255	695	1255	1560	400
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	88			100			100	100	100	70	100	83
cM capacity (veh/h)	692			1159			94	152	442	135	99	650

Direction, Lane #	EB 1	EB 2	WB 1	NW 1	NW 2
Volume Total	80	400	1000	40	110
Volume Left	80	0	0	40	0
Volume Right	0	0	610	0	110
cSH	692	1700	1700	135	650
Volume to Capacity	0.12	0.24	0.59	0.30	0.17
Queue Length 95th (ft)	10	0	0	29	15
Control Delay (s)	10.9	0.0	0.0	42.4	11.7
Lane LOS	B			E	B
Approach Delay (s)	1.8		0.0	19.9	
Approach LOS				C	

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	95.4%	ICU Level of Service	F
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	110	20	290	130	0	370	0	90	0	0	0
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	0	110	20	290	130	0	370	0	90	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									22			
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	130			130			830	840	130	875	830	120
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	130			130			830	840	130	875	830	120
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			80			0	100	90	100	100	100
cM capacity (veh/h)	1455			1455			245	241	920	206	245	931

Direction, Lane #	EB 1	WB 1	WB 2	SE 1
Volume Total	130	290	130	460
Volume Left	0	290	0	370
Volume Right	20	0	0	90
cSH	1700	1455	1700	300
Volume to Capacity	0.08	0.20	0.08	1.54
Queue Length 95th (ft)	0	19	0	664
Control Delay (s)	0.0	8.1	0.0	288.5
Lane LOS		A		F
Approach Delay (s)	0.0	5.6		288.5
Approach LOS				F

Intersection Summary			
Average Delay	133.7		
Intersection Capacity Utilization	95.4%	ICU Level of Service	F
Analysis Period (min)	15		

25. Cm Capistrano & J. Serra

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1700	0	.00	0	.00
NBT	1	1700	220	.13*	110	.06*
NBR	2	3400	600	.18	630	.19
SBL	1	1700	70	.04*	100	.06*
SBT	1	1700	180	.11	130	.08
SBR	0	0	0		0	
EBL	1	1700	0	.00	0	.00
EBT	1	1700	0	.00*	0	.00*
EBR	0	0	0		0	
WBL	2	3400	680	.20*	750	.22*
WBT	1	1700	0	.00	10	.01
WBR	1	1700	160	.09	50	.03
Clearance Interval				.05*		.05*

TOTAL CAPACITY UTILIZATION .42 .39

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1700	0	.00	0	.00
NBT	1	1700	230	.14*	120	.07
NBR	2	3400	1110	.33	850	.25
SBL	1	1700	130	.08*	140	.08
SBT	1	1700	190	.11	250	.15*
SBR	0	0	0		0	
EBL	1	1700	0	.00	0	.00
EBT	1	1700	0	.00*	0	.00*
EBR	0	0	0		0	
WBL	2	3400	850	.25*	1160	.34*
WBT	1	1700	0	.00	20	.01
WBR	1	1700	170	.10	220	.13
Clearance Interval				.05*		.05*

TOTAL CAPACITY UTILIZATION .52 .54

2040 Build

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1700	0	.00	0	.00
NBT	1	1700	230	.14*	120	.07
NBR	2	3400	1110	.33	850	.25
SBL	1	1700	130	.08*	140	.08
SBT	1	1700	190	.11	250	.15*
SBR	0	0	0		0	
EBL	1	1700	0	.00	0	.00
EBT	1	1700	0	.00*	0	.00*
EBR	0	0	0		0	
WBL	2	3400	850	.25*	1160	.34*
WBT	1	1700	0	.00	20	.01
WBR	1	1700	170	.10	220	.13
Clearance Interval				.05*		.05*

TOTAL CAPACITY UTILIZATION .52 .54

26. Rancho Viejo & J. Serra

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1700	300	.18*	350	.21*
NBT	2	3400	120	.04	260	.08
NBR	0	0	10		10	
SBL	1	1700	10	.01	0	.00
SBT	1	1700	100	.06*	200	.12*
SBR	1	1700	430	.25	450	.26
EBL	1	1700	280	.16*	430	.25*
EBT	1	1700	30	.16	20	.21
EBR	0	0	240		340	
WBL	0.5		0		10	
WBT	1.5	3400	20	.01*	30	.01*
WBR	0		0		10	
Right Turn Adjustment			SBR	.07*		
Clearance Interval				.05*		.05*
TOTAL CAPACITY UTILIZATION				**.53**		**.64**

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1700	600	.35*	440	.26*
NBT	2	3400	210	.06	200	.06
NBR	0	0	10		10	
SBL	1	1700	10	.01	10	.01
SBT	1	1700	170	.10*	290	.17*
SBR	1	1700	520	.31	670	.39
EBL	1	1700	630	.37*	420	.25
EBT	1	1700	30	.20	30	.27*
EBR	0	0	310		430	
WBL	0.5		10		10	{.01}*
WBT	1.5	3400	30	.01*	50	.02
WBR	0		10		10	
Right Turn Adjustment					SBR	.02*
Clearance Interval				.05*		.05*
TOTAL CAPACITY UTILIZATION				**.88**		**.78**

2040 Build

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1700	500	.29*	360	.21*
NBT	2	3400	300	.09	270	.08
NBR	0	0	10		10	
SBL	1	1700	10	.01	10	.01
SBT	1	1700	230	.14*	380	.22*
SBR	1	1700	610	.36	780	.46
EBL	1	1700	700	.41*	500	.29*
EBT	1	1700	30	.16	30	.22
EBR	0	0	240		350	
WBL	0.5		10		10	
WBT	1.5	3400	30	.01*	40	.02*
WBR	0		10		10	
Right Turn Adjustment					SBR	.02*
Clearance Interval				.05*		.05*
TOTAL CAPACITY UTILIZATION				**.90**		**.81**

27. Del Obispo & Ortega

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1700	30	.02*	80	.05*
NBT	0	0	0		0	
NBR	2	3400	1030	.30	990	.29
SBL	0	0	0		0	
SBT	0	0	0		0	
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	3	5100	360	.08*	340	.08*
EBR	0	0	50		70	
WBL	2	3400	920	.27*	1200	.35*
WBT	1	1700	510	.30	400	.24
WBR	0	0	0		0	
Right Turn Adjustment			NBR	.08*		
Clearance Interval				.05*		.05*

TOTAL CAPACITY UTILIZATION .50 .53

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1700	40	.02*	100	.06*
NBT	3	5100	1260	.25	1290	.25
NBR	0	0	10		10	
SBL	0	0	0		0	
SBT	2	3400	1220	.36*	1320	.39*
SBR	1	1700	710	.42	680	.40
EBL	2	3400	370	.11*	530	.16*
EBT	1	1700	10	.06	10	.07
EBR	0	0	90		110	
WBL	1	1700	10	.01	10	.01
WBT	1	1700	10	.01*	10	.01*
WBR	0	0	10		10	
Clearance Interval				.05*		.05*

TOTAL CAPACITY UTILIZATION .55 .67

2040 Build

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1700	40	.02*	100	.06*
NBT	3	5100	1260	.25	1290	.25
NBR	0	0	10		10	
SBL	0	0	0		0	
SBT	2	3400	1220	.36*	1320	.39*
SBR	1	1700	710	.42	680	.40
EBL	2	3400	370	.11*	530	.16*
EBT	1	1700	10	.06	10	.07
EBR	0	0	90		110	
WBL	1	1700	10	.01	10	.01
WBT	1	1700	10	.01*	10	.01*
WBR	0	0	10		10	
Clearance Interval				.05*		.05*

TOTAL CAPACITY UTILIZATION .55 .67

28. Rancho Viejo & Ortega

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3400	330	.10	580	.17*
NBT	1	1700	190	.14*	130	.13
NBR	0	0	40		90	
SBL	1.5		140	.08	170	
SBT	0.5	3400	160	.09*	150	.09*
SBR	1	1700	170	.10	140	.08
EBL	1	1700	240	.14*	150	.09
EBT	2	3400	1050	.31	1640	.48*
EBR	1	1700	560	.33	350	.21
WBL	1	1700	110	.06	70	.04*
WBT	3	5100	1510	.30*	1020	.20
WBR	1	1700	350	.21	130	.08
Clearance Interval				.05*		.05*

Note: Assumes N/S Split Phasing

TOTAL CAPACITY UTILIZATION .72 .83

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3400	380	.11	590	.17*
NBT	1	1700	200	.12*	140	.08
NBR	1	1700	60	.04	100	.06
SBL	1.5		170	.10	290	
SBT	0.5	3400	170	.10*	170	.14*
SBR	1	1700	180	.11	200	.12
EBL	1	1700	250	.15*	250	.15
EBT	2	3400	1270	.37	1800	.53*
EBR	1	1700	760	.45	490	.29
WBL	1	1700	120	.07	80	.05*
WBT	3	5100	1760	.35*	1270	.25
WBR	1	1700	550	.32	180	.11
Clearance Interval				.05*		.05*

Note: Assumes N/S Split Phasing

TOTAL CAPACITY UTILIZATION .77 .94

2040 Build

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3400	380	.11	590	.17*
NBT	1	1700	200	.12*	140	.08
NBR	1	1700	60	.04	100	.06
SBL	1.5		170	.10	290	
SBT	0.5	3400	170	.10*	170	.14*
SBR	1	1700	180	.11	200	.12
EBL	1	1700	250	.15*	250	.15
EBT	2	3400	1270	.37	1790	.53*
EBR	1	1700	760	.45	490	.29
WBL	1	1700	120	.07	80	.05*
WBT	3	5100	1760	.35*	1270	.25
WBR	1	1700	550	.32	180	.11
Clearance Interval				.05*		.05*

Note: Assumes N/S Split Phasing

TOTAL CAPACITY UTILIZATION .77 .94

29. La Pata & Ortega

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3400	290	.09*	60	.02
NBT	2	3400	150	.04	20	.01*
NBR	1	1700	10	.01	10	.01
SBL	1	1700	90	.05	240	.14*
SBT	2	3400	220	.06*	60	.02
SBR	2	3400	600	.18	420	.12
EBL	2	3400	310	.09*	340	.10
EBT	1	1700	250	.15	820	.48*
EBR	f		320		50	
WBL	1	1700	10	.01	0	.00
WBT	1	1700	660	.39*	220	.13
WBR	1	1700	210	.12	60	.04
Right Turn Adjustment			SBR	.12*		
Clearance Interval				.05*		.05*

TOTAL CAPACITY UTILIZATION .80 .68

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3400	310	.09*	110	.03
NBT	3	5100	510	.10	600	.12*
NBR	1	1700	100	.06	360	.21
SBL	1	1700	100	.06	240	.14*
SBT	3	5100	800	.16*	480	.09
SBR	2	3400	1230	.36	970	.29
EBL	2	3400	820	.24*	1050	.31*
EBT	2	3400	270	.08	850	.25
EBR	1	1700	340	.20	90	.05
WBL	1	1700	380	.22	120	.07
WBT	2	3400	680	.20*	310	.09*
WBR	1	1700	220	.13	80	.05
Right Turn Adjustment					NBR	.02*
Clearance Interval				.05*		.05*

Note: Assumes Right-Turn Overlap for SBR NBR EBR

TOTAL CAPACITY UTILIZATION .74 .73

2040 Build

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3400	300	.09*	110	.03
NBT	3	5100	520	.10	610	.12*
NBR	1	1700	100	.06	350	.21
SBL	1	1700	100	.06	250	.15*
SBT	3	5100	810	.16*	480	.09
SBR	2	3400	1240	.36	970	.29
EBL	2	3400	820	.24*	1060	.31*
EBT	2	3400	260	.08	830	.24
EBR	1	1700	330	.19	90	.05
WBL	1	1700	370	.22	120	.07
WBT	2	3400	670	.20*	300	.09*
WBR	1	1700	220	.13	80	.05
Right Turn Adjustment					NBR	.02*
Clearance Interval				.05*		.05*

Note: Assumes Right-Turn Overlap for SBR NBR EBR

TOTAL CAPACITY UTILIZATION .74 .74

30. Cm Capistrano & Del Obispo

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3400	410	.12*	450	.13*
NBT	1	1700	130	.08	110	.06
NBR	1	1700	160	.09	140	.08
SBL	1	1700	50	.03	50	.03
SBT	1	1700	210	.12*	270	.16*
SBR	1	1700	400	.24	390	.23
EBL	1	1700	320	.19*	380	.22*
EBT	2	3400	640	.19	650	.19
EBR	1	1700	240	.14	350	.21
WBL	1	1700	70	.04	200	.12
WBT	2	3400	680	.20*	780	.23*
WBR	1	1700	20	.01	30	.02
Clearance Interval				.05*		.05*
TOTAL CAPACITY UTILIZATION				**.68**		**.79**

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3400	570	.17	460	.14*
NBT	1	1700	790	.46*	400	.24
NBR	1	1700	240	.14	290	.17
SBL	1	1700	60	.04*	70	.04
SBT	2	3400	400	.24	780	.35*
SBR	0	0	700	.41	400	
EBL	2	3400	330	.10	390	.11*
EBT	2	3400	1040	.31*	790	.23
EBR	1	1700	430	.25	420	.25
WBL	2	3400	300	.09*	360	.11
WBT	2	3400	690	.20	860	.25*
WBR	1	1700	70	.04	30	.02
Clearance Interval				.05*		.05*
TOTAL CAPACITY UTILIZATION				**.95**		**.90**

2040 Build

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3400	580	.17	460	.14*
NBT	1	1700	780	.46*	400	.24
NBR	1	1700	240	.14	290	.17
SBL	1	1700	60	.04*	70	.04
SBT	2	3400	400	.24	770	.34*
SBR	0	0	700	.41	400	
EBL	2	3400	330	.10	390	.11*
EBT	2	3400	1040	.31*	790	.23
EBR	1	1700	430	.25	420	.25
WBL	2	3400	300	.09*	360	.11
WBT	2	3400	690	.20	860	.25*
WBR	1	1700	70	.04	30	.02
Clearance Interval				.05*		.05*
TOTAL CAPACITY UTILIZATION				**.95**		**.89**

31. Cm Capistrano & San Juan Crk

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	0	0	0		0	
NBT	2	3400	310	.09*	390	.11*
NBR	1	1700	300	.18	320	.19
SBL	2	3400	220	.06*	320	.09*
SBT	2	3400	390	.11	510	.15
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	0	0	0		0	
EBR	0	0	0		0	
WBL	1.5		460		480	
WBT	0	5100	0	{.16}*	0	{.15}*
WBR	1.5		450		420	
Clearance Interval				.05*		.05*

TOTAL CAPACITY UTILIZATION .36 .40

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	0	0	0		0	
NBT	2	3400	860	.25*	800	.24*
NBR	1	1700	510	.30	550	.32
SBL	2	3400	240	.07*	620	.18*
SBT	2	3400	700	.21	1080	.32
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	0	0	0		0	
EBR	0	0	0		0	
WBL	1.5		880		790	.23*
WBT	0	5100	0	{.28}*	0	
WBR	1.5		620		550	{.19}
Clearance Interval				.05*		.05*

TOTAL CAPACITY UTILIZATION .65 .70

2040 Build

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	0	0	0		0	
NBT	2	3400	860	.25*	800	.24*
NBR	1	1700	510	.30	550	.32
SBL	2	3400	240	.07*	620	.18*
SBT	2	3400	700	.21	1080	.32
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	0	0	0		0	
EBR	0	0	0		0	
WBL	1.5		880		790	.23*
WBT	0	5100	0	{.28}*	0	
WBR	1.5		620		550	{.19}
Clearance Interval				.05*		.05*

TOTAL CAPACITY UTILIZATION .65 .70

32. Valle & San Juan Creek

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	0	0	310		410	
NBT	1	1700	0	.28*	0	.35*
NBR	0	0	170		190	
SBL	0	0	0		0	
SBT	0	0	0		0	
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	1	1700	290	.17	290	.17
EBR	1	1700	230	.14	420	.25
WBL	1	1700	130	.08	50	.03
WBT	1	1700	600	.35*	420	.25*
WBR	0	0	0		0	
Clearance Interval				.05*		.05*

TOTAL CAPACITY UTILIZATION .68 .65

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1700	560	.33*	510	.30*
NBT	0	0	0		0	
NBR	1	1700	210	.12	310	.18
SBL	0	0	0		0	
SBT	0	0	0		0	
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	1	1700	390	.23*	590	.35*
EBR	1	1700	360	.21	590	.35
WBL	1	1700	240	.14*	150	.09*
WBT	2	3400	940	.28	830	.24
WBR	0	0	0		0	
Clearance Interval				.05*		.05*

TOTAL CAPACITY UTILIZATION .75 .79

2040 Build

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1700	560	.33*	510	.30*
NBT	0	0	0		0	
NBR	1	1700	210	.12	310	.18
SBL	0	0	0		0	
SBT	0	0	0		0	
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	1	1700	390	.23*	590	.35*
EBR	1	1700	360	.21	590	.35
WBL	1	1700	240	.14*	150	.09*
WBT	2	3400	940	.28	830	.24
WBR	0	0	0		0	
Clearance Interval				.05*		.05*

TOTAL CAPACITY UTILIZATION .75 .79

33. La Novia & San Juan Creek

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1700	120	.07	60	.04
NBT	1	1700	160	.09*	130	.08*
NBR	1	1700	60	.04	40	.02
SBL	1	1700	210	.12*	140	.08*
SBT	1	1700	90	.05	140	.08
SBR	1	1700	300	.18	240	.14
EBL	1	1700	130	.08*	200	.12*
EBT	1	1700	140	.08	150	.09
EBR	1	1700	40	.02	120	.07
WBL	1	1700	40	.02	10	.01
WBT	1	1700	230	.14*	70	.04*
WBR	1	1700	260	.15	130	.08
Clearance Interval				.05*		.05*

TOTAL CAPACITY UTILIZATION .48 .37

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1700	170	.10	150	.09
NBT	1	1700	270	.16*	170	.10*
NBR	1	1700	100	.06	50	.03
SBL	1	1700	290	.17*	320	.19*
SBT	1	1700	170	.10	270	.16
SBR	1	1700	590	.35	390	.23
EBL	1	1700	240	.14*	370	.22*
EBT	1	1700	270	.16	310	.18
EBR	1	1700	60	.04	150	.09
WBL	1	1700	60	.04	70	.04
WBT	1	1700	410	.24*	300	.18*
WBR	1	1700	420	.25	250	.15
Right Turn Adjustment			SBR	.01*		
Clearance Interval				.05*		.05*

TOTAL CAPACITY UTILIZATION .77 .74

2040 Build

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1700	170	.10	150	.09
NBT	1	1700	270	.16*	170	.10*
NBR	1	1700	100	.06	50	.03
SBL	1	1700	290	.17*	320	.19*
SBT	1	1700	170	.10	270	.16
SBR	1	1700	580	.34	380	.22
EBL	1	1700	240	.14*	360	.21*
EBT	1	1700	270	.16	310	.18
EBR	1	1700	60	.04	150	.09
WBL	1	1700	60	.04	70	.04
WBT	1	1700	410	.24*	300	.18*
WBR	1	1700	420	.25	250	.15
Clearance Interval				.05*		.05*

TOTAL CAPACITY UTILIZATION .76 .73

34. Del Obispo & Stonehill

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1700	110	.06	110	.06
NBT	2	3400	190	.09*	280	.11*
NBR	0	0	130		100	
SBL	1	1700	330	.19*	250	.15*
SBT	2	3400	310	.13	300	.12
SBR	0	0	140		120	
EBL	1	1700	160	.09	130	.08*
EBT	2	3400	1080	.32*	720	.21
EBR	1	1700	100	.06	80	.05
WBL	1	1700	70	.04*	160	.09
WBT	2	3400	480	.14	880	.26*
WBR	1	1700	180	.11	370	.22
Clearance Interval				.05*		.05*

TOTAL CAPACITY UTILIZATION .69 .65

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1700	110	.06	150	.09
NBT	2	3400	190	.10*	380	.15*
NBR	0	0	150		120	
SBL	1	1700	340	.20*	250	.15*
SBT	2	3400	400	.16	470	.17
SBR	0	0	140		120	
EBL	1	1700	160	.09	190	.11*
EBT	2	3400	1360	.40*	730	.21
EBR	1	1700	100	.06	120	.07
WBL	1	1700	70	.04*	230	.14
WBT	2	3400	500	.15	880	.26*
WBR	1	1700	220	.13	520	.31
Clearance Interval				.05*		.05*

TOTAL CAPACITY UTILIZATION .79 .72

2040 Build

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1700	110	.06	150	.09
NBT	2	3400	190	.10*	380	.15*
NBR	0	0	150		120	
SBL	1	1700	340	.20*	250	.15*
SBT	2	3400	400	.16	470	.17
SBR	0	0	140		120	
EBL	1	1700	160	.09	190	.11*
EBT	2	3400	1360	.40*	730	.21
EBR	1	1700	100	.06	120	.07
WBL	1	1700	70	.04*	230	.14
WBT	2	3400	500	.15	880	.26*
WBR	1	1700	220	.13	520	.31
Clearance Interval				.05*		.05*

TOTAL CAPACITY UTILIZATION .79 .72

35. Cm Capistrano & Stonehill

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1.5		310	{.16}*	550	{.24}*
NBT	0.5	3400	230	.16	260	.24
NBR	1	1700	210	.12	280	.16
SBL	1	1700	50	.03	180	.11
SBT	2	3400	250	.07*	750	.22*
SBR	2	3400	600	.18	990	.29
EBL	1	1700	210	.12	180	.11
EBT	2	3400	1240	.36*	590	.17*
EBR	1	1700	290	.17	340	.20
WBL	0	0	0		0	
WBT	0	0	0		0	
WBR	0	0	0		0	
Clearance Interval				.05*		.05*
TOTAL CAPACITY UTILIZATION				**.64**		**.68**

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1.5		340	.20	370	.22*
NBT	0.5	3400	750	.44*	430	.25
NBR	1	1700	210	.12	520	.31
SBL	1	1700	60	.04*	270	.16
SBT	2	3400	590	.17	1040	.31*
SBR	2	3400	780	.23	1170	.34
EBL	1	1700	510	.30	390	.23
EBT	2	3400	1250	.37*	880	.26*
EBR	1	1700	290	.17	410	.24
WBL	0	0	0		0	
WBT	0	0	0		0	
WBR	0	0	0		0	
Clearance Interval				.05*		.05*
TOTAL CAPACITY UTILIZATION				**.90**		**.84**

2040 Build

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1.5		340	.20	370	.22*
NBT	0.5	3400	750	.44*	430	.25
NBR	1	1700	210	.12	520	.31
SBL	1	1700	60	.04*	270	.16
SBT	2	3400	590	.17	1040	.31*
SBR	2	3400	780	.23	1170	.34
EBL	1	1700	510	.30	390	.23
EBT	2	3400	1250	.37*	880	.26*
EBR	1	1700	290	.17	410	.24
WBL	0	0	0		0	
WBT	0	0	0		0	
WBR	0	0	0		0	
Clearance Interval				.05*		.05*
TOTAL CAPACITY UTILIZATION				**.90**		**.84**

36. Cm Mira Costa & Cm Estrella

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	30	.02*	40	.03*
NBT	0	0	0		0	
NBR	1	1600	360	.23	340	.21
SBL	0	0	0		0	
SBT	0	0	0		0	
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	2	3200	180	.06*	200	.08*
EBR	0	0	20		40	
WBL	1	1600	240	.15*	260	.16*
WBT	2	3200	250	.08	380	.12
WBR	0	0	0		0	
Right Turn Adjustment			NBR	.10*	NBR	.06*

TOTAL CAPACITY UTILIZATION .33 .33

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	40	.03*	40	.03*
NBT	0	0	0		0	
NBR	1	1600	400	.25	370	.23
SBL	0	0	0		0	
SBT	0	0	0		0	
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	2	3200	170	.06*	240	.09*
EBR	0	0	30		50	
WBL	1	1600	250	.16*	260	.16*
WBT	2	3200	290	.09	390	.12
WBR	0	0	0		0	
Right Turn Adjustment			NBR	.10*	NBR	.08*

TOTAL CAPACITY UTILIZATION .35 .36

2040 Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	40	.03*	40	.03*
NBT	0	0	0		0	
NBR	1	1600	400	.25	370	.23
SBL	0	0	0		0	
SBT	0	0	0		0	
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	2	3200	170	.06*	240	.09*
EBR	0	0	30		50	
WBL	1	1600	250	.16*	260	.16*
WBT	2	3200	290	.09	390	.12
WBR	0	0	0		0	
Right Turn Adjustment			NBR	.10*	NBR	.08*

TOTAL CAPACITY UTILIZATION .35 .36

37. Avd Vaquero & Cm De Los Mares

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1.5		230	{.08}*	130	{.07}*
NBT	0	3200	0	.08	0	.07
NBR	0.5		30		80	
SBL	0	0	0		0	
SBT	0	0	0		0	
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	2	3200	430	.13	850	.27*
EBR	1	1600	130	.08	290	.18
WBL	1	1600	60	.04	60	.04*
WBT	2	3200	910	.28*	520	.16
WBR	0	0	0		0	

TOTAL CAPACITY UTILIZATION .36 .38

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1.5		290	{.11}*	150	{.07}*
NBT	0	3200	0	.11	0	.07
NBR	0.5		50		80	
SBL	0	0	0		0	
SBT	0	0	0		0	
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	2	3200	480	.15	920	.29*
EBR	1	1600	150	.09	300	.19
WBL	1	1600	50	.03	80	.05*
WBT	2	3200	1050	.33*	570	.18
WBR	0	0	0		0	

TOTAL CAPACITY UTILIZATION .44 .41

2040 Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1.5		290	{.11}*	150	{.07}*
NBT	0	3200	0	.11	0	.07
NBR	0.5		50		80	
SBL	0	0	0		0	
SBT	0	0	0		0	
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	2	3200	480	.15	920	.29*
EBR	1	1600	150	.09	300	.19
WBL	1	1600	50	.03	80	.05*
WBT	2	3200	1040	.33*	570	.18
WBR	0	0	0		0	

TOTAL CAPACITY UTILIZATION .44 .41

38. Cm Vera Cruz & Cm De Los Mares

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1.5		480	{.16}*	310	{.10}*
NBT	0.5	3200	20	.16	10	.10
NBR	1	1600	40	.03	60	.04
SBL	0	0	0		0	
SBT	1	1600	10	.02*	10	.02*
SBR	0	0	20		20	
EBL	1	1600	10	.01*	20	.01
EBT	2	3200	110	.03	340	.11*
EBR	1	1600	310	.19	450	.28
WBL	1	1600	110	.07	60	.04*
WBT	2	3200	350	.11*	190	.06
WBR	d	1600	0	.00	0	.00
Right Turn Adjustment			EBR	.02*	EBR	.09*

TOTAL CAPACITY UTILIZATION .32 .36

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1.5		510	{.17}*	280	{.09}*
NBT	0.5	3200	20	.17	10	.09
NBR	1	1600	30	.02	20	.01
SBL	0	0	0		10	
SBT	1	1600	20	.02*	10	.03*
SBR	0	0	10		20	
EBL	1	1600	10	.01*	100	.06
EBT	2	3200	170	.05	430	.13*
EBR	1	1600	330	.21	420	.26
WBL	1	1600	80	.05	50	.03*
WBT	2	3200	450	.14*	280	.09
WBR	d	1600	10	.01	10	.01
Right Turn Adjustment					EBR	.06*

TOTAL CAPACITY UTILIZATION .34 .34

2040 Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1.5		510	{.17}*	280	{.09}*
NBT	0.5	3200	20	.17	10	.09
NBR	1	1600	30	.02	20	.01
SBL	0	0	0		10	
SBT	1	1600	20	.02*	10	.03*
SBR	0	0	10		20	
EBL	1	1600	10	.01*	100	.06
EBT	2	3200	170	.05	430	.13*
EBR	1	1600	330	.21	420	.26
WBL	1	1600	80	.05	50	.03*
WBT	2	3200	460	.14*	280	.09
WBR	d	1600	10	.01	10	.01
Right Turn Adjustment					EBR	.06*

TOTAL CAPACITY UTILIZATION .34 .34

39. Cm Del Rio & Cm De Los Mares

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	270	.17*	130	.08*
NBT	1	1600	20	.01	10	.01
NBR	1	1600	10	.01	0	.00
SBL	0	0	0		0	
SBT	1	1600	10	.05*	0	.03*
SBR	0	0	70		50	
EBL	0.5		20		70	
EBT	1.5	3200	20	.03*	50	.08*
EBR	0		80	.05	190	.12
WBL	0.5		0		10	{.01}*
WBT	1.5	3200	40	.01	30	.01
WBR	0	0	0		0	

TOTAL CAPACITY UTILIZATION .25 .20

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	400	.25*	240	.15*
NBT	1	1600	50	.03	110	.07
NBR	1	1600	20	.01	10	.01
SBL	0	0	10		10	
SBT	1	1600	80	.10*	30	.06*
SBR	0	0	70		50	
EBL	0.5		10	{.01}*	50	
EBT	1.5	3200	10	.01	50	.06*
EBR	0		180	.11	340	.21
WBL	0.5		30		10	{.01}*
WBT	1.5	3200	30	.02*	20	.01
WBR	0		10		10	
Right Turn Adjustment					EBR	.04*

TOTAL CAPACITY UTILIZATION .38 .32

2040 Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	400	.25*	240	.15*
NBT	1	1600	50	.03	110	.07
NBR	1	1600	20	.01	10	.01
SBL	0	0	10		10	
SBT	1	1600	80	.10*	30	.06*
SBR	0	0	70		50	
EBL	0.5		10	{.01}*	50	
EBT	1.5	3200	10	.01	50	.06*
EBR	0		180	.11	340	.21
WBL	0.5		30		10	{.01}*
WBT	1.5	3200	30	.02*	20	.01
WBR	0		10		10	
Right Turn Adjustment					EBR	.04*

TOTAL CAPACITY UTILIZATION .38 .32

40. Cm Vera Cruz & Avd Vista Hermosa

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	150	.09*	250	.16*
NBT	2	3200	210	.08	330	.11
NBR	0	0	30		10	
SBL	1	1600	170	.11	210	.13
SBT	2	3200	260	.16*	260	.15*
SBR	0	0	360	.23	210	
EBL	1	1600	220	.14*	270	.17*
EBT	2	3200	1020	.32	690	.22
EBR	1	1600	380	.24	160	.10
WBL	1	1600	20	.01	10	.01
WBT	2	3200	1000	.31*	790	.25*
WBR	1	1600	120	.08	180	.11

TOTAL CAPACITY UTILIZATION .70 .73

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	140	.09*	110	.07
NBT	2	3200	190	.08	270	.10*
NBR	0	0	50		40	
SBL	1	1600	180	.11	260	.16*
SBT	2	3200	290	.18*	230	.14
SBR	0	0	360	.23	230	
EBL	1	1600	200	.13*	270	.17*
EBT	2	3200	1220	.38	790	.25
EBR	1	1600	340	.21	180	.11
WBL	1	1600	20	.01	10	.01
WBT	2	3200	1090	.34*	950	.30*
WBR	1	1600	200	.13	210	.13

TOTAL CAPACITY UTILIZATION .74 .73

2040 Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	140	.09*	110	.07
NBT	2	3200	180	.07	250	.09*
NBR	0	0	50		40	
SBL	1	1600	160	.10	240	.15*
SBT	2	3200	260	.16*	210	.13
SBR	0	0	380	.24	240	.15
EBL	1	1600	210	.13*	280	.18*
EBT	2	3200	1240	.39	810	.25
EBR	1	1600	340	.21	180	.11
WBL	1	1600	20	.01	10	.01
WBT	2	3200	1110	.35*	960	.30*
WBR	1	1600	180	.11	190	.12

TOTAL CAPACITY UTILIZATION .73 .72

41. La Pata & Avd Vista Hermosa

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3200	47	.01*	283	.09*
NBT	3	4800	83	.02	63	.01
NBR	1	1600	18	.01	76	.05
SBL	1	1600	7	.00	7	.00
SBT	3	4800	61	.01*	52	.01*
SBR	1	1600	346	.22	100	.06
EBL	1	1600	70	.04*	130	.08*
EBT	2	3200	507	.16	570	.18
EBR	1	1600	219	.14	115	.07
WBL	2	3200	76	.02	77	.02
WBT	2	3200	708	.22*	549	.17*
WBR	1	1600	18	.01	16	.01
Right Turn Adjustment			SBR	.18*		

TOTAL CAPACITY UTILIZATION .46 .35

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3200	60	.02	300	.09
NBT	3	4800	200	.04*	650	.14*
NBR	1	1600	50	.03	190	.12
SBL	1	1600	240	.15*	130	.08*
SBT	3	4800	590	.12	220	.05
SBR	1	1600	510	.32	220	.14
EBL	1	1600	190	.12*	230	.14*
EBT	2	3200	570	.18	590	.18
EBR	1	1600	290	.18	160	.10
WBL	2	3200	110	.03	150	.05
WBT	2	3200	680	.21*	700	.22*
WBR	1	1600	240	.15	230	.14
Right Turn Adjustment			SBR	.06*		

TOTAL CAPACITY UTILIZATION .58 .58

2040 Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3200	60	.02	300	.09
NBT	3	4800	190	.04*	610	.13*
NBR	1	1600	50	.03	190	.12
SBL	1	1600	230	.14*	120	.08*
SBT	3	4800	550	.11	200	.04
SBR	1	1600	480	.30	210	.13
EBL	1	1600	180	.11*	220	.14*
EBT	2	3200	590	.18	610	.19
EBR	1	1600	290	.18	160	.10
WBL	2	3200	110	.03	150	.05
WBT	2	3200	710	.22*	720	.23*
WBR	1	1600	220	.14	220	.14
Right Turn Adjustment			SBR	.06*		

TOTAL CAPACITY UTILIZATION .57 .58

42. N. El Cm Real & Avd Pico

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	20	.01	30	.02
NBT	2	3200	420	.16*	390	.16*
NBR	0	0	90		130	
SBL	1	1600	200	.13*	180	.11*
SBT	2	3200	290	.10	450	.16
SBR	0	0	40		50	
EBL	1	1600	100	.06	60	.04
EBT	1	1600	130	.09*	130	.10*
EBR	0	0	20		30	
WBL	1.5		90	.06*	150	{.09}*
WBT	0.5	3200	90	.06	140	.09
WBR	1	1600	220	.14	200	.13

TOTAL CAPACITY UTILIZATION .44 .46

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	20	.01	30	.02
NBT	2	3200	600	.27*	560	.30*
NBR	0	0	270		410	
SBL	2	3200	270	.08*	310	.10*
SBT	2	3200	370	.13	570	.19
SBR	0	0	40		50	
EBL	1	1600	100	.06	60	.04
EBT	1	1600	190	.14*	160	.13*
EBR	0	0	30		40	
WBL	2	3200	200	.06*	530	.17*
WBT	1	1600	100	.06	200	.13
WBR	1	1600	270	.17	240	.15

TOTAL CAPACITY UTILIZATION .55 .70

2040 Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	20	.01	30	.02
NBT	2	3200	580	.27*	540	.30*
NBR	0	0	290		430	
SBL	2	3200	280	.09*	330	.10*
SBT	2	3200	350	.12	540	.18
SBR	0	0	40		50	
EBL	1	1600	90	.06	60	.04
EBT	1	1600	200	.14*	160	.13*
EBR	0	0	30		40	
WBL	2	3200	220	.07*	560	.18*
WBT	1	1600	100	.06	200	.13
WBR	1	1600	280	.18	260	.16

TOTAL CAPACITY UTILIZATION .57 .71

43. La Pata & Avd Pico

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	50	.03	290	.18*
NBT	3	4800	90	.02*	280	.06
NBR	d	1600	50	.03	70	.04
SBL	1	1600	140	.09*	220	.14
SBT	3	4800	250	.05	100	.02*
SBR	d	1600	90	.06	130	.08
EBL	2	3200	110	.03*	160	.05*
EBT	3	4800	440	.09	530	.11
EBR	1	1600	180	.11	100	.06
WBL	2	3200	90	.03	50	.02
WBT	3	4800	520	.11*	550	.11*
WBR	1	1600	20	.01	60	.04
Right Turn Adjustment					SBR	.02*

TOTAL CAPACITY UTILIZATION .25 .38

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	40	.03	210	.13
NBT	3	4800	120	.03*	470	.10*
NBR	d	1600	180	.11	220	.14
SBL	2	3200	560	.18*	340	.11*
SBT	2	3200	410	.13	100	.03
SBR	1	1600	190	.12	130	.08
EBL	2	3200	120	.04	270	.08*
EBT	3	4800	740	.15*	860	.18
EBR	1	1600	120	.08	80	.05
WBL	2	3200	230	.07*	160	.05
WBT	3	4800	820	.17	860	.18*
WBR	1	1600	40	.03	290	.18
Right Turn Adjustment			NBR	.03*		

TOTAL CAPACITY UTILIZATION .46 .47

2040 Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	40	.03	220	.14
NBT	3	4800	120	.03*	490	.10*
NBR	d	1600	180	.11	220	.14
SBL	2	3200	550	.17*	340	.11*
SBT	2	3200	430	.13	110	.03
SBR	1	1600	200	.13	140	.09
EBL	2	3200	120	.04	280	.09*
EBT	3	4800	740	.15*	860	.18
EBR	1	1600	130	.08	80	.05
WBL	2	3200	230	.07*	160	.05
WBT	3	4800	820	.17	860	.18*
WBR	1	1600	40	.03	280	.18
Right Turn Adjustment			NBR	.03*		

TOTAL CAPACITY UTILIZATION .45 .48

44. Avd Vista Hermosa & Avd Pico

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3200	50	.02*	130	.04
NBT	2	3200	20	.01	120	.04*
NBR	0	0	0		0	
SBL	2	3200	170	.05	80	.03*
SBT	1	1600	130	.08*	20	.01
SBR	2	3200	290	.09	180	.06
EBL	2	3200	180	.06*	230	.07*
EBT	3	4800	170	.04	210	.04
EBR	1	1600	130	.08	50	.03
WBL	1	1600	10	.01	10	.01
WBT	3	4800	280	.08*	280	.09*
WBR	0	0	120		150	.09

TOTAL CAPACITY UTILIZATION .24 .23

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3200	50	.02*	90	.03
NBT	2	3200	30	.01	210	.07*
NBR	0	0	0		10	
SBL	2	3200	440	.14	310	.10*
SBT	1	1600	280	.18*	30	.02
SBR	2	3200	590	.18	250	.08
EBL	2	3200	310	.10*	430	.13*
EBT	3	4800	1010	.21	530	.11
EBR	1	1600	100	.06	40	.03
WBL	1	1600	10	.01	10	.01
WBT	3	4800	450	.14*	950	.30*
WBR	0	0	400	.25	590	.37

TOTAL CAPACITY UTILIZATION .44 .60

2040 Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3200	50	.02*	90	.03
NBT	2	3200	30	.01	210	.07*
NBR	0	0	0		10	
SBL	2	3200	440	.14	310	.10*
SBT	1	1600	280	.18*	30	.02
SBR	2	3200	590	.18	250	.08
EBL	2	3200	310	.10*	430	.13*
EBT	3	4800	1010	.21	530	.11
EBR	1	1600	100	.06	40	.03
WBL	1	1600	10	.01	10	.01
WBT	3	4800	450	.14*	950	.30*
WBR	0	0	400	.25	590	.37

TOTAL CAPACITY UTILIZATION .44 .60

45. N. El Cm Real & Avd Palizada

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	10	.01	20	.01
NBT	2	3200	340	.13*	470	.18*
NBR	0	0	90		90	
SBL	1	1600	120	.08*	90	.06*
SBT	2	3200	260	.09	620	.22
SBR	0	0	30		80	
EBL	1	1600	80	.05	130	.08
EBT	1	1600	230	.15*	230	.16*
EBR	0	0	10		20	
WBL	1	1600	210	.13*	300	.19*
WBT	1	1600	170	.11	330	.21
WBR	1	1600	100	.06	150	.09

TOTAL CAPACITY UTILIZATION .49 .59

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	10	.01	30	.02
NBT	2	3200	400	.16*	620	.23*
NBR	0	0	110		120	
SBL	1	1600	120	.08*	100	.06*
SBT	2	3200	360	.13	680	.24
SBR	0	0	40		80	
EBL	1	1600	120	.08	150	.09
EBT	1	1600	280	.19*	280	.19*
EBR	0	0	20		20	
WBL	1	1600	210	.13*	350	.22*
WBT	1	1600	180	.11	410	.26
WBR	1	1600	100	.06	140	.09

TOTAL CAPACITY UTILIZATION .56 .70

2040 Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	10	.01	30	.02
NBT	2	3200	400	.16*	620	.23*
NBR	0	0	100		110	
SBL	1	1600	130	.08*	110	.07*
SBT	2	3200	370	.13	690	.24
SBR	0	0	40		90	
EBL	1	1600	130	.08	160	.10
EBT	1	1600	270	.18*	270	.18*
EBR	0	0	20		20	
WBL	1	1600	200	.13*	320	.20*
WBT	1	1600	180	.11	400	.25
WBR	1	1600	100	.06	150	.09

TOTAL CAPACITY UTILIZATION .55 .68

46. Cm Estrella & Avd Palizada

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	10	.01	20	.01
NBT	1	1600	100	.08*	130	.10*
NBR	0	0	20		30	
SBL	1	1600	260	.16*	220	.14*
SBT	1	1600	60	.06	150	.12
SBR	0	0	30		40	
EBL	0.5		20		30	{.02}*
EBT	1.5	3200	400	.13*	380	.14
EBR	0		10		30	
WBL	1	1600	140	.09*	190	.12
WBT	2	3200	410	.21	670	.29*
WBR	0	0	260		260	

TOTAL CAPACITY UTILIZATION .46 .55

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	10	.01	20	.01
NBT	1	1600	120	.09*	180	.14*
NBR	0	0	20		40	
SBL	1	1600	260	.16*	210	.13*
SBT	1	1600	90	.08	170	.13
SBR	0	0	30		40	
EBL	0.5		20		30	{.02}*
EBT	1.5	3200	430	.15*	400	.15
EBR	0		20		60	
WBL	1	1600	200	.13*	200	.13
WBT	2	3200	420	.21	700	.30*
WBR	0	0	260		270	

TOTAL CAPACITY UTILIZATION .53 .59

2040 Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	10	.01	20	.01
NBT	1	1600	120	.09*	180	.14*
NBR	0	0	20		40	
SBL	1	1600	260	.16*	220	.14*
SBT	1	1600	90	.08	160	.13
SBR	0	0	30		40	
EBL	0.5		20		30	{.02}*
EBT	1.5	3200	420	.14*	390	.15
EBR	0		20		60	
WBL	1	1600	200	.13*	210	.13
WBT	2	3200	410	.21	690	.30*
WBR	0	0	260		270	

TOTAL CAPACITY UTILIZATION .52 .60

47. N. El Cm Real & Avd Presidio/Victoria

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	0	.00	10	.01
NBT	2	3200	250	.08*	400	.13*
NBR	1	1600	220	.14	230	.14
SBL	1	1600	360	.23*	300	.19*
SBT	2	3200	230	.08	470	.15
SBR	0	0	40		10	
EBL	0	0	0		0	
EBT	0	0	0		0	
EBR	0	0	0		0	
WBL	1	1600	90	.06*	150	.09*
WBT	0	0	30		20	
WBR	1	1600	80	.05	150	.09
Right Turn Adjustment			NBR	.01*		

TOTAL CAPACITY UTILIZATION .38 .41

2040 No-Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	10	.01	10	.01
NBT	2	3200	280	.09*	460	.14*
NBR	1	1600	210	.13	240	.15
SBL	1	1600	470	.29*	370	.23*
SBT	2	3200	290	.10	480	.15
SBR	0	0	40		10	
EBL	0	0	0		0	
EBT	0	0	0		0	
EBR	0	0	0		0	
WBL	1	1600	100	.06*	150	.09*
WBT	0	0	30		20	
WBR	1	1600	110	.07	260	.16

TOTAL CAPACITY UTILIZATION .44 .46

2040 Build Scenario

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	10	.01	10	.01
NBT	2	3200	280	.09*	460	.14*
NBR	1	1600	220	.14	250	.16
SBL	1	1600	460	.29*	360	.23*
SBT	2	3200	290	.10	480	.15
SBR	0	0	40		10	
EBL	0	0	0		0	
EBT	0	0	0		0	
EBR	0	0	0		0	
WBL	1	1600	100	.06*	160	.10*
WBT	0	0	30		20	
WBR	1	1600	110	.07	250	.16

TOTAL CAPACITY UTILIZATION .44 .47

APPENDIX G

INTERSECTION QUEUE WORKSHEETS

Intersection: 4: Ortega Hwy & I-5 NB Ramp

Movement	EB	EB	EB	EB	EB	WB	WB	WB	NB	NB	SB
Directions Served	L	T	T	T	R	T	T	TR	LTR	R	LR
Maximum Queue (ft)	123	192	192	192	169	677	811	753	497	518	23
Average Queue (ft)	11	191	192	187	11	333	762	726	339	269	10
95th Queue (ft)	61	196	193	200	81	648	841	751	504	450	27
Link Distance (ft)		132	132	132	132	698	698	698	940		482
Upstream Blk Time (%)	0	43	88	50	0		11	19			
Queuing Penalty (veh)	0	278	576	328	1		85	149			
Storage Bay Dist (ft)	200									500	
Storage Blk Time (%)	0	43							0	0	
Queuing Penalty (veh)	0	4							1	0	

Intersection: 5: I-5 SB Ramp & Camino Capistrano

Movement	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	R	T	TR	L	L	T
Maximum Queue (ft)	398	362	824	825	272	284	487
Average Queue (ft)	398	176	611	679	158	215	472
95th Queue (ft)	399	370	867	958	246	325	489
Link Distance (ft)	383		810	810			461
Upstream Blk Time (%)	38		3	7			18
Queuing Penalty (veh)	0		0	0			290
Storage Bay Dist (ft)		250			250	250	
Storage Blk Time (%)	39	0			2	2	25
Queuing Penalty (veh)	106	1			15	15	157

Intersection: 6: I-5 NB Ramp & Valle

Movement	EB	EB	NB	NB	SB
Directions Served	L	R	L	T	TR
Maximum Queue (ft)	457	438	144	506	133
Average Queue (ft)	372	275	103	259	91
95th Queue (ft)	589	579	166	569	133
Link Distance (ft)	423			484	1216
Upstream Blk Time (%)	73	6		17	
Queuing Penalty (veh)	0	0		0	
Storage Bay Dist (ft)		680	100		
Storage Blk Time (%)	73	6	22	31	
Queuing Penalty (veh)	51	24	29	87	

Intersection: 7: SR-1/Camino Las Ramblas & I-5 SB Ramp

Movement	NB	NB	NB	SB	SB	SE	SE
Directions Served	T	T	R	T	R	L	L
Maximum Queue (ft)	100	422	596	410	429	70	44
Average Queue (ft)	52	76	76	396	353	32	23
95th Queue (ft)	91	233	395	451	582	57	47
Link Distance (ft)	1210	1210	1210	790	790	1647	1647
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 8: SR-1/Camino Las Ramblas & Camino De Vista

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	T	T	T	TR	LT	R	L	R
Maximum Queue (ft)	28	95	98	112	95	75	134	75	23	18
Average Queue (ft)	9	55	41	62	46	27	53	30	6	13
95th Queue (ft)	31	82	88	99	78	61	95	63	23	26
Link Distance (ft)		188	188	977	977	977	1429		187	187
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	310							260		
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 9: I-5 SB Ramp & Camino De Estrella/Camino De Los Mares

Movement	EB	EB	EB	NE	NE	NE	SW	SW	SW
Directions Served	L	LT	R	T	T	R	L	T	T
Maximum Queue (ft)	246	254	73	151	137	65	202	74	56
Average Queue (ft)	106	127	42	94	79	29	130	46	29
95th Queue (ft)	191	194	65	139	128	53	201	71	57
Link Distance (ft)		1690		747	747			434	434
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	500		680			150	320		
Storage Blk Time (%)					0				
Queuing Penalty (veh)					0				

Intersection: 10: Calle Naranja & Camino De Estrella/Camino De Los Mares

Movement	SE	SE	NW	NW	NE	NE	NE	SW	SW	SW
Directions Served	L	R	LR	R	T	T	T	T	T	T
Maximum Queue (ft)	73	110	158	134	116	124	137	242	200	152
Average Queue (ft)	52	61	112	51	87	83	64	155	132	98
95th Queue (ft)	77	101	160	93	135	141	129	210	191	155
Link Distance (ft)	490	490	1382		207	207	207	981	981	981
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)				730						
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 11: I-5 SB Ramp & Vista Hermosa

Movement	EB	EB	EB	NB	NB	NB	NB	SB	SB	SB
Directions Served	L	LR	R	L	T	T	T	T	T	R
Maximum Queue (ft)	343	1785	524	71	117	131	73	205	181	166
Average Queue (ft)	320	923	134	33	79	74	27	110	83	28
95th Queue (ft)	349	1903	450	72	122	128	60	192	155	113
Link Distance (ft)		1770			637	637	637	770	770	
Upstream Blk Time (%)		1								
Queuing Penalty (veh)		0								
Storage Bay Dist (ft)	300		500	160						140
Storage Blk Time (%)	22	6	1						1	
Queuing Penalty (veh)	180	41	16						2	

Intersection: 12: I-5 NB Ramp & Vista Hermosa

Movement	NW	NW	NW	NE	NE	SW	SW
Directions Served	L	LR	R	T	T	T	TR
Maximum Queue (ft)	65	261	146	152	151	150	264
Average Queue (ft)	26	118	96	82	86	48	73
95th Queue (ft)	64	215	165	150	156	105	185
Link Distance (ft)	1295	1295		770	770	309	309
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)			120				
Storage Blk Time (%)		4	5				
Queuing Penalty (veh)		8	13				

Intersection: 13: I-5 SB Ramp & Pico

Movement	SE	SE	SE	NE	NE	NE	NE	NE	SW	SW	SW	SW
Directions Served	L	LT	R	T	T	T	T	R	L	L	T	T
Maximum Queue (ft)	328	332	118	70	119	196	176	108	205	169	54	75
Average Queue (ft)	225	222	69	42	29	127	103	50	113	109	40	36
95th Queue (ft)	326	329	109	76	86	192	175	95	185	171	57	79
Link Distance (ft)	1848	1848		842	842	842	842		351	351	351	351
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)			800					175				
Storage Blk Time (%)							0					
Queuing Penalty (veh)							1					

Intersection: 14: I-5 NB Ramp & Pico

Movement	NW	NW	NW	NE	NE	NE	NE	SW	SW	SW	SW	SW
Directions Served	<	R	R	L	L	T	T	T	T	T	T	R
Maximum Queue (ft)	137	156	140	167	164	30	27	114	100	70	71	21
Average Queue (ft)	88	118	102	99	91	5	4	58	40	58	38	3
95th Queue (ft)	136	161	145	166	148	17	18	95	89	74	63	14
Link Distance (ft)	1115			351	351	351	351	1325	1325	1325	1325	1325
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)		400	400									
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 15: I-5 SB Ramp & Avenida Palizada/De La Paz

Movement	SE	SE	NE	NE	SW	SW
Directions Served	LR	R	T	T	T	T
Maximum Queue (ft)	1360	436	182	136	80	74
Average Queue (ft)	665	307	148	90	25	41
95th Queue (ft)	1413	589	170	129	65	70
Link Distance (ft)	1345		124	124	265	265
Upstream Blk Time (%)	2		30	1		
Queuing Penalty (veh)	0		103	5		
Storage Bay Dist (ft)		410				
Storage Blk Time (%)	20	1				
Queuing Penalty (veh)	70	5				

Intersection: 32: San Juan Creek & Valle

Movement	EB	EB	WB	WB	WB	NB	NB
Directions Served	T	R	L	T	T	L	R
Maximum Queue (ft)	396	126	305	812	814	343	1230
Average Queue (ft)	203	96	276	811	804	323	1147
95th Queue (ft)	377	157	402	816	829	336	1365
Link Distance (ft)	377			797	797		1216
Upstream Blk Time (%)	1			73	42		42
Queuing Penalty (veh)	8			0	0		223
Storage Bay Dist (ft)		100	280			300	
Storage Blk Time (%)	24	0	0	84		80	
Queuing Penalty (veh)	86	2	0	202		169	

Intersection: 35: Stonehill & Cm Capistrano

Movement	EB	EB	EB	EB	NB	NB	NB	SB	SB	SB	SB	SB
Directions Served	L	T	T	R	L	LT	R	L	T	T	R	R
Maximum Queue (ft)	210	871	843	575	274	1287	1287	235	1194	1200	396	118
Average Queue (ft)	182	712	641	188	153	1287	1100	47	691	752	311	62
95th Queue (ft)	223	845	842	569	302	1287	1539	171	1085	1266	531	103
Link Distance (ft)		965	965			1272	1272		1185	1185		
Upstream Blk Time (%)						61	29		2	6		
Queuing Penalty (veh)						0	0		0	0		
Storage Bay Dist (ft)	170			550	230			210			360	360
Storage Blk Time (%)	37	41	12	0	0	50			78	47		
Queuing Penalty (veh)	233	207	35	0	0	85			47	364		

Intersection: 45: El Camino Real & Avenida Palizada/De La Paz

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	TR	L	T	R
Maximum Queue (ft)	87	221	65	25	234	216	75	551	139	95	53
Average Queue (ft)	52	94	30	5	84	105	46	220	84	40	27
95th Queue (ft)	88	194	62	20	168	188	88	564	141	88	53
Link Distance (ft)		927	927		1753	1753		536	136	136	136
Upstream Blk Time (%)								2	1		
Queuing Penalty (veh)								0	2		
Storage Bay Dist (ft)	50			50			50				
Storage Blk Time (%)	28	13			17		6	34			
Queuing Penalty (veh)	52	17			2		18	45			

Intersection: 4: Ortega Hwy & I-5 NB Ramp

Movement	EB	EB	EB	EB	WB	WB	WB	NB	NB	SB
Directions Served	L	T	T	T	T	T	TR	LTR	R	LR
Maximum Queue (ft)	37	192	205	192	658	807	770	654	525	23
Average Queue (ft)	6	191	193	190	395	754	725	374	307	11
95th Queue (ft)	23	196	198	197	643	822	753	602	533	29
Link Distance (ft)		132	132	132	698	698	698	940		482
Upstream Blk Time (%)		47	92	61		13	22			
Queuing Penalty (veh)		351	679	452		88	150			
Storage Bay Dist (ft)	200								500	
Storage Blk Time (%)		47						3	0	
Queuing Penalty (veh)		5						11	1	

Intersection: 5: I-5 SB Ramp & Camino Capistrano

Movement	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	R	T	TR	L	L	T
Maximum Queue (ft)	398	389	534	605	160	285	489
Average Queue (ft)	397	128	278	365	123	156	473
95th Queue (ft)	400	333	443	557	168	246	487
Link Distance (ft)	383		810	810			461
Upstream Blk Time (%)	38	1					24
Queuing Penalty (veh)	0	0					445
Storage Bay Dist (ft)		250			250	250	
Storage Blk Time (%)	41	0					30
Queuing Penalty (veh)	167	1					160

Intersection: 6: I-5 NB Ramp & Valle

Movement	EB	EB	NB	NB	SB
Directions Served	L	R	L	T	TR
Maximum Queue (ft)	457	438	126	499	93
Average Queue (ft)	435	416	75	378	64
95th Queue (ft)	448	470	165	644	84
Link Distance (ft)	423			484	1216
Upstream Blk Time (%)	92	33		41	
Queuing Penalty (veh)	0	0		0	
Storage Bay Dist (ft)		680	100		
Storage Blk Time (%)	92	33	5	77	
Queuing Penalty (veh)	102	175	7	100	

Intersection: 7: SR-1/Camino Las Ramblas & I-5 SB Ramp

Movement	NB	NB	NB	SB	SB	SE	SE
Directions Served	T	T	R	T	R	L	L
Maximum Queue (ft)	80	1006	1115	429	410	91	105
Average Queue (ft)	52	443	608	412	214	66	59
95th Queue (ft)	75	1035	1292	426	545	96	97
Link Distance (ft)	1210	1210	1210	790	790	1647	1647
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 8: SR-1/Camino Las Ramblas & Camino De Vista

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	T	T	T	TR	LT	R	L	R
Maximum Queue (ft)	72	112	109	116	54	55	90	138	23	44
Average Queue (ft)	42	87	74	65	41	26	36	57	3	13
95th Queue (ft)	67	118	125	102	65	56	77	108	16	33
Link Distance (ft)		188	188	977	977	977	1429		187	187
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	310							260		
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 9: I-5 SB Ramp & Camino De Estrella/Camino De Los Mares

Movement	EB	EB	EB	NE	NE	NE	SW	SW	SW
Directions Served	L	LT	R	T	T	R	L	T	T
Maximum Queue (ft)	435	458	434	219	223	130	251	224	210
Average Queue (ft)	288	299	110	128	100	54	211	97	81
95th Queue (ft)	427	443	266	182	177	107	287	183	172
Link Distance (ft)		1690		747	747			434	434
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	500		680			150	320		
Storage Blk Time (%)					1				
Queuing Penalty (veh)					2				

Intersection: 10: Calle Naranja & Camino De Estrella/Camino De Los Mares

Movement	SE	SE	NW	NW	NE	NE	NE	SW	SW	SW
Directions Served	L	R	LR	R	T	T	T	T	T	T
Maximum Queue (ft)	93	89	224	186	118	118	134	281	252	226
Average Queue (ft)	54	39	158	91	115	115	116	180	131	95
95th Queue (ft)	96	76	225	185	126	121	131	259	226	186
Link Distance (ft)	490	490	1382		207	207	207	981	981	981
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)				730						
Storage Blk Time (%)										
Queuing Penalty (veh)										

Intersection: 11: I-5 SB Ramp & Vista Hermosa

Movement	EB	EB	EB	NB	NB	NB	NB	SB	SB	SB
Directions Served	L	LR	R	L	T	T	T	T	T	R
Maximum Queue (ft)	262	206	124	54	157	139	75	159	180	166
Average Queue (ft)	200	149	65	34	97	85	41	102	92	27
95th Queue (ft)	261	204	100	64	151	125	81	154	145	108
Link Distance (ft)		1770			637	637	637	770	770	
Upstream Blk Time (%)										
Queuing Penalty (veh)										
Storage Bay Dist (ft)	300		500	160						140
Storage Blk Time (%)					0				0	
Queuing Penalty (veh)					0				1	

Intersection: 12: I-5 NB Ramp & Vista Hermosa

Movement	NW	NW	NW	NE	NE	SW	SW
Directions Served	L	LR	R	T	T	T	TR
Maximum Queue (ft)	63	154	134	151	139	151	125
Average Queue (ft)	34	91	68	102	89	77	58
95th Queue (ft)	65	132	123	146	139	128	102
Link Distance (ft)	1295	1295		770	770	309	309
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)			120				
Storage Blk Time (%)		0	1				
Queuing Penalty (veh)		1	2				

Intersection: 13: I-5 SB Ramp & Pico

Movement	SE	SE	SE	NE	NE	NE	NE	NE	SW	SW	SW	SW
Directions Served	L	LT	R	T	T	T	T	R	L	L	T	T
Maximum Queue (ft)	1222	1171	842	575	564	751	775	201	116	96	29	23
Average Queue (ft)	745	724	569	380	393	425	410	135	72	49	11	2
95th Queue (ft)	1159	1154	1055	595	613	712	727	252	113	85	31	11
Link Distance (ft)	1848	1848		842	842	842	842		351	351	351	351
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)			800					175				
Storage Blk Time (%)		17	8				15	3				
Queuing Penalty (veh)		58	31				55	9				

Intersection: 14: I-5 NB Ramp & Pico

Movement	NW	NW	NW	NE	NE	NE	NE	SW	SW	SW	SW	SW
Directions Served	<	R	R	L	L	T	T	T	T	T	T	R
Maximum Queue (ft)	193	117	135	366	370	201	239	79	163	243	206	43
Average Queue (ft)	114	85	69	360	359	21	38	61	78	150	131	6
95th Queue (ft)	160	123	121	366	368	101	132	87	151	225	197	28
Link Distance (ft)	1115			351	351	351	351	1325	1325	1325	1325	1325
Upstream Blk Time (%)				42	40							
Queuing Penalty (veh)				210	202							
Storage Bay Dist (ft)		400	400									
Storage Blk Time (%)												
Queuing Penalty (veh)												

Intersection: 15: I-5 SB Ramp & Avenida Palizada/De La Paz

Movement	SE	SE	NE	NE	SW	SW
Directions Served	LR	R	T	T	T	T
Maximum Queue (ft)	1360	436	169	170	54	94
Average Queue (ft)	804	393	146	106	20	53
95th Queue (ft)	1415	521	169	167	54	87
Link Distance (ft)	1345		124	124	265	265
Upstream Blk Time (%)	2		22	3		
Queuing Penalty (veh)	0		73	11		
Storage Bay Dist (ft)		410				
Storage Blk Time (%)	19	10				
Queuing Penalty (veh)	99	70				

Intersection: 32: San Juan Creek & Valle

Movement	EB	EB	WB	WB	WB	NB	NB
Directions Served	T	R	L	T	T	L	R
Maximum Queue (ft)	404	126	305	812	831	345	1229
Average Queue (ft)	256	87	171	810	814	321	1220
95th Queue (ft)	426	147	381	818	826	337	1227
Link Distance (ft)	377			797	797		1216
Upstream Blk Time (%)	2			75	76		67
Queuing Penalty (veh)	24			0	0		465
Storage Bay Dist (ft)		100	280			300	
Storage Blk Time (%)	20	1		90		87	
Queuing Penalty (veh)	118	5		135		270	

Intersection: 35: Stonehill & Cm Capistrano

Movement	EB	EB	EB	EB	NB	NB	NB	SB	SB	SB	SB	SB
Directions Served	L	T	T	R	L	LT	R	L	T	T	R	R
Maximum Queue (ft)	196	440	414	119	255	496	256	231	209	257	110	92
Average Queue (ft)	165	238	212	61	142	247	151	69	135	129	56	52
95th Queue (ft)	229	414	336	114	248	422	263	155	188	197	102	83
Link Distance (ft)		965	965			1272	1272		1185	1185		
Upstream Blk Time (%)												
Queuing Penalty (veh)												
Storage Bay Dist (ft)	170			550	230			210			360	360
Storage Blk Time (%)	21	8			0	9			0			
Queuing Penalty (veh)	91	31			0	17			1			

Intersection: 45: El Camino Real & Avenida Palizada/De La Paz

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	TR	L	T	R
Maximum Queue (ft)	76	218	182	70	137	155	75	269	162	179	100
Average Queue (ft)	41	93	86	17	86	102	65	141	104	73	29
95th Queue (ft)	78	165	149	47	133	150	89	256	163	145	75
Link Distance (ft)		927	927		1753	1753		536	136	136	136
Upstream Blk Time (%)									6	2	
Queuing Penalty (veh)									16	6	
Storage Bay Dist (ft)	50			50			50				
Storage Blk Time (%)	12	25			17		25	27			
Queuing Penalty (veh)	41	27			5		72	43			

APPENDIX H

RAMP MERGE/DIVERGE LOS WORKSHEETS

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4200	0.90	Level	4	1	0.978	1.00	4769
Ramp	170	0.90	Level	4	1	0.978	1.00	193
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 2188 pc/h
V_3 or V_{av34} 1290 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4769	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	4576	Exhibit 25-14	9600	No
V_R	193	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2188	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 22.2 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.445 (Exhibit 25-19)
S_R= 57.5 mph (Exhibit 25-19)
S_0= 75.7 mph (Exhibit 25-19)
S = 66.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4030	0.90	Level	4	1	0.978	1.00	4576
Ramp	250	0.90	Level	4	1	0.978	1.00	284
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.182 using Equation (Exhibit 25-5)

V_{12} = 834 pc/h

V_3 or V_{av34} 1871 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 1830 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	4860	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2114	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 20.1 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.334 (Exibit 25-19)

S_R= 60.6 mph (Exhibit 25-19)

S_0= 66.9 mph (Exhibit 25-19)

S = 64.0 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Calafia/Magdalena
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4280	0.90	Level	4	1	0.978	1.00	4860
Ramp	140	0.90	Level	4	1	0.978	1.00	159
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 2209 pc/h
V_3 or V_{av34} 1325 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4860	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	4701	Exhibit 25-14	9600	No
V_R	159	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2209	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 22.3 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.442 (Exhibit 25-19)
S_R= 57.6 mph (Exhibit 25-19)
S_0= 75.5 mph (Exhibit 25-19)
S = 66.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Avenida Vista Hermosa
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6230	0.90	Level	4	1	0.978	1.00	7075
Ramp	1040	0.90	Level	4	1	0.978	1.00	1181
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.070 using Equation (Exhibit 25-5)
V_{12} = 496 pc/h
V_3 or V_{av34} 3289 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 2830 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8256	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4011	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 34.3 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.515 (Exibit 25-19)
S_R= 55.6 mph (Exhibit 25-19)
S_0= 64.2 mph (Exhibit 25-19)
S = 59.7 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Camino de los Mares/Estrella
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7270	0.90	Level	4	1	0.978	1.00	8255
Ramp	390	0.90	Level	4	1	0.978	1.00	443
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 3849 pc/h
V_3 or V_{av34} 2203 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8255	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	7812	Exhibit 25-14	9600	No
V_R	443	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3849	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 36.5 (pc/mi/ln)
LOS = E (Exhibit 25-4)

Speed Determination

D_s = 0.468 (Exhibit 25-19)
S_R= 56.9 mph (Exhibit 25-19)
S_0= 72.1 mph (Exhibit 25-19)
S = 64.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	SR-1/Camino La Ramblas
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6140	0.90	Level	4	1	0.978	1.00	6972
Ramp	780	0.90	Level	4	1	0.978	1.00	886
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.107 using Equation (Exhibit 25-5)

V_{12} = 746 pc/h

V_3 or V_{av34} 3113 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2788 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7858	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3674	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 32.5 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.461 (Exibit 25-19)

S_R= 57.1 mph (Exhibit 25-19)

S_0= 64.3 mph (Exhibit 25-19)

S = 60.7 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Camino Capistrano/Stone Hill
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6620	0.90	Level	4	1	0.978	1.00	7517
Ramp	1510	0.90	Level	4	1	0.978	1.00	1715
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.003 using Equation (Exhibit 25-5)
V_{12} = 26 pc/h
V_3 or V_{av34} 3745 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 3006 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	9232	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4721	Exhibit 25-7	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 35.6 (pc/mi/ln)
LOS = E (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.692 (Exibit 25-19)
S_R= 50.6 mph (Exhibit 25-19)
S_0= 63.7 mph (Exhibit 25-19)
S = 56.3 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp	Terrain: Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 70.0 mph S_{FR} = 35.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8130	0.90	Level	4	1	0.978	1.00	9232
Ramp	60	0.90	Level	4	1	0.978	1.00	68
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 using Equation (Exhibit 25-12)

V_{12} = 4064 pc/h

V_3 or V_{av34} 2584 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	9232	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	9164	Exhibit 25-14	9600	No
V_R	68	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4064	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 38.3 (pc/mi/ln)

LOS = E (Exhibit 25-4)

Speed Determination

D_s = 0.434 (Exhibit 25-19)

S_R= 57.8 mph (Exhibit 25-19)

S_0= 70.6 mph (Exhibit 25-19)

S = 64.4 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8070	0.90	Level	4	1	0.978	1.00	9164
Ramp	320	0.90	Level	4	1	0.978	1.00	363
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.172 using Equation (Exhibit 25-5)

V_{12} = 1580 pc/h

V_3 or V_{av34} 3792 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3665 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	9527	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4028	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 35.0 (pc/mi/ln)

LOS = E (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.521 (Exibit 25-19)

S_R= 55.4 mph (Exhibit 25-19)

S_0= 60.8 mph (Exhibit 25-19)

S = 58.4 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8090	0.90	Level	4	1	0.978	1.00	9187
Ramp	750	0.90	Level	4	1	0.978	1.00	852
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 4486 pc/h
V_3 or V_{av34} 2350 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	9187	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	8335	Exhibit 25-14	9600	No
V_R	852	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4486	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 41.9 (pc/mi/ln)
LOS = E (Exhibit 25-4)

Speed Determination

D_s = 0.505 (Exhibit 25-19)
S_R= 55.9 mph (Exhibit 25-19)
S_0= 71.5 mph (Exhibit 25-19)
S = 62.9 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7340	0.90	Level	4	1	0.978	1.00	8335
Ramp	1380	0.90	Level	4	1	0.978	1.00	1567
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.022 using Equation (Exhibit 25-5)

V_{12} = 183 pc/h

V_3 or V_{av34} 4076 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3334 pc/h (Equation 25-8)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	9902	Exhibit 25-7		Yes

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4901	Exhibit 25-7	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 33.6 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.740 (Exibit 25-19)

S_R= 49.3 mph (Exhibit 25-19)

S_0= 62.3 mph (Exhibit 25-19)

S = 55.1 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Junipero Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp	Terrain: Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 70.0 mph S_{FR} = 35.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8770	0.90	Level	4	1	0.978	1.00	9959
Ramp	320	0.90	Level	4	1	0.978	1.00	363
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 using Equation (Exhibit 25-12)

V_{12} = 3679 pc/h

V_3 or V_{av34} 2144 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7968	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	7605	Exhibit 25-14	9600	No
V_R	363	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3679	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 35.0 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Speed Determination

D_s = 0.461 (Exhibit 25-19)

S_R= 57.1 mph (Exhibit 25-19)

S_0= 72.3 mph (Exhibit 25-19)

S = 64.4 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Juniper Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8450	0.90	Level	4	1	0.978	1.00	9595
Ramp	560	0.90	Level	4	1	0.978	1.00	636
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.138 using Equation (Exhibit 25-5)

V_{12} = 981 pc/h

V_3 or V_{av34} 3057 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2838 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7731	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3474	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 22.9 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.342 (Exibit 25-19)

S_R= 60.4 mph (Exhibit 25-19)

S_0= 64.1 mph (Exhibit 25-19)

S = 62.4 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4500	0.90	Level	4	1	0.978	1.00	5110
Ramp	170	0.90	Level	4	1	0.978	1.00	193
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 2337 pc/h
V_3 or V_{av34} 1386 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5110	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	4917	Exhibit 25-14	9600	No
V_R	193	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2337	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 23.5 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.445 (Exhibit 25-19)
S_R= 57.5 mph (Exhibit 25-19)
S_0= 75.3 mph (Exhibit 25-19)
S = 66.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4330	0.90	Level	4	1	0.978	1.00	4917
Ramp	120	0.90	Level	4	1	0.978	1.00	136
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.201 using Equation (Exhibit 25-5)

V_{12} = 987 pc/h

V_3 or V_{av34} 1965 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 1966 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5053	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2102	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 20.4 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.337 (Exibit 25-19)

S_R= 60.6 mph (Exhibit 25-19)

S_0= 66.5 mph (Exhibit 25-19)

S = 63.9 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Calafia/Magdalena
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4410	0.90	Level	4	1	0.978	1.00	5008
Ramp	90	0.90	Level	4	1	0.978	1.00	102
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.205 using Equation (Exhibit 25-5)

V_{12} = 1027 pc/h

V_3 or V_{av34} 1990 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2003 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5110	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2105	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 20.5 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.338 (Exibit 25-19)

S_R= 60.5 mph (Exhibit 25-19)

S_0= 66.4 mph (Exhibit 25-19)

S = 63.9 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Avenida Vista Hermosa
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp	Terrain: Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 70.0 mph S_{FR} = 35.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6510	0.90	Level	4	1	0.978	1.00	7392
Ramp	860	0.90	Level	4	1	0.978	1.00	977
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 using Equation (Exhibit 25-12)

V_{12} = 3774 pc/h

V_3 or V_{av34} 1809 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7392	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	6415	Exhibit 25-14	9600	No
V_R	977	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3774	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 35.8 (pc/mi/ln)

LOS = E (Exhibit 25-4)

Speed Determination

D_s = 0.516 (Exhibit 25-19)

S_R= 55.6 mph (Exhibit 25-19)

S_0= 73.6 mph (Exhibit 25-19)

S = 63.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Camino de los Mares/Estrella
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6770	0.90	Level	4	1	0.978	1.00	7688
Ramp	740	0.90	Level	4	1	0.978	1.00	840
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 3826 pc/h
V_3 or V_{av34} 1931 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7688	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	6848	Exhibit 25-14	9600	No
V_R	840	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3826	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 23.7 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.504 (Exhibit 25-19)
S_R= 55.9 mph (Exhibit 25-19)
S_0= 73.2 mph (Exhibit 25-19)
S = 63.4 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Camino de los Mares/Estrella
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6030	0.90	Level	4	1	0.978	1.00	6847
Ramp	480	0.90	Level	4	1	0.978	1.00	545
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.150 using Equation (Exhibit 25-5)

V_{12} = 1025 pc/h

V_3 or V_{av34} 2911 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2738 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7392	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3283	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 30.2 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.418 (Exibit 25-19)

S_R= 58.3 mph (Exhibit 25-19)

S_0= 64.4 mph (Exhibit 25-19)

S = 61.5 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	SR-1/Camino La Ramblas
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6520	0.90	Level	4	1	0.978	1.00	7404
Ramp	760	0.90	Level	4	1	0.978	1.00	863
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 3070 pc/h
V_3 or V_{av34} 1427 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5924	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	5061	Exhibit 25-14	9600	No
V_R	863	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3070	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 18.8 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

D_s = 0.506 (Exhibit 25-19)
S_R= 55.8 mph (Exhibit 25-19)
S_0= 75.1 mph (Exhibit 25-19)
S = 63.7 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	SR-1/Camino La Ramblas
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5880	0.90	Level	4	1	0.978	1.00	6677
Ramp	890	0.90	Level	4	1	0.978	1.00	1011
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.091 using Equation (Exhibit 25-5)

V_{12} = 446 pc/h

V_3 or V_{av34} 2214 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 1950 pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5886	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2961	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 25.9 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

M_S = 0.372 (Exibit 25-19)

S_R= 59.6 mph (Exhibit 25-19)

S_0= 66.5 mph (Exhibit 25-19)

S = 62.9 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5700	0.90	Level	4	1	0.978	1.00	6473
Ramp	730	0.90	Level	4	1	0.978	1.00	829
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 3290 pc/h
V_3 or V_{av34} 1591 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6473	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	5644	Exhibit 25-14	9600	No
V_R	829	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3290	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 31.6 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.503 (Exhibit 25-19)
S_R= 55.9 mph (Exhibit 25-19)
S_0= 74.5 mph (Exhibit 25-19)
S = 63.7 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4970	0.90	Level	4	1	0.978	1.00	5644
Ramp	350	0.90	Level	4	1	0.978	1.00	397
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.168 using Equation (Exhibit 25-5)

V_{12} = 949 pc/h

V_3 or V_{av34} 2347 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2257 pc/h (Equation 25-8)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6041	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2654	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 24.7 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.362 (Exibit 25-19)

S_R= 59.9 mph (Exhibit 25-19)

S_0= 65.7 mph (Exhibit 25-19)

S = 63.0 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp	Terrain: Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 70.0 mph S_{FR} = 35.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6520	0.90	Level	4	1	0.978	1.00	7404
Ramp	1360	0.90	Level	4	1	0.978	1.00	1544
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-8)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 using Equation (Exhibit 25-12)

V_{12} = 4099 pc/h

V_3 or V_{av34} 1652 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

	Actual	Capacity		LOS F?
V_F	7404	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	5860	Exhibit 25-14	9600	No
V_R	1544	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4099	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 26.0 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

D_s = 0.567 (Exhibit 25-19)

S_R= 54.1 mph (Exhibit 25-19)

S_0= 74.2 mph (Exhibit 25-19)

S = 61.6 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5110	0.90	Level	4	1	0.978	1.00	5803
Ramp	590	0.90	Level	4	1	0.978	1.00	670
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.134 using Equation (Exhibit 25-5)

V_{12} = 778 pc/h

V_3 or V_{av34} 2512 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2321 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6473	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2991	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 27.9 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.392 (Exibit 25-19)

S_R= 59.0 mph (Exhibit 25-19)

S_0= 65.5 mph (Exhibit 25-19)

S = 62.4 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Junipero Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6800	0.90	Level	4	1	0.978	1.00	7722
Ramp	660	0.90	Level	4	1	0.978	1.00	749
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 3116 pc/h
V_3 or V_{av34} 1531 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6178	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	5429	Exhibit 25-14	9600	No
V_R	749	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3116	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 17.5 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Speed Determination

D_s = 0.495 (Exhibit 25-19)
S_R= 56.1 mph (Exhibit 25-19)
S_0= 74.7 mph (Exhibit 25-19)
S = 64.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Junipero Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6190	0.90	Level	4	1	0.978	1.00	7029
Ramp	330	0.90	Level	4	1	0.978	1.00	375
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.171 using Equation (Exhibit 25-5)

V_{12} = 877 pc/h

V_3 or V_{av34} 2127 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2052 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5507	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2427	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 23.3 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.355 (Exibit 25-19)

S_R= 60.1 mph (Exhibit 25-19)

S_0= 66.3 mph (Exhibit 25-19)

S = 63.4 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4400	0.90	Level	4	1	0.978	1.00	4996
Ramp	150	0.90	Level	4	1	0.978	1.00	170
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 2274 pc/h
V_3 or V_{av34} 1361 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4996	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	4826	Exhibit 25-14	9600	No
V_R	170	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2274	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 22.9 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.443 (Exhibit 25-19)
S_R= 57.6 mph (Exhibit 25-19)
S_0= 75.4 mph (Exhibit 25-19)
S = 66.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4250	0.90	Level	4	1	0.978	1.00	4826
Ramp	200	0.90	Level	4	1	0.978	1.00	227
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.189 using Equation (Exhibit 25-5)

V_{12} = 914 pc/h

V_3 or V_{av34} 1956 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 1930 pc/h (Equation 25-8)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5053	Exhibit 25-7		No

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2157	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 20.5 (pc/mi/ln)

LOS = C (Exhibit 25-4)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.336 (Exibit 25-19)

S_R= 60.6 mph (Exhibit 25-19)

S_0= 66.6 mph (Exhibit 25-19)

S = 63.9 mph (Exhibit 25-14)

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Calafia/Magdalena
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4450	0.90	Level	4	1	0.978	1.00	5053
Ramp	160	0.90	Level	4	1	0.978	1.00	182
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 2306 pc/h
V_3 or V_{av34} 1373 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5053	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	4871	Exhibit 25-14	9600	No
V_R	182	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2306	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 23.2 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.444 (Exhibit 25-19)
S_R= 57.6 mph (Exhibit 25-19)
S_0= 75.3 mph (Exhibit 25-19)
S = 66.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Avenida Vista Hermosa
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6290	0.90	Level	4	1	0.978	1.00	7143
Ramp	840	0.90	Level	4	1	0.978	1.00	954
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.099 using Equation (Exhibit 25-5)
V_{12} = 704 pc/h
V_3 or V_{av34} 3219 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 2857 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8097	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3811	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 32.9 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.476 (Exibit 25-19)
S_R= 56.7 mph (Exhibit 25-19)
S_0= 64.1 mph (Exhibit 25-19)
S = 60.4 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Camino de los Mares/Estrella
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7130	0.90	Level	4	1	0.978	1.00	8097
Ramp	530	0.90	Level	4	1	0.978	1.00	602
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 3870 pc/h
V_3 or V_{av34} 2113 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8097	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	7495	Exhibit 25-14	9600	No
V_R	602	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3870	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 36.6 (pc/mi/ln)
LOS = E (Exhibit 25-4)

Speed Determination

D_s = 0.482 (Exhibit 25-19)
S_R= 56.5 mph (Exhibit 25-19)
S_0= 72.4 mph (Exhibit 25-19)
S = 63.8 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	SR-1/Camino La Ramblas
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	7700	0.90	Level	4	1	0.978	1.00	8744
Ramp	800	0.90	Level	4	1	0.978	1.00	908
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.104 using Equation (Exhibit 25-5)
V_{12} = 912 pc/h
V_3 or V_{av34} 3916 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 3497 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	9652	Exhibit 25-7		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4405	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 38.2 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.626 (Exibit 25-19)
S_R= 52.5 mph (Exhibit 25-19)
S_0= 61.5 mph (Exhibit 25-19)
S = 57.0 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Camino Capistrano/Stone Hill
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5820	0.90	Level	4	1	0.978	1.00	6609
Ramp	1040	0.90	Level	4	1	0.978	1.00	1181
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.070 using Equation (Exhibit 25-5)
V_{12} = 464 pc/h
V_3 or V_{av34} 3072 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 2643 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7790	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3824	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 28.8 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.433 (Exibit 25-19)
S_R= 57.9 mph (Exhibit 25-19)
S_0= 64.7 mph (Exhibit 25-19)
S = 61.1 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6860	0.90	Level	4	1	0.978	1.00	7790
Ramp	100	0.90	Level	4	1	0.978	1.00	114
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 using Equation (Exhibit 25-12)

V_{12} = 3461 pc/h

V_3 or V_{av34} 2164 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7790	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	7676	Exhibit 25-14	9600	No
V_R	114	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3461	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 33.1 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.438 (Exhibit 25-19)

S_R= 57.7 mph (Exhibit 25-19)

S_0= 72.3 mph (Exhibit 25-19)

S = 65.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6760	0.90	Level	4	1	0.978	1.00	7676
Ramp	300	0.90	Level	4	1	0.978	1.00	341
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.175 using Equation (Exhibit 25-5)

V_{12} = 1345 pc/h

V_3 or V_{av34} 3165 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3070 pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8017	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3411	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 30.2 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.420 (Exibit 25-19)

S_R= 58.2 mph (Exhibit 25-19)

S_0= 63.5 mph (Exhibit 25-19)

S = 61.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6860	0.90	Level	4	1	0.978	1.00	7790
Ramp	710	0.90	Level	4	1	0.978	1.00	806
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 3851 pc/h
V_3 or V_{av34} 1969 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7790	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	6984	Exhibit 25-14	9600	No
V_R	806	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3851	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 36.5 (pc/mi/ln)
LOS = E (Exhibit 25-4)

Speed Determination

D_s = 0.501 (Exhibit 25-19)
S_R= 56.0 mph (Exhibit 25-19)
S_0= 73.0 mph (Exhibit 25-19)
S = 63.5 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6150	0.90	Level	4	1	0.978	1.00	6984
Ramp	1320	0.90	Level	4	1	0.978	1.00	1499
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.030 using Equation (Exhibit 25-5)

V_{12} = 212 pc/h

V_3 or V_{av34} 3386 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2793 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8483	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4292	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 28.9 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.501 (Exibit 25-19)

S_R= 56.0 mph (Exhibit 25-19)

S_0= 64.3 mph (Exhibit 25-19)

S = 59.8 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Junipero Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7420	0.90	Level	4	1	0.978	1.00	8426
Ramp	280	0.90	Level	4	1	0.978	1.00	318
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 3118 pc/h
V_3 or V_{av34} 1811 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6741	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	6423	Exhibit 25-14	9600	No
V_R	318	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3118	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 30.2 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.457 (Exhibit 25-19)
S_R= 57.2 mph (Exhibit 25-19)
S_0= 73.6 mph (Exhibit 25-19)
S = 65.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Juniper Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7140	0.90	Level	4	1	0.978	1.00	8108
Ramp	660	0.90	Level	4	1	0.978	1.00	749
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.124 using Equation (Exhibit 25-5)
V_{12} = 720 pc/h
V_3 or V_{av34} 2539 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 2319 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6547	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3068	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 19.7 (pc/mi/ln)
LOS = B (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.300 (Exibit 25-19)
S_R= 61.6 mph (Exhibit 25-19)
S_0= 65.5 mph (Exhibit 25-19)
S = 63.6 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4700	0.90	Level	4	1	0.978	1.00	5337
Ramp	180	0.90	Level	4	1	0.978	1.00	204
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 2442 pc/h
V_3 or V_{av34} 1447 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5337	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	5133	Exhibit 25-14	9600	No
V_R	204	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2442	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 24.4 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.446 (Exhibit 25-19)
S_R= 57.5 mph (Exhibit 25-19)
S_0= 75.0 mph (Exhibit 25-19)
S = 65.9 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4520	0.90	Level	4	1	0.978	1.00	5133
Ramp	310	0.90	Level	4	1	0.978	1.00	352
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.174 using Equation (Exhibit 25-5)

V_{12} = 892 pc/h

V_3 or V_{av34} 2120 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2053 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5485	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2405	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 22.6 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.348 (Exibit 25-19)

S_R= 60.3 mph (Exhibit 25-19)

S_0= 66.3 mph (Exhibit 25-19)

S = 63.5 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Calafia/Magdalena
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4630	0.90	Level	4	1	0.978	1.00	5258
Ramp	70	0.90	Level	4	1	0.978	1.00	79
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.208 using Equation (Exhibit 25-5)

V_{12} = 1093 pc/h

V_3 or V_{av34} 2082 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2103 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5337	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2182	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 21.1 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.340 (Exibit 25-19)

S_R= 60.5 mph (Exhibit 25-19)

S_0= 66.1 mph (Exhibit 25-19)

S = 63.7 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Avenida Vista Hermosa
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7860	0.90	Level	4	1	0.978	1.00	8925
Ramp	1200	0.90	Level	4	1	0.978	1.00	1363
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 4660 pc/h
V_3 or V_{av34} 2132 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8925	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	7562	Exhibit 25-14	9600	No
V_R	1363	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4660	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 43.4 (pc/mi/ln)
LOS = E (Exhibit 25-4)

Speed Determination

D_s = 0.551 (Exhibit 25-19)
S_R= 54.6 mph (Exhibit 25-19)
S_0= 72.4 mph (Exhibit 25-19)
S = 61.8 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Camino de los Mares/Estrella
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8760	0.90	Level	4	1	0.978	1.00	9947
Ramp	1420	0.90	Level	4	1	0.978	1.00	1612
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 5246 pc/h
V_3 or V_{av34} 2350 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	9947	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	8335	Exhibit 25-14	9600	No
V_R	1612	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5246	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 35.9 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.573 (Exhibit 25-19)
S_R= 54.0 mph (Exhibit 25-19)
S_0= 71.5 mph (Exhibit 25-19)
S = 61.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Camino de los Mares/Estrella
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	7340	0.90	Level	4	1	0.978	1.00	8335
Ramp	520	0.90	Level	4	1	0.978	1.00	590
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.144 using Equation (Exhibit 25-5)
V_{12} = 1201 pc/h
V_3 or V_{av34} 3567 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 3334 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8925	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3924	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 35.2 (pc/mi/ln)
LOS = E (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.511 (Exibit 25-19)
S_R= 55.7 mph (Exhibit 25-19)
S_0= 62.3 mph (Exhibit 25-19)
S = 59.2 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	SR-1/Camino La Ramblas
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8870	0.90	Level	4	1	0.978	1.00	10072
Ramp	1270	0.90	Level	4	1	0.978	1.00	1442
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 4327 pc/h
V_3 or V_{av34} 1865 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8058	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	6616	Exhibit 25-14	9600	No
V_R	1442	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4327	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 29.6 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.558 (Exhibit 25-19)
S_R= 54.4 mph (Exhibit 25-19)
S_0= 73.4 mph (Exhibit 25-19)
S = 61.8 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	SR-1/Camino La Ramblas
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	7690	0.90	Level	4	1	0.978	1.00	8732
Ramp	1070	0.90	Level	4	1	0.978	1.00	1215
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.066 using Equation (Exhibit 25-5)
V_{12} = 411 pc/h
V_3 or V_{av34} 2910 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 2492 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7447	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3707	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 31.6 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.455 (Exibit 25-19)
S_R= 57.3 mph (Exhibit 25-19)
S_0= 65.1 mph (Exhibit 25-19)
S = 60.9 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8190	0.90	Level	4	1	0.978	1.00	9300
Ramp	1160	0.90	Level	4	1	0.978	1.00	1317
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 4798 pc/h
V_3 or V_{av34} 2251 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	9300	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	7983	Exhibit 25-14	9600	No
V_R	1317	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4798	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 44.6 (pc/mi/ln)
LOS = E (Exhibit 25-4)

Speed Determination

D_s = 0.547 (Exhibit 25-19)
S_R= 54.7 mph (Exhibit 25-19)
S_0= 71.9 mph (Exhibit 25-19)
S = 61.9 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7030	0.90	Level	4	1	0.978	1.00	7983
Ramp	440	0.90	Level	4	1	0.978	1.00	500
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.155 using Equation (Exhibit 25-5)

V_{12} = 1240 pc/h

V_3 or V_{av34} 3371 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3193 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8483	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3693	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 32.8 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.464 (Exibit 25-19)

S_R= 57.0 mph (Exhibit 25-19)

S_0= 62.9 mph (Exhibit 25-19)

S = 60.2 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	9310	0.90	Level	4	1	0.978	1.00	10572
Ramp	1680	0.90	Level	4	1	0.978	1.00	1908
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 5686 pc/h
V_3 or V_{av34} 2443 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	10572	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	8664	Exhibit 25-14	9600	No
V_R	1908	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5686	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 39.7 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Speed Determination

D_s = 0.600 (Exhibit 25-19)
S_R= 53.2 mph (Exhibit 25-19)
S_0= 71.2 mph (Exhibit 25-19)
S = 60.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7580	0.90	Level	4	1	0.978	1.00	8608
Ramp	610	0.90	Level	4	1	0.978	1.00	693
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.131 using Equation (Exhibit 25-5)

V_{12} = 1129 pc/h

V_3 or V_{av34} 3739 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3443 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	9301	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4136	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 36.8 (pc/mi/ln)

LOS = E (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.558 (Exibit 25-19)

S_R= 54.4 mph (Exhibit 25-19)

S_0= 61.8 mph (Exhibit 25-19)

S = 58.3 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Junipero Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	9700	0.90	Level	4	1	0.978	1.00	11015
Ramp	700	0.90	Level	4	1	0.978	1.00	795
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 4290 pc/h
V_3 or V_{av34} 2261 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8812	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	8017	Exhibit 25-14	9600	No
V_R	795	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4290	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 27.6 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.500 (Exhibit 25-19)
S_R= 56.0 mph (Exhibit 25-19)
S_0= 71.9 mph (Exhibit 25-19)
S = 63.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Junipero Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Existing

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	8950	0.90	Level	4	1	0.978	1.00	10163
Ramp	360	0.90	Level	4	1	0.978	1.00	409
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.167 using Equation (Exhibit 25-5)

V_{12} = 1277 pc/h

V_3 or V_{av34} 3193 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3065 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8072	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3474	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 31.4 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.436 (Exibit 25-19)

S_R= 57.8 mph (Exhibit 25-19)

S_0= 63.5 mph (Exhibit 25-19)

S = 60.9 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6010	0.90	Level	4	1	0.978	1.00	6825
Ramp	240	0.90	Level	4	1	0.978	1.00	273
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 3130 pc/h
V_3 or V_{av34} 1847 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6825	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	6552	Exhibit 25-14	9600	No
V_R	273	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3130	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 30.3 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.453 (Exhibit 25-19)
S_R= 57.3 mph (Exhibit 25-19)
S_0= 73.5 mph (Exhibit 25-19)
S = 65.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5770	0.90	Level	4	1	0.978	1.00	6552
Ramp	400	0.90	Level	4	1	0.978	1.00	454
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.161 using Equation (Exhibit 25-5)

V_{12} = 1055 pc/h

V_3 or V_{av34} 2748 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2620 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7006	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3074	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 27.6 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.386 (Exibit 25-19)

S_R= 59.2 mph (Exhibit 25-19)

S_0= 64.7 mph (Exhibit 25-19)

S = 62.2 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Calafia/Magdalena
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6170	0.90	Level	4	1	0.978	1.00	7006
Ramp	210	0.90	Level	4	1	0.978	1.00	238
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 3189 pc/h
V_3 or V_{av34} 1908 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7006	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	6768	Exhibit 25-14	9600	No
V_R	238	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3189	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 30.8 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.449 (Exhibit 25-19)
S_R= 57.4 mph (Exhibit 25-19)
S_0= 73.2 mph (Exhibit 25-19)
S = 65.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Avenida Vista Hermosa
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8350	0.90	Level	4	1	0.978	1.00	9482
Ramp	1410	0.90	Level	4	1	0.978	1.00	1601
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.018 using Equation (Exhibit 25-5)

V_{12} = 168 pc/h

V_3 or V_{av34} 4657 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3792 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	11083	Exhibit 25-7		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5393	Exhibit 25-7	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 44.9 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 1.157 (Exibit 25-19)

S_R= 37.6 mph (Exhibit 25-19)

S_0= 60.2 mph (Exhibit 25-19)

S = 46.6 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Camino de los Mares/Estrella
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	9760	0.90	Level	4	1	0.978	1.00	11083
Ramp	470	0.90	Level	4	1	0.978	1.00	534
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 5133 pc/h
V_3 or V_{av34} 2975 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = 5683 pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	11083	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	10549	Exhibit 25-14	9600	Yes
V_R	534	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5133	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 52.2 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.476 (Exhibit 25-19)
S_R= 56.7 mph (Exhibit 25-19)
S_0= 70.2 mph (Exhibit 25-19)
S = 62.5 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	SR-1/Camino La Ramblas
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	9030	0.90	Level	4	1	0.978	1.00	10254
Ramp	360	0.90	Level	4	1	0.978	1.00	409
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.167 using Equation (Exhibit 25-5)

V_{12} = 1709 pc/h

V_3 or V_{av34} 4272 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 4101 pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	10663	Exhibit 25-7		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4510	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 39.2 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Speed Determination

M_S = 0.662 (Exibit 25-19)

S_R= 51.5 mph (Exhibit 25-19)

S_0= 58.8 mph (Exhibit 25-19)

S = 55.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Camino Capistrano/Stone Hill
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	9390	0.90	Level	4	1	0.978	1.00	10663
Ramp	1530	0.90	Level	4	1	0.978	1.00	1737
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.001 using Equation (Exhibit 25-5)

V_{12} = 7 pc/h

V_3 or V_{av34} 5328 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 4265 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	12400	Exhibit 25-7		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	6002	Exhibit 25-7	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 45.5 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 1.831 (Exibit 25-19)

S_R= 18.7 mph (Exhibit 25-19)

S_0= 58.1 mph (Exhibit 25-19)

S = 28.8 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	10920	0.90	Level	4	1	0.978	1.00	12400
Ramp	690	0.90	Level	4	1	0.978	1.00	784
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 5849 pc/h
V_3 or V_{av34} 3275 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = 7000 pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	12400	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	11616	Exhibit 25-14	9600	Yes
V_R	784	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5849	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 63.6 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.499 (Exhibit 25-19)
S_R= 56.0 mph (Exhibit 25-19)
S_0= 70.2 mph (Exhibit 25-19)
S = 61.4 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	10230	0.90	Level	4	1	0.978	1.00	11617
Ramp	790	0.90	Level	4	1	0.978	1.00	897
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.106 using Equation (Exhibit 25-5)

V_{12} = 1228 pc/h

V_3 or V_{av34} 5194 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 4646 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	12514	Exhibit 25-7		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5543	Exhibit 25-7	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 46.6 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 1.298 (Exibit 25-19)

S_R= 33.7 mph (Exhibit 25-19)

S_0= 56.4 mph (Exhibit 25-19)

S = 43.4 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	10930	0.90	Level	4	1	0.978	1.00	12412
Ramp	1180	0.90	Level	4	1	0.978	1.00	1340
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 6167 pc/h
V_3 or V_{av34} 3122 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = 7012 pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	12412	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	11072	Exhibit 25-14	9600	Yes
V_R	1340	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	6167	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 63.7 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.549 (Exhibit 25-19)
S_R= 54.6 mph (Exhibit 25-19)
S_0= 70.2 mph (Exhibit 25-19)
S = 60.5 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	9750	0.90	Level	4	1	0.978	1.00	11072
Ramp	1910	0.90	Level	4	1	0.978	1.00	2169
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = -0.053 using Equation (Exhibit 25-5)

V_{12} = -589 pc/h

V_3 or V_{av34} 5830 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 4428 pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	13241	Exhibit 25-7		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	6597	Exhibit 25-7	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 46.5 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Speed Determination

M_S = 3.074 (Exibit 25-19)

S_R= -16.1 mph (Exhibit 25-19)

S_0= 57.3 mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Junipero Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	11580	0.90	Level	4	1	0.978	1.00	13150
Ramp	610	0.90	Level	4	1	0.978	1.00	693
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 4978 pc/h
V_3 or V_{av34} 2771 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = 5120 pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	10520	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	9827	Exhibit 25-14	9600	Yes
V_R	693	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4978	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 47.4 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.490 (Exhibit 25-19)
S_R= 56.3 mph (Exhibit 25-19)
S_0= 70.2 mph (Exhibit 25-19)
S = 62.6 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Junipero Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	10970	0.90	Level	4	1	0.978	1.00	12457
Ramp	1180	0.90	Level	4	1	0.978	1.00	1340
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.050 using Equation (Exhibit 25-5)

V_{12} = 501 pc/h

V_3 or V_{av34} 4728 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3982 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	11297	Exhibit 25-7		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5322	Exhibit 25-7	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 37.0 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 1.015 (Exibit 25-19)

S_R= 41.6 mph (Exhibit 25-19)

S_0= 59.3 mph (Exhibit 25-19)

S = 49.4 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6680	0.90	Level	4	1	0.978	1.00	7586
Ramp	480	0.90	Level	4	1	0.978	1.00	545
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 3615 pc/h
V_3 or V_{av34} 1985 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7586	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	7041	Exhibit 25-14	9600	No
V_R	545	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3615	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 34.4 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.477 (Exhibit 25-19)
S_R= 56.6 mph (Exhibit 25-19)
S_0= 72.9 mph (Exhibit 25-19)
S = 64.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6200	0.90	Level	4	1	0.978	1.00	7040
Ramp	160	0.90	Level	4	1	0.978	1.00	182
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.195 using Equation (Exhibit 25-5)

V_{12} = 1373 pc/h

V_3 or V_{av34} 2833 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2816 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7222	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2998	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 27.3 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.383 (Exibit 25-19)

S_R= 59.3 mph (Exhibit 25-19)

S_0= 64.2 mph (Exhibit 25-19)

S = 62.1 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Calafia/Magdalena
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6810	0.90	Level	4	1	0.978	1.00	7733
Ramp	130	0.90	Level	4	1	0.978	1.00	148
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.199 using Equation (Exhibit 25-5)

V_{12} = 1541 pc/h

V_3 or V_{av34} 3096 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3093 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7881	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3241	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 29.3 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.405 (Exibit 25-19)

S_R= 58.7 mph (Exhibit 25-19)

S_0= 63.3 mph (Exhibit 25-19)

S = 61.3 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Avenida Vista Hermosa
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8980	0.90	Level	4	1	0.978	1.00	10197
Ramp	1300	0.90	Level	4	1	0.978	1.00	1476
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 5278 pc/h
V_3 or V_{av34} 2459 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	10197	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	8721	Exhibit 25-14	9600	No
V_R	1476	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5278	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 48.7 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.561 (Exhibit 25-19)
S_R= 54.3 mph (Exhibit 25-19)
S_0= 71.1 mph (Exhibit 25-19)
S = 61.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Camino de los Mares/Estrella
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	9220	0.90	Level	4	1	0.978	1.00	10470
Ramp	830	0.90	Level	4	1	0.978	1.00	943
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 5097 pc/h
V_3 or V_{av34} 2686 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	10470	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	9527	Exhibit 25-14	9600	No
V_R	943	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5097	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 34.6 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.513 (Exhibit 25-19)
S_R= 55.6 mph (Exhibit 25-19)
S_0= 70.2 mph (Exhibit 25-19)
S = 62.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Camino de los Mares/Estrella
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8390	0.90	Level	4	1	0.978	1.00	9527
Ramp	590	0.90	Level	4	1	0.978	1.00	670
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.134 using Equation (Exhibit 25-5)

V_{12} = 1277 pc/h

V_3 or V_{av34} 4125 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3810 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	10197	Exhibit 25-7		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4480	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 39.5 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.658 (Exibit 25-19)

S_R= 51.6 mph (Exhibit 25-19)

S_0= 60.1 mph (Exhibit 25-19)

S = 56.0 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	SR-1/Camino La Ramblas
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp	Terrain: Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 70.0 mph S_{FR} = 35.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8640	0.90	Level	4	1	0.978	1.00	9811
Ramp	830	0.90	Level	4	1	0.978	1.00	943
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 using Equation (Exhibit 25-12)

V_{12} = 3954 pc/h

V_3 or V_{av34} 1947 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7849	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	6906	Exhibit 25-14	9600	No
V_R	943	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3954	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 26.4 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.513 (Exhibit 25-19)

S_R= 55.6 mph (Exhibit 25-19)

S_0= 73.1 mph (Exhibit 25-19)

S = 63.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	SR-1/Camino La Ramblas
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8040	0.90	Level	4	1	0.978	1.00	9130
Ramp	1180	0.90	Level	4	1	0.978	1.00	1340
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.050 using Equation (Exhibit 25-5)
V_{12} = 333 pc/h
V_3 or V_{av34} 3148 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 2652 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7970	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3992	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 33.8 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.508 (Exibit 25-19)
S_R= 55.8 mph (Exhibit 25-19)
S_0= 64.6 mph (Exhibit 25-19)
S = 59.9 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7520	0.90	Level	4	1	0.978	1.00	8539
Ramp	1070	0.90	Level	4	1	0.978	1.00	1215
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 4408 pc/h
V_3 or V_{av34} 2065 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8539	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	7324	Exhibit 25-14	9600	No
V_R	1215	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4408	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 41.3 (pc/mi/ln)
LOS = E (Exhibit 25-4)

Speed Determination

D_s = 0.537 (Exhibit 25-19)
S_R= 55.0 mph (Exhibit 25-19)
S_0= 72.6 mph (Exhibit 25-19)
S = 62.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6450	0.90	Level	4	1	0.978	1.00	7324
Ramp	750	0.90	Level	4	1	0.978	1.00	852
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.111 using Equation (Exhibit 25-5)
V_{12} = 815 pc/h
V_3 or V_{av34} 3254 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 2929 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8176	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3781	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 33.3 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.478 (Exibit 25-19)
S_R= 56.6 mph (Exhibit 25-19)
S_0= 63.9 mph (Exhibit 25-19)
S = 60.3 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8570	0.90	Level	4	1	0.978	1.00	9732
Ramp	1800	0.90	Level	4	1	0.978	1.00	2044
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 5396 pc/h
V_3 or V_{av34} 2168 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	9732	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	7688	Exhibit 25-14	9600	No
V_R	2044	Exhibit 25-3	2000	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5396	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 37.2 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.612 (Exhibit 25-19)
S_R= 52.9 mph (Exhibit 25-19)
S_0= 72.2 mph (Exhibit 25-19)
S = 60.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6760	0.90	Level	4	1	0.978	1.00	7676
Ramp	760	0.90	Level	4	1	0.978	1.00	863
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.110 using Equation (Exhibit 25-5)

V_{12} = 844 pc/h

V_3 or V_{av34} 3416 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3070 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8539	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3933	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 35.1 (pc/mi/ln)

LOS = E (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.513 (Exibit 25-19)

S_R= 55.6 mph (Exhibit 25-19)

S_0= 63.5 mph (Exhibit 25-19)

S = 59.6 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Junipero Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8880	0.90	Level	4	1	0.978	1.00	10084
Ramp	860	0.90	Level	4	1	0.978	1.00	977
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 4069 pc/h
V_3 or V_{av34} 1999 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8068	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	7091	Exhibit 25-14	9600	No
V_R	977	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4069	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 25.7 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.516 (Exhibit 25-19)
S_R= 55.6 mph (Exhibit 25-19)
S_0= 72.9 mph (Exhibit 25-19)
S = 63.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Junipero Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	8070	0.90	Level	4	1	0.978	1.00	9164
Ramp	500	0.90	Level	4	1	0.978	1.00	568
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.147 using Equation (Exhibit 25-5)

V_{12} = 978 pc/h

V_3 or V_{av34} 2843 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2665 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7232	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3233	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 29.5 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.409 (Exibit 25-19)

S_R= 58.5 mph (Exhibit 25-19)

S_0= 64.6 mph (Exhibit 25-19)

S = 61.7 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6920	0.90	Level	4	1	0.978	1.00	7858
Ramp	220	0.90	Level	4	1	0.978	1.00	250
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 3567 pc/h
V_3 or V_{av34} 2145 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7858	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	7608	Exhibit 25-14	9600	No
V_R	250	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3567	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 34.0 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.451 (Exhibit 25-19)
S_R= 57.4 mph (Exhibit 25-19)
S_0= 72.3 mph (Exhibit 25-19)
S = 64.7 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6070	0.90	Level	4	1	0.978	1.00	6893
Ramp	270	0.90	Level	4	1	0.978	1.00	307
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.179 using Equation (Exhibit 25-5)
V_{12} = 1237 pc/h
V_3 or V_{av34} 2828 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 2757 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7200	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3064	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 27.5 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.386 (Exibit 25-19)
S_R= 59.2 mph (Exhibit 25-19)
S_0= 64.4 mph (Exhibit 25-19)
S = 62.1 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Calafia/Magdalena
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6340	0.90	Level	4	1	0.978	1.00	7199
Ramp	240	0.90	Level	4	1	0.978	1.00	273
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 3293 pc/h
V_3 or V_{av34} 1953 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7199	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	6926	Exhibit 25-14	9600	No
V_R	273	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3293	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 31.7 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.453 (Exhibit 25-19)
S_R= 57.3 mph (Exhibit 25-19)
S_0= 73.1 mph (Exhibit 25-19)
S = 64.9 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Avenida Vista Hermosa
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7810	0.90	Level	4	1	0.978	1.00	8869
Ramp	1030	0.90	Level	4	1	0.978	1.00	1170
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.072 using Equation (Exhibit 25-5)

V_{12} = 635 pc/h

V_3 or V_{av34} 4117 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3547 pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	10039	Exhibit 25-7		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4717	Exhibit 25-7	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 39.8 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Speed Determination

M_S = 0.736 (Exibit 25-19)

S_R= 49.4 mph (Exhibit 25-19)

S_0= 61.3 mph (Exhibit 25-19)

S = 55.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Camino de los Mares/Estrella
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8840	0.90	Level	4	1	0.978	1.00	10038
Ramp	820	0.90	Level	4	1	0.978	1.00	931
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 4902 pc/h
V_3 or V_{av34} 2568 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	10038	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	9107	Exhibit 25-14	9600	No
V_R	931	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4902	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 45.5 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.512 (Exhibit 25-19)
S_R= 55.7 mph (Exhibit 25-19)
S_0= 70.7 mph (Exhibit 25-19)
S = 62.5 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	SR-1/Camino La Ramblas
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6690	0.90	Level	4	1	0.978	1.00	7597
Ramp	220	0.90	Level	4	1	0.978	1.00	250
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.187 using Equation (Exhibit 25-5)

V_{12} = 1417 pc/h

V_3 or V_{av34} 3090 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3038 pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7847	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3288	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 29.8 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.411 (Exibit 25-19)

S_R= 58.5 mph (Exhibit 25-19)

S_0= 63.6 mph (Exhibit 25-19)

S = 61.3 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Camino Capistrano/Stone Hill
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7210	0.90	Level	4	1	0.978	1.00	8187
Ramp	1680	0.90	Level	4	1	0.978	1.00	1908
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = -0.021 using Equation (Exhibit 25-5)

V_{12} = -168 pc/h

V_3 or V_{av34} 4177 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3274 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	10095	Exhibit 25-7		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5182	Exhibit 25-7	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 39.1 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.949 (Exibit 25-19)

S_R= 43.4 mph (Exhibit 25-19)

S_0= 62.5 mph (Exhibit 25-19)

S = 51.0 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8890	0.90	Level	4	1	0.978	1.00	10095
Ramp	550	0.90	Level	4	1	0.978	1.00	625
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 4754 pc/h
V_3 or V_{av34} 2670 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	10095	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	9470	Exhibit 25-14	9600	No
V_R	625	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4754	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 44.2 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.484 (Exhibit 25-19)
S_R= 56.4 mph (Exhibit 25-19)
S_0= 70.3 mph (Exhibit 25-19)
S = 63.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	8340	0.90	Level	4	1	0.978	1.00	9471
Ramp	480	0.90	Level	4	1	0.978	1.00	545
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.150 using Equation (Exhibit 25-5)

V_{12} = 1418 pc/h

V_3 or V_{av34} 4026 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3788 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	10016	Exhibit 25-7		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4333	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 37.3 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.599 (Exibit 25-19)

S_R= 53.2 mph (Exhibit 25-19)

S_0= 60.2 mph (Exhibit 25-19)

S = 57.0 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8630	0.90	Level	4	1	0.978	1.00	9800
Ramp	940	0.90	Level	4	1	0.978	1.00	1067
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 4875 pc/h
V_3 or V_{av34} 2462 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	9800	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	8733	Exhibit 25-14	9600	No
V_R	1067	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4875	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 45.3 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.524 (Exhibit 25-19)
S_R= 55.3 mph (Exhibit 25-19)
S_0= 71.1 mph (Exhibit 25-19)
S = 62.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	7690	0.90	Level	4	1	0.978	1.00	8732
Ramp	1930	0.90	Level	4	1	0.978	1.00	2192
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = -0.056 using Equation (Exhibit 25-5)

V_{12} = -490 pc/h

V_3 or V_{av34} 4611 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3492 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	10924	Exhibit 25-7		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5684	Exhibit 25-7	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 39.4 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 1.363 (Exibit 25-19)

S_R= 31.8 mph (Exhibit 25-19)

S_0= 61.5 mph (Exhibit 25-19)

S = 41.4 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Junipero Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	9530	0.90	Level	4	1	0.978	1.00	10822
Ramp	390	0.90	Level	4	1	0.978	1.00	443
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 4025 pc/h
V_3 or V_{av34} 2316 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8658	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	8215	Exhibit 25-14	9600	No
V_R	443	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4025	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 38.0 (pc/mi/ln)
LOS = E (Exhibit 25-4)

Speed Determination

D_s = 0.468 (Exhibit 25-19)
S_R= 56.9 mph (Exhibit 25-19)
S_0= 71.7 mph (Exhibit 25-19)
S = 63.9 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Junipero Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	9530	0.90	Level	4	1	0.978	1.00	10822
Ramp	390	0.90	Level	4	1	0.978	1.00	443
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.162 using Equation (Exhibit 25-5)

V_{12} = 1352 pc/h

V_3 or V_{av34} 3485 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3328 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8765	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3771	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 25.3 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.385 (Exibit 25-19)

S_R= 59.2 mph (Exhibit 25-19)

S_0= 62.3 mph (Exhibit 25-19)

S = 60.9 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7020	0.90	Level	4	1	0.978	1.00	7972
Ramp	450	0.90	Level	4	1	0.978	1.00	511
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 3764 pc/h
V_3 or V_{av34} 2104 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7972	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	7461	Exhibit 25-14	9600	No
V_R	511	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3764	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 35.7 (pc/mi/ln)
LOS = E (Exhibit 25-4)

Speed Determination

D_s = 0.474 (Exhibit 25-19)
S_R= 56.7 mph (Exhibit 25-19)
S_0= 72.5 mph (Exhibit 25-19)
S = 64.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6570	0.90	Level	4	1	0.978	1.00	7461
Ramp	340	0.90	Level	4	1	0.978	1.00	386
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.170 using Equation (Exhibit 25-5)

V_{12} = 1265 pc/h

V_3 or V_{av34} 3098 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2984 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7847	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3370	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 30.1 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.418 (Exibit 25-19)

S_R= 58.3 mph (Exhibit 25-19)

S_0= 63.7 mph (Exhibit 25-19)

S = 61.3 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Calafia/Magdalena
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6930	0.90	Level	4	1	0.978	1.00	7869
Ramp	90	0.90	Level	4	1	0.978	1.00	102
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.205 using Equation (Exhibit 25-5)

V_{12} = 1614 pc/h

V_3 or V_{av34} 3127 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3147 pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7971	Exhibit 25-7		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3249	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 29.4 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Speed Determination

M_S = 0.406 (Exibit 25-19)

S_R= 58.6 mph (Exhibit 25-19)

S_0= 63.1 mph (Exhibit 25-19)

S = 61.2 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Avenida Vista Hermosa
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	10620	0.90	Level	4	1	0.978	1.00	12060
Ramp	1690	0.90	Level	4	1	0.978	1.00	1919
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 6340 pc/h
V_3 or V_{av34} 2860 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = 6660 pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	12060	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	10141	Exhibit 25-14	9600	Yes
V_R	1919	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	6340	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 60.6 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.601 (Exhibit 25-19)
S_R= 53.2 mph (Exhibit 25-19)
S_0= 70.2 mph (Exhibit 25-19)
S = 59.6 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Camino de los Mares/Estrella
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	11340	0.90	Level	4	1	0.978	1.00	12877
Ramp	1490	0.90	Level	4	1	0.978	1.00	1692
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 6569 pc/h
V_3 or V_{av34} 3154 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = 7477 pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	12877	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	11185	Exhibit 25-14	9600	Yes
V_R	1692	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	6569	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 55.1 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.580 (Exhibit 25-19)
S_R= 53.8 mph (Exhibit 25-19)
S_0= 70.2 mph (Exhibit 25-19)
S = 59.6 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Camino de los Mares/Estrella
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	9850	0.90	Level	4	1	0.978	1.00	11185
Ramp	770	0.90	Level	4	1	0.978	1.00	874
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.109 using Equation (Exhibit 25-5)

V_{12} = 1214 pc/h

V_3 or V_{av34} 4985 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 4474 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	12059	Exhibit 25-7		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5348	Exhibit 25-7	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 46.2 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 1.134 (Exibit 25-19)

S_R= 38.3 mph (Exhibit 25-19)

S_0= 57.1 mph (Exhibit 25-19)

S = 46.9 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	SR-1/Camino La Ramblas
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	11050	0.90	Level	4	1	0.978	1.00	12548
Ramp	1280	0.90	Level	4	1	0.978	1.00	1454
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 5197 pc/h
V_3 or V_{av34} 2421 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	10039	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	8585	Exhibit 25-14	9600	No
V_R	1454	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5197	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 37.1 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.559 (Exhibit 25-19)
S_R= 54.4 mph (Exhibit 25-19)
S_0= 71.2 mph (Exhibit 25-19)
S = 61.4 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	SR-1/Camino La Ramblas
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	9960	0.90	Level	4	1	0.978	1.00	11310
Ramp	1380	0.90	Level	4	1	0.978	1.00	1567
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.022 using Equation (Exhibit 25-5)

V_{12} = 193 pc/h

V_3 or V_{av34} 4308 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3524 pc/h (Equation 25-8)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	10377	Exhibit 25-7		Yes

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5091	Exhibit 25-7	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 42.3 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.930 (Exibit 25-19)

S_R= 43.9 mph (Exhibit 25-19)

S_0= 61.4 mph (Exhibit 25-19)

S = 51.4 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	10310	0.90	Level	4	1	0.978	1.00	11708
Ramp	1440	0.90	Level	4	1	0.978	1.00	1635
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 6027 pc/h
V_3 or V_{av34} 2840 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = 6308 pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	11708	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	10073	Exhibit 25-14	9600	Yes
V_R	1635	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	6027	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 57.6 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.575 (Exhibit 25-19)
S_R= 53.9 mph (Exhibit 25-19)
S_0= 70.2 mph (Exhibit 25-19)
S = 60.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8870	0.90	Level	4	1	0.978	1.00	10072
Ramp	600	0.90	Level	4	1	0.978	1.00	681
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.133 using Equation (Exhibit 25-5)

V_{12} = 1336 pc/h

V_3 or V_{av34} 4368 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 4028 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	10753	Exhibit 25-7		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4709	Exhibit 25-7	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 40.6 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.740 (Exibit 25-19)

S_R= 49.3 mph (Exhibit 25-19)

S_0= 59.1 mph (Exhibit 25-19)

S = 54.4 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	11650	0.90	Level	4	1	0.978	1.00	13229
Ramp	2210	0.90	Level	4	1	0.978	1.00	2510
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 7183 pc/h
V_3 or V_{av34} 3023 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = 7829 pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	13229	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	10719	Exhibit 25-14	9600	Yes
V_R	2510	Exhibit 25-3	2000	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	7183	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 58.1 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.654 (Exhibit 25-19)
S_R= 51.7 mph (Exhibit 25-19)
S_0= 70.2 mph (Exhibit 25-19)
S = 57.9 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	9550	0.90	Level	4	1	0.978	1.00	10845
Ramp	760	0.90	Level	4	1	0.978	1.00	863
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.110 using Equation (Exhibit 25-5)

V_{12} = 1192 pc/h

V_3 or V_{av34} 4826 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 4338 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	11708	Exhibit 25-7		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5201	Exhibit 25-7	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 45.0 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 1.022 (Exibit 25-19)

S_R= 41.4 mph (Exhibit 25-19)

S_0= 57.8 mph (Exhibit 25-19)

S = 49.1 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Junipero Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	12650	0.90	Level	4	1	0.978	1.00	14365
Ramp	1480	0.90	Level	4	1	0.978	1.00	1681
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 5959 pc/h
V_3 or V_{av34} 2766 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = 6092 pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	11492	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	9811	Exhibit 25-14	9600	Yes
V_R	1681	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5959	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 43.1 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.579 (Exhibit 25-19)
S_R= 53.8 mph (Exhibit 25-19)
S_0= 70.2 mph (Exhibit 25-19)
S = 60.4 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Junipero Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	11120	0.90	Level	4	1	0.978	1.00	12627
Ramp	530	0.90	Level	4	1	0.978	1.00	602
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.143 using Equation (Exhibit 25-5)

V_{12} = 1444 pc/h

V_3 or V_{av34} 4341 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 4050 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	10729	Exhibit 25-7		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4652	Exhibit 25-7	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 40.5 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.719 (Exibit 25-19)

S_R= 49.9 mph (Exhibit 25-19)

S_0= 59.0 mph (Exhibit 25-19)

S = 54.7 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6010	0.90	Level	4	1	0.978	1.00	6825
Ramp	240	0.90	Level	4	1	0.978	1.00	273
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 3130 pc/h
V_3 or V_{av34} 1847 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6825	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	6552	Exhibit 25-14	9600	No
V_R	273	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3130	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 30.3 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.453 (Exhibit 25-19)
S_R= 57.3 mph (Exhibit 25-19)
S_0= 73.5 mph (Exhibit 25-19)
S = 65.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5770	0.90	Level	4	1	0.978	1.00	6552
Ramp	400	0.90	Level	4	1	0.978	1.00	454
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.161 using Equation (Exhibit 25-5)
V_{12} = 1055 pc/h
V_3 or V_{av34} 2748 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 2620 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7006	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3074	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 27.6 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.386 (Exibit 25-19)
S_R= 59.2 mph (Exhibit 25-19)
S_0= 64.7 mph (Exhibit 25-19)
S = 62.2 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Calafia/Magdalena
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6170	0.90	Level	4	1	0.978	1.00	7006
Ramp	200	0.90	Level	4	1	0.978	1.00	227
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 3183 pc/h
V_3 or V_{av34} 1911 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7006	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	6779	Exhibit 25-14	9600	No
V_R	227	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3183	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 30.7 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.448 (Exhibit 25-19)
S_R= 57.4 mph (Exhibit 25-19)
S_0= 73.2 mph (Exhibit 25-19)
S = 65.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Avenida Vista Hermosa
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7430	0.90	Level	4	1	0.978	1.00	8437
Ramp	1420	0.90	Level	4	1	0.978	1.00	1612
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.016 using Equation (Exhibit 25-5)

V_{12} = 138 pc/h

V_3 or V_{av34} 4149 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3374 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	10049	Exhibit 25-7		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4986	Exhibit 25-7	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 34.2 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.787 (Exibit 25-19)

S_R= 48.0 mph (Exhibit 25-19)

S_0= 62.1 mph (Exhibit 25-19)

S = 54.2 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Camino de los Mares/Estrella
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8750	0.90	Level	4	1	0.978	1.00	9936
Ramp	470	0.90	Level	4	1	0.978	1.00	534
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 4633 pc/h
V_3 or V_{av34} 2651 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	9936	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	9402	Exhibit 25-14	9600	No
V_R	534	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4633	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 43.2 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Speed Determination

D_s = 0.476 (Exhibit 25-19)
S_R= 56.7 mph (Exhibit 25-19)
S_0= 70.4 mph (Exhibit 25-19)
S = 63.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	SR-1/Camino La Ramblas
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8890	0.90	Level	4	1	0.978	1.00	10095
Ramp	350	0.90	Level	4	1	0.978	1.00	397
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.168 using Equation (Exhibit 25-5)

V_{12} = 1698 pc/h

V_3 or V_{av34} 4198 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 4038 pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	10492	Exhibit 25-7		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4435	Exhibit 25-7	4600:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 38.6 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Speed Determination

M_S = 0.636 (Exibit 25-19)

S_R= 52.2 mph (Exhibit 25-19)

S_0= 59.1 mph (Exhibit 25-19)

S = 56.0 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Camino Capistrano/Stone Hill
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	9340	0.90	Level	4	1	0.978	1.00	10606
Ramp	1520	0.90	Level	4	1	0.978	1.00	1726
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.002 using Equation (Exhibit 25-5)

V_{12} = 22 pc/h

V_3 or V_{av34} 5292 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 4242 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	12332	Exhibit 25-7		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5968	Exhibit 25-7	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 45.3 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 1.778 (Exibit 25-19)

S_R= 20.2 mph (Exhibit 25-19)

S_0= 58.2 mph (Exhibit 25-19)

S = 30.5 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	12/2/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	10860	0.90	Level	4	1	0.978	1.00	12332
Ramp	680	0.90	Level	4	1	0.978	1.00	772
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 using Equation (Exhibit 25-12)

V_{12} = 5812 pc/h

V_3 or V_{av34} 3260 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = 6932 pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	12332	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	11560	Exhibit 25-14	9600	Yes
V_R	772	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5812	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 63.0 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.497 (Exhibit 25-19)

S_R= 56.1 mph (Exhibit 25-19)

S_0= 70.2 mph (Exhibit 25-19)

S = 61.5 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	10180	0.90	Level	4	1	0.978	1.00	11560
Ramp	780	0.90	Level	4	1	0.978	1.00	886
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.107 using Equation (Exhibit 25-5)

V_{12} = 1237 pc/h

V_3 or V_{av34} 5161 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 4624 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	12446	Exhibit 25-7		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5510	Exhibit 25-7	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 46.3 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 1.266 (Exibit 25-19)

S_R= 34.6 mph (Exhibit 25-19)

S_0= 56.5 mph (Exhibit 25-19)

S = 44.1 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp	Terrain: Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 70.0 mph S_{FR} = 35.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	10870	0.90	Level	4	1	0.978	1.00	12343
Ramp	1180	0.90	Level	4	1	0.978	1.00	1340
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 using Equation (Exhibit 25-12)

V_{12} = 6137 pc/h

V_3 or V_{av34} 3103 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = 6943 pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	12343	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	11003	Exhibit 25-14	9600	Yes
V_R	1340	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	6137	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 63.1 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.549 (Exhibit 25-19)

S_R= 54.6 mph (Exhibit 25-19)

S_0= 70.2 mph (Exhibit 25-19)

S = 60.5 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	9690	0.90	Level	4	1	0.978	1.00	11004
Ramp	1930	0.90	Level	4	1	0.978	1.00	2192
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = -0.056 using Equation (Exhibit 25-5)
V_{12} = -617 pc/h
V_3 or V_{av34} 5810 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 4401 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	13196	Exhibit 25-7		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	6593	Exhibit 25-7	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 46.5 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = 3.063 (Exibit 25-19)
S_R= -15.8 mph (Exhibit 25-19)
S_0= 57.5 mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Junipero Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp	Terrain: Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 70.0 mph S_{FR} = 35.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	11540	0.90	Level	4	1	0.978	1.00	13104
Ramp	610	0.90	Level	4	1	0.978	1.00	693
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 using Equation (Exhibit 25-12)

V_{12} = 4962 pc/h

V_3 or V_{av34} 2761 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = 5084 pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	10484	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	9791	Exhibit 25-14	9600	Yes
V_R	693	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4962	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 47.1 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.490 (Exhibit 25-19)

S_R= 56.3 mph (Exhibit 25-19)

S_0= 70.2 mph (Exhibit 25-19)

S = 62.7 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Junipero Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	10930	0.90	Level	4	1	0.978	1.00	12412
Ramp	1180	0.90	Level	4	1	0.978	1.00	1340
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.050 using Equation (Exhibit 25-5)

V_{12} = 499 pc/h

V_3 or V_{av34} 4706 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3964 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	11252	Exhibit 25-7		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5304	Exhibit 25-7	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 36.8 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 1.000 (Exibit 25-19)

S_R= 42.0 mph (Exhibit 25-19)

S_0= 59.4 mph (Exhibit 25-19)

S = 49.7 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6680	0.90	Level	4	1	0.978	1.00	7586
Ramp	480	0.90	Level	4	1	0.978	1.00	545
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 3615 pc/h
V_3 or V_{av34} 1985 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7586	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	7041	Exhibit 25-14	9600	No
V_R	545	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3615	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 34.4 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.477 (Exhibit 25-19)
S_R= 56.6 mph (Exhibit 25-19)
S_0= 72.9 mph (Exhibit 25-19)
S = 64.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6210	0.90	Level	4	1	0.978	1.00	7052
Ramp	150	0.90	Level	4	1	0.978	1.00	170
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.197 using Equation (Exhibit 25-5)
V_{12} = 1386 pc/h
V_3 or V_{av34} 2833 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 2820 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7222	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2990	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 27.3 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.382 (Exibit 25-19)
S_R= 59.3 mph (Exhibit 25-19)
S_0= 64.2 mph (Exhibit 25-19)
S = 62.1 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Calafia/Magdalena
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6680	0.90	Level	4	1	0.978	1.00	7586
Ramp	130	0.90	Level	4	1	0.978	1.00	148
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.199 using Equation (Exhibit 25-5)
V_{12} = 1512 pc/h
V_3 or V_{av34} 3037 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 3034 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7734	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3182	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 28.8 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.400 (Exibit 25-19)
S_R= 58.8 mph (Exhibit 25-19)
S_0= 63.6 mph (Exhibit 25-19)
S = 61.5 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Avenida Vista Hermosa
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8060	0.90	Level	4	1	0.978	1.00	9153
Ramp	1310	0.90	Level	4	1	0.978	1.00	1488
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 4830 pc/h
V_3 or V_{av34} 2161 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	9153	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	7665	Exhibit 25-14	9600	No
V_R	1488	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4830	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 32.3 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.562 (Exhibit 25-19)
S_R= 54.3 mph (Exhibit 25-19)
S_0= 72.3 mph (Exhibit 25-19)
S = 61.5 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Camino de los Mares/Estrella
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8090	0.90	Level	4	1	0.978	1.00	9187
Ramp	820	0.90	Level	4	1	0.978	1.00	931
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 4531 pc/h
V_3 or V_{av34} 2328 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	9187	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	8256	Exhibit 25-14	9600	No
V_R	931	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4531	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 29.7 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Speed Determination

D_s = 0.512 (Exhibit 25-19)
S_R= 55.7 mph (Exhibit 25-19)
S_0= 71.6 mph (Exhibit 25-19)
S = 62.7 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Camino de los Mares/Estrella
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	7480	0.90	Level	4	1	0.978	1.00	8494
Ramp	580	0.90	Level	4	1	0.978	1.00	659
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.135 using Equation (Exhibit 25-5)
V_{12} = 1150 pc/h
V_3 or V_{av34} 3672 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 3397 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	9153	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4056	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 27.4 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.441 (Exibit 25-19)
S_R= 57.6 mph (Exhibit 25-19)
S_0= 62.0 mph (Exhibit 25-19)
S = 60.0 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	SR-1/Camino La Ramblas
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7300	0.90	Level	4	1	0.978	1.00	8290
Ramp	820	0.90	Level	4	1	0.978	1.00	931
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 4140 pc/h
V_3 or V_{av34} 2075 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8290	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	7359	Exhibit 25-14	9600	No
V_R	931	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4140	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 28.0 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.512 (Exhibit 25-19)
S_R= 55.7 mph (Exhibit 25-19)
S_0= 72.6 mph (Exhibit 25-19)
S = 63.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	SR-1/Camino La Ramblas
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6710	0.90	Level	4	1	0.978	1.00	7620
Ramp	1380	0.90	Level	4	1	0.978	1.00	1567
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.022 using Equation (Exhibit 25-5)

V_{12} = 119 pc/h

V_3 or V_{av34} 2665 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2179 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7016	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3746	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 24.6 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.381 (Exibit 25-19)

S_R= 59.3 mph (Exhibit 25-19)

S_0= 65.9 mph (Exhibit 25-19)

S = 62.2 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp	Terrain: Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 70.0 mph S_{FR} = 35.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7490	0.90	Level	4	1	0.978	1.00	8505
Ramp	1080	0.90	Level	4	1	0.978	1.00	1226
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 using Equation (Exhibit 25-12)

V_{12} = 4400 pc/h

V_3 or V_{av34} 2052 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8505	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	7279	Exhibit 25-14	9600	No
V_R	1226	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4400	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 41.2 (pc/mi/ln)

LOS = E (Exhibit 25-4)

Speed Determination

D_s = 0.538 (Exhibit 25-19)

S_R= 54.9 mph (Exhibit 25-19)

S_0= 72.7 mph (Exhibit 25-19)

S = 62.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6410	0.90	Level	4	1	0.978	1.00	7279
Ramp	770	0.90	Level	4	1	0.978	1.00	874
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.109 using Equation (Exhibit 25-5)
V_{12} = 790 pc/h
V_3 or V_{av34} 3244 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 2911 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8153	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3785	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 33.3 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.479 (Exibit 25-19)
S_R= 56.6 mph (Exhibit 25-19)
S_0= 63.9 mph (Exhibit 25-19)
S = 60.3 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8560	0.90	Level	4	1	0.978	1.00	9720
Ramp	1880	0.90	Level	4	1	0.978	1.00	2135
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 5442 pc/h
V_3 or V_{av34} 2139 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	9720	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	7585	Exhibit 25-14	9600	No
V_R	2135	Exhibit 25-3	2000	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5442	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 37.6 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.620 (Exhibit 25-19)
S_R= 52.6 mph (Exhibit 25-19)
S_0= 72.3 mph (Exhibit 25-19)
S = 59.8 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6730	0.90	Level	4	1	0.978	1.00	7642
Ramp	760	0.90	Level	4	1	0.978	1.00	863
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.110 using Equation (Exhibit 25-5)

V_{12} = 840 pc/h

V_3 or V_{av34} 3401 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3056 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8505	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3919	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 35.0 (pc/mi/ln)

LOS = E (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.510 (Exibit 25-19)

S_R= 55.7 mph (Exhibit 25-19)

S_0= 63.5 mph (Exhibit 25-19)

S = 59.7 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Junipero Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp	Terrain: Level	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☑ No ☐ Off		☑ No ☐ Off
L_{up} = ft		L_{down} = ft
V_u = veh/h	S_{FF} = 70.0 mph S_{FR} = 35.0 mph Sketch (show lanes, L_A, L_D, V_R, V_f)	V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8860	0.90	Level	4	1	0.978	1.00	10061
Ramp	850	0.90	Level	4	1	0.978	1.00	965
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 using Equation (Exhibit 25-12)

V_{12} = 4054 pc/h

V_3 or V_{av34} 1997 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8049	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	7084	Exhibit 25-14	9600	No
V_R	965	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4054	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 25.6 (pc/mi/ln)

LOS = C (Exhibit 25-4)

Speed Determination

D_s = 0.515 (Exhibit 25-19)

S_R= 55.6 mph (Exhibit 25-19)

S_0= 72.9 mph (Exhibit 25-19)

S = 63.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Junipero Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	AM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	8060	0.90	Level	4	1	0.978	1.00	9153
Ramp	500	0.90	Level	4	1	0.978	1.00	568
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.147 using Equation (Exhibit 25-5)

V_{12} = 977 pc/h

V_3 or V_{av34} 2838 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2661 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7221	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3229	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 29.5 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.409 (Exibit 25-19)

S_R= 58.5 mph (Exhibit 25-19)

S_0= 64.6 mph (Exhibit 25-19)

S = 61.8 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6920	0.90	Level	4	1	0.978	1.00	7858
Ramp	220	0.90	Level	4	1	0.978	1.00	250
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 3567 pc/h
V_3 or V_{av34} 2145 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7858	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	7608	Exhibit 25-14	9600	No
V_R	250	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3567	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 34.0 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.451 (Exhibit 25-19)
S_R= 57.4 mph (Exhibit 25-19)
S_0= 72.3 mph (Exhibit 25-19)
S = 64.7 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6070	0.90	Level	4	1	0.978	1.00	6893
Ramp	270	0.90	Level	4	1	0.978	1.00	307
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.179 using Equation (Exhibit 25-5)
V_{12} = 1237 pc/h
V_3 or V_{av34} 2828 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 2757 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7200	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3064	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 27.5 (pc/mi/ln)
LOS = C (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.386 (Exibit 25-19)
S_R= 59.2 mph (Exhibit 25-19)
S_0= 64.4 mph (Exhibit 25-19)
S = 62.1 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Calafia/Magdalena
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6340	0.90	Level	4	1	0.978	1.00	7199
Ramp	230	0.90	Level	4	1	0.978	1.00	261
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 3286 pc/h
V_3 or V_{av34} 1956 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7199	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	6938	Exhibit 25-14	9600	No
V_R	261	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3286	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 31.6 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Speed Determination

D_s = 0.451 (Exhibit 25-19)
S_R= 57.4 mph (Exhibit 25-19)
S_0= 73.1 mph (Exhibit 25-19)
S = 64.9 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Avenida Vista Hermosa
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7050	0.90	Level	4	1	0.978	1.00	8006
Ramp	1040	0.90	Level	4	1	0.978	1.00	1181
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.070 using Equation (Exhibit 25-5)

V_{12} = 562 pc/h

V_3 or V_{av34} 3722 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3202 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	9187	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4383	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 29.7 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.528 (Exibit 25-19)

S_R= 55.2 mph (Exhibit 25-19)

S_0= 62.9 mph (Exhibit 25-19)

S = 59.0 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Camino de los Mares/Estrella
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8090	0.90	Level	4	1	0.978	1.00	9187
Ramp	830	0.90	Level	4	1	0.978	1.00	943
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 4537 pc/h
V_3 or V_{av34} 2325 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	9187	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	8244	Exhibit 25-14	9600	No
V_R	943	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4537	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 42.4 (pc/mi/ln)
LOS = E (Exhibit 25-4)

Speed Determination

D_s = 0.513 (Exhibit 25-19)
S_R= 55.6 mph (Exhibit 25-19)
S_0= 71.6 mph (Exhibit 25-19)
S = 62.7 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	SR-1/Camino La Ramblas
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6670	0.90	Level	4	1	0.978	1.00	7574
Ramp	210	0.90	Level	4	1	0.978	1.00	238
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.188 using Equation (Exhibit 25-5)

V_{12} = 1424 pc/h

V_3 or V_{av34} 3075 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3029 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7812	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3267	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 29.6 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.409 (Exibit 25-19)

S_R= 58.5 mph (Exhibit 25-19)

S_0= 63.6 mph (Exhibit 25-19)

S = 61.4 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Camino Capistrano/Stone Hill
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7180	0.90	Level	4	1	0.978	1.00	8153
Ramp	1670	0.90	Level	4	1	0.978	1.00	1896
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = -0.019 using Equation (Exhibit 25-5)
V_{12} = -156 pc/h
V_3 or V_{av34} 4154 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 3261 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	10049	Exhibit 25-7		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5157	Exhibit 25-7	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 38.9 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.932 (Exibit 25-19)
S_R= 43.9 mph (Exhibit 25-19)
S_0= 62.6 mph (Exhibit 25-19)
S = 51.4 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	12/2/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Alt 2

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8850	0.90	Level	4	1	0.978	1.00	10050
Ramp	550	0.90	Level	4	1	0.978	1.00	625
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.260 using Equation (Exhibit 25-12)

V_{12} = 3075 pc/h

V_3 or V_{av34} 3487 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = 4650 pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	10050	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	9425	Exhibit 25-14	9600	No
V_R	625	Exhibit 25-3	3800	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3075	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 17.2 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.484 (Exhibit 25-19)

S_R= 56.4 mph (Exhibit 25-19)

S_0= 70.2 mph (Exhibit 25-19)

S = 63.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	12/2/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8850	0.90	Level	4	1	0.978	1.00	10050
Ramp	550	0.90	Level	4	1	0.978	1.00	625
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = using Equation (Exhibit 25-5)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 using Equation (Exhibit 25-12)

V_{12} = 4734 pc/h

V_3 or V_{av34} 2658 pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	10050	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	9425	Exhibit 25-14	9600	No
V_R	625	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4734	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 44.1 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.484 (Exhibit 25-19)

S_R= 56.4 mph (Exhibit 25-19)

S_0= 70.3 mph (Exhibit 25-19)

S = 63.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8580	0.90	Level	4	1	0.978	1.00	9743
Ramp	940	0.90	Level	4	1	0.978	1.00	1067
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 4850 pc/h
V_3 or V_{av34} 2446 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	9743	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	8676	Exhibit 25-14	9600	No
V_R	1067	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4850	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 45.1 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.524 (Exhibit 25-19)
S_R= 55.3 mph (Exhibit 25-19)
S_0= 71.2 mph (Exhibit 25-19)
S = 62.3 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7640	0.90	Level	4	1	0.978	1.00	8676
Ramp	1960	0.90	Level	4	1	0.978	1.00	2226
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = -0.060 using Equation (Exhibit 25-5)

V_{12} = -523 pc/h

V_3 or V_{av34} 4599 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3470 pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	10902	Exhibit 25-7		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5696	Exhibit 25-7	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 39.5 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Speed Determination

M_S = 1.377 (Exibit 25-19)

S_R= 31.4 mph (Exhibit 25-19)

S_0= 61.7 mph (Exhibit 25-19)

S = 41.1 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Junipero Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	9500	0.90	Level	4	1	0.978	1.00	10788
Ramp	390	0.90	Level	4	1	0.978	1.00	443
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 4013 pc/h
V_3 or V_{av34} 2309 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8631	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	8188	Exhibit 25-14	9600	No
V_R	443	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4013	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 37.9 (pc/mi/ln)
LOS = E (Exhibit 25-4)

Speed Determination

D_s = 0.468 (Exhibit 25-19)
S_R= 56.9 mph (Exhibit 25-19)
S_0= 71.7 mph (Exhibit 25-19)
S = 64.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Northbound
Agency or Company	Austin-Foust Associates	Junction	Junipero Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	9110	0.90	Level	4	1	0.978	1.00	10345
Ramp	990	0.90	Level	4	1	0.978	1.00	1124
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.077 using Equation (Exhibit 25-5)
V_{12} = 606 pc/h
V_3 or V_{av34} 3619 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 3138 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8969	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4262	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 28.8 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.493 (Exibit 25-19)
S_R= 56.2 mph (Exhibit 25-19)
S_0= 63.2 mph (Exhibit 25-19)
S = 59.6 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7020	0.90	Level	4	1	0.978	1.00	7972
Ramp	440	0.90	Level	4	1	0.978	1.00	500
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 3758 pc/h
V_3 or V_{av34} 2107 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7972	Exhibit 25-14	9600	No
$V_{FO} = V_F - V_R$	7472	Exhibit 25-14	9600	No
V_R	500	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3758	Exhibit 25-14	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 35.7 (pc/mi/ln)
LOS = E (Exhibit 25-4)

Speed Determination

D_s = 0.473 (Exhibit 25-19)
S_R= 56.8 mph (Exhibit 25-19)
S_0= 72.5 mph (Exhibit 25-19)
S = 64.1 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Cristianitos
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6580	0.90	Level	4	1	0.978	1.00	7472
Ramp	330	0.90	Level	4	1	0.978	1.00	375
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.171 using Equation (Exhibit 25-5)
V_{12} = 1277 pc/h
V_3 or V_{av34} 3097 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 2988 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7847	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3363	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 30.1 (pc/mi/ln)
LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.418 (Exibit 25-19)
S_R= 58.3 mph (Exhibit 25-19)
S_0= 63.7 mph (Exhibit 25-19)
S = 61.3 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Calafia/Magdalena
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6930	0.90	Level	4	1	0.978	1.00	7869
Ramp	90	0.90	Level	4	1	0.978	1.00	102
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.205 using Equation (Exhibit 25-5)

V_{12} = 1614 pc/h

V_3 or V_{av34} 3127 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3147 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7971	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3249	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 29.4 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.406 (Exibit 25-19)

S_R= 58.6 mph (Exhibit 25-19)

S_0= 63.1 mph (Exhibit 25-19)

S = 61.2 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Avenida Vista Hermosa
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	9210	0.90	Level	4	1	0.978	1.00	10458
Ramp	1700	0.90	Level	4	1	0.978	1.00	1930
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 5648 pc/h
V_3 or V_{av34} 2405 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	10458	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	8528	Exhibit 25-14	9600	No
V_R	1930	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5648	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 39.3 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Speed Determination

D_s = 0.602 (Exhibit 25-19)
S_R= 53.2 mph (Exhibit 25-19)
S_0= 71.3 mph (Exhibit 25-19)
S = 60.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Camino de los Mares/Estrella
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	9870	0.90	Level	4	1	0.978	1.00	11208
Ramp	1500	0.90	Level	4	1	0.978	1.00	1703
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 5847 pc/h
V_3 or V_{av34} 2680 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	11208	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	9505	Exhibit 25-14	9600	No
V_R	1703	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5847	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 41.0 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Speed Determination

D_s = 0.581 (Exhibit 25-19)
S_R= 53.7 mph (Exhibit 25-19)
S_0= 70.2 mph (Exhibit 25-19)
S = 60.5 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Camino de los Mares/Estrella
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	8450	0.90	Level	4	1	0.978	1.00	9595
Ramp	760	0.90	Level	4	1	0.978	1.00	863
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.110 using Equation (Exhibit 25-5)

V_{12} = 1055 pc/h

V_3 or V_{av34} 4270 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 3838 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	10458	Exhibit 25-7		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4701	Exhibit 25-7	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 32.3 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.645 (Exibit 25-19)

S_R= 51.9 mph (Exhibit 25-19)

S_0= 60.0 mph (Exhibit 25-19)

S = 56.1 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	SR-1/Camino La Ramblas
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	9480	0.90	Level	4	1	0.978	1.00	10765
Ramp	1280	0.90	Level	4	1	0.978	1.00	1454
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 5514 pc/h
V_3 or V_{av34} 2625 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	10765	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	9311	Exhibit 25-14	9600	No
V_R	1454	Exhibit 25-3	2000	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5514	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 39.8 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Speed Determination

D_s = 0.559 (Exhibit 25-19)
S_R= 54.4 mph (Exhibit 25-19)
S_0= 70.5 mph (Exhibit 25-19)
S = 61.2 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	SR-1/Camino La Ramblas
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	8410	0.90	Level	4	1	0.978	1.00	9550
Ramp	1460	0.90	Level	4	1	0.978	1.00	1658
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.011 using Equation (Exhibit 25-5)

V_{12} = 74 pc/h

V_3 or V_{av34} 3488 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2820 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8708	Exhibit 25-7		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4478	Exhibit 25-7	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 30.2 (pc/mi/ln)

LOS = D (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.559 (Exibit 25-19)

S_R= 54.3 mph (Exhibit 25-19)

S_0= 64.2 mph (Exhibit 25-19)

S = 58.7 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	10240	0.90	Level	4	1	0.978	1.00	11628
Ramp	1420	0.90	Level	4	1	0.978	1.00	1612
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 5979 pc/h
V_3 or V_{av34} 2824 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = 6228 pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	11628	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	10016	Exhibit 25-14	9600	Yes
V_R	1612	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5979	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 56.9 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.573 (Exhibit 25-19)
S_R= 54.0 mph (Exhibit 25-19)
S_0= 70.2 mph (Exhibit 25-19)
S = 60.4 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	San Juan Creek
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	8820	0.90	Level	4	1	0.978	1.00	10016
Ramp	610	0.90	Level	4	1	0.978	1.00	693
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.131 using Equation (Exhibit 25-5)
V_{12} = 1314 pc/h
V_3 or V_{av34} 4351 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 4006 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	10709	Exhibit 25-7		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4699	Exhibit 25-7	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 40.6 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.735 (Exibit 25-19)
S_R= 49.4 mph (Exhibit 25-19)
S_0= 59.2 mph (Exhibit 25-19)
S = 54.5 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	11640	0.90	Level	4	1	0.978	1.00	13218
Ramp	2190	0.90	Level	4	1	0.978	1.00	2487
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 7166 pc/h
V_3 or V_{av34} 3026 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = 7818 pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	13218	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	10731	Exhibit 25-14	9600	Yes
V_R	2487	Exhibit 25-3	2000	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	7166	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 58.0 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.652 (Exhibit 25-19)
S_R= 51.7 mph (Exhibit 25-19)
S_0= 70.2 mph (Exhibit 25-19)
S = 58.0 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Ortega
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	9470	0.90	Level	4	1	0.978	1.00	10754
Ramp	770	0.90	Level	4	1	0.978	1.00	874
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = 0.109 using Equation (Exhibit 25-5)
V_{12} = 1167 pc/h
V_3 or V_{av34} 4793 pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No
If Yes, V_{12a} = 4301 pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	11628	Exhibit 25-7		Yes

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5175	Exhibit 25-7	4600:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 44.8 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

M_S = 1.004 (Exibit 25-19)
S_R= 41.9 mph (Exhibit 25-19)
S_0= 57.9 mph (Exhibit 25-19)
S = 49.5 mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = using Equation (Exhibit 25-12)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

D_s = (Exhibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Junipero Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - No Build

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph
Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp
☐ Yes ☐ On
☑ No ☐ Off
L_{down} = ft
V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	12620	0.90	Level	4	1	0.978	1.00	14331
Ramp	1460	0.90	Level	4	1	0.978	1.00	1658
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)
P_{FM} = using Equation (Exhibit 25-5)
V_{12} = pc/h
V_3 or V_{av34} pc/h (Equation 25-4 or 25-5)
Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No
If Yes, V_{12a} = pc/h (Equation 25-8)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 25-7		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 25-7		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)
LOS = (Exhibit 25-4)

Speed Determination

M_S = (Exibit 25-19)
S_R= mph (Exhibit 25-19)
S_0= mph (Exhibit 25-19)
S = mph (Exhibit 25-14)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)
P_{FD} = 0.436 using Equation (Exhibit 25-12)
V_{12} = 5934 pc/h
V_3 or V_{av34} 2765 pc/h (Equation 25-15 or 25-16)
Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No
Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No
If Yes, V_{12a} = 6065 pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	11465	Exhibit 25-14	9600	Yes
$V_{FO} = V_F - V_R$	9807	Exhibit 25-14	9600	Yes
V_R	1658	Exhibit 25-3	2000	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	5934	Exhibit 25-14	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 42.9 (pc/mi/ln)
LOS = F (Exhibit 25-4)

Speed Determination

D_s = 0.577 (Exhibit 25-19)
S_R= 53.8 mph (Exhibit 25-19)
S_0= 70.2 mph (Exhibit 25-19)
S = 60.5 mph (Exhibit 25-15)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Ryan	Freeway/Dir of Travel	Southbound
Agency or Company	Austin-Foust Associates	Junction	Junipero Serra
Date Performed	11/4/2009	Jurisdiction	
Analysis Time Period	PM Peak Hour	Analysis Year	Year 2040 - Build Lanes

Project Description I-5 HOV Extension

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Level

S_{FF} = 70.0 mph S_{FR} = 35.0 mph

Sketch (show lanes, L_A, L_D, V_R, V_f)

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	11120	0.90	Level	4	1	0.978	1.00	12627
Ramp	530	0.90	Level	4	1	0.978	1.00	602
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.143 using Equation (Exhibit 25-5)

V_{12} = 1444 pc/h

V_3 or V_{av34} 4341 pc/h (Equation 25-4 or 25-5)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 4050 pc/h (Equation 25-8)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = using Equation (Exhibit 25-12)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 25-15 or 25-16)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 25-18)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	10729	Exhibit 25-7		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 25-14		
$V_{FO} = V_F - V_R$		Exhibit 25-14		
V_R		Exhibit 25-3		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4652	Exhibit 25-7	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 25-14		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 40.5 (pc/mi/ln)

LOS = F (Exhibit 25-4)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 25-4)

Speed Determination

M_S = 0.719 (Exibit 25-19)

S_R= 49.9 mph (Exhibit 25-19)

S_0= 59.0 mph (Exhibit 25-19)

S = 54.7 mph (Exhibit 25-14)

Speed Determination

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

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APPENDIX I

RAMP METER QUEUE WORKSHEETS

AM PEAK HOUR QUEUE CALCULATION
(Avenida Vista Hermosa NB Loop-On)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	3.40%	3.4%	125	125	210	0	0	0	0
2	4.50%	7.9%	165	290	210	0	0	0	0.00
3	5.40%	13.3%	198	488	210	0	0	0	0.00
4	5.70%	19.0%	209	697	210	0	0	0	0.00
5	5.90%	24.9%	217	914	210	7	7	217	0.00
6	5.90%	30.8%	217	1130	210	7	13	433	1.31
7	5.90%	36.7%	217	1347	210	7	20	650	1.96
8	5.80%	42.5%	213	1560	210	3	22	862	2.25
9	5.70%	48.2%	209	1769	210	0	22	1072	2.16
10	5.60%	53.8%	206	1974	210	0	17	1277	1.72
11	5.40%	59.2%	198	2173	210	0	5	1475	0.53
12	5.10%	64.3%	187	2360	210	0	0	0	0.00
13	5.00%	69.3%	184	2543	210	0	0	0	0.00
14	4.90%	74.2%	180	2723	210	0	0	0	0.00
15	4.50%	78.7%	165	2888	210	0	0	0	0.00
16	4.40%	83.1%	161	3050	210	0	0	0	0.00
17	4.30%	87.4%	158	3208	210	0	0	0	0.00
18	4.20%	91.6%	154	3362	210	0	0	0	0.00
19	4.20%	95.8%	154	3516	210	0	0	0	0.00
20	4.20%	100.0%	154	3670	210	0	0	0	0.00
Peak Period Volume =			3670	PH Cap. =	1050	Max Q =	22	1475	9.92
Maximum 1-hour volume =			2070	Lanes =	2	Average Delay =		0.40	Mins/Veh
Maximum Queue Length (vehicles) =				11					
Maximum Queue Length (feet) =				337					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

AM PEAK HOUR QUEUE CALCULATION
(Avenida Vista Hermosa NB Direct-On)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	3.40%	3.4%	86	86	140	0	0	0	0
2	4.50%	7.9%	113	199	140	0	0	0	0.00
3	5.40%	13.3%	136	335	140	0	0	0	0.00
4	5.70%	19.0%	144	478	140	4	4	144	0.00
5	5.90%	24.9%	149	627	140	9	12	292	1.21
6	5.90%	30.8%	149	776	140	9	21	441	2.07
7	5.90%	36.7%	149	924	140	9	29	589	2.92
8	5.80%	42.5%	146	1070	140	6	35	735	3.53
9	5.70%	48.2%	144	1214	140	4	39	879	3.88
10	5.60%	53.8%	141	1355	140	1	40	1020	3.98
11	5.40%	59.2%	136	1491	140	0	36	1156	3.58
12	5.10%	64.3%	128	1619	140	0	24	1284	2.42
13	5.00%	69.3%	126	1745	140	0	10	1410	1.01
14	4.90%	74.2%	123	1868	140	0	0	0	0.00
15	4.50%	78.7%	113	1982	140	0	0	0	0.00
16	4.40%	83.1%	111	2092	140	0	0	0	0.00
17	4.30%	87.4%	108	2201	140	0	0	0	0.00
18	4.20%	91.6%	106	2306	140	0	0	0	0.00
19	4.20%	95.8%	106	2412	140	0	0	0	0.00
20	4.20%	100.0%	106	2518	140	0	0	0	0.00
Peak Period Volume =			2518	PH Cap. =	700	Max Q =	40	1410	24.58
Maximum 1-hour volume =			1420	Lanes =	2	Average Delay =		1.05	Mins/Veh
Maximum Queue Length (vehicles) =				20					
Maximum Queue Length (feet) =				597					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

AM PEAK HOUR QUEUE CALCULATION
(Camino De Los Mares NB Loop-On)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	3.40%	3.4%	28	28	50	0	0	0	0
2	4.50%	7.9%	37	66	50	0	0	0	0.00
3	5.40%	13.3%	45	111	50	0	0	0	0.00
4	5.70%	19.0%	47	158	50	0	0	0	0.00
5	5.90%	24.9%	49	207	50	0	0	0	0.00
6	5.90%	30.8%	49	257	50	0	0	0	0.00
7	5.90%	36.7%	49	306	50	0	0	0	0.00
8	5.80%	42.5%	48	354	50	0	0	0	0.00
9	5.70%	48.2%	47	402	50	0	0	0	0.00
10	5.60%	53.8%	47	448	50	0	0	0	0.00
11	5.40%	59.2%	45	493	50	0	0	0	0.00
12	5.10%	64.3%	42	536	50	0	0	0	0.00
13	5.00%	69.3%	42	577	50	0	0	0	0.00
14	4.90%	74.2%	41	618	50	0	0	0	0.00
15	4.50%	78.7%	37	656	50	0	0	0	0.00
16	4.40%	83.1%	37	692	50	0	0	0	0.00
17	4.30%	87.4%	36	728	50	0	0	0	0.00
18	4.20%	91.6%	35	763	50	0	0	0	0.00
19	4.20%	95.8%	35	798	50	0	0	0	0.00
20	4.20%	100.0%	35	833	50	0	0	0	0.00
Peak Period Volume =			833	PH Cap. =	500	Max Q =	0	0	0.00
Maximum 1-hour volume =			470	Lanes =	1	Average Delay =		#DIV/0!	Mins/Veh
Maximum Queue Length (vehicles) =				0					
Maximum Queue Length (feet) =				0					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

AM PEAK HOUR QUEUE CALCULATION
(Camino De Los Mares NB Direct-On)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	3.40%	3.4%	83	83	140	0	0	0	0
2	4.50%	7.9%	109	192	140	0	0	0	0.00
3	5.40%	13.3%	131	323	140	0	0	0	0.00
4	5.70%	19.0%	138	462	140	0	0	0	0.00
5	5.90%	24.9%	143	605	140	3	3	143	0.00
6	5.90%	30.8%	143	748	140	3	7	287	0.66
7	5.90%	36.7%	143	891	140	3	10	430	0.99
8	5.80%	42.5%	141	1032	140	1	11	571	1.08
9	5.70%	48.2%	138	1171	140	0	9	709	0.93
10	5.60%	53.8%	136	1307	140	0	5	845	0.53
11	5.40%	59.2%	131	1438	140	0	0	0	0.00
12	5.10%	64.3%	124	1562	140	0	0	0	0.00
13	5.00%	69.3%	121	1683	140	0	0	0	0.00
14	4.90%	74.2%	119	1802	140	0	0	0	0.00
15	4.50%	78.7%	109	1912	140	0	0	0	0.00
16	4.40%	83.1%	107	2018	140	0	0	0	0.00
17	4.30%	87.4%	104	2123	140	0	0	0	0.00
18	4.20%	91.6%	102	2225	140	0	0	0	0.00
19	4.20%	95.8%	102	2327	140	0	0	0	0.00
20	4.20%	100.0%	102	2429	140	0	0	0	0.00
Peak Period Volume =			2429	PH Cap. =	700	Max Q =	11	845	4.19
Maximum 1-hour volume =			1370	Lanes =	2	Average Delay =		0.30	Mins/Veh
Maximum Queue Length (vehicles) =				5					
Maximum Queue Length (feet) =				162					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

AM PEAK HOUR QUEUE CALCULATION
(SR-1 NB)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	3.40%	3.4%	27	27	45	0	0	0	0
2	4.50%	7.9%	36	63	45	0	0	0	0.00
3	5.40%	13.3%	43	106	45	0	0	0	0.00
4	5.70%	19.0%	45	152	45	0	0	45	0.00
5	5.90%	24.9%	47	199	45	2	3	93	0.26
6	5.90%	30.8%	47	246	45	2	5	140	0.47
7	5.90%	36.7%	47	293	45	2	7	187	0.67
8	5.80%	42.5%	46	339	45	1	8	233	0.80
9	5.70%	48.2%	45	385	45	0	9	279	0.85
10	5.60%	53.8%	45	429	45	0	8	323	0.82
11	5.40%	59.2%	43	472	45	0	6	366	0.63
12	5.10%	64.3%	41	513	45	0	2	407	0.20
13	5.00%	69.3%	40	553	45	0	0	0	0.00
14	4.90%	74.2%	39	592	45	0	0	0	0.00
15	4.50%	78.7%	36	628	45	0	0	0	0.00
16	4.40%	83.1%	35	663	45	0	0	0	0.00
17	4.30%	87.4%	34	697	45	0	0	0	0.00
18	4.20%	91.6%	34	731	45	0	0	0	0.00
19	4.20%	95.8%	34	764	45	0	0	0	0.00
20	4.20%	100.0%	34	798	45	0	0	0	0.00
Peak Period Volume =			798	PH Cap. =	450	Max Q =	9	407	4.69
Maximum 1-hour volume =			450	Lanes =	1	Average Delay =		0.69	Mins/Veh
Maximum Queue Length (vehicles) =				9					
Maximum Queue Length (feet) =				255					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

PM PEAK HOUR QUEUE CALCULATION
(Stonehill NB)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	4.30%	4.3%	133	133	170	0	0	0	0
2	4.70%	9.0%	145	277	170	0	0	0	0.00
3	4.80%	13.8%	148	425	170	0	0	0	0.00
4	4.90%	18.7%	151	576	170	0	0	0	0.00
5	4.80%	23.5%	148	724	170	0	0	0	0.00
6	4.90%	28.4%	151	875	170	0	0	0	0.00
7	5.00%	33.4%	154	1029	170	0	0	0	0.00
8	5.10%	38.5%	157	1187	170	0	0	0	0.00
9	5.20%	43.7%	160	1347	170	0	0	0	0.00
10	5.30%	49.0%	163	1510	170	0	0	0	0.00
11	5.50%	54.5%	170	1680	170	0	0	0	0.00
12	5.70%	60.2%	176	1855	170	6	6	176	0.00
13	5.90%	66.1%	182	2037	170	12	18	358	1.75
14	5.80%	71.9%	179	2216	170	9	26	536	2.63
15	5.50%	77.4%	170	2385	170	0	26	706	2.58
16	5.20%	82.6%	160	2546	170	0	16	866	1.60
17	4.80%	87.4%	148	2694	170	0	0	0	0.00
18	4.60%	92.0%	142	2835	170	0	0	0	0.00
19	4.20%	96.2%	129	2965	170	0	0	0	0.00
20	3.80%	100.0%	117	3082	170	0	0	0	0.00
Peak Period Volume =			3082	PH Cap. =	850	Max Q =	26	866	8.56
Maximum 1-hour volume =			1670	Lanes =	2	Average Delay =		0.59	Mins/Veh
Maximum Queue Length (vehicles) =				13					
Maximum Queue Length (feet) =				394					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

AM PEAK HOUR QUEUE CALCULATION
(Avenida Vista Hermosa SB)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	3.40%	3.4%	31	31	60	0	0	0	0
2	4.50%	7.9%	41	71	60	0	0	0	0.00
3	5.40%	13.3%	49	120	60	0	0	0	0.00
4	5.70%	19.0%	52	172	60	0	0	0	0.00
5	5.90%	24.9%	53	225	60	0	0	0	0.00
6	5.90%	30.8%	53	279	60	0	0	0	0.00
7	5.90%	36.7%	53	332	60	0	0	0	0.00
8	5.80%	42.5%	52	385	60	0	0	0	0.00
9	5.70%	48.2%	52	436	60	0	0	0	0.00
10	5.60%	53.8%	51	487	60	0	0	0	0.00
11	5.40%	59.2%	49	536	60	0	0	0	0.00
12	5.10%	64.3%	46	582	60	0	0	0	0.00
13	5.00%	69.3%	45	627	60	0	0	0	0.00
14	4.90%	74.2%	44	672	60	0	0	0	0.00
15	4.50%	78.7%	41	712	60	0	0	0	0.00
16	4.40%	83.1%	40	752	60	0	0	0	0.00
17	4.30%	87.4%	39	791	60	0	0	0	0.00
18	4.20%	91.6%	38	829	60	0	0	0	0.00
19	4.20%	95.8%	38	867	60	0	0	0	0.00
20	4.20%	100.0%	38	905	60	0	0	0	0.00
Peak Period Volume =			905	PH Cap. =	300	Max Q =	0	0	0.00
Maximum 1-hour volume =			510	Lanes =	2	Average Delay =		#DIV/0!	Mins/Veh
Maximum Queue Length (vehicles) =				0					
Maximum Queue Length (feet) =				0					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

PM PEAK HOUR QUEUE CALCULATION
(Camino De Estrella SB)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	4.30%	4.3%	60	60	80	0	0	0	0
2	4.70%	9.0%	66	126	80	0	0	0	0.00
3	4.80%	13.8%	67	193	80	0	0	0	0.00
4	4.90%	18.7%	69	262	80	0	0	0	0.00
5	4.80%	23.5%	67	329	80	0	0	0	0.00
6	4.90%	28.4%	69	398	80	0	0	0	0.00
7	5.00%	33.4%	70	468	80	0	0	0	0.00
8	5.10%	38.5%	72	540	80	0	0	0	0.00
9	5.20%	43.7%	73	613	80	0	0	0	0.00
10	5.30%	49.0%	74	687	80	0	0	0	0.00
11	5.50%	54.5%	77	764	80	0	0	0	0.00
12	5.70%	60.2%	80	844	80	0	0	0	0.00
13	5.90%	66.1%	83	927	80	3	3	83	0.00
14	5.80%	71.9%	81	1008	80	1	4	164	0.40
15	5.50%	77.4%	77	1085	80	0	1	241	0.11
16	5.20%	82.6%	73	1158	80	0	0	0	0.00
17	4.80%	87.4%	67	1225	80	0	0	0	0.00
18	4.60%	92.0%	64	1290	80	0	0	0	0.00
19	4.20%	96.2%	59	1349	80	0	0	0	0.00
20	3.80%	100.0%	53	1402	80	0	0	0	0.00
Peak Period Volume =			1402	PH Cap. =	400	Max Q =	4	241	0.52
Maximum 1-hour volume =			760	Lanes =	2	Average Delay =		0.13	Mins/Veh
Maximum Queue Length (vehicles) =				2					
Maximum Queue Length (feet) =				61					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

PM PEAK HOUR QUEUE CALCULATION
(SR-1 SB Direct-On)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	4.30%	4.3%	116	116	150	0	0	0	0
2	4.70%	9.0%	127	242	150	0	0	0	0.00
3	4.80%	13.8%	129	372	150	0	0	0	0.00
4	4.90%	18.7%	132	504	150	0	0	0	0.00
5	4.80%	23.5%	129	633	150	0	0	0	0.00
6	4.90%	28.4%	132	765	150	0	0	0	0.00
7	5.00%	33.4%	135	899	150	0	0	0	0.00
8	5.10%	38.5%	137	1037	150	0	0	0	0.00
9	5.20%	43.7%	140	1177	150	0	0	0	0.00
10	5.30%	49.0%	143	1320	150	0	0	0	0.00
11	5.50%	54.5%	148	1468	150	0	0	0	0.00
12	5.70%	60.2%	154	1621	150	4	4	154	0.00
13	5.90%	66.1%	159	1780	150	9	12	312	1.24
14	5.80%	71.9%	156	1936	150	6	19	469	1.86
15	5.50%	77.4%	148	2084	150	0	17	617	1.67
16	5.20%	82.6%	140	2224	150	0	7	757	0.67
17	4.80%	87.4%	129	2354	150	0	0	0	0.00
18	4.60%	92.0%	124	2478	150	0	0	0	0.00
19	4.20%	96.2%	113	2591	150	0	0	0	0.00
20	3.80%	100.0%	102	2693	150	0	0	0	0.00
Peak Period Volume =			2693	PH Cap. =	750	Max Q =	19	757	5.44
Maximum 1-hour volume =			1460	Lanes =	2	Average Delay =		0.43	Mins/Veh
Maximum Queue Length (vehicles) =				9					
Maximum Queue Length (feet) =				279					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

AM PEAK HOUR QUEUE CALCULATION
(SR-1 SB Loop-On)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	3.40%	3.4%	14	14	40	0	0	0	0
2	4.50%	7.9%	18	32	40	0	0	0	0.00
3	5.40%	13.3%	22	54	40	0	0	0	0.00
4	5.70%	19.0%	23	78	40	0	0	0	0.00
5	5.90%	24.9%	24	102	40	0	0	0	0.00
6	5.90%	30.8%	24	126	40	0	0	0	0.00
7	5.90%	36.7%	24	150	40	0	0	0	0.00
8	5.80%	42.5%	24	173	40	0	0	0	0.00
9	5.70%	48.2%	23	197	40	0	0	0	0.00
10	5.60%	53.8%	23	220	40	0	0	0	0.00
11	5.40%	59.2%	22	242	40	0	0	0	0.00
12	5.10%	64.3%	21	262	40	0	0	0	0.00
13	5.00%	69.3%	20	283	40	0	0	0	0.00
14	4.90%	74.2%	20	303	40	0	0	0	0.00
15	4.50%	78.7%	18	321	40	0	0	0	0.00
16	4.40%	83.1%	18	339	40	0	0	0	0.00
17	4.30%	87.4%	18	357	40	0	0	0	0.00
18	4.20%	91.6%	17	374	40	0	0	0	0.00
19	4.20%	95.8%	17	391	40	0	0	0	0.00
20	4.20%	100.0%	17	408	40	0	0	0	0.00
Peak Period Volume =			408	PH Cap. =	400	Max Q =	0	0	0.00
Maximum 1-hour volume =			230	Lanes =	1	Average Delay =		#DIV/0!	Mins/Veh
Maximum Queue Length (vehicles) =				0					
Maximum Queue Length (feet) =				0					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

AM PEAK HOUR QUEUE CALCULATION
(San Juan Creek SB)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	3.40%	3.4%	46	46	80	0	0	0	0
2	4.50%	7.9%	61	108	80	0	0	0	0.00
3	5.40%	13.3%	74	182	80	0	0	0	0.00
4	5.70%	19.0%	78	259	80	0	0	0	0.00
5	5.90%	24.9%	81	340	80	1	1	81	0.00
6	5.90%	30.8%	81	420	80	1	1	161	0.11
7	5.90%	36.7%	81	501	80	1	2	242	0.16
8	5.80%	42.5%	79	580	80	0	1	321	0.08
9	5.70%	48.2%	78	658	80	0	0	0	0.00
10	5.60%	53.8%	76	734	80	0	0	0	0.00
11	5.40%	59.2%	74	808	80	0	0	0	0.00
12	5.10%	64.3%	70	878	80	0	0	0	0.00
13	5.00%	69.3%	68	946	80	0	0	0	0.00
14	4.90%	74.2%	67	1013	80	0	0	0	0.00
15	4.50%	78.7%	61	1074	80	0	0	0	0.00
16	4.40%	83.1%	60	1134	80	0	0	0	0.00
17	4.30%	87.4%	59	1193	80	0	0	0	0.00
18	4.20%	91.6%	57	1250	80	0	0	0	0.00
19	4.20%	95.8%	57	1308	80	0	0	0	0.00
20	4.20%	100.0%	57	1365	80	0	0	0	0.00
Peak Period Volume =			1365	PH Cap. =	400	Max Q =	2	321	0.34
Maximum 1-hour volume =			770	Lanes =	2	Average Delay =		0.06	Mins/Veh
Maximum Queue Length (vehicles) =				1					
Maximum Queue Length (feet) =				24					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

APPENDIX J

VMT/VHT TABLES

I-5 HOV Lane Extension PA/ED

Table 1 - Vehicle Miles Traveled (VMT) Summary

ADT			
	Scenario		
Roadways	No Build	Build	Difference
Freeways, Toll Roads, & Ramps	6,244,871.9	6,148,444.0	-96,427.9
High Occupancy Vehicle (HOV) Lanes	570,444.7	674,662.6	104,217.9
Arterials	3,993,762.2	3,987,267.0	-6,495.2
Total:	**10,809,078.8**	**10,810,373.6**	**1,294.8**

AM Peak Hour			
	Scenario		
Roadways	No Build	Build	Difference
Freeways, Toll Roads, & Ramps	439,028.0	431,777.6	-7,250.4
High Occupancy Vehicle (HOV) Lanes	39,771.8	46,456.0	6,684.2
Arterials	336,799.9	335,121.6	-1,678.3
Total:	**815,599.7**	**813,355.2**	**-2,244.5**

PM Peak Hour			
	Scenario		
Roadways	No Build	Build	Difference
Freeways, Toll Roads, & Ramps	466,737.5	461,092.7	-5,644.8
High Occupancy Vehicle (HOV) Lanes	41,287.1	48,972.1	7,685.0
Arterials	350,267.3	349,554.5	-712.8
Total:	**858,291.9**	**859,619.3**	**1,327.4**

see Figure 1 for VMT analysis area.

Austin-Foust Associates, Inc.
1142002_VMT.xls

I-5 HOV Lane Extension PA/ED

Table 2 - Vehicle Hours Traveled (VHT) Summary

ADT			
	Scenario		
Roadways	No Build	Build	Difference
Freeways, Toll Roads, & Ramps	99,328.4	97,866.6	-1,461.8
High Occupancy Vehicle (HOV) Lanes	8,788.8	9,798.9	1,010.1
Arterials	111,656.3	111,489.0	-167.3
Total:	**219,773.5**	**219,154.5**	**-619.0**

AM Peak Hour			
	Scenario		
Roadways	No Build	Build	Difference
Freeways, Toll Roads, & Ramps	14,686.8	13,650.6	-1,036.2
High Occupancy Vehicle (HOV) Lanes	1,081.1	1,157.8	76.7
Arterials	26,071.5	24,641.9	-1,429.6
Total:	**41,839.4**	**39,450.3**	**-2,389.1**

PM Peak Hour			
	Scenario		
Roadways	No Build	Build	Difference
Freeways, Toll Roads, & Ramps	15,812.8	15,588.6	-224.2
High Occupancy Vehicle (HOV) Lanes	996.7	1,038.8	42.1
Arterials	23,471.9	23,240.4	-231.5
Total:	**40,281.4**	**39,867.8**	**-413.6**

see Figure 1 for VHT analysis area.

Legend

Study Area

Figure J-1

VEHICLE MILES TRAVELLED (VMT) ANALYSIS AREA

APPENDIX K

WEAVING LOS WORKSHEETS – AVENIDA PICO INTERCHANGE

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Palizada-Avd. Pico
Jurisdiction:	
Analysis Year:	Existing
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1453	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.28	
Weaving ratio, R	0.40	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	3408	15	810	550	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	947	4	225	153	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	3869	17	919	624	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.58	0.20
Weaving and non-weaving speeds, Si	38.28	64.82
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.77
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	54.15	mph
Weaving segment density, D	20.05	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	10732	pc/h
Capacity as a 15-minute flow rate, c	10501	pc/h
Capacity as a full-hour volume, ch	9451	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1543	2800	a
Average flow rate (pcphpl)	1085	2400	b
Volume ratio, VR	0.28	0.20	c
Weaving ratio, R	0.40	N/A	d
Weaving length (ft)	1453	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".

b. Capacity constrained by basic freeway capacity.

c. Capacity occurs under constrained operating conditions.

d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.

e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.

f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).

g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.

h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.

i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Pico-Vista Hermosa
Jurisdiction:	
Analysis Year:	Existing
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1800	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.23	
Weaving ratio, R	0.30	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4650	15	1000	420	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1292	4	278	117	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5280	17	1135	476	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.54	0.20
Weaving and non-weaving speeds, Si	38.66	64.90
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.66
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	56.03	mph
Weaving segment density, D	24.66	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	11083	pc/h
Capacity as a 15-minute flow rate, c	10844	pc/h
Capacity as a full-hour volume, ch	9760	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1611	2800	a
Average flow rate (pcphpl)	1381	2400	b
Volume ratio, VR	0.23	0.20	c
Weaving ratio, R	0.30	N/A	d
Weaving length (ft)	1800	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	2/3/2010
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Palizada-Avd. Pico
Jurisdiction:	
Analysis Year:	Year 2018 DO A
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1425	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.27	
Weaving ratio, R	0.48	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4350	15	860	790	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1208	4	239	219	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	4939	17	976	897	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.97	0.27
Weaving and non-weaving speeds, Si	35.22	62.21
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.78
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	51.41	mph
Weaving segment density, D	26.57	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	10694	pc/h
Capacity as a 15-minute flow rate, c	10464	pc/h
Capacity as a full-hour volume, ch	9418	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1873	2800	a
Average flow rate (pcphpl)	1365	2400	b
Volume ratio, VR	0.27	0.20	c
Weaving ratio, R	0.48	N/A	d
Weaving length (ft)	1425	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	2/3/2010
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Pico-Vista Hermosa
Jurisdiction:	
Analysis Year:	Year 2018 DO A
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1738	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.25	
Weaving ratio, R	0.27	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4880	15	1190	450	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1356	4	331	125	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5541	17	1351	511	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.75	0.24
Weaving and non-weaving speeds, Si	36.84	63.33
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.75
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	53.65	mph
Weaving segment density, D	27.66	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	11023	pc/h
Capacity as a 15-minute flow rate, c	10786	pc/h
Capacity as a full-hour volume, ch	9707	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1862	2800	a
Average flow rate (pcphpl)	1484	2400	b
Volume ratio, VR	0.25	0.20	c
Weaving ratio, R	0.27	N/A	d
Weaving length (ft)	1738	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	2/3/2010
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Palizada-Avd. Pico
Jurisdiction:	
Analysis Year:	Year 2018 DO B
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1425	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.27	
Weaving ratio, R	0.48	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4350	15	860	790	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1208	4	239	219	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	4939	17	976	897	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.97	0.27
Weaving and non-weaving speeds, Si	35.22	62.21
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.78
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	51.41	mph
Weaving segment density, D	26.57	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	10694	pc/h
Capacity as a 15-minute flow rate, c	10464	pc/h
Capacity as a full-hour volume, ch	9418	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1873	2800	a
Average flow rate (pcphpl)	1365	2400	b
Volume ratio, VR	0.27	0.20	c
Weaving ratio, R	0.48	N/A	d
Weaving length (ft)	1425	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	2/3/2010
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Pico-Vista Hermosa
Jurisdiction:	
Analysis Year:	Year 2018 DO B
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1738	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.25	
Weaving ratio, R	0.27	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4880	15	1190	450	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1356	4	331	125	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5541	17	1351	511	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.75	0.24
Weaving and non-weaving speeds, Si	36.84	63.33
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.75
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	53.65	mph
Weaving segment density, D	27.66	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	11023	pc/h
Capacity as a 15-minute flow rate, c	10786	pc/h
Capacity as a full-hour volume, ch	9707	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1862	2800	a
Average flow rate (pcphpl)	1484	2400	b
Volume ratio, VR	0.25	0.20	c
Weaving ratio, R	0.27	N/A	d
Weaving length (ft)	1738	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	1/27/2010
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Palizada-Avd. Pico
Jurisdiction:	
Analysis Year:	2040 No Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1453	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.27	
Weaving ratio, R	0.43	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4760	15	1000	740	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1322	4	278	206	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5405	17	1135	840	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.07	0.29
Weaving and non-weaving speeds, Si	34.56	61.53
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.77
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

Weaving Segment Speed, Density, Level of Service and Capacity

Weaving segment speed, S	50.92	mph
Weaving segment density, D	29.05	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	10732	pc/h
Capacity as a 15-minute flow rate, c	10501	pc/h
Capacity as a full-hour volume, ch	9451	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1975	2800	a
Average flow rate (pcphpl)	1479	2400	b
Volume ratio, VR	0.27	0.20	c
Weaving ratio, R	0.43	N/A	d
Weaving length (ft)	1453	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Pico-Vista Hermosa
Jurisdiction:	
Analysis Year:	2040 No Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1800	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.22	
Weaving ratio, R	0.29	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	6340	15	1250	520	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1761	4	347	144	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	7199	17	1419	590	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.98	0.28
Weaving and non-weaving speeds, Si	35.15	61.86
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.65
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	53.08	mph
Weaving segment density, D	34.76	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	11083	pc/h
Capacity as a 15-minute flow rate, c	10844	pc/h
Capacity as a full-hour volume, ch	9760	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2009	2800	a
Average flow rate (pcphpl)	1845	2400	b
Volume ratio, VR	0.22	0.20	c
Weaving ratio, R	0.29	N/A	d
Weaving length (ft)	1800	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	1/27/2010
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Palizada-Avd. Pico
Jurisdiction:	
Analysis Year:	2040 Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1425	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.26	
Weaving ratio, R	0.42	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4784	15	990	730	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1329	4	275	203	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5432	17	1124	828	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.09	0.29
Weaving and non-weaving speeds, Si	34.43	61.48
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.76
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	50.92	mph
Weaving segment density, D	29.07	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	10694	pc/h
Capacity as a 15-minute flow rate, c	10464	pc/h
Capacity as a full-hour volume, ch	9418	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1952	2800	a
Average flow rate (pcphpl)	1480	2400	b
Volume ratio, VR	0.26	0.20	c
Weaving ratio, R	0.42	N/A	d
Weaving length (ft)	1425	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Pico-Vista Hermosa
Jurisdiction:	
Analysis Year:	2040 Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1738	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.24	
Weaving ratio, R	0.29	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5740	15	1260	510	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1594	4	350	142	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6518	17	1430	579	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.95	0.28
Weaving and non-weaving speeds, Si	35.36	62.04
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.71
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	52.69	mph
Weaving segment density, D	32.43	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	11023	pc/h
Capacity as a 15-minute flow rate, c	10786	pc/h
Capacity as a full-hour volume, ch	9707	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2009	2800	a
Average flow rate (pcphpl)	1708	2400	b
Volume ratio, VR	0.24	0.20	c
Weaving ratio, R	0.29	N/A	d
Weaving length (ft)	1738	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Palizada-Avd. Pico
Jurisdiction:	
Analysis Year:	Existing
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1675	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.26	
Weaving ratio, R	0.49	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4590	15	800	780	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1275	4	222	217	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5212	17	908	885	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.72	0.23
Weaving and non-weaving speeds, Si	37.07	63.61
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.74
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	53.78	mph
Weaving segment density, D	26.11	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	10963	pc/h
Capacity as a 15-minute flow rate, c	10727	pc/h
Capacity as a full-hour volume, ch	9654	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1793	2800	a
Average flow rate (pcphpl)	1404	2400	b
Volume ratio, VR	0.26	0.20	c
Weaving ratio, R	0.49	N/A	d
Weaving length (ft)	1675	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Pico-Vista Hermosa
Jurisdiction:	
Analysis Year:	Existing
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1334	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.22	
Weaving ratio, R	0.23	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5040	15	1110	330	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1400	4	308	92	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5723	17	1260	374	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.04	0.27
Weaving and non-weaving speeds, Si	34.76	62.41
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.56
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	53.06	mph
Weaving segment density, D	27.80	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	10571	pc/h
Capacity as a 15-minute flow rate, c	10343	pc/h
Capacity as a full-hour volume, ch	9309	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1634	2800	a
Average flow rate (pcphpl)	1474	2400	b
Volume ratio, VR	0.22	0.20	c
Weaving ratio, R	0.23	N/A	d
Weaving length (ft)	1334	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	2/3/2010
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Palizada-Avd. Pico
Jurisdiction:	
Analysis Year:	Year 2018 DO A
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1951	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.24	
Weaving ratio, R	0.50	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5140	15	820	820	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1428	4	228	228	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5836	17	931	931	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.63	0.23
Weaving and non-weaving speeds, Si	37.85	63.95
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.74
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	54.82	mph
Weaving segment density, D	28.15	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	11228	pc/h
Capacity as a 15-minute flow rate, c	10986	pc/h
Capacity as a full-hour volume, ch	9887	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1862	2800	a
Average flow rate (pcphpl)	1543	2400	b
Volume ratio, VR	0.24	0.20	c
Weaving ratio, R	0.50	N/A	d
Weaving length (ft)	1951	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	2/3/2010
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Pico-Vista Hermosa
Jurisdiction:	
Analysis Year:	Year 2018 DO A
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1359	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.23	
Weaving ratio, R	0.24	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5280	15	1180	380	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1467	4	328	106	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5995	17	1339	431	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.14	0.29
Weaving and non-weaving speeds, Si	34.13	61.64
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.60
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	52.09	mph
Weaving segment density, D	29.88	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	10605	pc/h
Capacity as a 15-minute flow rate, c	10377	pc/h
Capacity as a full-hour volume, ch	9339	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1770	2800	a
Average flow rate (pcphpl)	1556	2400	b
Volume ratio, VR	0.23	0.20	c
Weaving ratio, R	0.24	N/A	d
Weaving length (ft)	1359	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	2/3/2010
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Palizada-Avd. Pico
Jurisdiction:	
Analysis Year:	Year 2018 DO B
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1801	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.24	
Weaving ratio, R	0.50	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5140	15	820	820	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1428	4	228	228	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5836	17	931	931	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.73	0.24
Weaving and non-weaving speeds, Si	36.95	63.40
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.72
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	54.06	mph
Weaving segment density, D	28.54	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	11084	pc/h
Capacity as a 15-minute flow rate, c	10845	pc/h
Capacity as a full-hour volume, ch	9760	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1862	2800	a
Average flow rate (pcphpl)	1543	2400	b
Volume ratio, VR	0.24	0.20	c
Weaving ratio, R	0.50	N/A	d
Weaving length (ft)	1801	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	2/3/2010
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Pico-Vista Hermosa
Jurisdiction:	
Analysis Year:	Year 2018 DO B
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1292	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.23	
Weaving ratio, R	0.24	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5280	15	1180	380	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1467	4	328	106	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5995	17	1339	431	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.22	0.30
Weaving and non-weaving speeds, Si	33.61	61.25
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.59
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	51.60	mph
Weaving segment density, D	30.17	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	10514	pc/h
Capacity as a 15-minute flow rate, c	10288	pc/h
Capacity as a full-hour volume, ch	9259	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1770	2800	a
Average flow rate (pcphpl)	1556	2400	b
Volume ratio, VR	0.23	0.20	c
Weaving ratio, R	0.24	N/A	d
Weaving length (ft)	1292	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Palizada-Avd. Pico
Jurisdiction:	
Analysis Year:	2040 No Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1675	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.21	
Weaving ratio, R	0.48	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	6390	15	900	830	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1775	4	250	231	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	7256	17	1022	942	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.08	0.29
Weaving and non-weaving speeds, Si	34.49	61.46
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.61
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	52.70	mph
Weaving segment density, D	35.05	pc/mi/ln
Level of service, LOS	E	
Capacity of base condition, cb	10963	pc/h
Capacity as a 15-minute flow rate, c	10727	pc/h
Capacity as a full-hour volume, ch	9654	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1964	2800	a
Average flow rate (pcphpl)	1847	2400	b
Volume ratio, VR	0.21	0.20	c
Weaving ratio, R	0.48	N/A	d
Weaving length (ft)	1675	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	1/27/2010
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Pico-Vista Hermosa
Jurisdiction:	
Analysis Year:	2040 No Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1334	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.21	
Weaving ratio, R	0.29	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	6770	15	1280	520	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1881	4	356	144	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	7687	17	1453	590	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.61	0.37
Weaving and non-weaving speeds, Si	31.61	58.89
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.57
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	49.87	mph
Weaving segment density, D	39.09	pc/mi/ln
Level of service, LOS	E	
Capacity of base condition, cb	10571	pc/h
Capacity as a 15-minute flow rate, c	10343	pc/h
Capacity as a full-hour volume, ch	9309	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2043	2800	a
Average flow rate (pcphpl)	1949	2400	b
Volume ratio, VR	0.21	0.20	c
Weaving ratio, R	0.29	N/A	d
Weaving length (ft)	1334	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Palizada-Avd. Pico
Jurisdiction:	
Analysis Year:	2040 Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1951	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.21	
Weaving ratio, R	0.47	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	6430	15	930	820	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1786	4	258	228	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	7301	17	1056	931	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.86	0.26
Weaving and non-weaving speeds, Si	36.01	62.50
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.65
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	54.02	mph
Weaving segment density, D	34.45	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	11228	pc/h
Capacity as a 15-minute flow rate, c	10986	pc/h
Capacity as a full-hour volume, ch	9887	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1987	2800	a
Average flow rate (pcphpl)	1861	2400	b
Volume ratio, VR	0.21	0.20	c
Weaving ratio, R	0.47	N/A	d
Weaving length (ft)	1951	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	1/27/2010
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Pico-Vista Hermosa
Jurisdiction:	
Analysis Year:	2040 Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1359	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.24	
Weaving ratio, R	0.28	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5840	15	1290	510	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1622	4	358	142	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6631	17	1464	579	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.41	0.34
Weaving and non-weaving speeds, Si	32.59	59.81
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.66
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	50.00	mph
Weaving segment density, D	34.77	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	10605	pc/h
Capacity as a 15-minute flow rate, c	10377	pc/h
Capacity as a full-hour volume, ch	9339	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2043	2800	a
Average flow rate (pcphpl)	1738	2400	b
Volume ratio, VR	0.24	0.20	c
Weaving ratio, R	0.28	N/A	d
Weaving length (ft)	1359	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Palizada-Avd. Pico
Jurisdiction:	
Analysis Year:	2040 Build Scenario DO B
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1801	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.21	
Weaving ratio, R	0.47	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	6430	15	930	820	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1786	4	258	228	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	7301	17	1056	931	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.98	0.28
Weaving and non-weaving speeds, Si	35.15	61.90
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.63
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	53.24	mph
Weaving segment density, D	34.95	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	11084	pc/h
Capacity as a 15-minute flow rate, c	10845	pc/h
Capacity as a full-hour volume, ch	9760	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1987	2800	a
Average flow rate (pcphpl)	1861	2400	b
Volume ratio, VR	0.21	0.20	c
Weaving ratio, R	0.47	N/A	d
Weaving length (ft)	1801	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	1/27/2010
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Pico-Vista Hermosa
Jurisdiction:	
Analysis Year:	2040 Build Scenario DO B
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1292	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.24	
Weaving ratio, R	0.28	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5840	15	1290	510	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1622	4	358	142	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6631	17	1464	579	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.51	0.35
Weaving and non-weaving speeds, Si	32.09	59.38
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.65
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	49.49	mph
Weaving segment density, D	35.12	pc/mi/ln
Level of service, LOS	E	
Capacity of base condition, cb	10514	pc/h
Capacity as a 15-minute flow rate, c	10288	pc/h
Capacity as a full-hour volume, ch	9259	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2043	2800	a
Average flow rate (pcphpl)	1738	2400	b
Volume ratio, VR	0.24	0.20	c
Weaving ratio, R	0.28	N/A	d
Weaving length (ft)	1292	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Palizada-Avd. Pico
Jurisdiction:	
Analysis Year:	Existing
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1453	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.34	
Weaving ratio, R	0.39	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	3856	15	1210	790	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1071	4	336	219	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	4378	17	1374	897	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.12	0.32
Weaving and non-weaving speeds, Si	34.26	60.56
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	2.05
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	48.00	mph
Weaving segment density, D	27.77	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	10732	pc/h
Capacity as a 15-minute flow rate, c	10501	pc/h
Capacity as a full-hour volume, ch	9451	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2271	2800	a
Average flow rate (pcphpl)	1333	2400	b
Volume ratio, VR	0.34	0.20	c
Weaving ratio, R	0.39	N/A	d
Weaving length (ft)	1453	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Pico-Vista Hermosa
Jurisdiction:	
Analysis Year:	Existing
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1800	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.21	
Weaving ratio, R	0.28	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5640	15	1110	430	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1567	4	308	119	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6404	17	1260	488	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.75	0.24
Weaving and non-weaving speeds, Si	36.85	63.53
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.61
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	55.01	mph
Weaving segment density, D	29.70	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	11083	pc/h
Capacity as a 15-minute flow rate, c	10844	pc/h
Capacity as a full-hour volume, ch	9760	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1748	2800	a
Average flow rate (pcphpl)	1633	2400	b
Volume ratio, VR	0.21	0.20	c
Weaving ratio, R	0.28	N/A	d
Weaving length (ft)	1800	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	2/3/2010
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Palizada-Avd. Pico
Jurisdiction:	
Analysis Year:	Year 2018 DO A
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1425	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.29	
Weaving ratio, R	0.42	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5050	15	1220	890	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1403	4	339	247	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5734	17	1385	1010	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.41	0.36
Weaving and non-weaving speeds, Si	32.57	59.05
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.91
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	47.66	mph
Weaving segment density, D	34.19	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	10694	pc/h
Capacity as a 15-minute flow rate, c	10464	pc/h
Capacity as a full-hour volume, ch	9418	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2395	2800	a
Average flow rate (pcphpl)	1629	2400	b
Volume ratio, VR	0.29	0.20	c
Weaving ratio, R	0.42	N/A	d
Weaving length (ft)	1425	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	2/3/2010
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Pico-Vista Hermosa
Jurisdiction:	
Analysis Year:	Year 2018 DO A
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1738	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.20	
Weaving ratio, R	0.28	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5910	15	1050	400	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1642	4	292	111	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6711	17	1192	454	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.78	0.24
Weaving and non-weaving speeds, Si	36.57	63.52
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.52
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	55.49	mph
Weaving segment density, D	30.18	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	11044	pc/h
Capacity as a 15-minute flow rate, c	10806	pc/h
Capacity as a full-hour volume, ch	9725	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1646	2800	a
Average flow rate (pcphpl)	1674	2400	b
Volume ratio, VR	0.20	0.20	c
Weaving ratio, R	0.28	N/A	d
Weaving length (ft)	1738	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	2/3/2010
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Palizada-Avd. Pico
Jurisdiction:	
Analysis Year:	Year 2018 DO B
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1425	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.29	
Weaving ratio, R	0.42	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5050	15	1220	890	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1403	4	339	247	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5734	17	1385	1010	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.41	0.36
Weaving and non-weaving speeds, Si	32.57	59.05
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.91
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	47.66	mph
Weaving segment density, D	34.19	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	10694	pc/h
Capacity as a 15-minute flow rate, c	10464	pc/h
Capacity as a full-hour volume, ch	9418	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2395	2800	a
Average flow rate (pcphpl)	1629	2400	b
Volume ratio, VR	0.29	0.20	c
Weaving ratio, R	0.42	N/A	d
Weaving length (ft)	1425	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	2/3/2010
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Pico-Vista Hermosa
Jurisdiction:	
Analysis Year:	Year 2018 DO B
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1738	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.20	
Weaving ratio, R	0.28	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5910	15	1050	400	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1642	4	292	111	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6711	17	1192	454	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.78	0.24
Weaving and non-weaving speeds, Si	36.57	63.52
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.52
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	55.49	mph
Weaving segment density, D	30.18	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	11044	pc/h
Capacity as a 15-minute flow rate, c	10806	pc/h
Capacity as a full-hour volume, ch	9725	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1646	2800	a
Average flow rate (pcphpl)	1674	2400	b
Volume ratio, VR	0.20	0.20	c
Weaving ratio, R	0.28	N/A	d
Weaving length (ft)	1738	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	1/27/2010
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Palizada-Avd. Pico
Jurisdiction:	
Analysis Year:	2040 No Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1453	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.28	
Weaving ratio, R	0.44	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5616	15	1240	960	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1560	4	344	267	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6377	17	1408	1090	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.53	0.38
Weaving and non-weaving speeds, Si	31.99	58.35
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.88
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	47.38	mph
Weaving segment density, D	37.53	pc/mi/ln
Level of service, LOS	E	
Capacity of base condition, cb	10732	pc/h
Capacity as a 15-minute flow rate, c	10501	pc/h
Capacity as a full-hour volume, ch	9451	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2498	2800	a
Average flow rate (pcphpl)	1778	2400	b
Volume ratio, VR	0.28	0.20	c
Weaving ratio, R	0.44	N/A	d
Weaving length (ft)	1453	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Pico-Vista Hermosa
Jurisdiction:	
Analysis Year:	2040 No Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1800	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.16	
Weaving ratio, R	0.28	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	7830	15	1110	430	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	2175	4	308	119	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	8891	17	1260	488	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.06	0.28
Weaving and non-weaving speeds, Si	34.61	61.79
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.41
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	54.74	mph
Weaving segment density, D	38.93	pc/mi/ln
Level of service, LOS	E	
Capacity of base condition, cb	11289	pc/h
Capacity as a 15-minute flow rate, c	11046	pc/h
Capacity as a full-hour volume, ch	9941	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1748	2800	a
Average flow rate (pcphpl)	2131	2400	b
Volume ratio, VR	0.16	0.20	c
Weaving ratio, R	0.28	N/A	d
Weaving length (ft)	1800	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	1/27/2010
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Palizada-Avd. Pico
Jurisdiction:	
Analysis Year:	2040 Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1425	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.28	
Weaving ratio, R	0.43	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5648	15	1260	950	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1569	4	350	264	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6413	17	1430	1078	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.58	0.39
Weaving and non-weaving speeds, Si	31.75	58.10
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.88
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	47.13	mph
Weaving segment density, D	37.93	pc/mi/ln
Level of service, LOS	E	
Capacity of base condition, cb	10694	pc/h
Capacity as a 15-minute flow rate, c	10464	pc/h
Capacity as a full-hour volume, ch	9418	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2508	2800	a
Average flow rate (pcphpl)	1787	2400	b
Volume ratio, VR	0.28	0.20	c
Weaving ratio, R	0.43	N/A	d
Weaving length (ft)	1425	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Southbound
Weaving Location:	Avd. Pico-Vista Hermosa
Jurisdiction:	
Analysis Year:	2040 Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1738	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.19	
Weaving ratio, R	0.27	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	6500	15	1110	420	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1806	4	308	117	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	7381	17	1260	476	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.91	0.26
Weaving and non-weaving speeds, Si	35.58	62.65
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.51
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	54.74	mph
Weaving segment density, D	33.37	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	11083	pc/h
Capacity as a 15-minute flow rate, c	10844	pc/h
Capacity as a full-hour volume, ch	9760	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1736	2800	a
Average flow rate (pcphpl)	1826	2400	b
Volume ratio, VR	0.19	0.20	c
Weaving ratio, R	0.27	N/A	d
Weaving length (ft)	1738	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Palizada-Avd. Pico
Jurisdiction:	
Analysis Year:	Existing
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1675	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.24	
Weaving ratio, R	0.48	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4570	15	760	700	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1269	4	211	194	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5189	17	863	794	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.64	0.22
Weaving and non-weaving speeds, Si	37.73	64.28
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.68
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	54.94	mph
Weaving segment density, D	24.98	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	10963	pc/h
Capacity as a 15-minute flow rate, c	10727	pc/h
Capacity as a full-hour volume, ch	9654	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1657	2800	a
Average flow rate (pcphpl)	1372	2400	b
Volume ratio, VR	0.24	0.20	c
Weaving ratio, R	0.48	N/A	d
Weaving length (ft)	1675	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
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Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Pico-Vista Hermosa
Jurisdiction:	
Analysis Year:	Existing
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1334	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.27	
Weaving ratio, R	0.23	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4850	15	1370	420	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1347	4	381	117	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5507	17	1555	476	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.27	0.32
Weaving and non-weaving speeds, Si	33.37	60.49
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.77
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	49.64	mph
Weaving segment density, D	30.44	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	10571	pc/h
Capacity as a 15-minute flow rate, c	10343	pc/h
Capacity as a full-hour volume, ch	9309	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2031	2800	a
Average flow rate (pcphpl)	1511	2400	b
Volume ratio, VR	0.27	0.20	c
Weaving ratio, R	0.23	N/A	d
Weaving length (ft)	1334	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	2/3/2010
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Palizada-Avd. Pico
Jurisdiction:	
Analysis Year:	Year 2018 DO A
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1951	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.24	
Weaving ratio, R	0.44	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4950	15	900	700	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1375	4	250	194	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5621	17	1022	794	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.58	0.22
Weaving and non-weaving speeds, Si	38.26	64.28
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.74
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	55.15	mph
Weaving segment density, D	27.03	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	11228	pc/h
Capacity as a 15-minute flow rate, c	10986	pc/h
Capacity as a full-hour volume, ch	9887	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1816	2800	a
Average flow rate (pcphpl)	1490	2400	b
Volume ratio, VR	0.24	0.20	c
Weaving ratio, R	0.44	N/A	d
Weaving length (ft)	1951	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	2/3/2010
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Pico-Vista Hermosa
Jurisdiction:	
Analysis Year:	Year 2018 DO A
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1359	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.27	
Weaving ratio, R	0.25	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4970	15	1410	470	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1381	4	392	131	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5643	17	1601	533	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.32	0.33
Weaving and non-weaving speeds, Si	33.07	60.02
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.80
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	49.07	mph
Weaving segment density, D	31.77	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	10605	pc/h
Capacity as a 15-minute flow rate, c	10377	pc/h
Capacity as a full-hour volume, ch	9339	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2134	2800	a
Average flow rate (pcphpl)	1558	2400	b
Volume ratio, VR	0.27	0.20	c
Weaving ratio, R	0.25	N/A	d
Weaving length (ft)	1359	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	2/3/2010
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Palizada-Avd. Pico
Jurisdiction:	
Analysis Year:	Year 2018 DO B
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1801	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.24	
Weaving ratio, R	0.44	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4950	15	900	700	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1375	4	250	194	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5621	17	1022	794	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.68	0.23
Weaving and non-weaving speeds, Si	37.36	63.74
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.72
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	54.38	mph
Weaving segment density, D	27.41	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	11084	pc/h
Capacity as a 15-minute flow rate, c	10845	pc/h
Capacity as a full-hour volume, ch	9760	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1816	2800	a
Average flow rate (pcphpl)	1490	2400	b
Volume ratio, VR	0.24	0.20	c
Weaving ratio, R	0.44	N/A	d
Weaving length (ft)	1801	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	2/3/2010
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Pico-Vista Hermosa
Jurisdiction:	
Analysis Year:	Year 2018 DO B
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1292	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.27	
Weaving ratio, R	0.25	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	4970	15	1410	470	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1381	4	392	131	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5643	17	1601	533	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.42	0.35
Weaving and non-weaving speeds, Si	32.56	59.59
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.79
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	48.55	mph
Weaving segment density, D	32.11	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	10514	pc/h
Capacity as a 15-minute flow rate, c	10288	pc/h
Capacity as a full-hour volume, ch	9259	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2134	2800	a
Average flow rate (pcphpl)	1558	2400	b
Volume ratio, VR	0.27	0.20	c
Weaving ratio, R	0.25	N/A	d
Weaving length (ft)	1292	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Palizada-Avd. Pico
Jurisdiction:	
Analysis Year:	2040 No Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1675	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.21	
Weaving ratio, R	0.43	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5800	15	900	680	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1611	4	250	189	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6586	17	1022	772	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.90	0.26
Weaving and non-weaving speeds, Si	35.71	62.68
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.60
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	53.97	mph
Weaving segment density, D	31.12	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	10963	pc/h
Capacity as a 15-minute flow rate, c	10727	pc/h
Capacity as a full-hour volume, ch	9654	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1794	2800	a
Average flow rate (pcphpl)	1679	2400	b
Volume ratio, VR	0.21	0.20	c
Weaving ratio, R	0.43	N/A	d
Weaving length (ft)	1675	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	1/27/2010
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Pico-Vista Hermosa
Jurisdiction:	
Analysis Year:	2040 No Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1334	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.27	
Weaving ratio, R	0.28	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5910	15	1580	600	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1642	4	439	167	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6711	17	1794	681	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.74	0.41
Weaving and non-weaving speeds, Si	31.02	57.48
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.82
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	46.76	mph
Weaving segment density, D	39.37	pc/mi/ln
Level of service, LOS	E	
Capacity of base condition, cb	10571	pc/h
Capacity as a 15-minute flow rate, c	10343	pc/h
Capacity as a full-hour volume, ch	9309	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2475	2800	a
Average flow rate (pcphpl)	1840	2400	b
Volume ratio, VR	0.27	0.20	c
Weaving ratio, R	0.28	N/A	d
Weaving length (ft)	1334	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
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Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Palizada-Avd. Pico
Jurisdiction:	
Analysis Year:	2040 Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1951	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.21	
Weaving ratio, R	0.44	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5840	15	890	710	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1622	4	247	197	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6631	17	1010	806	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.70	0.23
Weaving and non-weaving speeds, Si	37.26	63.64
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.63
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	55.25	mph
Weaving segment density, D	30.64	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	11228	pc/h
Capacity as a 15-minute flow rate, c	10986	pc/h
Capacity as a full-hour volume, ch	9887	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1816	2800	a
Average flow rate (pcphpl)	1692	2400	b
Volume ratio, VR	0.21	0.20	c
Weaving ratio, R	0.44	N/A	d
Weaving length (ft)	1951	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	1/27/2010
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Pico-Vista Hermosa
Jurisdiction:	
Analysis Year:	2040 Build Scenario
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1359	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.29	
Weaving ratio, R	0.27	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5240	15	1590	590	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1456	4	442	164	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5950	17	1805	669	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.59	0.39
Weaving and non-weaving speeds, Si	31.70	58.10
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.90
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	46.70	mph
Weaving segment density, D	36.15	pc/mi/ln
Level of service, LOS	E	
Capacity of base condition, cb	10605	pc/h
Capacity as a 15-minute flow rate, c	10377	pc/h
Capacity as a full-hour volume, ch	9339	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2474	2800	a
Average flow rate (pcphpl)	1688	2400	b
Volume ratio, VR	0.29	0.20	c
Weaving ratio, R	0.27	N/A	d
Weaving length (ft)	1359	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
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Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	9/10/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Palizada-Avd. Pico
Jurisdiction:	
Analysis Year:	2040 Build Scenario DO B
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1801	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.21	
Weaving ratio, R	0.44	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5840	15	890	710	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1622	4	247	197	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	6631	17	1010	806	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	1.81	0.25
Weaving and non-weaving speeds, Si	36.37	63.08
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.62
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	54.49	mph
Weaving segment density, D	31.06	pc/mi/ln
Level of service, LOS	D	
Capacity of base condition, cb	11084	pc/h
Capacity as a 15-minute flow rate, c	10845	pc/h
Capacity as a full-hour volume, ch	9760	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1816	2800	a
Average flow rate (pcphpl)	1692	2400	b
Volume ratio, VR	0.21	0.20	c
Weaving ratio, R	0.44	N/A	d
Weaving length (ft)	1801	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	Ryan
Agency/Co.:	Austin Foust Associates
Date Performed:	1/27/2010
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	I-5 Northbound
Weaving Location:	Avd. Pico-Vista Hermosa
Jurisdiction:	
Analysis Year:	2040 Build Scenario DO B
Description:	I-5 HOV Extension

Inputs

Freeway free-flow speed, SFF	70	mph
Weaving number of lanes, N	5	
Weaving segment length, L	1292	ft
Terrain type	Level	
Grade		%
Length		mi
Weaving type	A	
Volume ratio, VR	0.29	
Weaving ratio, R	0.27	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V_{o1}	V_{o2}	V_{w1}	V_{w2}	
Volume, V	5240	15	1590	590	veh/h
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	
Peak 15-min volume, v15	1456	4	442	164	v
Trucks and buses	4	4	4	4	%
Recreational vehicles	1	1	1	1	%
Trucks and buses PCE, ET	1.5*	1.5*	1.5*	1.5*	
Recreational vehicle PCE, ER	1.2	1.2	1.2	1.2	
Heavy vehicle adjustment, fHV	0.978	0.978	0.978	0.978	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	5950	17	1805	669	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.35	0.0020
b (Exhibit 24-6)	2.20	4.00
c (Exhibit 24-6)	0.97	1.30
d (Exhibit 24-6)	0.80	0.75
Weaving intensity factor, Wi	2.70	0.41
Weaving and non-weaving speeds, Si	31.22	57.64
Number of lanes required for		

unconstrained operation, Nw (Exhibit 24-7)	1.89
Maximum number of lanes, Nw (max) (Exhibit 24-7)	1.40
Type of operation is	Constrained

_____Weaving Segment Speed, Density, Level of Service and Capacity_____

Weaving segment speed, S	46.18	mph
Weaving segment density, D	36.55	pc/mi/ln
Level of service, LOS	E	
Capacity of base condition, cb	10514	pc/h
Capacity as a 15-minute flow rate, c	10288	pc/h
Capacity as a full-hour volume, ch	9259	pc/h

_____Limitations on Weaving Segments_____

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2474	2800	a
Average flow rate (pcphpl)	1688	2400	b
Volume ratio, VR	0.29	0.20	c
Weaving ratio, R	0.27	N/A	d
Weaving length (ft)	1292	2500	e

Notes:

a. Weaving segments longer than 2500 ft. are treated as isolated merge and diverge areas using the procedures of Chapter 25, "Ramps and Ramp Junctions".
b. Capacity constrained by basic freeway capacity.
c. Capacity occurs under constrained operating conditions.
d. Three-lane Type A segments do not operate well at volume ratios greater than 0.45. Poor operations and some local queuing are expected in such cases.
e. Four-lane Type A segments do not operate well at volume ratios greater than 0.35. Poor operations and some local queuing are expected in such cases.
f. Capacity constrained by maximum allowable weaving flow rate: 2,800 pc/h (Type A), 4,000 (Type B), 3,500 (Type C).
g. Five-lane Type A segments do not operate well at volume ratios greater than 0.20. Poor operations and some local queuing are expected in such cases.
h. Type B weaving segments do not operate well at volume ratios greater than 0.80. Poor operations and some local queuing are expected in such cases.
i. Type C weaving segments do not operate well at volume ratios greater than 0.50. Poor operations and some local queuing are expected in such cases.

APPENDIX L

INTERSECTION LOS HCM WORKSHEETS – AVENIDA PICO INTERCHANGE

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0					4.0	4.0	4.0	4.0	
Lane Util. Factor	0.95	0.91	0.95					0.91	1.00	0.91	0.91	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	0.95	1.00					1.00	1.00	0.95	0.99	
Satd. Flow (prot)	1681	1610	1504					5085	1583	1610	3348	
Flt Permitted	0.95	0.95	1.00					1.00	1.00	0.95	0.99	
Satd. Flow (perm)	1681	1610	1504					5085	1583	1610	3348	
Volume (vph)	800	0	330	0	0	0	0	660	160	490	500	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	800	0	330	0	0	0	0	660	160	490	500	0
RTOR Reduction (vph)	0	0	232	0	0	0	0	0	115	0	0	0
Lane Group Flow (vph)	400	400	98	0	0	0	0	660	45	319	671	0
Turn Type	Perm		Perm						Perm	Split		
Protected Phases		4						2		6	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)	20.8	20.8	20.8					19.9	19.9	17.3	17.3	
Effective Green, g (s)	20.8	20.8	20.8					19.9	19.9	17.3	17.3	
Actuated g/C Ratio	0.30	0.30	0.30					0.28	0.28	0.25	0.25	
Clearance Time (s)	4.0	4.0	4.0					4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	499	478	447					1446	450	398	827	
v/s Ratio Prot								c0.13		0.20	c0.20	
v/s Ratio Perm	0.24	0.25	0.07						0.03			
v/c Ratio	0.80	0.84	0.22					0.46	0.10	0.80	0.81	
Uniform Delay, d1	22.7	23.0	18.5					20.6	18.5	24.7	24.8	
Progression Factor	1.00	1.00	1.00					1.00	1.00	0.69	0.71	
Incremental Delay, d2	9.0	12.1	0.2					1.0	0.4	10.4	5.7	
Delay (s)	31.7	35.1	18.7					21.6	18.9	27.5	23.2	
Level of Service	C	D	B					C	B	C	C	
Approach Delay (s)		29.1			0.0			21.1			24.6	
Approach LOS		C			A			C			C	

Intersection Summary

HCM Average Control Delay	25.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NWL2	NWL	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations											
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0		4.0	4.0	4.0			4.0	4.0
Lane Util. Factor			1.00		0.88	1.00	0.95			0.91	1.00
Frt			1.00		0.85	1.00	1.00			1.00	0.85
Flt Protected			0.95		1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)			1770		2787	1770	3539			5085	1583
Flt Permitted			0.95		1.00	0.95	1.00			1.00	1.00
Satd. Flow (perm)			1770		2787	1770	3539			5085	1583
Volume (vph)	0	0	160	0	630	220	1240	0	0	830	890
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	0	160	0	630	220	1240	0	0	830	890
RTOR Reduction (vph)	0	0	0	0	78	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	160	0	552	220	1240	0	0	830	890
Turn Type			custom		custom	Prot					Free
Protected Phases						5	2			6	
Permitted Phases			3		8						Free
Actuated Green, G (s)			18.1		18.1	12.0	43.9			27.9	70.0
Effective Green, g (s)			18.1		18.1	12.0	43.9			27.9	70.0
Actuated g/C Ratio			0.26		0.26	0.17	0.63			0.40	1.00
Clearance Time (s)			4.0		4.0	4.0	4.0			4.0	
Vehicle Extension (s)			3.0		3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)			458		721	303	2219			2027	1583
v/s Ratio Prot						0.12	0.35			0.16	
v/s Ratio Perm			0.09		c0.20						c0.56
v/c Ratio			0.35		0.77	0.73	0.56			0.41	0.56
Uniform Delay, d1			21.2		24.0	27.4	7.5			15.1	0.0
Progression Factor			1.00		1.00	1.10	0.09			1.00	1.00
Incremental Delay, d2			0.5		4.9	5.7	0.7			0.6	1.4
Delay (s)			21.6		28.9	35.8	1.3			15.7	1.4
Level of Service			C		C	D	A			B	A
Approach Delay (s)	0.0			27.4			6.5			8.3	
Approach LOS	A			C			A			A	

Intersection Summary

HCM Average Control Delay	11.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	74.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.91	0.91					0.95	0.91	0.95
Frpb, ped/bikes		1.00	0.95	1.00	1.00					1.00	1.00	0.95
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	0.99					0.95	0.95	1.00
Satd. Flow (prot)		5085	1512	1610	3340					1681	1610	1436
Flt Permitted		1.00	1.00	0.95	0.99					0.95	0.95	1.00
Satd. Flow (perm)		5085	1512	1610	3340					1681	1610	1436
Volume (vph)	0	740	170	630	570	0	0	0	0	860	0	320
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	779	179	663	600	0	0	0	0	905	0	337
RTOR Reduction (vph)	0	0	136	0	0	0	0	0	0	0	0	256
Lane Group Flow (vph)	0	779	43	407	856	0	0	0	0	453	452	81
Confl. Peds. (#/hr)			20									20
Turn Type			Perm	Split						Split		custom
Protected Phases		2		1	1					4	4	
Permitted Phases			2									2
Actuated Green, G (s)		21.7	21.7	28.1	28.1					28.2	28.2	21.7
Effective Green, g (s)		21.7	21.7	28.1	28.1					28.2	28.2	21.7
Actuated g/C Ratio		0.24	0.24	0.31	0.31					0.31	0.31	0.24
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		4.7	4.7	4.7	4.7					3.0	3.0	4.7
Lane Grp Cap (vph)		1226	365	503	1043					527	504	346
v/s Ratio Prot		c0.15		0.25	c0.26					0.27	c0.28	
v/s Ratio Perm			0.03									0.06
v/c Ratio		0.64	0.12	0.81	0.82					0.86	0.90	0.23
Uniform Delay, d1		30.6	26.7	28.5	28.6					29.0	29.5	27.5
Progression Factor		0.56	1.04	0.59	0.56					1.00	1.00	1.00
Incremental Delay, d2		2.3	0.6	8.7	5.1					13.2	18.3	1.6
Delay (s)		19.4	28.3	25.5	21.1					42.2	47.8	29.1
Level of Service		B	C	C	C					D	D	C
Approach Delay (s)		21.1			22.5			0.0			40.7	
Approach LOS		C			C			A			D	

Intersection Summary			
HCM Average Control Delay	28.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	86.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0		4.0			
Lane Util. Factor	1.00	0.95			0.91	1.00	1.00		0.88			
Frpb, ped/bikes	1.00	1.00			1.00	0.98	1.00		0.95			
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00		1.00			
Frt	1.00	1.00			1.00	0.85	1.00		0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (prot)	1770	3539			5085	1555	1770		2661			
Flt Permitted	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (perm)	1770	3539			5085	1555	1770		2661			
Volume (vph)	260	1350	0	0	990	920	200	0	630	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	274	1421	0	0	1042	968	211	0	663	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	54	0	0	0
Lane Group Flow (vph)	274	1421	0	0	1042	968	211	0	609	0	0	0
Confl. Peds. (#/hr)						20			20			
Turn Type	Prot					Free	custom		custom			
Protected Phases	5	2			6							
Permitted Phases						Free	3		3			
Actuated Green, G (s)	21.7	57.2			31.5	90.0	24.8		24.8			
Effective Green, g (s)	21.7	57.2			31.5	90.0	24.8		24.8			
Actuated g/C Ratio	0.24	0.64			0.35	1.00	0.28		0.28			
Clearance Time (s)	4.0	4.0			4.0		4.0		4.0			
Vehicle Extension (s)	4.7	4.7			4.7		3.0		3.0			
Lane Grp Cap (vph)	427	2249			1780	1555	488		733			
v/s Ratio Prot	0.15	0.40			0.20							
v/s Ratio Perm						c0.62	0.12		c0.23			
v/c Ratio	0.64	0.63			0.59	0.62	0.43		0.83			
Uniform Delay, d1	30.7	10.0			23.9	0.0	26.8		30.6			
Progression Factor	0.12	0.06			1.00	1.00	1.00		1.00			
Incremental Delay, d2	3.3	0.8			1.4	1.9	0.6		7.9			
Delay (s)	7.1	1.5			25.3	1.9	27.4		38.6			
Level of Service	A	A			C	A	C		D			
Approach Delay (s)		2.4			14.0			35.9			0.0	
Approach LOS		A			B			D			A	

Intersection Summary			
HCM Average Control Delay	13.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	86.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		0.97	0.91		0.95	0.95	1.00		1.00	
Frt	1.00	1.00		1.00	1.00		1.00	1.00	0.85		0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1770	3523		3433	5075		1681	1770	1583		1758	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.97	
Satd. Flow (perm)	1770	3523		3433	5075		1681	1770	1583		1758	
Volume (vph)	10	795	25	100	780	10	15	10	90	25	10	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	837	26	105	821	11	16	11	95	26	11	11
RTOR Reduction (vph)	0	2	0	0	1	0	0	0	73	0	10	0
Lane Group Flow (vph)	11	861	0	105	831	0	16	11	22	0	38	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases									2			
Actuated Green, G (s)	1.6	39.7		8.7	46.8		20.5	20.5	20.5		5.1	
Effective Green, g (s)	1.6	39.7		8.7	46.8		20.5	20.5	20.5		5.1	
Actuated g/C Ratio	0.02	0.44		0.10	0.52		0.23	0.23	0.23		0.06	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	31	1554		332	2639		383	403	361		100	
v/s Ratio Prot	0.01	c0.24		c0.03	c0.16		0.01	0.01			c0.02	
v/s Ratio Perm									c0.01			
v/c Ratio	0.35	0.55		0.32	0.31		0.04	0.03	0.06		0.38	
Uniform Delay, d1	43.7	18.6		37.9	12.4		27.1	27.0	27.2		40.9	
Progression Factor	1.00	1.00		0.86	0.34		1.00	1.00	1.00		1.00	
Incremental Delay, d2	6.9	1.4		0.4	0.2		0.2	0.1	0.3		2.4	
Delay (s)	50.6	20.0		33.0	4.4		27.3	27.1	27.5		43.3	
Level of Service	D	C		C	A		C	C	C		D	
Approach Delay (s)		20.4			7.6			27.5			43.3	
Approach LOS		C			A			C			D	

Intersection Summary			
HCM Average Control Delay	15.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	45.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Lane Util. Factor		0.86	1.00	0.97	0.95					0.97		1.00
Frpb, ped/bikes		1.00	0.95	1.00	1.00					1.00		0.97
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00		1.00
Frt		1.00	0.85	1.00	1.00					1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (prot)		6408	1512	3433	3539					3433		1536
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		6408	1512	3433	3539					3433		1536
Volume (vph)	0	720	170	620	550	0	0	0	0	860	0	330
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	758	179	653	579	0	0	0	0	905	0	347
RTOR Reduction (vph)	0	0	147	0	0	0	0	0	0	0	0	163
Lane Group Flow (vph)	0	758	32	653	579	0	0	0	0	905	0	184
Confl. Peds. (#/hr)			20									20
Turn Type			Perm	Prot						custom		custom
Protected Phases		2		1	2 1							
Permitted Phases			2							4 12		4 12
Actuated Green, G (s)		16.0	16.0	28.7	44.7					29.3		29.3
Effective Green, g (s)		16.0	16.0	28.7	44.7					29.3		29.3
Actuated g/C Ratio		0.18	0.18	0.32	0.50					0.33		0.33
Clearance Time (s)		4.0	4.0	4.0								
Vehicle Extension (s)		4.7	4.7	4.7								
Lane Grp Cap (vph)		1139	269	1095	1758					1118		500
v/s Ratio Prot		c0.12		c0.19	0.16							
v/s Ratio Perm			0.02							c0.26		0.12
v/c Ratio		0.67	0.12	0.60	0.33					0.81		0.37
Uniform Delay, d1		34.5	31.1	25.8	13.6					27.8		23.3
Progression Factor		0.67	1.33	0.07	0.41					1.00		1.00
Incremental Delay, d2		2.9	0.8	0.8	0.2					4.4		0.5
Delay (s)		26.1	42.3	2.7	5.8					32.2		23.7
Level of Service		C	D	A	A					C		C
Approach Delay (s)		29.2			4.2			0.0			29.9	
Approach LOS		C			A			A			C	

Intersection Summary			
HCM Average Control Delay	20.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	65.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0		4.0			
Lane Util. Factor	0.97	0.91			0.86	1.00	1.00		0.88			
Frpb, ped/bikes	1.00	1.00			1.00	0.98	1.00		0.95			
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00		1.00			
Frt	1.00	1.00			1.00	0.85	1.00		0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (prot)	3433	5085			6408	1555	1770		2661			
Flt Permitted	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (perm)	3433	5085			6408	1555	1770		2661			
Volume (vph)	220	1360	0	0	1000	960	170	0	650	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	232	1432	0	0	1053	1011	179	0	684	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	30	0	0	0
Lane Group Flow (vph)	232	1432	0	0	1053	1011	179	0	654	0	0	0
Confl. Peds. (#/hr)						20			20			
Turn Type	Prot					Free	custom		custom			
Protected Phases	5	5 6			6							
Permitted Phases						Free	8 16		8 16			
Actuated Green, G (s)	21.0	41.1			20.1	90.0	32.9		32.9			
Effective Green, g (s)	21.0	41.1			20.1	90.0	32.9		32.9			
Actuated g/C Ratio	0.23	0.46			0.22	1.00	0.37		0.37			
Clearance Time (s)	4.0				4.0							
Vehicle Extension (s)	4.7				4.7							
Lane Grp Cap (vph)	801	2322			1431	1555	647		973			
v/s Ratio Prot	0.07	0.28			0.16							
v/s Ratio Perm						c0.65	0.10		0.25			
v/c Ratio	0.29	0.62			0.74	0.65	0.28		0.67			
Uniform Delay, d1	28.4	18.5			32.5	0.0	20.2		24.0			
Progression Factor	0.05	0.71			1.00	1.00	1.00		1.00			
Incremental Delay, d2	0.3	0.4			2.3	2.1	0.2		1.8			
Delay (s)	1.7	13.6			34.8	2.1	20.4		25.9			
Level of Service	A	B			C	A	C		C			
Approach Delay (s)		11.9			18.8			24.7			0.0	
Approach LOS		B			B			C			A	

Intersection Summary			
HCM Average Control Delay	17.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	65.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		0.97	0.95		1.00	0.95	0.95		1.00	
Frt	1.00	1.00		1.00	1.00		1.00	0.88	0.85		0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1770	3523		3433	3532		1770	1555	1504		1758	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.97	
Satd. Flow (perm)	1770	3523		3433	3532		1770	1555	1504		1758	
Volume (vph)	10	775	25	100	770	10	15	10	90	25	10	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	816	26	105	811	11	16	11	95	26	11	11
RTOR Reduction (vph)	0	2	0	0	1	0	0	37	39	0	10	0
Lane Group Flow (vph)	11	840	0	105	821	0	16	20	10	0	38	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases									2			
Actuated Green, G (s)	1.0	43.9		7.2	50.1		17.8	17.8	17.8		5.1	
Effective Green, g (s)	1.0	43.9		7.2	50.1		17.8	17.8	17.8		5.1	
Actuated g/C Ratio	0.01	0.49		0.08	0.56		0.20	0.20	0.20		0.06	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	20	1718		275	1966		350	308	297		100	
v/s Ratio Prot	0.01	c0.24		c0.03	c0.23		0.01	c0.01			c0.02	
v/s Ratio Perm									0.01			
v/c Ratio	0.55	0.49		0.38	0.42		0.05	0.07	0.03		0.38	
Uniform Delay, d1	44.3	15.5		39.3	11.5		29.2	29.3	29.1		40.9	
Progression Factor	1.00	1.00		1.01	0.59		1.00	1.00	1.00		1.00	
Incremental Delay, d2	28.9	1.0		0.8	0.6		0.2	0.4	0.2		2.4	
Delay (s)	73.2	16.5		40.3	7.4		29.5	29.7	29.4		43.3	
Level of Service	E	B		D	A		C	C	C		D	
Approach Delay (s)		17.2			11.2			29.6			43.3	
Approach LOS		B			B			C			D	

Intersection Summary			
HCM Average Control Delay	15.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	44.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Lane Util. Factor		0.91	1.00	0.97	0.95					0.97		1.00
Frpb, ped/bikes		1.00	0.95	1.00	1.00					1.00		0.95
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00		1.00
Frt		1.00	0.85	1.00	1.00					1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (prot)		5085	1512	3433	3539					3433		1512
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		5085	1512	3433	3539					3433		1512
Volume (vph)	0	720	170	620	550	0	0	0	0	860	0	330
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	758	179	653	579	0	0	0	0	905	0	347
RTOR Reduction (vph)	0	0	128	0	0	0	0	0	0	0	0	184
Lane Group Flow (vph)	0	758	51	653	579	0	0	0	0	905	0	163
Confl. Peds. (#/hr)			20									20
Turn Type			Perm	Prot						custom		custom
Protected Phases		2		1	6							
Permitted Phases			2							4		4
Actuated Green, G (s)		25.7	25.7	22.8	52.5					29.5		29.5
Effective Green, g (s)		25.7	25.7	22.8	52.5					29.5		29.5
Actuated g/C Ratio		0.29	0.29	0.25	0.58					0.33		0.33
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Vehicle Extension (s)		4.7	4.7	4.7	4.7					3.0		3.0
Lane Grp Cap (vph)		1452	432	870	2064					1125		496
v/s Ratio Prot		c0.15		c0.19	0.16							
v/s Ratio Perm			0.03							c0.26		0.11
v/c Ratio		0.52	0.12	0.75	0.28					0.80		0.33
Uniform Delay, d1		27.0	23.8	31.0	9.3					27.6		22.8
Progression Factor		0.57	1.43	0.68	1.23					1.00		1.00
Incremental Delay, d2		1.2	0.5	3.6	0.1					4.3		0.4
Delay (s)		16.7	34.5	24.7	11.6					31.9		23.2
Level of Service		B	C	C	B					C		C
Approach Delay (s)		20.1			18.6			0.0			29.5	
Approach LOS		C			B			A			C	

Intersection Summary			
HCM Average Control Delay	23.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	66.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.91	1.00		0.86	1.00	0.88
Frpb, ped/bikes	1.00	0.92		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	1.00	1.00		1.00	0.95	1.00
Satd. Flow (prot)	5085	1464		6408	1770	2787
Flt Permitted	1.00	1.00		1.00	0.95	1.00
Satd. Flow (perm)	5085	1464		6408	1770	2787
Volume (vph)	1360	220	0	1960	170	650
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1432	232	0	2063	179	684
RTOR Reduction (vph)	0	103	0	0	0	34
Lane Group Flow (vph)	1432	129	0	2063	179	650
Confl. Peds. (#/hr)		20				
Turn Type		Perm				Perm
Protected Phases	4			8	2	
Permitted Phases		4				2
Actuated Green, G (s)	50.0	50.0		50.0	32.0	32.0
Effective Green, g (s)	50.0	50.0		50.0	32.0	32.0
Actuated g/C Ratio	0.56	0.56		0.56	0.36	0.36
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0
Lane Grp Cap (vph)	2825	813		3560	629	991
v/s Ratio Prot	0.28			c0.32	0.10	
v/s Ratio Perm		0.09				c0.23
v/c Ratio	0.51	0.16		0.58	0.28	0.66
Uniform Delay, d1	12.4	9.7		13.1	20.8	24.4
Progression Factor	0.34	0.81		1.00	1.00	1.00
Incremental Delay, d2	0.5	0.3		0.7	1.1	3.4
Delay (s)	4.6	8.2		13.8	21.9	27.8
Level of Service	A	A		B	C	C
Approach Delay (s)	5.1			13.8	26.5	
Approach LOS	A			B	C	

Intersection Summary			
HCM Average Control Delay	13.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	55.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		0.97	0.95		1.00	0.95	0.95		1.00	
Frt	1.00	1.00		1.00	1.00		1.00	0.88	0.85		0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1770	3523		3433	3532		1770	1555	1504		1758	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.97	
Satd. Flow (perm)	1770	3523		3433	3532		1770	1555	1504		1758	
Volume (vph)	10	775	25	100	770	10	15	10	90	25	10	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	816	26	105	811	11	16	11	95	26	11	11
RTOR Reduction (vph)	0	2	0	0	1	0	0	36	39	0	10	0
Lane Group Flow (vph)	11	840	0	105	821	0	16	21	10	0	38	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases									2			
Actuated Green, G (s)	1.0	42.1		8.0	49.1		18.8	18.8	18.8		5.1	
Effective Green, g (s)	1.0	42.1		8.0	49.1		18.8	18.8	18.8		5.1	
Actuated g/C Ratio	0.01	0.47		0.09	0.55		0.21	0.21	0.21		0.06	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	20	1648		305	1927		370	325	314		100	
v/s Ratio Prot	0.01	c0.24		c0.03	c0.23		0.01	c0.01			c0.02	
v/s Ratio Perm									0.01			
v/c Ratio	0.55	0.51		0.34	0.43		0.04	0.06	0.03		0.38	
Uniform Delay, d1	44.3	16.7		38.5	12.1		28.4	28.5	28.4		40.9	
Progression Factor	1.00	1.00		0.91	0.45		1.00	1.00	1.00		1.00	
Incremental Delay, d2	28.9	1.1		0.6	0.7		0.2	0.4	0.2		2.4	
Delay (s)	73.2	17.9		35.9	6.1		28.6	28.9	28.5		43.3	
Level of Service	E	B		D	A		C	C	C		D	
Approach Delay (s)		18.6			9.5			28.7			43.3	
Approach LOS		B			A			C			D	

Intersection Summary			
HCM Average Control Delay	15.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	44.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.91	0.91					0.95	0.91	0.95
Frpb, ped/bikes		1.00	0.95	1.00	1.00					1.00	1.00	0.95
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	0.98					0.95	0.95	1.00
Satd. Flow (prot)		5085	1512	1610	3327					1681	1610	1436
Flt Permitted		1.00	1.00	0.95	0.98					0.95	0.95	1.00
Satd. Flow (perm)		5085	1512	1610	3327					1681	1610	1436
Volume (vph)	0	880	190	940	680	0	0	0	0	1010	0	340
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	926	200	989	716	0	0	0	0	1063	0	358
RTOR Reduction (vph)	0	0	162	0	0	0	0	0	0	0	0	290
Lane Group Flow (vph)	0	926	38	549	1156	0	0	0	0	532	531	68
Confl. Peds. (#/hr)			20									20
Turn Type			Perm	Split						Split		custom
Protected Phases		2		1	1					4	4	
Permitted Phases			2									2
Actuated Green, G (s)		17.0	17.0	32.0	32.0					29.0	29.0	17.0
Effective Green, g (s)		17.0	17.0	32.0	32.0					29.0	29.0	17.0
Actuated g/C Ratio		0.19	0.19	0.36	0.36					0.32	0.32	0.19
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		4.7	4.7	4.7	4.7					3.0	3.0	4.7
Lane Grp Cap (vph)		961	286	572	1183					542	519	271
v/s Ratio Prot		c0.18		0.34	c0.35					0.32	c0.33	
v/s Ratio Perm			0.02									0.05
v/c Ratio		0.96	0.13	0.96	0.98					0.98	1.02	0.25
Uniform Delay, d1		36.2	30.4	28.4	28.6					30.2	30.5	31.1
Progression Factor		0.65	1.14	0.76	0.58					1.00	1.00	1.00
Incremental Delay, d2		19.7	0.8	21.3	17.7					33.8	45.5	2.2
Delay (s)		43.1	35.5	42.9	34.2					64.0	76.0	33.3
Level of Service		D	D	D	C					E	E	C
Approach Delay (s)		41.8			37.0			0.0			60.7	
Approach LOS		D			D			A			E	

Intersection Summary

HCM Average Control Delay	46.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	103.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0		4.0			
Lane Util. Factor	1.00	0.95			0.91	1.00	1.00		0.88			
Frpb, ped/bikes	1.00	1.00			1.00	0.98	1.00		0.95			
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00		1.00			
Frt	1.00	1.00			1.00	0.85	1.00		0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (prot)	1770	3539			5085	1555	1770		2661			
Flt Permitted	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (perm)	1770	3539			5085	1555	1770		2661			
Volume (vph)	230	1660	0	0	1420	1140	200	0	690	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	242	1747	0	0	1495	1200	211	0	726	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	26	0	0	0
Lane Group Flow (vph)	242	1747	0	0	1495	1200	211	0	700	0	0	0
Confl. Peds. (#/hr)						20			20			
Turn Type	Prot					Free	custom		custom			
Protected Phases	5	2			6							
Permitted Phases						Free	3		3			
Actuated Green, G (s)	15.8	55.6			35.8	90.0	26.4		26.4			
Effective Green, g (s)	15.8	55.6			35.8	90.0	26.4		26.4			
Actuated g/C Ratio	0.18	0.62			0.40	1.00	0.29		0.29			
Clearance Time (s)	4.0	4.0			4.0		4.0		4.0			
Vehicle Extension (s)	4.7	4.7			4.7		3.0		3.0			
Lane Grp Cap (vph)	311	2186			2023	1555	519		781			
v/s Ratio Prot	0.14	0.49			0.29							
v/s Ratio Perm						c0.77	0.12		c0.26			
v/c Ratio	0.78	0.80			0.74	0.77	0.41		0.90			
Uniform Delay, d1	35.4	13.0			23.1	0.0	25.5		30.5			
Progression Factor	0.17	0.06			1.00	1.00	1.00		1.00			
Incremental Delay, d2	4.3	0.8			2.5	3.8	0.5		12.8			
Delay (s)	10.2	1.5			25.6	3.8	26.0		43.3			
Level of Service	B	A			C	A	C		D			
Approach Delay (s)		2.6			15.9			39.4			0.0	
Approach LOS		A			B			D			A	

Intersection Summary

HCM Average Control Delay	15.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	103.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Lane Util. Factor		0.86	1.00	0.97	0.95					0.97		1.00
Frpb, ped/bikes		1.00	0.95	1.00	1.00					1.00		0.97
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00		1.00
Frt		1.00	0.85	1.00	1.00					1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (prot)		6408	1512	3433	3539					3433		1539
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		6408	1512	3433	3539					3433		1539
Volume (vph)	0	810	230	500	600	0	0	0	0	930	0	330
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	853	242	526	632	0	0	0	0	979	0	347
RTOR Reduction (vph)	0	0	193	0	0	0	0	0	0	0	0	112
Lane Group Flow (vph)	0	853	49	526	632	0	0	0	0	979	0	235
Confl. Peds. (#/hr)			20									20
Turn Type			Perm	Prot						custom		custom
Protected Phases		2		1	2 1							
Permitted Phases			2							4 12		4 12
Actuated Green, G (s)		18.2	18.2	22.8	41.0					33.0		33.0
Effective Green, g (s)		18.2	18.2	22.8	41.0					33.0		33.0
Actuated g/C Ratio		0.20	0.20	0.25	0.46					0.37		0.37
Clearance Time (s)		4.0	4.0	4.0								
Vehicle Extension (s)		4.7	4.7	4.7								
Lane Grp Cap (vph)		1296	306	870	1612					1259		564
v/s Ratio Prot		c0.13		c0.15	0.18							
v/s Ratio Perm			0.03							c0.29		0.15
v/c Ratio		0.66	0.16	0.60	0.39					0.78		0.42
Uniform Delay, d1		33.0	29.6	29.6	16.2					25.2		21.3
Progression Factor		0.62	1.98	0.13	0.45					1.00		1.00
Incremental Delay, d2		2.3	1.0	1.1	0.2					3.1		0.5
Delay (s)		22.9	59.5	4.9	7.5					28.3		21.8
Level of Service		C	E	A	A					C		C
Approach Delay (s)		31.0			6.3			0.0			26.6	
Approach LOS		C			A			A			C	

Intersection Summary			
HCM Average Control Delay	21.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0		4.0			
Lane Util. Factor	0.97	0.91			0.86	1.00	1.00		0.88			
Frpb, ped/bikes	1.00	1.00			1.00	0.98	1.00		0.95			
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00		1.00			
Frt	1.00	1.00			1.00	0.85	1.00		0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (prot)	3433	5085			6408	1555	1770		2661			
Flt Permitted	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (perm)	3433	5085			6408	1555	1770		2661			
Volume (vph)	230	1510	0	0	910	1060	190	0	630	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	242	1589	0	0	958	1116	200	0	663	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	19	0	0	0
Lane Group Flow (vph)	242	1589	0	0	958	1116	200	0	644	0	0	0
Confl. Peds. (#/hr)						20			20			
Turn Type	Prot					Free	custom		custom			
Protected Phases	5	5 6			6							
Permitted Phases						Free	8 16		8 16			
Actuated Green, G (s)	23.2	41.5			18.3	90.0	32.5		32.5			
Effective Green, g (s)	23.2	41.5			18.3	90.0	32.5		32.5			
Actuated g/C Ratio	0.26	0.46			0.20	1.00	0.36		0.36			
Clearance Time (s)	4.0				4.0							
Vehicle Extension (s)	4.7				4.7							
Lane Grp Cap (vph)	885	2345			1303	1555	639		961			
v/s Ratio Prot	0.07	0.31			0.15							
v/s Ratio Perm						c0.72	0.11		0.24			
v/c Ratio	0.27	0.68			0.74	0.72	0.31		0.67			
Uniform Delay, d1	26.7	19.0			33.6	0.0	20.7		24.2			
Progression Factor	0.04	0.77			1.00	1.00	1.00		1.00			
Incremental Delay, d2	0.2	0.6			2.6	2.9	0.3		1.8			
Delay (s)	1.4	15.3			36.1	2.9	21.0		26.0			
Level of Service	A	B			D	A	C		C			
Approach Delay (s)		13.5			18.2			24.9			0.0	
Approach LOS		B			B			C			A	

Intersection Summary			
HCM Average Control Delay	17.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	67.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		0.97	0.95		1.00	0.95	0.95		1.00	
Frt	1.00	1.00		1.00	1.00		1.00	0.88	0.85		0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1770	3525		3433	3533		1770	1555	1504		1758	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.97	
Satd. Flow (perm)	1770	3525		3433	3533		1770	1555	1504		1758	
Volume (vph)	10	925	25	100	820	10	15	10	90	25	10	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	974	26	105	863	11	16	11	95	26	11	11
RTOR Reduction (vph)	0	2	0	0	1	0	0	36	39	0	10	0
Lane Group Flow (vph)	11	998	0	105	873	0	16	21	10	0	38	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases									2			
Actuated Green, G (s)	0.8	43.1		7.2	49.5		18.6	18.6	18.6		5.1	
Effective Green, g (s)	0.8	43.1		7.2	49.5		18.6	18.6	18.6		5.1	
Actuated g/C Ratio	0.01	0.48		0.08	0.55		0.21	0.21	0.21		0.06	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	16	1688		275	1943		366	321	311		100	
v/s Ratio Prot	0.01	c0.28		c0.03	c0.25		0.01	c0.01			c0.02	
v/s Ratio Perm									0.01			
v/c Ratio	0.69	0.59		0.38	0.45		0.04	0.06	0.03		0.38	
Uniform Delay, d1	44.5	17.0		39.3	12.1		28.6	28.7	28.5		40.9	
Progression Factor	1.00	1.00		0.89	0.49		1.00	1.00	1.00		1.00	
Incremental Delay, d2	80.1	1.5		0.8	0.7		0.2	0.4	0.2		2.4	
Delay (s)	124.6	18.6		35.9	6.7		28.8	29.1	28.7		43.3	
Level of Service	F	B		D	A		C	C	C		D	
Approach Delay (s)		19.7			9.8			28.9			43.3	
Approach LOS		B			A			C			D	

Intersection Summary			
HCM Average Control Delay	16.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	48.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Lane Util. Factor		0.91	1.00	0.97	0.95					0.97		1.00
Frpb, ped/bikes		1.00	0.95	1.00	1.00					1.00		0.95
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00		1.00
Frt		1.00	0.85	1.00	1.00					1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (prot)		5085	1512	3433	3539					3433		1512
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		5085	1512	3433	3539					3433		1512
Volume (vph)	0	810	230	500	600	0	0	0	0	930	0	330
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	853	242	526	632	0	0	0	0	979	0	347
RTOR Reduction (vph)	0	0	164	0	0	0	0	0	0	0	0	178
Lane Group Flow (vph)	0	853	78	526	632	0	0	0	0	979	0	169
Confl. Peds. (#/hr)			20									20
Turn Type			Perm	Prot						custom		custom
Protected Phases		2		1	6							
Permitted Phases			2							4		4
Actuated Green, G (s)		28.9	28.9	20.0	52.9					29.1		29.1
Effective Green, g (s)		28.9	28.9	20.0	52.9					29.1		29.1
Actuated g/C Ratio		0.32	0.32	0.22	0.59					0.32		0.32
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Vehicle Extension (s)		4.7	4.7	4.7	4.7					3.0		3.0
Lane Grp Cap (vph)		1633	486	763	2080					1110		489
v/s Ratio Prot		c0.17		c0.15	0.18							
v/s Ratio Perm			0.05							c0.29		0.11
v/c Ratio		0.52	0.16	0.69	0.30					0.88		0.35
Uniform Delay, d1		24.9	21.9	32.1	9.3					28.8		23.2
Progression Factor		0.53	1.48	0.65	1.18					1.00		1.00
Incremental Delay, d2		1.1	0.6	2.6	0.1					8.4		0.4
Delay (s)		14.3	33.0	23.4	11.1					37.3		23.6
Level of Service		B	C	C	B					D		C
Approach Delay (s)		18.5			16.7			0.0			33.7	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM Average Control Delay	23.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	67.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.91	1.00		0.86	1.00	0.88
Frpb, ped/bikes	1.00	0.92		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	1.00	1.00		1.00	0.95	1.00
Satd. Flow (prot)	5085	1464		6408	1770	2787
Flt Permitted	1.00	1.00		1.00	0.95	1.00
Satd. Flow (perm)	5085	1464		6408	1770	2787
Volume (vph)	1510	230	0	1970	190	630
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1589	242	0	2074	200	663
RTOR Reduction (vph)	0	113	0	0	0	19
Lane Group Flow (vph)	1589	129	0	2074	200	644
Confl. Peds. (#/hr)		20				
Turn Type		Perm				Perm
Protected Phases	4			8	2	
Permitted Phases		4				2
Actuated Green, G (s)	48.0	48.0		48.0	34.0	34.0
Effective Green, g (s)	48.0	48.0		48.0	34.0	34.0
Actuated g/C Ratio	0.53	0.53		0.53	0.38	0.38
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0
Lane Grp Cap (vph)	2712	781		3418	669	1053
v/s Ratio Prot	0.31			c0.32	0.11	
v/s Ratio Perm		0.09				c0.23
v/c Ratio	0.59	0.17		0.61	0.30	0.61
Uniform Delay, d1	14.3	10.7		14.5	19.6	22.7
Progression Factor	0.43	1.30		1.00	1.00	1.00
Incremental Delay, d2	0.6	0.3		0.8	1.1	2.7
Delay (s)	6.7	14.3		15.3	20.8	25.3
Level of Service	A	B		B	C	C
Approach Delay (s)	7.7			15.3	24.3	
Approach LOS	A			B	C	

Intersection Summary			
HCM Average Control Delay	14.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	57.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		0.97	0.95		1.00	0.95	0.95		1.00	
Frt	1.00	1.00		1.00	1.00		1.00	0.88	0.85		0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1770	3525		3433	3533		1770	1555	1504		1758	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.97	
Satd. Flow (perm)	1770	3525		3433	3533		1770	1555	1504		1758	
Volume (vph)	10	925	25	100	820	10	15	10	90	25	10	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	974	26	105	863	11	16	11	95	26	11	11
RTOR Reduction (vph)	0	2	0	0	1	0	0	37	39	0	10	0
Lane Group Flow (vph)	11	998	0	105	873	0	16	20	10	0	38	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases									2			
Actuated Green, G (s)	0.8	44.1		7.2	50.5		17.6	17.6	17.6		5.1	
Effective Green, g (s)	0.8	44.1		7.2	50.5		17.6	17.6	17.6		5.1	
Actuated g/C Ratio	0.01	0.49		0.08	0.56		0.20	0.20	0.20		0.06	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	16	1727		275	1982		346	304	294		100	
v/s Ratio Prot	0.01	c0.28		c0.03	c0.25		0.01	c0.01			c0.02	
v/s Ratio Perm									0.01			
v/c Ratio	0.69	0.58		0.38	0.44		0.05	0.07	0.03		0.38	
Uniform Delay, d1	44.5	16.3		39.3	11.5		29.4	29.5	29.3		40.9	
Progression Factor	1.00	1.00		0.92	0.45		1.00	1.00	1.00		1.00	
Incremental Delay, d2	80.1	1.4		0.8	0.7		0.3	0.4	0.2		2.4	
Delay (s)	124.6	17.7		36.8	5.8		29.6	29.9	29.5		43.3	
Level of Service	F	B		D	A		C	C	C		D	
Approach Delay (s)		18.9			9.1			29.7			43.3	
Approach LOS		B			A			C			D	

Intersection Summary			
HCM Average Control Delay	15.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	48.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Lane Util. Factor		0.86	1.00	0.97	0.95					0.97		1.00
Frpb, ped/bikes		1.00	0.95	1.00	1.00					1.00		0.97
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00		1.00
Frt		1.00	0.85	1.00	1.00					1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (prot)		6408	1512	3433	3539					3433		1536
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		6408	1512	3433	3539					3433		1536
Volume (vph)	0	880	190	940	680	0	0	0	0	1010	0	340
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	926	200	989	716	0	0	0	0	1063	0	358
RTOR Reduction (vph)	0	0	160	0	0	0	0	0	0	0	0	106
Lane Group Flow (vph)	0	926	40	989	716	0	0	0	0	1063	0	252
Confl. Peds. (#/hr)			20									20
Turn Type			Perm	Prot						custom		custom
Protected Phases		2		1	2 1							
Permitted Phases			2							4 12		4 12
Actuated Green, G (s)		18.0	18.0	26.0	44.0					30.0		30.0
Effective Green, g (s)		18.0	18.0	26.0	44.0					30.0		30.0
Actuated g/C Ratio		0.20	0.20	0.29	0.49					0.33		0.33
Clearance Time (s)		4.0	4.0	4.0								
Vehicle Extension (s)		4.7	4.7	4.7								
Lane Grp Cap (vph)		1282	302	992	1730					1144		512
v/s Ratio Prot		c0.14		c0.29	0.20							
v/s Ratio Perm			0.03							c0.31		0.16
v/c Ratio		0.72	0.13	1.00	0.41					0.93		0.49
Uniform Delay, d1		33.7	29.6	32.0	14.7					29.0		23.9
Progression Factor		0.63	1.59	0.49	0.53					1.00		1.00
Incremental Delay, d2		3.1	0.8	19.3	0.2					12.8		0.7
Delay (s)		24.4	47.7	35.0	8.0					41.8		24.7
Level of Service		C	D	C	A					D		C
Approach Delay (s)		28.5			23.7			0.0			37.5	
Approach LOS		C			C			A			D	

Intersection Summary			
HCM Average Control Delay	29.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	90.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0		4.0			
Lane Util. Factor	0.97	0.91			0.86	1.00	1.00		0.88			
Frpb, ped/bikes	1.00	1.00			1.00	0.98	1.00		0.95			
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00		1.00			
Frt	1.00	1.00			1.00	0.85	1.00		0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (prot)	3433	5085			6408	1555	1770		2661			
Flt Permitted	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (perm)	3433	5085			6408	1555	1770		2661			
Volume (vph)	230	1660	0	0	1420	1140	200	0	690	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	242	1747	0	0	1495	1200	211	0	726	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	19	0	0	0
Lane Group Flow (vph)	242	1747	0	0	1495	1200	211	0	707	0	0	0
Confl. Peds. (#/hr)						20			20			
Turn Type	Prot					Free	custom		custom			
Protected Phases	5	5 6			6							
Permitted Phases						Free	8 16		8 16			
Actuated Green, G (s)	24.6	49.3			24.7	90.0	24.7		24.7			
Effective Green, g (s)	24.6	49.3			24.7	90.0	24.7		24.7			
Actuated g/C Ratio	0.27	0.55			0.27	1.00	0.27		0.27			
Clearance Time (s)	4.0				4.0							
Vehicle Extension (s)	4.7				4.7							
Lane Grp Cap (vph)	938	2785			1759	1555	486		730			
v/s Ratio Prot	0.07	0.34			0.23							
v/s Ratio Perm						c0.77	0.12		c0.27			
v/c Ratio	0.26	0.63			0.85	0.77	0.43		0.97			
Uniform Delay, d1	25.6	14.0			30.9	0.0	26.9		32.3			
Progression Factor	0.00	0.93			1.00	1.00	1.00		1.00			
Incremental Delay, d2	0.2	0.3			4.4	3.8	0.6		25.4			
Delay (s)	0.3	13.3			35.3	3.8	27.5		57.7			
Level of Service	A	B			D	A	C		E			
Approach Delay (s)		11.8			21.3			50.9			0.0	
Approach LOS		B			C			D			A	

Intersection Summary			
HCM Average Control Delay	22.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	90.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		0.97	0.95		1.00	0.95	0.95		1.00	
Frt	1.00	1.00		1.00	1.00		1.00	0.88	0.85		0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1770	3526		3433	3533		1770	1555	1504		1758	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.97	
Satd. Flow (perm)	1770	3526		3433	3533		1770	1555	1504		1758	
Volume (vph)	10	955	25	100	910	10	15	10	90	25	10	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	1005	26	105	958	11	16	11	95	26	11	11
RTOR Reduction (vph)	0	2	0	0	1	0	0	37	39	0	10	0
Lane Group Flow (vph)	11	1029	0	105	968	0	16	20	10	0	38	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases									2			
Actuated Green, G (s)	0.8	44.1		7.2	50.5		17.6	17.6	17.6		5.1	
Effective Green, g (s)	0.8	44.1		7.2	50.5		17.6	17.6	17.6		5.1	
Actuated g/C Ratio	0.01	0.49		0.08	0.56		0.20	0.20	0.20		0.06	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	16	1728		275	1982		346	304	294		100	
v/s Ratio Prot	0.01	c0.29		c0.03	c0.27		0.01	c0.01			c0.02	
v/s Ratio Perm									0.01			
v/c Ratio	0.69	0.60		0.38	0.49		0.05	0.07	0.03		0.38	
Uniform Delay, d1	44.5	16.5		39.3	11.9		29.4	29.5	29.3		40.9	
Progression Factor	1.00	1.00		0.86	0.51		1.00	1.00	1.00		1.00	
Incremental Delay, d2	80.1	1.5		0.8	0.8		0.3	0.4	0.2		2.4	
Delay (s)	124.6	18.1		34.6	6.9		29.6	29.9	29.5		43.3	
Level of Service	F	B		C	A		C	C	C		D	
Approach Delay (s)		19.2			9.6			29.7			43.3	
Approach LOS		B			A			C			D	

Intersection Summary			
HCM Average Control Delay	15.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	49.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Lane Util. Factor		0.91	1.00	0.97	0.95					0.97		1.00
Frpb, ped/bikes		1.00	0.95	1.00	1.00					1.00		0.95
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00		1.00
Frt		1.00	0.85	1.00	1.00					1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (prot)		5085	1512	3433	3539					3433		1512
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		5085	1512	3433	3539					3433		1512
Volume (vph)	0	880	190	940	680	0	0	0	0	1010	0	340
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	926	200	989	716	0	0	0	0	1063	0	358
RTOR Reduction (vph)	0	0	156	0	0	0	0	0	0	0	0	144
Lane Group Flow (vph)	0	926	44	989	716	0	0	0	0	1063	0	214
Confl. Peds. (#/hr)			20									20
Turn Type			Perm	Prot						custom		custom
Protected Phases		2		1	6							
Permitted Phases			2							4		4
Actuated Green, G (s)		20.0	20.0	28.2	52.2					29.8		29.8
Effective Green, g (s)		20.0	20.0	28.2	52.2					29.8		29.8
Actuated g/C Ratio		0.22	0.22	0.31	0.58					0.33		0.33
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Vehicle Extension (s)		4.7	4.7	4.7	4.7					3.0		3.0
Lane Grp Cap (vph)		1130	336	1076	2053					1137		501
v/s Ratio Prot		c0.18		c0.29	0.20							
v/s Ratio Perm			0.03							c0.31		0.14
v/c Ratio		0.82	0.13	0.92	0.35					0.93		0.43
Uniform Delay, d1		33.3	28.0	29.8	10.0					29.2		23.4
Progression Factor		0.62	1.59	0.68	1.27					1.00		1.00
Incremental Delay, d2		5.9	0.7	9.6	0.1					13.7		0.6
Delay (s)		26.6	45.4	29.9	12.8					42.9		24.0
Level of Service		C	D	C	B					D		C
Approach Delay (s)		29.9			22.7			0.0			38.1	
Approach LOS		C			C			A			D	

Intersection Summary			
HCM Average Control Delay	29.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.1%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.91	1.00		0.86	1.00	0.88
Frpb, ped/bikes	1.00	0.92		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	1.00	1.00		1.00	0.95	1.00
Satd. Flow (prot)	5085	1464		6408	1770	2787
Flt Permitted	1.00	1.00		1.00	0.95	1.00
Satd. Flow (perm)	5085	1464		6408	1770	2787
Volume (vph)	1660	230	0	2560	200	690
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1747	242	0	2695	211	726
RTOR Reduction (vph)	0	99	0	0	0	21
Lane Group Flow (vph)	1747	143	0	2695	211	705
Confl. Peds. (#/hr)		20				
Turn Type		Perm				Perm
Protected Phases	4			8	2	
Permitted Phases		4				2
Actuated Green, G (s)	53.0	53.0		53.0	29.0	29.0
Effective Green, g (s)	53.0	53.0		53.0	29.0	29.0
Actuated g/C Ratio	0.59	0.59		0.59	0.32	0.32
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0
Lane Grp Cap (vph)	2995	862		3774	570	898
v/s Ratio Prot	0.34			c0.42	0.12	
v/s Ratio Perm		0.10				c0.25
v/c Ratio	0.58	0.17		0.71	0.37	0.79
Uniform Delay, d1	11.6	8.4		13.1	23.5	27.7
Progression Factor	0.10	0.13		1.00	1.00	1.00
Incremental Delay, d2	0.4	0.2		1.2	1.8	6.8
Delay (s)	1.5	1.2		14.3	25.3	34.5
Level of Service	A	A		B	C	C
Approach Delay (s)	1.5			14.3	32.4	
Approach LOS	A			B	C	

Intersection Summary			
HCM Average Control Delay	12.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		0.97	0.95		0.95	0.95	1.00		1.00	
Frt	1.00	1.00		1.00	1.00		1.00	1.00	0.85		0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1770	3526		3433	3533		1681	1770	1583		1758	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.97	
Satd. Flow (perm)	1770	3526		3433	3533		1681	1770	1583		1758	
Volume (vph)	10	955	25	100	910	10	15	10	90	25	10	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	1005	26	105	958	11	16	11	95	26	11	11
RTOR Reduction (vph)	0	2	0	0	1	0	0	0	76	0	10	0
Lane Group Flow (vph)	11	1029	0	105	968	0	16	11	19	0	38	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases									2			
Actuated Green, G (s)	0.8	44.1		7.2	50.5		17.6	17.6	17.6		5.1	
Effective Green, g (s)	0.8	44.1		7.2	50.5		17.6	17.6	17.6		5.1	
Actuated g/C Ratio	0.01	0.49		0.08	0.56		0.20	0.20	0.20		0.06	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	16	1728		275	1982		329	346	310		100	
v/s Ratio Prot	0.01	c0.29		c0.03	c0.27		0.01	0.01			c0.02	
v/s Ratio Perm									c0.01			
v/c Ratio	0.69	0.60		0.38	0.49		0.05	0.03	0.06		0.38	
Uniform Delay, d1	44.5	16.5		39.3	11.9		29.4	29.3	29.5		40.9	
Progression Factor	1.00	1.00		0.91	0.45		1.00	1.00	1.00		1.00	
Incremental Delay, d2	80.1	1.5		0.8	0.8		0.3	0.2	0.4		2.4	
Delay (s)	124.6	18.1		36.8	6.2		29.7	29.5	29.8		43.3	
Level of Service	F	B		D	A		C	C	C		D	
Approach Delay (s)		19.2			9.2			29.8			43.3	
Approach LOS		B			A			C			D	

Intersection Summary			
HCM Average Control Delay	15.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	49.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0					4.0	4.0	4.0	4.0	
Lane Util. Factor	0.95	0.91	0.95					0.91	1.00	0.91	0.91	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	0.95	1.00					1.00	1.00	0.95	0.99	
Satd. Flow (prot)	1681	1610	1504					5085	1583	1610	3366	
Flt Permitted	0.95	0.95	1.00					1.00	1.00	0.95	0.99	
Satd. Flow (perm)	1681	1610	1504					5085	1583	1610	3366	
Volume (vph)	720	0	290	0	0	0	0	980	230	580	800	0
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	720	0	290	0	0	0	0	980	230	580	800	0
RTOR Reduction (vph)	0	0	215	0	0	0	0	0	172	0	0	0
Lane Group Flow (vph)	360	360	75	0	0	0	0	980	58	444	936	0
Turn Type	Perm		Perm						Perm	Split		
Protected Phases		4						2		6	6	
Permitted Phases	4		4						2			
Actuated Green, G (s)	18.1	18.1	18.1					17.6	17.6	22.3	22.3	
Effective Green, g (s)	18.1	18.1	18.1					17.6	17.6	22.3	22.3	
Actuated g/C Ratio	0.26	0.26	0.26					0.25	0.25	0.32	0.32	
Clearance Time (s)	4.0	4.0	4.0					4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	435	416	389					1279	398	513	1072	
v/s Ratio Prot								c0.19		0.28	c0.28	
v/s Ratio Perm	0.21	0.22	0.05						0.04			
v/c Ratio	0.83	0.87	0.19					0.77	0.15	0.87	0.87	
Uniform Delay, d1	24.5	24.8	20.2					24.3	20.4	22.4	22.5	
Progression Factor	1.00	1.00	1.00					1.00	1.00	0.40	0.39	
Incremental Delay, d2	12.2	16.9	0.2					4.4	0.8	9.6	5.3	
Delay (s)	36.7	41.7	20.5					28.7	21.1	18.5	14.1	
Level of Service	D	D	C					C	C	B	B	
Approach Delay (s)		33.8			0.0			27.3			15.5	
Approach LOS		C			A			C			B	

Intersection Summary

HCM Average Control Delay	24.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBR	NWL2	NWL	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations											
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0		4.0	4.0	4.0			4.0	4.0
Lane Util. Factor			1.00		0.88	1.00	0.95			0.91	1.00
Frt			1.00		0.85	1.00	1.00			1.00	0.85
Flt Protected			0.95		1.00	0.95	1.00			1.00	1.00
Satd. Flow (prot)			1770		2787	1770	3539			5085	1583
Flt Permitted			0.95		1.00	0.95	1.00			1.00	1.00
Satd. Flow (perm)			1770		2787	1770	3539			5085	1583
Volume (vph)	0	0	220	0	540	540	1160	0	0	1160	830
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	0	220	0	540	540	1160	0	0	1160	830
RTOR Reduction (vph)	0	0	0	0	149	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	220	0	391	540	1160	0	0	1160	830
Turn Type			custom		custom	Prot					Free
Protected Phases						5	2			6	
Permitted Phases			3		8						Free
Actuated Green, G (s)			13.5		13.5	23.8	48.5			20.7	70.0
Effective Green, g (s)			13.5		13.5	23.8	48.5			20.7	70.0
Actuated g/C Ratio			0.19		0.19	0.34	0.69			0.30	1.00
Clearance Time (s)			4.0		4.0	4.0	4.0			4.0	
Vehicle Extension (s)			3.0		3.0	3.0	3.0			3.0	
Lane Grp Cap (vph)			341		537	602	2452			1504	1583
v/s Ratio Prot						c0.31	0.33			c0.23	
v/s Ratio Perm			0.12		c0.14						0.52
v/c Ratio			0.65		0.73	0.90	0.47			0.77	0.52
Uniform Delay, d1			26.0		26.5	21.9	4.9			22.5	0.0
Progression Factor			1.00		1.00	0.77	0.16			1.00	1.00
Incremental Delay, d2			4.2		4.9	9.5	0.3			3.9	1.2
Delay (s)			30.2		31.4	26.3	1.2			26.4	1.2
Level of Service			C		C	C	A			C	A
Approach Delay (s)	0.0			31.1			9.1			15.9	
Approach LOS	A			C			A			B	

Intersection Summary

HCM Average Control Delay	15.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	81.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.91	0.91					0.95	0.91	0.95
Frpb, ped/bikes		1.00	0.95	1.00	1.00					1.00	1.00	0.95
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	0.99					0.95	0.95	1.00
Satd. Flow (prot)		5085	1512	1610	3368					1681	1610	1436
Flt Permitted		1.00	1.00	0.95	0.99					0.95	0.95	1.00
Satd. Flow (perm)		5085	1512	1610	3368					1681	1610	1436
Volume (vph)	0	1110	260	640	920	0	0	0	0	760	0	280
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1168	274	674	968	0	0	0	0	800	0	295
RTOR Reduction (vph)	0	0	204	0	0	0	0	0	0	0	0	220
Lane Group Flow (vph)	0	1168	70	529	1113	0	0	0	0	400	400	75
Confl. Peds. (#/hr)			20									20
Turn Type			Perm	Split						Perm		custom
Protected Phases		2		1	1						4	
Permitted Phases			2							4		2
Actuated Green, G (s)		23.0	23.0	31.4	31.4					23.6	23.6	23.0
Effective Green, g (s)		23.0	23.0	31.4	31.4					23.6	23.6	23.0
Actuated g/C Ratio		0.26	0.26	0.35	0.35					0.26	0.26	0.26
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		4.7	4.7	4.7	4.7					3.0	3.0	4.7
Lane Grp Cap (vph)		1300	386	562	1175					441	422	367
v/s Ratio Prot		c0.23		0.33	c0.33							
v/s Ratio Perm			0.05							0.24	0.25	0.05
v/c Ratio		0.90	0.18	0.94	0.95					0.91	0.95	0.21
Uniform Delay, d1		32.4	26.2	28.4	28.5					32.1	32.6	26.3
Progression Factor		0.69	0.63	0.46	0.27					1.00	1.00	1.00
Incremental Delay, d2		7.1	0.7	13.1	8.4					21.9	30.5	1.3
Delay (s)		29.5	17.1	26.0	16.0					54.1	63.1	27.6
Level of Service		C	B	C	B					D	E	C
Approach Delay (s)		27.1			19.2			0.0			50.2	
Approach LOS		C			B			A			D	

Intersection Summary			
HCM Average Control Delay	30.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	96.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0		4.0			
Lane Util. Factor	1.00	0.95			0.91	1.00	1.00		0.88			
Frpb, ped/bikes	1.00	1.00			1.00	0.98	1.00		0.95			
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00		1.00			
Frt	1.00	1.00			1.00	0.85	1.00		0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (prot)	1770	3539			5085	1555	1770		2661			
Flt Permitted	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (perm)	1770	3539			5085	1555	1770		2661			
Volume (vph)	590	1280	0	0	1290	820	280	0	630	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	621	1347	0	0	1358	863	295	0	663	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	124	0	0	0
Lane Group Flow (vph)	621	1347	0	0	1358	863	295	0	539	0	0	0
Confl. Peds. (#/hr)						20			20			
Turn Type	Prot					Free	custom		custom			
Protected Phases	5	2			6							
Permitted Phases						Free	3		3			
Actuated Green, G (s)	33.4	64.0			26.6	90.0	18.0		18.0			
Effective Green, g (s)	33.4	64.0			26.6	90.0	18.0		18.0			
Actuated g/C Ratio	0.37	0.71			0.30	1.00	0.20		0.20			
Clearance Time (s)	4.0	4.0			4.0		4.0		4.0			
Vehicle Extension (s)	4.7	4.7			4.7		3.0		3.0			
Lane Grp Cap (vph)	657	2517			1503	1555	354		532			
v/s Ratio Prot	c0.35	0.38			c0.27							
v/s Ratio Perm						0.55	0.17		c0.20			
v/c Ratio	0.95	0.54			0.90	0.55	0.83		1.01			
Uniform Delay, d1	27.4	6.1			30.5	0.0	34.6		36.0			
Progression Factor	0.64	2.10			1.00	1.00	1.00		1.00			
Incremental Delay, d2	12.3	0.3			8.4	1.4	15.4		42.3			
Delay (s)	30.0	13.0			38.8	1.4	49.9		78.3			
Level of Service	C	B			D	A	D		E			
Approach Delay (s)		18.4			24.3			69.6			0.0	
Approach LOS		B			C			E			A	

Intersection Summary			
HCM Average Control Delay	30.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	96.3%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		0.97	0.91		0.95	0.95	1.00		1.00	
Frt	1.00	0.98		1.00	0.99		1.00	1.00	0.85		0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.96	1.00		0.96	
Satd. Flow (prot)	1770	3460		3433	5049		1681	1697	1583		1758	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	0.96	1.00		0.96	
Satd. Flow (perm)	1770	3460		3433	5049		1681	1697	1583		1758	
Volume (vph)	15	825	145	350	810	40	135	10	440	105	10	20
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	868	153	368	853	42	142	11	463	111	11	21
RTOR Reduction (vph)	0	15	0	0	4	0	0	0	352	0	7	0
Lane Group Flow (vph)	16	1006	0	368	891	0	75	78	111	0	136	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases									2			
Actuated Green, G (s)	1.2	35.6		15.2	49.6		11.4	11.4	11.4		11.8	
Effective Green, g (s)	1.2	35.6		15.2	49.6		11.4	11.4	11.4		11.8	
Actuated g/C Ratio	0.01	0.40		0.17	0.55		0.13	0.13	0.13		0.13	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	24	1369		580	2783		213	215	201		230	
v/s Ratio Prot	0.01	c0.29		c0.11	0.18		0.04	0.05			c0.08	
v/s Ratio Perm									c0.07			
v/c Ratio	0.67	0.74		0.63	0.32		0.35	0.36	0.55		0.59	
Uniform Delay, d1	44.2	23.2		34.8	11.0		35.9	36.0	36.9		36.8	
Progression Factor	1.00	1.00		0.87	0.41		1.00	1.00	1.00		1.00	
Incremental Delay, d2	52.8	3.5		1.2	0.2		1.0	1.0	3.3		4.0	
Delay (s)	97.0	26.7		31.4	4.7		36.9	37.0	40.2		40.9	
Level of Service	F	C		C	A		D	D	D		D	
Approach Delay (s)		27.8			12.5			39.4			40.9	
Approach LOS		C			B			D			D	

Intersection Summary			
HCM Average Control Delay	24.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Lane Util. Factor		0.86	1.00	0.97	0.95					0.97		1.00
Frpb, ped/bikes		1.00	0.95	1.00	1.00					1.00		0.97
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00		1.00
Frt		1.00	0.85	1.00	1.00					1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (prot)		6408	1512	3433	3539					3433		1535
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		6408	1512	3433	3539					3433		1535
Volume (vph)	0	1080	260	630	900	0	0	0	0	760	0	290
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1137	274	663	947	0	0	0	0	800	0	305
RTOR Reduction (vph)	0	0	213	0	0	0	0	0	0	0	0	60
Lane Group Flow (vph)	0	1137	61	663	947	0	0	0	0	800	0	245
Confl. Peds. (#/hr)			20									20
Turn Type			Perm	Prot						custom		custom
Protected Phases		2		1	2 1							
Permitted Phases			2							4 12		4 12
Actuated Green, G (s)		20.0	20.0	25.5	45.5					28.5		28.5
Effective Green, g (s)		20.0	20.0	25.5	45.5					28.5		28.5
Actuated g/C Ratio		0.22	0.22	0.28	0.51					0.32		0.32
Clearance Time (s)		4.0	4.0	4.0								
Vehicle Extension (s)		4.7	4.7	4.7								
Lane Grp Cap (vph)		1424	336	973	1789					1087		486
v/s Ratio Prot		c0.18		c0.19	0.27							
v/s Ratio Perm			0.04							c0.23		0.16
v/c Ratio		0.80	0.18	0.68	0.53					0.74		0.50
Uniform Delay, d1		33.1	28.4	28.6	15.0					27.4		25.0
Progression Factor		0.71	0.98	0.23	0.55					1.00		1.00
Incremental Delay, d2		3.7	0.9	1.1	0.3					2.6		0.8
Delay (s)		27.3	28.7	7.7	8.6					30.0		25.8
Level of Service		C	C	A	A					C		C
Approach Delay (s)		27.6			8.2			0.0			28.9	
Approach LOS		C			A			A			C	

Intersection Summary			
HCM Average Control Delay	20.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	67.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0		4.0			
Lane Util. Factor	0.97	0.91			0.86	1.00	1.00		0.88			
Frpb, ped/bikes	1.00	1.00			1.00	0.98	1.00		0.95			
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00		1.00			
Frt	1.00	1.00			1.00	0.85	1.00		0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (prot)	3433	5085			6408	1555	1770		2661			
Flt Permitted	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (perm)	3433	5085			6408	1555	1770		2661			
Volume (vph)	540	1300	0	0	1290	870	240	0	660	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	568	1368	0	0	1358	916	253	0	695	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	29	0	0	0
Lane Group Flow (vph)	568	1368	0	0	1358	916	253	0	666	0	0	0
Confl. Peds. (#/hr)						20			20			
Turn Type	Prot					Free	custom		custom			
Protected Phases	5	5 6			6							
Permitted Phases						Free	8 16		8 16			
Actuated Green, G (s)	22.0	43.9			21.9	90.0	30.1		30.1			
Effective Green, g (s)	22.0	43.9			21.9	90.0	30.1		30.1			
Actuated g/C Ratio	0.24	0.49			0.24	1.00	0.33		0.33			
Clearance Time (s)	4.0				4.0							
Vehicle Extension (s)	4.7				4.7							
Lane Grp Cap (vph)	839	2480			1559	1555	592		890			
v/s Ratio Prot	c0.17	0.27			c0.21							
v/s Ratio Perm						c0.59	0.14		c0.25			
v/c Ratio	0.68	0.55			0.87	0.59	0.43		0.75			
Uniform Delay, d1	30.8	16.2			32.7	0.0	23.3		26.6			
Progression Factor	0.25	0.83			1.00	1.00	1.00		1.00			
Incremental Delay, d2	1.6	0.3			6.0	1.6	0.5		3.5			
Delay (s)	9.2	13.6			38.7	1.6	23.8		30.1			
Level of Service	A	B			D	A	C		C			
Approach Delay (s)		12.3			23.8			28.4			0.0	
Approach LOS		B			C			C			A	

Intersection Summary			
HCM Average Control Delay	20.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	67.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		0.97	0.95		1.00	0.95	0.95		1.00	
Frt	1.00	0.98		1.00	0.99		1.00	0.86	0.85		0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.96	
Satd. Flow (prot)	1770	3457		3433	3514		1770	1516	1504		1758	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.96	
Satd. Flow (perm)	1770	3457		3433	3514		1770	1516	1504		1758	
Volume (vph)	15	795	145	350	800	40	135	10	440	105	10	20
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	837	153	368	842	42	142	11	463	111	11	21
RTOR Reduction (vph)	0	16	0	0	4	0	0	201	202	0	7	0
Lane Group Flow (vph)	16	974	0	368	880	0	142	41	30	0	136	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases									2			
Actuated Green, G (s)	1.6	35.9		15.6	49.9		11.8	11.8	11.8		10.7	
Effective Green, g (s)	1.6	35.9		15.6	49.9		11.8	11.8	11.8		10.7	
Actuated g/C Ratio	0.02	0.40		0.17	0.55		0.13	0.13	0.13		0.12	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	31	1379		595	1948		232	199	197		209	
v/s Ratio Prot	0.01	c0.28		c0.11	0.25		c0.08	0.03			c0.08	
v/s Ratio Perm									0.02			
v/c Ratio	0.52	0.71		0.62	0.45		0.61	0.21	0.15		0.65	
Uniform Delay, d1	43.8	22.6		34.4	11.9		36.9	34.9	34.7		37.9	
Progression Factor	1.00	1.00		0.98	0.50		1.00	1.00	1.00		1.00	
Incremental Delay, d2	13.7	3.1		1.6	0.6		4.7	0.5	0.4		7.1	
Delay (s)	57.6	25.7		35.3	6.6		41.7	35.4	35.0		44.9	
Level of Service	E	C		D	A		D	D	D		D	
Approach Delay (s)		26.2			15.1			36.7			44.9	
Approach LOS		C			B			D			D	

Intersection Summary			
HCM Average Control Delay	24.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Lane Util. Factor		0.91	1.00	0.97	0.95					0.97		1.00
Frpb, ped/bikes		1.00	0.95	1.00	1.00					1.00		0.95
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00		1.00
Frt		1.00	0.85	1.00	1.00					1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (prot)		5085	1512	3433	3539					3433		1512
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		5085	1512	3433	3539					3433		1512
Volume (vph)	0	1080	260	630	900	0	0	0	0	760	0	290
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1137	274	663	947	0	0	0	0	800	0	305
RTOR Reduction (vph)	0	0	169	0	0	0	0	0	0	0	0	84
Lane Group Flow (vph)	0	1137	105	663	947	0	0	0	0	800	0	221
Confl. Peds. (#/hr)			20									20
Turn Type			Perm	Prot						custom		custom
Protected Phases		2		1	6							
Permitted Phases			2							4		4
Actuated Green, G (s)		28.8	28.8	22.5	55.3					26.7		26.7
Effective Green, g (s)		28.8	28.8	22.5	55.3					26.7		26.7
Actuated g/C Ratio		0.32	0.32	0.25	0.61					0.30		0.30
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Vehicle Extension (s)		4.7	4.7	4.7	3.0					3.0		3.0
Lane Grp Cap (vph)		1627	484	858	2175					1018		449
v/s Ratio Prot		c0.22		c0.19	0.27							
v/s Ratio Perm			0.07							c0.23		0.15
v/c Ratio		0.70	0.22	0.77	0.44					0.79		0.49
Uniform Delay, d1		26.8	22.4	31.4	9.1					29.0		26.1
Progression Factor		0.58	0.42	0.70	1.37					1.00		1.00
Incremental Delay, d2		1.9	0.8	4.0	0.1					4.1		0.8
Delay (s)		17.3	10.2	26.0	12.6					33.1		26.9
Level of Service		B	B	C	B					C		C
Approach Delay (s)		15.9			18.1			0.0			31.4	
Approach LOS		B			B			A			C	

Intersection Summary			
HCM Average Control Delay	20.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	70.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.91	1.00		0.86	1.00	0.88
Frpb, ped/bikes	1.00	0.92		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	1.00	1.00		1.00	0.95	1.00
Satd. Flow (prot)	5085	1464		6408	1770	2787
Flt Permitted	1.00	1.00		1.00	0.95	1.00
Satd. Flow (perm)	5085	1464		6408	1770	2787
Volume (vph)	1300	540	0	2160	240	660
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1368	568	0	2274	253	695
RTOR Reduction (vph)	0	246	0	0	0	45
Lane Group Flow (vph)	1368	322	0	2274	253	650
Confl. Peds. (#/hr)		20				
Turn Type		Perm				Perm
Protected Phases	4			8	2	
Permitted Phases		4				2
Actuated Green, G (s)	51.0	51.0		51.0	31.0	31.0
Effective Green, g (s)	51.0	51.0		51.0	31.0	31.0
Actuated g/C Ratio	0.57	0.57		0.57	0.34	0.34
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0
Lane Grp Cap (vph)	2882	830		3631	610	960
v/s Ratio Prot	0.27			c0.35	0.14	
v/s Ratio Perm		0.22				c0.23
v/c Ratio	0.47	0.39		0.63	0.41	0.68
Uniform Delay, d1	11.6	10.8		13.1	22.6	25.2
Progression Factor	0.44	3.78		1.00	1.00	1.00
Incremental Delay, d2	0.4	0.9		0.8	2.1	3.8
Delay (s)	5.5	41.8		13.9	24.6	29.1
Level of Service	A	D		B	C	C
Approach Delay (s)	16.1			13.9	27.9	
Approach LOS	B			B	C	

Intersection Summary			
HCM Average Control Delay	17.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	54.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		0.97	0.95		1.00	0.95	0.95		1.00	
Frt	1.00	0.98		1.00	0.99		1.00	0.86	0.85		0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.96	
Satd. Flow (prot)	1770	3457		3433	3514		1770	1516	1504		1758	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.96	
Satd. Flow (perm)	1770	3457		3433	3514		1770	1516	1504		1758	
Volume (vph)	15	795	145	350	800	40	135	10	440	105	10	20
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	837	153	368	842	42	142	11	463	111	11	21
RTOR Reduction (vph)	0	17	0	0	4	0	0	195	196	0	7	0
Lane Group Flow (vph)	16	973	0	368	880	0	142	47	36	0	136	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases									2			
Actuated Green, G (s)	1.6	32.9		16.4	47.7		14.0	14.0	14.0		10.7	
Effective Green, g (s)	1.6	32.9		16.4	47.7		14.0	14.0	14.0		10.7	
Actuated g/C Ratio	0.02	0.37		0.18	0.53		0.16	0.16	0.16		0.12	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	31	1264		626	1862		275	236	234		209	
v/s Ratio Prot	0.01	c0.28		c0.11	0.25		c0.08	0.03			c0.08	
v/s Ratio Perm									0.02			
v/c Ratio	0.52	0.77		0.59	0.47		0.52	0.20	0.15		0.65	
Uniform Delay, d1	43.8	25.2		33.7	13.3		34.9	33.1	32.9		37.9	
Progression Factor	1.00	1.00		1.00	0.74		1.00	1.00	1.00		1.00	
Incremental Delay, d2	13.7	4.6		1.3	0.8		6.8	1.9	1.4		7.1	
Delay (s)	57.6	29.8		35.0	10.6		41.7	35.0	34.3		44.9	
Level of Service	E	C		C	B		D	C	C		D	
Approach Delay (s)		30.2			17.8			36.3			44.9	
Approach LOS		C			B			D			D	

Intersection Summary			
HCM Average Control Delay	27.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	67.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	0.91	0.91					0.95	0.91	0.95
Frpb, ped/bikes		1.00	0.95	1.00	1.00					1.00	1.00	0.95
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00					1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	0.99					0.95	0.95	1.00
Satd. Flow (prot)		5085	1512	1610	3372					1681	1610	1436
Flt Permitted		1.00	1.00	0.95	0.99					0.95	0.95	1.00
Satd. Flow (perm)		5085	1512	1610	3372					1681	1610	1436
Volume (vph)	0	1310	330	750	1150	0	0	0	0	870	0	300
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1379	347	789	1211	0	0	0	0	916	0	316
RTOR Reduction (vph)	0	0	258	0	0	0	0	0	0	0	0	235
Lane Group Flow (vph)	0	1379	89	644	1356	0	0	0	0	458	458	81
Confl. Peds. (#/hr)			20									20
Turn Type			Perm	Split						Perm		custom
Protected Phases		2		1	1						4	
Permitted Phases			2							4		2
Actuated Green, G (s)		23.0	23.0	32.0	32.0					23.0	23.0	23.0
Effective Green, g (s)		23.0	23.0	32.0	32.0					23.0	23.0	23.0
Actuated g/C Ratio		0.26	0.26	0.36	0.36					0.26	0.26	0.26
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0	4.0	4.0
Vehicle Extension (s)		4.7	4.7	4.7	4.7					3.0	3.0	4.7
Lane Grp Cap (vph)		1300	386	572	1199					430	411	367
v/s Ratio Prot		c0.27		0.40	c0.40							
v/s Ratio Perm			0.06							0.27	0.28	0.06
v/c Ratio		1.06	0.23	1.13	1.13					1.07	1.11	0.22
Uniform Delay, d1		33.5	26.5	29.0	29.0					33.5	33.5	26.4
Progression Factor		0.60	0.54	1.08	0.84					1.00	1.00	1.00
Incremental Delay, d2		36.6	0.7	59.1	62.8					61.8	79.2	1.4
Delay (s)		56.8	15.0	90.5	87.1					95.3	112.7	27.8
Level of Service		E	B	F	F					F	F	C
Approach Delay (s)		48.4			88.2			0.0			84.4	
Approach LOS		D			F			A			F	

Intersection Summary

HCM Average Control Delay	73.4	HCM Level of Service	E
HCM Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	121.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0		4.0			
Lane Util. Factor	1.00	0.95			0.91	1.00	1.00		0.88			
Frpb, ped/bikes	1.00	1.00			1.00	0.98	1.00		0.95			
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00		1.00			
Frt	1.00	1.00			1.00	0.85	1.00		0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (prot)	1770	3539			5085	1555	1770		2661			
Flt Permitted	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (perm)	1770	3539			5085	1555	1770		2661			
Volume (vph)	550	1630	0	0	1610	980	290	0	970	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	579	1716	0	0	1695	1032	305	0	1021	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	33	0	0	0
Lane Group Flow (vph)	579	1716	0	0	1695	1032	305	0	988	0	0	0
Confl. Peds. (#/hr)						20			20			
Turn Type	Prot					Free	custom		custom			
Protected Phases	5	2			6							
Permitted Phases						Free	3		3			
Actuated Green, G (s)	24.0	56.0			28.0	90.0	26.0		26.0			
Effective Green, g (s)	24.0	56.0			28.0	90.0	26.0		26.0			
Actuated g/C Ratio	0.27	0.62			0.31	1.00	0.29		0.29			
Clearance Time (s)	4.0	4.0			4.0		4.0		4.0			
Vehicle Extension (s)	4.7	4.7			4.7		3.0		3.0			
Lane Grp Cap (vph)	472	2202			1582	1555	511		769			
v/s Ratio Prot	c0.33	0.48			c0.33							
v/s Ratio Perm						0.66	0.17		c0.37			
v/c Ratio	1.23	0.78			1.07	0.66	0.60		1.29			
Uniform Delay, d1	33.0	12.5			31.0	0.0	27.5		32.0			
Progression Factor	0.08	1.32			1.00	1.00	1.00		1.00			
Incremental Delay, d2	103.8	0.3			44.5	2.3	1.9		138.1			
Delay (s)	106.5	16.7			75.5	2.3	29.4		170.1			
Level of Service	F	B			E	A	C		F			
Approach Delay (s)		39.4			47.8			137.7			0.0	
Approach LOS		D			D			F			A	

Intersection Summary

HCM Average Control Delay	63.5	HCM Level of Service	E
HCM Volume to Capacity ratio	1.19		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	121.5%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Lane Util. Factor		0.86	1.00	0.97	0.95					0.97		1.00
Frpb, ped/bikes		1.00	0.95	1.00	1.00					1.00		0.96
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00		1.00
Frt		1.00	0.85	1.00	1.00					1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (prot)		6408	1512	3433	3539					3433		1526
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		6408	1512	3433	3539					3433		1526
Volume (vph)	0	1240	360	590	1030	0	0	0	0	760	0	350
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1305	379	621	1084	0	0	0	0	800	0	368
RTOR Reduction (vph)	0	0	280	0	0	0	0	0	0	0	0	72
Lane Group Flow (vph)	0	1305	99	621	1084	0	0	0	0	800	0	296
Confl. Peds. (#/hr)			20									20
Turn Type			Perm	Prot						custom		custom
Protected Phases		2		1	2 1							
Permitted Phases			2							4 12		4 12
Actuated Green, G (s)		22.0	22.0	30.1	52.1					21.9		21.9
Effective Green, g (s)		22.0	22.0	30.1	52.1					21.9		21.9
Actuated g/C Ratio		0.24	0.24	0.33	0.58					0.24		0.24
Clearance Time (s)		4.0	4.0	4.0								
Vehicle Extension (s)		4.7	4.7	4.7								
Lane Grp Cap (vph)		1566	370	1148	2049					835		371
v/s Ratio Prot		c0.20		c0.18	0.31							
v/s Ratio Perm			0.07							c0.23		0.19
v/c Ratio		0.83	0.27	0.54	0.53					0.96		0.80
Uniform Delay, d1		32.3	27.5	24.3	11.5					33.6		32.0
Progression Factor		0.66	1.06	0.00	0.35					1.00		1.00
Incremental Delay, d2		3.6	1.2	0.3	0.2					21.3		11.4
Delay (s)		24.8	30.2	0.4	4.2					54.9		43.3
Level of Service		C	C	A	A					D		D
Approach Delay (s)		26.0			2.8			0.0			51.2	
Approach LOS		C			A			A			D	

Intersection Summary			
HCM Average Control Delay	23.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0		4.0			
Lane Util. Factor	0.97	0.91			0.86	1.00	1.00		0.88			
Frpb, ped/bikes	1.00	1.00			1.00	0.98	1.00		0.95			
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00		1.00			
Frt	1.00	1.00			1.00	0.85	1.00		0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (prot)	3433	5085			6408	1555	1770		2661			
Flt Permitted	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (perm)	3433	5085			6408	1555	1770		2661			
Volume (vph)	570	1430	0	0	1280	1020	340	0	550	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	600	1505	0	0	1347	1074	358	0	579	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	53	0	0	0
Lane Group Flow (vph)	600	1505	0	0	1347	1074	358	0	526	0	0	0
Confl. Peds. (#/hr)						20			20			
Turn Type	Prot					Free	custom		custom			
Protected Phases	5	5 6			6							
Permitted Phases						Free	8 16		8 16			
Actuated Green, G (s)	31.7	52.7			21.0	90.0	21.3		21.3			
Effective Green, g (s)	31.7	52.7			21.0	90.0	21.3		21.3			
Actuated g/C Ratio	0.35	0.59			0.23	1.00	0.24		0.24			
Clearance Time (s)	4.0				4.0							
Vehicle Extension (s)	4.7				4.7							
Lane Grp Cap (vph)	1209	2978			1495	1555	419		630			
v/s Ratio Prot	0.17	0.30			c0.21							
v/s Ratio Perm						c0.69	c0.20		0.20			
v/c Ratio	0.50	0.51			0.90	0.69	0.85		0.83			
Uniform Delay, d1	22.9	11.0			33.5	0.0	32.9		32.7			
Progression Factor	0.00	0.84			1.00	1.00	1.00		1.00			
Incremental Delay, d2	0.3	0.1			8.2	2.5	15.5		9.3			
Delay (s)	0.3	9.4			41.7	2.5	48.4		42.0			
Level of Service	A	A			D	A	D		D			
Approach Delay (s)		6.8			24.3			44.4			0.0	
Approach LOS		A			C			D			A	

Intersection Summary			
HCM Average Control Delay	21.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	72.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		0.97	0.95		1.00	0.95	0.95		1.00	
Frt	1.00	0.98		1.00	0.99		1.00	0.86	0.85		0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.96	
Satd. Flow (prot)	1770	3475		3433	3519		1770	1516	1504		1758	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.96	
Satd. Flow (perm)	1770	3475		3433	3519		1770	1516	1504		1758	
Volume (vph)	15	1055	145	350	990	40	135	10	440	105	10	20
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	1111	153	368	1042	42	142	11	463	111	11	21
RTOR Reduction (vph)	0	12	0	0	3	0	0	201	201	0	7	0
Lane Group Flow (vph)	16	1252	0	368	1081	0	142	41	31	0	136	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases									2			
Actuated Green, G (s)	1.6	39.8		14.3	52.5		10.3	10.3	10.3		9.6	
Effective Green, g (s)	1.6	39.8		14.3	52.5		10.3	10.3	10.3		9.6	
Actuated g/C Ratio	0.02	0.44		0.16	0.58		0.11	0.11	0.11		0.11	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	31	1537		545	2053		203	173	172		188	
v/s Ratio Prot	0.01	c0.36		c0.11	0.31		c0.08	0.03			c0.08	
v/s Ratio Perm									0.02			
v/c Ratio	0.52	0.81		0.68	0.53		0.70	0.24	0.18		0.72	
Uniform Delay, d1	43.8	21.9		35.7	11.3		38.4	36.3	36.0		38.9	
Progression Factor	1.00	1.00		1.01	0.51		1.00	1.00	1.00		1.00	
Incremental Delay, d2	13.7	4.9		2.6	0.8		10.1	0.7	0.5		12.8	
Delay (s)	57.6	26.7		38.8	6.6		48.4	37.0	36.5		51.8	
Level of Service	E	C		D	A		D	D	D		D	
Approach Delay (s)		27.1			14.7			39.5			51.8	
Approach LOS		C			B			D			D	

Intersection Summary			
HCM Average Control Delay	25.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	74.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Lane Util. Factor		0.91	1.00	0.97	0.95					0.97		1.00
Frpb, ped/bikes		1.00	0.95	1.00	1.00					1.00		0.95
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00		1.00
Frt		1.00	0.85	1.00	1.00					1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (prot)		5085	1512	3433	3539					3433		1512
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		5085	1512	3433	3539					3433		1512
Volume (vph)	0	1240	360	590	1030	0	0	0	0	760	0	350
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1305	379	621	1084	0	0	0	0	800	0	368
RTOR Reduction (vph)	0	0	213	0	0	0	0	0	0	0	0	79
Lane Group Flow (vph)	0	1305	166	621	1084	0	0	0	0	800	0	289
Confl. Peds. (#/hr)			20									20
Turn Type			Perm	Prot						custom		custom
Protected Phases		2		1	6							
Permitted Phases			2							4		4
Actuated Green, G (s)		32.4	32.4	20.9	57.3					24.7		24.7
Effective Green, g (s)		32.4	32.4	20.9	57.3					24.7		24.7
Actuated g/C Ratio		0.36	0.36	0.23	0.64					0.27		0.27
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Vehicle Extension (s)		4.7	4.7	4.7	3.0					3.0		3.0
Lane Grp Cap (vph)		1831	544	797	2253					942		415
v/s Ratio Prot		c0.26		c0.18	0.31							
v/s Ratio Perm			0.11							c0.23		0.19
v/c Ratio		0.71	0.30	0.78	0.48					0.85		0.70
Uniform Delay, d1		24.8	20.7	32.4	8.6					30.9		29.3
Progression Factor		0.56	0.18	0.65	1.55					1.00		1.00
Incremental Delay, d2		1.6	1.0	3.9	0.1					7.2		5.0
Delay (s)		15.5	4.8	24.9	13.4					38.1		34.3
Level of Service		B	A	C	B					D		C
Approach Delay (s)		13.1			17.6			0.0			36.9	
Approach LOS		B			B			A			D	

Intersection Summary			
HCM Average Control Delay	20.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	72.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.91	1.00		0.86	1.00	0.88
Frpb, ped/bikes	1.00	0.92		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	1.00	1.00		1.00	0.95	1.00
Satd. Flow (prot)	5085	1464		6408	1770	2787
Flt Permitted	1.00	1.00		1.00	0.95	1.00
Satd. Flow (perm)	5085	1464		6408	1770	2787
Volume (vph)	1430	570	0	2300	340	550
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1505	600	0	2421	358	579
RTOR Reduction (vph)	0	287	0	0	0	21
Lane Group Flow (vph)	1505	313	0	2421	358	558
Confl. Peds. (#/hr)		20				
Turn Type		Perm				Perm
Protected Phases	4			8	2	
Permitted Phases		4				2
Actuated Green, G (s)	47.0	47.0		47.0	35.0	35.0
Effective Green, g (s)	47.0	47.0		47.0	35.0	35.0
Actuated g/C Ratio	0.52	0.52		0.52	0.39	0.39
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0
Lane Grp Cap (vph)	2656	765		3346	688	1084
v/s Ratio Prot	0.30			c0.38	c0.20	
v/s Ratio Perm		0.21				0.20
v/c Ratio	0.57	0.41		0.72	0.52	0.51
Uniform Delay, d1	14.6	13.1		16.5	21.1	21.0
Progression Factor	0.42	3.27		1.00	1.00	1.00
Incremental Delay, d2	0.5	1.0		1.4	2.8	1.7
Delay (s)	6.7	43.8		17.9	23.9	22.8
Level of Service	A	D		B	C	C
Approach Delay (s)	17.3			17.9	23.2	
Approach LOS	B			B	C	

Intersection Summary			
HCM Average Control Delay	18.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		0.97	0.95		1.00	0.95	0.95		1.00	
Frt	1.00	0.98		1.00	0.99		1.00	0.86	0.85		0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.96	
Satd. Flow (prot)	1770	3475		3433	3519		1770	1516	1504		1758	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.96	
Satd. Flow (perm)	1770	3475		3433	3519		1770	1516	1504		1758	
Volume (vph)	15	1055	145	350	990	40	135	10	440	105	10	20
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	1111	153	368	1042	42	142	11	463	111	11	21
RTOR Reduction (vph)	0	12	0	0	3	0	0	203	204	0	7	0
Lane Group Flow (vph)	16	1252	0	368	1081	0	142	39	28	0	136	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases									2			
Actuated Green, G (s)	1.6	39.0		14.4	51.8		11.0	11.0	11.0		9.6	
Effective Green, g (s)	1.6	39.0		14.4	51.8		11.0	11.0	11.0		9.6	
Actuated g/C Ratio	0.02	0.43		0.16	0.58		0.12	0.12	0.12		0.11	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	31	1506		549	2025		216	185	184		188	
v/s Ratio Prot	0.01	c0.36		c0.11	0.31		c0.08	0.03			c0.08	
v/s Ratio Perm									0.02			
v/c Ratio	0.52	0.83		0.67	0.53		0.66	0.21	0.15		0.72	
Uniform Delay, d1	43.8	22.6		35.6	11.7		37.7	35.6	35.3		38.9	
Progression Factor	1.00	1.00		1.16	1.23		1.00	1.00	1.00		1.00	
Incremental Delay, d2	13.7	5.5		2.7	0.9		14.6	2.6	1.8		12.8	
Delay (s)	57.6	28.1		43.8	15.3		52.3	38.2	37.1		51.8	
Level of Service	E	C		D	B		D	D	D		D	
Approach Delay (s)		28.4			22.5			41.0			51.8	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	29.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	74.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Lane Util. Factor		0.86	1.00	0.97	0.95					0.97		1.00
Frpb, ped/bikes		1.00	0.95	1.00	1.00					1.00		0.97
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00		1.00
Frt		1.00	0.85	1.00	1.00					1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (prot)		6408	1506	3433	3539					3433		1537
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		6408	1506	3433	3539					3433		1537
Volume (vph)	0	1310	330	750	1150	0	0	0	0	870	0	300
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1379	347	789	1211	0	0	0	0	916	0	316
RTOR Reduction (vph)	0	0	218	0	0	0	0	0	0	0	0	42
Lane Group Flow (vph)	0	1379	129	789	1211	0	0	0	0	916	0	274
Confl. Peds. (#/hr)			20									20
Turn Type			Perm	Prot						custom		custom
Protected Phases		2		1	2 1							
Permitted Phases			2							4 12		4 12
Actuated Green, G (s)		21.0	21.0	33.0	58.0					34.0		34.0
Effective Green, g (s)		21.0	21.0	33.0	58.0					34.0		34.0
Actuated g/C Ratio		0.21	0.21	0.33	0.58					0.34		0.34
Clearance Time (s)		4.0	4.0	4.0								
Vehicle Extension (s)		4.7	4.7	4.7								
Lane Grp Cap (vph)		1346	316	1133	2053					1167		523
v/s Ratio Prot		c0.22		c0.23	0.34							
v/s Ratio Perm			0.09							c0.27		0.18
v/c Ratio		1.02	0.41	0.70	0.59					0.78		0.52
Uniform Delay, d1		39.5	34.1	29.1	13.4					29.7		26.5
Progression Factor		0.65	0.51	0.45	0.90					1.00		1.00
Incremental Delay, d2		25.7	2.4	0.6	0.3					3.5		0.9
Delay (s)		51.5	19.7	13.7	12.4					33.2		27.4
Level of Service		D	B	B	B					C		C
Approach Delay (s)		45.1			12.9			0.0			31.8	
Approach LOS		D			B			A			C	

Intersection Summary			
HCM Average Control Delay	28.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	78.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0	4.0		4.0			
Lane Util. Factor	0.97	0.91			0.86	1.00	1.00		0.88			
Frpb, ped/bikes	1.00	1.00			1.00	0.98	1.00		0.95			
Flpb, ped/bikes	1.00	1.00			1.00	1.00	1.00		1.00			
Frt	1.00	1.00			1.00	0.85	1.00		0.85			
Flt Protected	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (prot)	3433	5085			6408	1555	1770		2651			
Flt Permitted	0.95	1.00			1.00	1.00	0.95		1.00			
Satd. Flow (perm)	3433	5085			6408	1555	1770		2651			
Volume (vph)	550	1630	0	0	1610	980	290	0	970	0	0	0
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	579	1716	0	0	1695	1032	305	0	1021	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	9	0	0	0
Lane Group Flow (vph)	579	1716	0	0	1695	1032	305	0	1012	0	0	0
Confl. Peds. (#/hr)						20			20			
Turn Type	Prot					Free	custom		custom			
Protected Phases	5	5 6			6							
Permitted Phases						Free	8 16		8 16			
Actuated Green, G (s)	18.7	49.7			27.0	100.0	42.3		42.3			
Effective Green, g (s)	18.7	49.7			27.0	100.0	42.3		42.3			
Actuated g/C Ratio	0.19	0.50			0.27	1.00	0.42		0.42			
Clearance Time (s)	4.0				4.0							
Vehicle Extension (s)	4.7				4.7							
Lane Grp Cap (vph)	642	2527			1730	1555	749		1121			
v/s Ratio Prot	c0.17	0.34			c0.26							
v/s Ratio Perm						c0.66	0.17		c0.38			
v/c Ratio	0.90	0.68			0.98	0.66	0.41		0.90			
Uniform Delay, d1	39.8	19.1			36.2	0.0	20.1		26.9			
Progression Factor	0.27	0.28			1.00	1.00	1.00		1.00			
Incremental Delay, d2	2.0	0.4			17.0	2.3	0.4		10.2			
Delay (s)	12.6	5.7			53.2	2.3	20.5		37.1			
Level of Service	B	A			D	A	C		D			
Approach Delay (s)		7.4			33.9			33.3			0.0	
Approach LOS		A			C			C			A	

Intersection Summary			
HCM Average Control Delay	24.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	78.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		0.97	0.95		1.00	0.95	0.95		1.00	
Frt	1.00	0.98		1.00	0.99		1.00	0.86	0.85		0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.96	
Satd. Flow (prot)	1770	3477		3433	3520		1770	1516	1504		1758	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.96	
Satd. Flow (perm)	1770	3477		3433	3520		1770	1516	1504		1758	
Volume (vph)	15	1095	145	350	1060	40	135	10	440	105	10	20
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	1153	153	368	1116	42	142	11	463	111	11	21
RTOR Reduction (vph)	0	9	0	0	3	0	0	203	204	0	6	0
Lane Group Flow (vph)	16	1297	0	368	1155	0	142	39	28	0	137	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases									2			
Actuated Green, G (s)	1.6	44.1		15.8	58.3		12.2	12.2	12.2		11.9	
Effective Green, g (s)	1.6	44.1		15.8	58.3		12.2	12.2	12.2		11.9	
Actuated g/C Ratio	0.02	0.44		0.16	0.58		0.12	0.12	0.12		0.12	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	28	1533		542	2052		216	185	183		209	
v/s Ratio Prot	0.01	c0.37		c0.11	0.33		c0.08	0.03			c0.08	
v/s Ratio Perm									0.02			
v/c Ratio	0.57	0.85		0.68	0.56		0.66	0.21	0.15		0.65	
Uniform Delay, d1	48.9	24.9		39.7	12.9		41.9	39.6	39.3		42.1	
Progression Factor	1.00	1.00		1.41	0.45		1.00	1.00	1.00		1.00	
Incremental Delay, d2	25.2	5.9		2.8	0.9		7.0	0.6	0.4		7.2	
Delay (s)	74.0	30.9		58.9	6.8		48.9	40.1	39.7		49.3	
Level of Service	E	C		E	A		D	D	D		D	
Approach Delay (s)		31.4			19.3			42.0			49.3	
Approach LOS		C			B			D			D	

Intersection Summary			
HCM Average Control Delay	28.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Lane Util. Factor		0.91	1.00	0.97	0.95					0.97		1.00
Frpb, ped/bikes		1.00	0.95	1.00	1.00					1.00		0.95
Flpb, ped/bikes		1.00	1.00	1.00	1.00					1.00		1.00
Frt		1.00	0.85	1.00	1.00					1.00		0.85
Flt Protected		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (prot)		5085	1512	3433	3539					3433		1512
Flt Permitted		1.00	1.00	0.95	1.00					0.95		1.00
Satd. Flow (perm)		5085	1512	3433	3539					3433		1512
Volume (vph)	0	1310	330	750	1150	0	0	0	0	870	0	300
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	1379	347	789	1211	0	0	0	0	916	0	316
RTOR Reduction (vph)	0	0	192	0	0	0	0	0	0	0	0	55
Lane Group Flow (vph)	0	1379	155	789	1211	0	0	0	0	916	0	261
Confl. Peds. (#/hr)			20									20
Turn Type			Perm	Prot						custom		custom
Protected Phases		2		1	6							
Permitted Phases			2							4		4
Actuated Green, G (s)		28.2	28.2	23.3	55.5					26.5		26.5
Effective Green, g (s)		28.2	28.2	23.3	55.5					26.5		26.5
Actuated g/C Ratio		0.31	0.31	0.26	0.62					0.29		0.29
Clearance Time (s)		4.0	4.0	4.0	4.0					4.0		4.0
Vehicle Extension (s)		4.7	4.7	4.7	3.0					3.0		3.0
Lane Grp Cap (vph)		1593	474	889	2182					1011		445
v/s Ratio Prot		c0.27		c0.23	0.34							
v/s Ratio Perm			0.10							c0.27		0.17
v/c Ratio		0.87	0.33	0.89	0.55					0.91		0.59
Uniform Delay, d1		29.1	23.6	32.1	10.1					30.6		27.1
Progression Factor		0.65	0.54	0.44	1.14					1.00		1.00
Incremental Delay, d2		4.1	1.1	5.6	0.1					11.4		2.0
Delay (s)		23.0	13.8	19.8	11.6					41.9		29.1
Level of Service		C	B	B	B					D		C
Approach Delay (s)		21.1			14.8			0.0			38.6	
Approach LOS		C			B			A			D	

Intersection Summary			
HCM Average Control Delay	22.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	81.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	0.91	1.00		0.86	1.00	0.88
Frpb, ped/bikes	1.00	0.92		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.85		1.00	1.00	0.85
Flt Protected	1.00	1.00		1.00	0.95	1.00
Satd. Flow (prot)	5085	1464		6408	1770	2787
Flt Permitted	1.00	1.00		1.00	0.95	1.00
Satd. Flow (perm)	5085	1464		6408	1770	2787
Volume (vph)	1630	550	0	2590	290	970
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1716	579	0	2726	305	1021
RTOR Reduction (vph)	0	315	0	0	0	5
Lane Group Flow (vph)	1716	264	0	2726	305	1016
Confl. Peds. (#/hr)		20				
Turn Type		Perm				Perm
Protected Phases	4			8	2	
Permitted Phases		4				2
Actuated Green, G (s)	41.0	41.0		41.0	41.0	41.0
Effective Green, g (s)	41.0	41.0		41.0	41.0	41.0
Actuated g/C Ratio	0.46	0.46		0.46	0.46	0.46
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0
Lane Grp Cap (vph)	2317	667		2919	806	1270
v/s Ratio Prot	0.34			c0.43	0.17	
v/s Ratio Perm		0.18				c0.36
v/c Ratio	0.74	0.40		0.93	0.38	0.80
Uniform Delay, d1	20.1	16.3		23.2	16.1	21.0
Progression Factor	0.46	3.04		1.00	1.00	1.00
Incremental Delay, d2	1.0	0.8		7.0	1.4	5.4
Delay (s)	10.2	50.3		30.3	17.5	26.3
Level of Service	B	D		C	B	C
Approach Delay (s)	20.3			30.3	24.3	
Approach LOS	C			C	C	

Intersection Summary			
HCM Average Control Delay	25.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	72.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		0.97	0.95		1.00	0.95	0.95		1.00	
Frt	1.00	0.98		1.00	0.99		1.00	0.86	0.85		0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.96	
Satd. Flow (prot)	1770	3477		3433	3520		1770	1517	1504		1758	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.96	
Satd. Flow (perm)	1770	3477		3433	3520		1770	1517	1504		1758	
Volume (vph)	15	1095	145	350	1060	40	135	10	440	105	10	20
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	16	1153	153	368	1116	42	142	11	463	111	11	21
RTOR Reduction (vph)	0	12	0	0	2	0	0	189	207	0	7	0
Lane Group Flow (vph)	16	1294	0	368	1156	0	142	43	35	0	136	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases									2			
Actuated Green, G (s)	1.6	34.6		15.3	48.3		13.0	13.0	13.0		11.1	
Effective Green, g (s)	1.6	34.6		15.3	48.3		13.0	13.0	13.0		11.1	
Actuated g/C Ratio	0.02	0.38		0.17	0.54		0.14	0.14	0.14		0.12	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	31	1337		584	1889		256	219	217		217	
v/s Ratio Prot	0.01	c0.37		0.11	c0.33		c0.08	0.03			c0.08	
v/s Ratio Perm									0.02			
v/c Ratio	0.52	0.97		0.63	0.61		0.55	0.20	0.16		0.63	
Uniform Delay, d1	43.8	27.2		34.7	14.4		35.8	33.9	33.7		37.5	
Progression Factor	1.00	1.00		0.82	0.45		1.00	1.00	1.00		1.00	
Incremental Delay, d2	13.7	18.1		1.8	1.2		8.4	2.0	1.6		5.6	
Delay (s)	57.6	45.2		30.4	7.7		44.2	35.9	35.3		43.0	
Level of Service	E	D		C	A		D	D	D		D	
Approach Delay (s)		45.4			13.2			37.6			43.0	
Approach LOS		D			B			D			D	

Intersection Summary			
HCM Average Control Delay	30.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX M

INTERSECTION ICU WORKSHEETS – AVENIDA PICO INTERCHANGE

13. I-5 SB Ramps & Avd Pico

2018 No Build

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	0	0	0		0	
NBT	0	0	0		0	
NBR	0	0	0		0	
SBL	1.5		860	.27*	760	.24*
SBT	0	4800	0		0	
SBR	1.5		330	{.06}	290	
EBL	0	0	0		0	
EBT	3	4800	720	.15*	1080	.23*
EBR	1	1600	170	.11	260	.16
WBL	1.5		620		630	
WBT	1.5	4800	550	.24*	900	.32*
WBR	0	0	0		0	

Note: Assumes E/W Split Phasing
Note: Assumes Right-Turn Overlap for SBR

TOTAL CAPACITY UTILIZATION .66 .79

48. Calle Industrias/Via Pico & Avd Pico

2018 No Build

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1.5		15		135	
NBT	0.5	3200	10	.01*	10	.05*
NBR	1	1600	190	.12	440	.28
SBL	0	0	25		105	
SBT	1	1600	10	.03*	10	.08*
SBR	0	0	10		20	
EBL	1	1600	10	.01	15	.01
EBT	2	3200	675	.22*	795	.29*
EBR	0	0	25		145	
WBL	2	3200	100	.03*	350	.11*
WBT	3	4800	770	.16	800	.18
WBR	0	0	10		40	
Right Turn Adjustment			NBR	.09*	NBR	.15*

Note: Assumes N/S Split Phasing

TOTAL CAPACITY UTILIZATION .38 .68

14. I-5 NB Ramps & Avd Pico

2018 No Build

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	170	.11*	240	.15*
NBT	0	0	0		0	
NBR	2	3200	650	.20	660	.21
SBL	0	0	0		0	
SBT	0	0	0		0	
SBR	0	0	0		0	
EBL	1	1600	220	.14	540	.34*
EBT	2	3200	1360	.43*	1300	.41
EBR	0	0	0		0	
WBL	0	0	0		0	
WBT	3	4800	1000	.21	1290	.27*
WBR	f		960		870	
Right Turn Adjustment			NBR	.09*		

TOTAL CAPACITY UTILIZATION .63 .76

13. I-5 SB Ramps & Avd Pico

2018 Design Option A

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	0	0	0		0	
NBT	0	0	0		0	
NBR	0	0	0		0	
SBL	1.5		860		760	
SBT	0.5	3200	0	.27*	0	.24*
SBR	1	1600	330	.21	290	.18
EBL	0	0	0		0	
EBT	4	6400	720	.11*	1080	.17*
EBR	1	1600	170	.11	260	.16
WBL	2	3200	620	.19*	630	.20*
WBT	2	3200	550	.17	900	.28
WBR	0	0	0		0	

TOTAL CAPACITY UTILIZATION .57 .61

14. I-5 NB Ramps & Avd Pico

2018 Design Option A

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	170	.11*	240	.15*
NBT	0	0	0		0	
NBR	2	3200	650	.20	660	.21
SBL	0	0	0		0	
SBT	0	0	0		0	
SBR	0	0	0		0	
EBL	2	3200	220	.07	540	.17*
EBT	3	4800	1360	.28*	1300	.27
EBR	0	0	0		0	
WBL	0	0	0		0	
WBT	4	6400	1000	.16	1290	.20*
WBR	f		960		870	
Right Turn Adjustment			NBR	.09*		

TOTAL CAPACITY UTILIZATION .48 .52

48. Calle Industrias/Via Pico & Avd Pico

2018 Design Option A

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1.5		15		135	
NBT	0.5	3200	10	.01*	10	.05*
NBR	1	1600	190	.12	440	.28
SBL	0	0	25		105	
SBT	1	1600	10	.03*	10	.08*
SBR	0	0	10		20	
EBL	1	1600	10	.01	15	.01
EBT	2	3200	675	.22*	795	.29*
EBR	0	0	25		145	
WBL	2	3200	100	.03*	350	.11*
WBT	2	3200	770	.24	800	.26
WBR	0	0	10		40	
Right Turn Adjustment			NBR	.09*	NBR	.15*

Note: Assumes N/S Split Phasing

TOTAL CAPACITY UTILIZATION .38 .68

13. I-5 SB Ramps & Avd Pico

2018 Design Option B

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	0	0	0		0	
NBT	0	0	0		0	
NBR	0	0	0		0	
SBL	1.5		860		760	
SBT	0.5	3200	0	.27*	0	.24*
SBR	1	1600	330	.21	290	.18
EBL	0	0	0		0	
EBT	3	4800	720	.15*	1080	.23*
EBR	1	1600	170	.11	260	.16
WBL	2	3200	620	.19*	630	.20*
WBT	2	3200	550	.17	900	.28
WBR	0	0	0		0	

TOTAL CAPACITY UTILIZATION .61 .67

14. I-5 NB Ramps & Avd Pico

2018 Design Option B

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	170	.11*	240	.15*
NBT	0	0	0		0	
NBR	2	3200	650	.20	660	.21
SBL	0	0	0		0	
SBT	0	0	0		0	
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	3	4800	1360	.28*	1300	.27
EBR	1	1600	220	.14	540	.34
WBL	0	0	0		0	
WBT	4	6400	1000	.21	1290	.27*
WBR	0	0	960	.60	870	.54
Right Turn Adjustment			Multi	.33*	Multi	.22*

TOTAL CAPACITY UTILIZATION .72 .64

48. Calle Industrias/Via Pico & Avd Pico

2018 Design Option B

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	15	.01	135	.08
NBT	0.5	3200	10	{.05}*	10	{.10}*
NBR	1.5		190		440	
SBL	0	0	25		105	
SBT	1	1600	10	.03*	10	.08*
SBR	0	0	10		20	
EBL	1	1600	10	.01	15	.01
EBT	2	3200	675	.22*	795	.29*
EBR	0	0	25		145	
WBL	2	3200	100	.03*	350	.11*
WBT	2	3200	770	.24	800	.26
WBR	0	0	10		40	

Note: Assumes N/S Split Phasing

TOTAL CAPACITY UTILIZATION .33 .58

13. I-5 SB Ramps & Avd Pico

2040 No Build

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	0	0	0		0	
NBT	0	0	0		0	
NBR	0	0	0		0	
SBL	1.5		930	.29*	760	.24*
SBT	0	4800	0		0	
SBR	1.5		330	{.03}	340	
EBL	0	0	0		0	
EBT	3	4800	840	.18*	1280	.27*
EBR	1	1600	230	.14	360	.23
WBL	1.5		510		600	
WBT	1.5	4800	620	.24*	1060	.35*
WBR	0	0	0		0	

Note: Assumes E/W Split Phasing
Note: Assumes Right-Turn Overlap for SBR

TOTAL CAPACITY UTILIZATION .71 .86

48. Calle Industrias/Via Pico & Avd Pico

2040 No Build

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1.5		15		135	
NBT	0.5	3200	10	.01*	10	.05*
NBR	1	1600	190	.12	440	.28
SBL	0	0	25		105	
SBT	1	1600	10	.03*	10	.08*
SBR	0	0	10		20	
EBL	1	1600	10	.01	15	.01
EBT	2	3200	855	.28*	1095	.39*
EBR	0	0	25		145	
WBL	2	3200	100	.03*	350	.11*
WBT	3	4800	840	.18	1010	.22
WBR	0	0	10		40	
Right Turn Adjustment			NBR	.09*	NBR	.15*

Note: Assumes N/S Split Phasing

TOTAL CAPACITY UTILIZATION .44 .78

14. I-5 NB Ramps & Avd Pico

2040 No Build

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	230	.14*	390	.24*
NBT	0	0	0		0	
NBR	2	3200	600	.19	510	.16
SBL	0	0	0		0	
SBT	0	0	0		0	
SBR	0	0	0		0	
EBL	1	1600	280	.18	640	.40*
EBT	2	3200	1500	.47*	1410	.44
EBR	0	0	0		0	
WBL	0	0	0		0	
WBT	3	4800	900	.19	1280	.27*
WBR	f		1010		950	
Right Turn Adjustment			NBR	.05*		

TOTAL CAPACITY UTILIZATION .66 .91

13. I-5 SB Ramps & Avd Pico

2040 Design Option A

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	0	0	0		0	
NBT	0	0	0		0	
NBR	0	0	0		0	
SBL	1.5		930		760	
SBT	0.5	3200	0	.29*	0	.24*
SBR	1	1600	330	.21	350	.22
EBL	0	0	0		0	
EBT	4	6400	810	.13*	1240	.19*
EBR	1	1600	230	.14	360	.23
WBL	2	3200	500	.16*	590	.18*
WBT	2	3200	600	.19	1030	.32
WBR	0	0	0		0	
Right Turn Adjustment			EBR	.01*	EBR	.04*

TOTAL CAPACITY UTILIZATION .59 .65

14. I-5 NB Ramps & Avd Pico

2040 Design Option A

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	190	.12*	340	.21*
NBT	0	0	0		0	
NBR	2	3200	630	.20	550	.17
SBL	0	0	0		0	
SBT	0	0	0		0	
SBR	0	0	0		0	
EBL	2	3200	230	.07	570	.18*
EBT	3	4800	1510	.31*	1430	.30
EBR	0	0	0		0	
WBL	0	0	0		0	
WBT	4	6400	910	.14	1280	.20*
WBR	f		1060		1020	
Right Turn Adjustment			NBR	.08*		

TOTAL CAPACITY UTILIZATION .51 .59

48. Calle Industrias/Via Pico & Avd Pico

2040 Design Option A

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1.5		15		135	
NBT	0.5	3200	10	.01*	10	.05*
NBR	1	1600	190	.12	440	.28
SBL	0	0	25		105	
SBT	1	1600	10	.03*	10	.08*
SBR	0	0	10		20	
EBL	1	1600	10	.01	15	.01
EBT	2	3200	825	.27*	1055	.38*
EBR	0	0	25		145	
WBL	2	3200	100	.03*	350	.11*
WBT	2	3200	820	.26	990	.32
WBR	0	0	10		40	
Right Turn Adjustment			NBR	.09*	NBR	.15*

Note: Assumes N/S Split Phasing

TOTAL CAPACITY UTILIZATION .43 .77

13. I-5 SB Ramps & Avd Pico

2040 Design Option B

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	0	0	0		0	
NBT	0	0	0		0	
NBR	0	0	0		0	
SBL	1.5		930		760	
SBT	0.5	3200	0	.29*	0	.24*
SBR	1	1600	330	.21	350	.22
EBL	0	0	0		0	
EBT	3	4800	810	.17*	1240	.26*
EBR	1	1600	230	.14	360	.23
WBL	2	3200	500	.16*	590	.18*
WBT	2	3200	600	.19	1030	.32
WBR	0	0	0		0	

TOTAL CAPACITY UTILIZATION .62 .68

14. I-5 NB Ramps & Avd Pico

2040 Design Option B

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	190	.12*	340	.21*
NBT	0	0	0		0	
NBR	2	3200	630	.20	550	.17
SBL	0	0	0		0	
SBT	0	0	0		0	
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	3	4800	1510	.31*	1430	.30*
EBR	1	1600	230	.14	570	.36
WBL	0	0	0		0	
WBT	4	6400	910	.19	1280	.27
WBR	0	0	1060	.66	1020	.64
Right Turn Adjustment			Multi	.34*	WBR	.18*

TOTAL CAPACITY UTILIZATION .77 .69

48. Calle Industrias/Via Pico & Avd Pico

2040 Design Option B

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	15	.01	135	.08
NBT	0.5	3200	10	{.05}*	10	{.10}*
NBR	1.5		190		440	
SBL	0	0	25		105	
SBT	1	1600	10	.03*	10	.08*
SBR	0	0	10		20	
EBL	1	1600	10	.01	15	.01
EBT	2	3200	825	.27*	1055	.38*
EBR	0	0	25		145	
WBL	2	3200	100	.03*	350	.11*
WBT	2	3200	820	.26	990	.32
WBR	0	0	10		40	

Note: Assumes N/S Split Phasing

TOTAL CAPACITY UTILIZATION .38 .67

48. **Calle Industrias/Via Pico & Avd Pico**

Year 2040 – Design Option A (High Demand)

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1.5		15		135	
NBT	0.5	3200	10	.01*	10	.05*
NBR	1	1600	190	.12	440	.28
SBL	0	0	25		105	
SBT	1	1600	10	.03*	10	.08*
SBR	0	0	10		20	
EBL	1	1600	10	.01	15	.01
EBT	2	3200	955	.31*	1095	.39*
EBR	0	0	25		145	
WBL	2	3200	100	.03*	350	.11*
WBT	2	3200	910	.29	1060	.34
WBR	0	0	10		40	
Right Turn Adjustment			NBR	.09*	NBR	.15*

Note: Assumes N/S Split Phasing

TOTAL CAPACITY UTILIZATION .47 .78

14. **I-5 NB Ramps & Avd Pico**

Year 2040 – Design Option A (High Demand)

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	200	.13*	290	.18*
NBT	0	0	0		0	
NBR	2	3200	690	.22	970	.30
SBL	0	0	0		0	
SBT	0	0	0		0	
SBR	0	0	0		0	
EBL	2	3200	230	.07	550	.17*
EBT	3	4800	1660	.35*	1630	.34
EBR	0	0	0		0	
WBL	0	0	0		0	
WBT	4	6400	1420	.22	1610	.25*
WBR	f		1140		980	
Right Turn Adjustment			NBR	.09*	NBR	.06*

TOTAL CAPACITY UTILIZATION .57 .66

13. **I-5 SB Ramps & Avd Pico**

Year 2040 – Design Option A (High Demand)

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	0	0	0		0	
NBT	0	0	0		0	
NBR	0	0	0		0	
SBL	1.5		1010		870	
SBT	0.5	3200	0	.32*	0	.27*
SBR	1	1600	340	.21	300	.19
EBL	0	0	0		0	
EBT	4	6400	880	.14*	1310	.20*
EBR	1	1600	190	.12	330	.21
WBL	2	3200	940	.29*	750	.23*
WBT	2	3200	680	.21	1150	.36
WBR	0	0	0		0	
Right Turn Adjustment					EBR	.01*

TOTAL CAPACITY UTILIZATION .75 .71

48. Calle Industrias/Via Pico & Avd Pico

Year 2040 – Design Option B (High Demand)

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	15	.01	135	.08
NBT	0.5	3200	10	{.05}*	10	{.10}*
NBR	1.5		190		440	
SBL	0	0	25		105	
SBT	1	1600	10	.03*	10	.08*
SBR	0	0	10		20	
EBL	1	1600	10	.01	15	.01
EBT	2	3200	955	.31*	1095	.39*
EBR	0	0	25		145	
WBL	2	3200	100	.03*	350	.11*
WBT	2	3200	910	.29	1060	.34
WBR	0	0	10		40	

Note: Assumes N/S Split Phasing

TOTAL CAPACITY UTILIZATION .42 .68

14. I-5 NB Ramps & Avd Pico

Year 2040 – Design Option B (High Demand)

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	200	.13*	290	.18*
NBT	0	0	0		0	
NBR	2	3200	690	.22	970	.30
SBL	0	0	0		0	
SBT	0	0	0		0	
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	3	4800	1660	.35	1630	.34
EBR	1	1600	230	.14	550	.34
WBL	0	0	0		0	
WBT	4	6400	2560	.40*	2590	.40*
WBR	0	0	0		0	
Right Turn Adjustment			NBR	.05*	NBR	.07*

TOTAL CAPACITY UTILIZATION .58 .65

13. I-5 SB Ramps & Avd Pico

Year 2040 – Design Option B (High Demand)

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	0	0	0		0	
NBT	0	0	0		0	
NBR	0	0	0		0	
SBL	1.5		1010		870	
SBT	0.5	3200	0	.32*	0	.27*
SBR	1	1600	340	.21	300	.19
EBL	0	0	0		0	
EBT	3	4800	880	.18*	1310	.27*
EBR	1	1600	190	.12	330	.21
WBL	2	3200	940	.29*	750	.23*
WBT	2	3200	680	.21	1150	.36
WBR	0	0	0		0	

TOTAL CAPACITY UTILIZATION .79 .77

APPENDIX N

INTERSECTION QUEUE WORKSHEETS – AVENIDA PICO INTERCHANGE

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		350	0		0	0		0	0		250
Storage Lanes	0		1	1		0	0		0	1		1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)		250	10	50	250					50	50	50
Trailing Detector (ft)		244	0	0	244					0	0	0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		499			411			485			414	
Travel Time (s)		8.5			7.0			11.0			9.4	
Lane Group Flow (vph)	0	779	179	407	856	0	0	0	0	453	452	337
v/c Ratio		0.64	0.36	0.81	0.82					0.86	0.90	0.56
Control Delay		20.4	7.2	28.9	22.5					45.8	50.8	7.8
Queue Delay		0.0	0.0	0.0	0.1					0.0	0.0	0.0
Total Delay		20.4	7.2	28.9	22.6					45.8	50.8	7.8
Queue Length 50th (ft)		154	48	276	199					240	254	0
Queue Length 95th (ft)		200	67	#390	257					#400	#431	76
Internal Link Dist (ft)		419			331			405			334	
Turn Bay Length (ft)			350									250
Base Capacity (vph)		1224	500	531	1100					579	555	602
Starvation Cap Reductn		0	0	0	16					0	0	0
Spillback Cap Reductn		0	0	0	0					0	0	0
Storage Cap Reductn		0	0	0	0					0	0	0
Reduced v/c Ratio		0.64	0.36	0.77	0.79					0.78	0.81	0.56

Intersection Summary

Area Type: Other

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		400	0		0	0		0
Storage Lanes	1		0	0		1	1		1	0		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	250			250	10	50		50			
Trailing Detector (ft)	0	244			244	0	0		0			
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		411			535			399			497	
Travel Time (s)		7.0			9.1			9.1			11.3	
Lane Group Flow (vph)	274	1421	0	0	1042	968	211	0	663	0	0	0
v/c Ratio	0.64	0.63			0.59	0.62	0.43		0.84			
Control Delay	9.5	1.5			27.2	1.9	28.8		37.2			
Queue Delay	0.0	0.2			0.0	0.0	0.1		0.0			
Total Delay	9.5	1.7			27.2	1.9	28.9		37.2			
Queue Length 50th (ft)	2	1			193	0	96		176			
Queue Length 95th (ft)	m3	m1			242	0	153		239			
Internal Link Dist (ft)		331			455			319			417	
Turn Bay Length (ft)						400						
Base Capacity (vph)	467	2248			1775	1555	570		908			
Starvation Cap Reductn	0	190			0	0	0		0			
Spillback Cap Reductn	0	0			30	0	32		0			
Storage Cap Reductn	0	0			0	0	0		0			
Reduced v/c Ratio	0.59	0.69			0.60	0.62	0.39		0.73			

Intersection Summary	
Area Type:	Other

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	150		100	200		0	0		0
Storage Lanes	1		0	2		0	1		1	0		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50	50	50	50	
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		355			499			201			312	
Travel Time (s)		6.1			8.5			4.6			7.1	
Lane Group Flow (vph)	11	863	0	105	832	0	16	11	95	0	48	0
v/c Ratio	0.09	0.49		0.37	0.29		0.04	0.03	0.22		0.31	
Control Delay	40.3	17.5		36.1	3.9		29.6	29.4	8.2		36.7	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0		0.0	
Total Delay	40.3	17.5		36.1	3.9		29.6	29.4	8.2		36.7	
Queue Length 50th (ft)	6	179		32	24		7	5	0		20	
Queue Length 95th (ft)	22	251		m44	m43		26	20	39		53	
Internal Link Dist (ft)		275			419			121			232	
Turn Bay Length (ft)	100			150			200					
Base Capacity (vph)	157	1744		305	2909		383	404	435		360	
Starvation Cap Reductn	0	0		0	0		0	0	0		0	
Spillback Cap Reductn	0	0		0	0		0	0	0		0	
Storage Cap Reductn	0	0		0	0		0	0	0		0	
Reduced v/c Ratio	0.07	0.49		0.34	0.29		0.04	0.03	0.22		0.13	

Intersection Summary	
Area Type:	Other

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		350	0		0	0		0	0		250
Storage Lanes	0		1	1		0	0		0	1		1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)		250	10	50	250					50	50	50
Trailing Detector (ft)		244	0	0	244					0	0	0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		510			407			472			394	
Travel Time (s)		8.7			6.9			10.7			9.0	
Lane Group Flow (vph)	0	1168	274	529	1113	0	0	0	0	400	400	295
v/c Ratio		0.90	0.46	0.94	0.95					0.91	0.95	0.50
Control Delay		30.4	4.1	30.2	19.0					58.8	66.9	6.7
Queue Delay		0.0	0.0	0.0	1.2					0.0	0.0	0.0
Total Delay		30.4	4.1	30.2	20.2					58.8	66.9	6.7
Queue Length 50th (ft)		245	40	79	125					230	243	0
Queue Length 95th (ft)		#317	m16	m#138	m#419					#406	#436	65
Internal Link Dist (ft)		430			327			392			314	
Turn Bay Length (ft)			350									250
Base Capacity (vph)		1300	590	562	1176					448	429	587
Starvation Cap Reductn		0	0	0	15					0	0	0
Spillback Cap Reductn		0	0	0	0					0	0	0
Storage Cap Reductn		0	0	0	0					0	0	0
Reduced v/c Ratio		0.90	0.46	0.94	0.96					0.89	0.93	0.50

Intersection Summary

Area Type: Other

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		400	0		0	0		0
Storage Lanes	1		0	0		1	1		1	0		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	250			250	10	50		50			
Trailing Detector (ft)	0	244			244	0	0		0			
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		407			583			444			476	
Travel Time (s)		6.9			9.9			10.1			10.8	
Lane Group Flow (vph)	621	1347	0	0	1358	863	295	0	663	0	0	0
v/c Ratio	0.95	0.54			0.90	0.55	0.83		1.01			
Control Delay	33.4	13.3			40.3	1.4	56.1		66.9			
Queue Delay	0.3	1.2			0.6	0.0	0.0		0.0			
Total Delay	33.7	14.5			40.9	1.4	56.1		66.9			
Queue Length 50th (ft)	137	262			268	0	162		~174			
Queue Length 95th (ft)	m#177	m286			#352	0	#299		#305			
Internal Link Dist (ft)		327			503			364			396	
Turn Bay Length (ft)						400						
Base Capacity (vph)	657	2517			1526	1555	354		656			
Starvation Cap Reductn	2	870			0	0	0		0			
Spillback Cap Reductn	0	0			31	0	0		0			
Storage Cap Reductn	0	0			0	0	0		0			
Reduced v/c Ratio	0.95	0.82			0.91	0.55	0.83		1.01			

Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	150		0	200		0	0		0
Storage Lanes	1		0	2		0	1		1	0		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50	50	50	50	
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		333			510			201			368	
Travel Time (s)		5.7			8.7			4.6			8.4	
Lane Group Flow (vph)	16	1021	0	368	895	0	75	78	463	0	143	0
v/c Ratio	0.14	0.68		0.80	0.30		0.35	0.36	0.84		0.60	
Control Delay	42.5	24.9		41.5	4.7		38.9	39.1	21.0		44.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0		0.0	
Total Delay	42.5	24.9		41.5	4.7		38.9	39.1	21.0		44.8	
Queue Length 50th (ft)	9	233		115	15		42	43	32		73	
Queue Length 95th (ft)	29	#393		m131	m160		81	83	#145		127	
Internal Link Dist (ft)		253			430			121			288	
Turn Bay Length (ft)	100			150			200					
Base Capacity (vph)	119	1505		458	2966		299	302	613		319	
Starvation Cap Reductn	0	0		0	0		0	0	0		0	
Spillback Cap Reductn	0	0		0	0		0	0	0		0	
Storage Cap Reductn	0	0		0	0		0	0	0		0	
Reduced v/c Ratio	0.13	0.68		0.80	0.30		0.25	0.26	0.76		0.45	

Intersection Summary	
Area Type:	Other

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		150	0		0	0		0	0		250
Storage Lanes	0		1	2		0	0		0	2		1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)		250	10	50	250					50		50
Trailing Detector (ft)		244	0	0	244					0		0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		499			411			485			414	
Travel Time (s)		8.5			7.0			11.0			9.4	
Volume (vph)	0	720	170	620	550	0	0	0	0	860	0	330
Confl. Peds. (#/hr)			20									20
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Lane Group Flow (vph)	0	758	179	653	579	0	0	0	0	905	0	347
v/c Ratio		0.67	0.43	0.60	0.33					0.81		0.52
Control Delay		26.2	10.4	3.5	3.3					25.0		7.1
Queue Delay		0.0	0.0	0.0	0.0					0.0		0.0
Total Delay		26.2	10.4	3.5	3.3					25.0		7.1
Queue Length 50th (ft)		118	41	18	26					136		25
Queue Length 95th (ft)		153	100	25	42					178		63
Internal Link Dist (ft)		419			331			405			334	
Turn Bay Length (ft)			150									250
Base Capacity (vph)		1139	416	1106	1770					1137		669
Starvation Cap Reductn		0	0	0	0					0		0
Spillback Cap Reductn		0	0	0	0					0		0
Storage Cap Reductn		0	0	0	0					0		0
Reduced v/c Ratio		0.67	0.43	0.59	0.33					0.80		0.52

Intersection Summary

Area Type: Other

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		400	0		0	0		0
Storage Lanes	1		0	0		1	1		1	0		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	250			250	10	50		50			
Trailing Detector (ft)	0	244			244	0	0		0			
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		411			535			399			497	
Travel Time (s)		7.0			9.1			9.1			11.3	
Volume (vph)	220	1360	0	0	1000	960	170	0	650	0	0	0
Confl. Peds. (#/hr)						20			20			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Lane Group Flow (vph)	232	1432	0	0	1053	1011	179	0	684	0	0	0
v/c Ratio	0.29	0.62			0.74	0.65	0.28		0.68			
Control Delay	2.1	7.4			35.4	2.1	12.1		16.8			
Queue Delay	0.0	0.0			0.0	0.0	0.0		0.0			
Total Delay	2.1	7.4			35.4	2.1	12.1		16.8			
Queue Length 50th (ft)	1	122			162	0	32		76			
Queue Length 95th (ft)	m2	158			182	0	66		#153			
Internal Link Dist (ft)		331			455			319			417	
Turn Bay Length (ft)						400						
Base Capacity (vph)	801	2656			1851	1555	656		1016			
Starvation Cap Reductn	0	0			0	0	0		0			
Spillback Cap Reductn	0	0			0	0	0		0			
Storage Cap Reductn	0	0			0	0	0		0			
Reduced v/c Ratio	0.29	0.54			0.57	0.65	0.27		0.67			

Intersection Summary

Area Type: Other

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		150	200		100	200		0	0		0
Storage Lanes	1		0	2		0	1		1	0		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50	50	50	50	
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		355			499			201			312	
Travel Time (s)		6.1			8.5			4.6			7.1	
Volume (vph)	10	775	25	100	770	10	15	10	90	25	10	10
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Lane Group Flow (vph)	11	842	0	105	822	0	16	57	49	0	48	0
v/c Ratio	0.11	0.44		0.46	0.38		0.05	0.17	0.15		0.31	
Control Delay	43.1	14.5		47.1	6.5		31.3	14.0	10.9		36.7	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0		0.0	
Total Delay	43.1	14.5		47.1	6.5		31.3	14.0	10.9		36.7	
Queue Length 50th (ft)	6	157		32	66		8	5	0		20	
Queue Length 95th (ft)	23	222		60	197		25	40	31		53	
Internal Link Dist (ft)		275			419			121			232	
Turn Bay Length (ft)	100			200			200					
Base Capacity (vph)	98	1908		229	2156		350	344	337		322	
Starvation Cap Reductn	0	0		0	0		0	0	0		0	
Spillback Cap Reductn	0	0		0	0		0	0	0		0	
Storage Cap Reductn	0	0		0	0		0	0	0		0	
Reduced v/c Ratio	0.11	0.44		0.46	0.38		0.05	0.17	0.15		0.15	

Intersection Summary	
Area Type:	Other

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		150	0		0	0		0	0		250
Storage Lanes	0		1	2		0	0		0	2		1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)		250	10	50	250					50		50
Trailing Detector (ft)		244	0	0	244					0		0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		510			407			472			394	
Travel Time (s)		8.7			6.9			10.7			9.0	
Volume (vph)	0	1080	260	630	900	0	0	0	0	760	0	290
Confl. Peds. (#/hr)			20									20
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Lane Group Flow (vph)	0	1137	274	663	947	0	0	0	0	800	0	305
v/c Ratio		0.80	0.50	0.68	0.53					0.74		0.56
Control Delay		27.5	6.5	8.5	5.0					18.7		13.2
Queue Delay		0.0	0.0	0.0	0.0					0.0		0.0
Total Delay		27.5	6.5	8.5	5.0					18.7		13.2
Queue Length 50th (ft)		186	42	10	48					101		47
Queue Length 95th (ft)		222	62	m42	m93					134		87
Internal Link Dist (ft)		430			327			392			314	
Turn Bay Length (ft)			150									250
Base Capacity (vph)		1424	549	973	1790					1106		554
Starvation Cap Reductn		0	0	0	0					0		0
Spillback Cap Reductn		0	0	0	0					0		0
Storage Cap Reductn		0	0	0	0					0		0
Reduced v/c Ratio		0.80	0.50	0.68	0.53					0.72		0.55

Intersection Summary

Area Type: Other

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		400	0		320	0		0
Storage Lanes	1		0	0		1	1		1	0		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	250			250	10	50		50			
Trailing Detector (ft)	0	244			244	0	0		0			
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		407			583			506			476	
Travel Time (s)		6.9			9.9			11.5			10.8	
Volume (vph)	540	1300	0	0	1290	870	240	0	660	0	0	0
Confl. Peds. (#/hr)						20			20			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Lane Group Flow (vph)	568	1368	0	0	1358	916	253	0	695	0	0	0
v/c Ratio	0.68	0.55			0.87	0.59	0.43		0.76			
Control Delay	10.3	7.3			40.2	1.6	14.2		18.7			
Queue Delay	0.0	0.0			0.0	0.0	0.0		0.0			
Total Delay	10.3	7.3			40.2	1.6	14.2		18.7			
Queue Length 50th (ft)	9	92			215	0	49		82			
Queue Length 95th (ft)	m53	145			#259	0	80		115			
Internal Link Dist (ft)		327			503			426			396	
Turn Bay Length (ft)						400			320			
Base Capacity (vph)	839	2486			1566	1555	603		935			
Starvation Cap Reductn	0	0			0	0	0		0			
Spillback Cap Reductn	0	0			0	0	0		0			
Storage Cap Reductn	0	0			0	0	0		0			
Reduced v/c Ratio	0.68	0.55			0.87	0.59	0.42		0.74			

Intersection Summary

Area Type: Other

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		150	200		0	200		0	0		0
Storage Lanes	1		0	2		0	1		1	0		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50	50	50	50	
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		333			510			201			368	
Travel Time (s)		5.7			8.7			4.6			8.4	
Volume (vph)	15	795	145	350	800	40	135	10	440	105	10	20
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Lane Group Flow (vph)	16	990	0	368	884	0	142	242	232	0	143	0
v/c Ratio	0.20	0.67		0.73	0.43		0.61	0.60	0.58		0.66	
Control Delay	47.6	24.1		43.6	6.6		47.9	12.8	11.3		50.6	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0		0.0	
Total Delay	47.6	24.1		43.6	6.6		47.9	12.8	11.3		50.6	
Queue Length 50th (ft)	9	243		117	127		76	5	0		73	
Queue Length 95th (ft)	30	321		164	201		134	75	66		134	
Internal Link Dist (ft)		253			430			121			288	
Turn Bay Length (ft)	100			200			200					
Base Capacity (vph)	79	1482		534	2043		275	431	430		242	
Starvation Cap Reductn	0	0		0	0		0	0	0		0	
Spillback Cap Reductn	0	0		0	0		0	0	0		0	
Storage Cap Reductn	0	0		0	0		0	0	0		0	
Reduced v/c Ratio	0.20	0.67		0.69	0.43		0.52	0.56	0.54		0.59	

Intersection Summary	
Area Type:	Other

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		150	0		0	0		0	0		250
Storage Lanes	0		1	2		0	0		0	2		1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)		250	10	50	250					50		50
Trailing Detector (ft)		244	0	0	244					0		0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		499			411			485			414	
Travel Time (s)		8.5			7.0			11.0			9.4	
Lane Group Flow (vph)	0	758	179	653	579	0	0	0	0	905	0	347
v/c Ratio		0.52	0.32	0.75	0.28					0.80		0.51
Control Delay		17.7	8.5	26.0	12.6					33.5		8.2
Queue Delay		0.0	0.0	0.0	0.0					0.0		0.0
Total Delay		17.7	8.5	26.0	12.6					33.5		8.2
Queue Length 50th (ft)		141	44	173	133					234		28
Queue Length 95th (ft)		190	105	235	188					294		95
Internal Link Dist (ft)		419			331			405			334	
Turn Bay Length (ft)			150									250
Base Capacity (vph)		1450	559	955	2064					1259		728
Starvation Cap Reductn		0	0	0	0					0		0
Spillback Cap Reductn		0	0	0	0					0		0
Storage Cap Reductn		0	0	0	0					0		0
Reduced v/c Ratio		0.52	0.32	0.68	0.28					0.72		0.48

Intersection Summary	
Area Type:	Other

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0	0		200	0
Storage Lanes		1	0		1	2
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)		9	15		15	9
Right Turn on Red		Yes				Yes
Link Speed (mph)	40			40	30	
Link Distance (ft)	442			446	306	
Travel Time (s)	7.5			7.6	7.0	
Lane Group Flow (vph)	1432	232	0	2063	179	684
v/c Ratio	0.51	0.25		0.58	0.28	0.67
Control Delay	4.7	1.7		13.9	22.4	26.3
Queue Delay	0.0	0.0		0.0	0.0	0.0
Total Delay	4.7	1.7		13.9	22.4	26.3
Queue Length 50th (ft)	134	13		208	72	170
Queue Length 95th (ft)	29	m3		243	123	238
Internal Link Dist (ft)	362			366	226	
Turn Bay Length (ft)					200	
Base Capacity (vph)	2825	916		3560	629	1025
Starvation Cap Reductn	0	0		0	0	0
Spillback Cap Reductn	0	0		0	0	0
Storage Cap Reductn	0	0		0	0	0
Reduced v/c Ratio	0.51	0.25		0.58	0.28	0.67

Intersection Summary	
Area Type:	Other

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	250		100	200		0	0		0
Storage Lanes	1		0	2		0	1		1	0		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50	50	50	50	
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		355			499			201			312	
Travel Time (s)		6.1			8.5			4.6			7.1	
Lane Group Flow (vph)	11	842	0	105	822	0	16	57	49	0	48	0
v/c Ratio	0.11	0.46		0.41	0.39		0.04	0.16	0.14		0.31	
Control Delay	43.1	15.8		40.9	5.3		30.4	13.6	10.5		36.7	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0		0.0	
Total Delay	43.1	15.8		40.9	5.3		30.4	13.6	10.5		36.7	
Queue Length 50th (ft)	6	165		31	51		8	5	0		20	
Queue Length 95th (ft)	23	232		58	100		25	38	31		53	
Internal Link Dist (ft)		275			419			121			232	
Turn Bay Length (ft)	100			250			200					
Base Capacity (vph)	98	1838		267	2117		369	361	353		341	
Starvation Cap Reductn	0	0		0	0		0	0	0		0	
Spillback Cap Reductn	0	0		0	0		0	0	0		0	
Storage Cap Reductn	0	0		0	0		0	0	0		0	
Reduced v/c Ratio	0.11	0.46		0.39	0.39		0.04	0.16	0.14		0.14	

Intersection Summary	
Area Type:	Other

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		150	0		0	0		0	0		250
Storage Lanes	0		1	2		0	0		0	2		1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)		250	10	50	250					50		50
Trailing Detector (ft)		244	0	0	244					0		0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		505			411			485			414	
Travel Time (s)		8.6			7.0			11.0			9.4	
Lane Group Flow (vph)	0	1137	274	663	947	0	0	0	0	800	0	305
v/c Ratio		0.70	0.42	0.77	0.44					0.79		0.57
Control Delay		18.9	3.7	27.3	14.1					34.7		19.6
Queue Delay		0.0	0.0	0.0	0.0					0.0		0.0
Total Delay		18.9	3.7	27.3	14.1					34.7		19.6
Queue Length 50th (ft)		209	13	179	228					212		85
Queue Length 95th (ft)		#307	m42	242	314					262		158
Internal Link Dist (ft)		425			331			405			334	
Turn Bay Length (ft)			150									250
Base Capacity (vph)		1625	652	920	2174					1182		599
Starvation Cap Reductn		0	0	0	0					0		0
Spillback Cap Reductn		0	0	0	0					0		0
Storage Cap Reductn		0	0	0	0					0		0
Reduced v/c Ratio		0.70	0.42	0.72	0.44					0.68		0.51

Intersection Summary

Area Type: Other

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0	0		200	0
Storage Lanes		1	0		1	2
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)		9	15		15	9
Right Turn on Red		Yes				Yes
Link Speed (mph)	40			40	30	
Link Distance (ft)	442			435	306	
Travel Time (s)	7.5			7.4	7.0	
Lane Group Flow (vph)	1368	568	0	2274	253	695
v/c Ratio	0.47	0.53		0.63	0.41	0.69
Control Delay	5.5	5.0		14.1	25.2	27.0
Queue Delay	0.0	0.0		0.0	0.0	0.0
Total Delay	5.5	5.0		14.1	25.2	27.0
Queue Length 50th (ft)	149	155		234	109	172
Queue Length 95th (ft)	50	m238		272	176	242
Internal Link Dist (ft)	362			355	226	
Turn Bay Length (ft)					200	
Base Capacity (vph)	2882	1076		3631	610	1005
Starvation Cap Reductn	0	0		0	0	0
Spillback Cap Reductn	0	0		0	0	0
Storage Cap Reductn	0	0		0	0	0
Reduced v/c Ratio	0.47	0.53		0.63	0.41	0.69

Intersection Summary	
Area Type:	Other

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	250		100	200		0	0		0
Storage Lanes	1		0	2		0	1		1	0		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50	50	50	50	
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		355			505			201			312	
Travel Time (s)		6.1			8.6			4.6			7.1	
Lane Group Flow (vph)	16	990	0	368	884	0	142	242	232	0	143	0
v/c Ratio	0.18	0.72		0.69	0.45		0.52	0.56	0.54		0.67	
Control Delay	46.1	26.5		42.7	10.2		42.4	11.3	10.0		50.8	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0		0.0	
Total Delay	46.1	26.5		42.7	10.2		42.4	11.3	10.0		50.8	
Queue Length 50th (ft)	9	245		115	70		75	5	0		73	
Queue Length 95th (ft)	30	321		161	255		134	75	66		134	
Internal Link Dist (ft)		275			425			121			232	
Turn Bay Length (ft)	100			250			200					
Base Capacity (vph)	91	1373		534	1961		275	431	430		241	
Starvation Cap Reductn	0	0		0	0		0	0	0		0	
Spillback Cap Reductn	0	0		0	0		0	0	0		0	
Storage Cap Reductn	0	0		0	0		0	0	0		0	
Reduced v/c Ratio	0.18	0.72		0.69	0.45		0.52	0.56	0.54		0.59	

Intersection Summary	
Area Type:	Other

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		150	0		0	0		0	0		250
Storage Lanes	0		1	2		0	0		0	2		1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)		250	10	50	250					50		50
Trailing Detector (ft)		244	0	0	244					0		0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		499			411			485			414	
Travel Time (s)		8.5			7.0			11.0			9.4	
Volume (vph)	0	810	230	500	600	0	0	0	0	930	0	330
Confl. Peds. (#/hr)			20									20
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Lane Group Flow (vph)	0	853	242	526	632	0	0	0	0	979	0	347
v/c Ratio		0.65	0.48	0.61	0.39					0.78		0.51
Control Delay		23.0	12.1	5.9	4.3					18.5		8.2
Queue Delay		0.0	0.0	0.0	0.0					0.0		0.0
Total Delay		23.0	12.1	5.9	4.3					18.5		8.2
Queue Length 50th (ft)		132	69	3	31					122		33
Queue Length 95th (ft)		168	144	23	53					159		68
Internal Link Dist (ft)		419			331			405			334	
Turn Bay Length (ft)			150									250
Base Capacity (vph)		1306	501	877	1625					1270		680
Starvation Cap Reductn		0	0	0	0					0		0
Spillback Cap Reductn		0	0	0	0					0		0
Storage Cap Reductn		0	0	0	0					0		0
Reduced v/c Ratio		0.65	0.48	0.60	0.39					0.77		0.51

Intersection Summary

Area Type: Other

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		400	0		0	0		0
Storage Lanes	1		0	0		1	1		1	0		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	250			250	10	50		50			
Trailing Detector (ft)	0	244			244	0	0		0			
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		411			535			399			497	
Travel Time (s)		7.0			9.1			9.1			11.3	
Volume (vph)	230	1510	0	0	910	1060	190	0	630	0	0	0
Confl. Peds. (#/hr)						20			20			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Lane Group Flow (vph)	242	1589	0	0	958	1116	200	0	663	0	0	0
v/c Ratio	0.27	0.68			0.74	0.72	0.31		0.68			
Control Delay	1.8	8.4			36.9	2.9	12.5		16.8			
Queue Delay	0.0	0.0			0.0	0.0	0.0		0.0			
Total Delay	1.8	8.4			36.9	2.9	12.5		16.8			
Queue Length 50th (ft)	1	113			150	0	39		82			
Queue Length 95th (ft)	m2	146			170	0	68		#134			
Internal Link Dist (ft)		331			455			319			417	
Turn Bay Length (ft)						400						
Base Capacity (vph)	884	2666			1709	1555	645		988			
Starvation Cap Reductn	0	0			0	0	0		0			
Spillback Cap Reductn	0	0			0	0	0		0			
Storage Cap Reductn	0	0			0	0	0		0			
Reduced v/c Ratio	0.27	0.60			0.56	0.72	0.31		0.67			

Intersection Summary

Area Type: Other

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		150	200		100	200		0	0		0
Storage Lanes	1		0	2		0	1		1	0		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50	50	50	50	
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		355			499			201			312	
Travel Time (s)		6.1			8.5			4.6			7.1	
Volume (vph)	10	925	25	100	820	10	15	10	90	25	10	10
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Lane Group Flow (vph)	11	1000	0	105	874	0	16	57	49	0	48	0
v/c Ratio	0.14	0.53		0.46	0.41		0.04	0.16	0.14		0.31	
Control Delay	45.4	16.3		42.4	5.8		30.5	13.6	10.5		36.7	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0		0.0	
Total Delay	45.4	16.3		42.4	5.8		30.5	13.6	10.5		36.7	
Queue Length 50th (ft)	6	204		30	44		8	5	0		20	
Queue Length 95th (ft)	23	283		58	153		25	38	31		53	
Internal Link Dist (ft)		275			419			121			232	
Turn Bay Length (ft)	100			200			200					
Base Capacity (vph)	79	1878		229	2132		366	358	350		341	
Starvation Cap Reductn	0	0		0	0		0	0	0		0	
Spillback Cap Reductn	0	0		0	0		0	0	0		0	
Storage Cap Reductn	0	0		0	0		0	0	0		0	
Reduced v/c Ratio	0.14	0.53		0.46	0.41		0.04	0.16	0.14		0.14	

Intersection Summary	
Area Type:	Other

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		150	0		0	0		0	0		250
Storage Lanes	0		1	2		0	0		0	2		1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)		250	10	50	250					50		50
Trailing Detector (ft)		244	0	0	244					0		0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		510			407			472			394	
Travel Time (s)		8.7			6.9			10.7			9.0	
Volume (vph)	0	1240	360	590	1030	0	0	0	0	760	0	350
Confl. Peds. (#/hr)			20									20
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Lane Group Flow (vph)	0	1305	379	621	1084	0	0	0	0	800	0	368
v/c Ratio		0.83	0.58	0.54	0.53					0.96		0.83
Control Delay		25.1	6.6	0.8	2.7					50.8		36.5
Queue Delay		0.0	0.0	0.0	0.1					0.0		0.0
Total Delay		25.1	6.6	0.8	2.7					50.8		36.5
Queue Length 50th (ft)		210	57	0	61					165		109
Queue Length 95th (ft)		237	m67	m0	m77					#300		#269
Internal Link Dist (ft)		430			327			392			314	
Turn Bay Length (ft)			150									250
Base Capacity (vph)		1566	650	1182	2084					835		442
Starvation Cap Reductn		0	0	0	120					0		0
Spillback Cap Reductn		0	0	0	0					0		0
Storage Cap Reductn		0	0	0	0					0		0
Reduced v/c Ratio		0.83	0.58	0.53	0.55					0.96		0.83

Intersection Summary

Area Type: Other

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		400	0		320	0		0
Storage Lanes	1		0	0		1	1		1	0		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	250			250	10	50		50			
Trailing Detector (ft)	0	244			244	0	0		0			
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		407			583			506			476	
Travel Time (s)		6.9			9.9			11.5			10.8	
Volume (vph)	570	1430	0	0	1280	1020	340	0	550	0	0	0
Confl. Peds. (#/hr)						20			20			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Lane Group Flow (vph)	600	1505	0	0	1347	1074	358	0	579	0	0	0
v/c Ratio	0.50	0.51			0.90	0.69	0.86		0.85			
Control Delay	0.8	5.0			43.1	2.5	44.7		33.6			
Queue Delay	0.0	0.0			0.0	0.0	0.0		0.0			
Total Delay	0.8	5.1			43.1	2.5	44.7		33.6			
Queue Length 50th (ft)	0	147			216	0	103		82			
Queue Length 95th (ft)	m0	m150			#280	0	#300		#227			
Internal Link Dist (ft)		327			503			426			396	
Turn Bay Length (ft)						400			320			
Base Capacity (vph)	1297	3108			1495	1555	418		682			
Starvation Cap Reductn	0	189			0	0	0		0			
Spillback Cap Reductn	0	0			0	0	0		0			
Storage Cap Reductn	0	0			0	0	0		0			
Reduced v/c Ratio	0.46	0.52			0.90	0.69	0.86		0.85			

Intersection Summary

Area Type: Other

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		150	200		0	200		0	0		0
Storage Lanes	1		0	2		0	1		1	0		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50	50	50	50	
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		333			510			201			368	
Travel Time (s)		5.7			8.7			4.6			8.4	
Volume (vph)	15	1055	145	350	990	40	135	10	440	105	10	20
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Lane Group Flow (vph)	16	1264	0	368	1084	0	142	242	232	0	143	0
v/c Ratio	0.20	0.77		0.81	0.50		0.70	0.65	0.62		0.73	
Control Delay	47.6	23.8		51.3	6.3		57.5	15.3	13.7		59.6	
Queue Delay	0.0	0.0		0.0	0.1		0.0	0.0	0.0		0.0	
Total Delay	47.6	23.8		51.3	6.4		57.5	15.3	13.7		59.6	
Queue Length 50th (ft)	9	306		118	96		78	8	3		75	
Queue Length 95th (ft)	30	394		m#170	123		#156	83	73		#162	
Internal Link Dist (ft)		253			430			121			288	
Turn Bay Length (ft)	100			200			200					
Base Capacity (vph)	79	1640		458	2147		216	385	383		203	
Starvation Cap Reductn	0	0		0	259		0	0	0		0	
Spillback Cap Reductn	0	0		0	0		0	0	0		0	
Storage Cap Reductn	0	0		0	0		0	0	0		0	
Reduced v/c Ratio	0.20	0.77		0.80	0.57		0.66	0.63	0.61		0.70	

Intersection Summary

Area Type: Other

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		150	0		0	0		0	0		250
Storage Lanes	0		1	2		0	0		0	2		1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)		250	10	50	250					50		50
Trailing Detector (ft)		244	0	0	244					0		0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		499			411			485			414	
Travel Time (s)		8.5			7.0			11.0			9.4	
Lane Group Flow (vph)	0	853	242	526	632	0	0	0	0	979	0	347
v/c Ratio		0.52	0.37	0.69	0.30					0.88		0.52
Control Delay		15.1	7.4	24.6	11.7					39.4		9.4
Queue Delay		0.0	0.0	0.0	0.0					0.0		0.0
Total Delay		15.1	7.4	24.6	11.7					39.4		9.4
Queue Length 50th (ft)		147	60	144	147					264		33
Queue Length 95th (ft)		210	137	182	198					#371		108
Internal Link Dist (ft)		419			331			405			334	
Turn Bay Length (ft)			150									250
Base Capacity (vph)		1634	650	1068	2080					1144		679
Starvation Cap Reductn		0	0	0	0					0		0
Spillback Cap Reductn		0	0	0	0					0		0
Storage Cap Reductn		0	0	0	0					0		0
Reduced v/c Ratio		0.52	0.37	0.49	0.30					0.86		0.51

Intersection Summary	
Area Type:	Other

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0	0		200	0
Storage Lanes		1	0		1	2
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)		9	15		15	9
Right Turn on Red		Yes				Yes
Link Speed (mph)	40			40	30	
Link Distance (ft)	442			446	306	
Travel Time (s)	7.5			7.6	7.0	
Lane Group Flow (vph)	1589	242	0	2074	200	663
v/c Ratio	0.59	0.27		0.61	0.30	0.62
Control Delay	6.8	2.6		15.4	21.2	24.7
Queue Delay	0.0	0.0		0.0	0.0	0.0
Total Delay	6.8	2.6		15.4	21.2	24.7
Queue Length 50th (ft)	157	28		222	78	162
Queue Length 95th (ft)	m145	m15		259	131	227
Internal Link Dist (ft)	362			366	226	
Turn Bay Length (ft)					200	
Base Capacity (vph)	2712	894		3418	669	1072
Starvation Cap Reductn	0	0		0	0	0
Spillback Cap Reductn	0	0		0	0	0
Storage Cap Reductn	0	0		0	0	0
Reduced v/c Ratio	0.59	0.27		0.61	0.30	0.62

Intersection Summary	
Area Type:	Other

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	250		100	200		0	0		0
Storage Lanes	1		0	2		0	1		1	0		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50	50	50	50	
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		355			499			201			312	
Travel Time (s)		6.1			8.5			4.6			7.1	
Lane Group Flow (vph)	11	1000	0	105	874	0	16	57	49	0	48	0
v/c Ratio	0.14	0.52		0.46	0.40		0.05	0.17	0.15		0.31	
Control Delay	45.4	15.5		43.5	5.1		31.3	14.1	10.9		36.7	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0		0.0	
Total Delay	45.4	15.5		43.5	5.1		31.3	14.1	10.9		36.7	
Queue Length 50th (ft)	6	199		32	52		8	5	0		20	
Queue Length 95th (ft)	23	276		59	101		25	40	31		53	
Internal Link Dist (ft)		275			419			121			232	
Turn Bay Length (ft)	100			250			200					
Base Capacity (vph)	79	1917		229	2172		346	341	334		322	
Starvation Cap Reductn	0	0		0	0		0	0	0		0	
Spillback Cap Reductn	0	0		0	0		0	0	0		0	
Storage Cap Reductn	0	0		0	0		0	0	0		0	
Reduced v/c Ratio	0.14	0.52		0.46	0.40		0.05	0.17	0.15		0.15	

Intersection Summary	
Area Type:	Other

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		150	0		0	0		0	0		250
Storage Lanes	0		1	2		0	0		0	2		1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)		250	10	50	250					50		50
Trailing Detector (ft)		244	0	0	244					0		0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		505			411			485			414	
Travel Time (s)		8.6			7.0			11.0			9.4	
Lane Group Flow (vph)	0	1305	379	621	1084	0	0	0	0	800	0	368
v/c Ratio		0.71	0.50	0.78	0.48					0.85		0.74
Control Delay		16.0	2.4	26.4	14.4					40.5		30.8
Queue Delay		0.0	0.0	0.0	0.0					0.0		0.0
Total Delay		16.0	2.4	26.4	14.4					40.5		30.8
Queue Length 50th (ft)		139	1	173	285					216		132
Queue Length 95th (ft)		230	m18	232	362					286		238
Internal Link Dist (ft)		425			331			405			334	
Turn Bay Length (ft)			150									250
Base Capacity (vph)		1829	757	839	2252					992		514
Starvation Cap Reductn		0	0	0	0					0		0
Spillback Cap Reductn		0	0	0	0					0		0
Storage Cap Reductn		0	0	0	0					0		0
Reduced v/c Ratio		0.71	0.50	0.74	0.48					0.81		0.72

Intersection Summary	
Area Type:	Other

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0	0		200	0
Storage Lanes		1	0		1	2
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)		9	15		15	9
Right Turn on Red		Yes				Yes
Link Speed (mph)	40			40	30	
Link Distance (ft)	442			435	306	
Travel Time (s)	7.5			7.4	7.0	
Lane Group Flow (vph)	1505	600	0	2421	358	579
v/c Ratio	0.57	0.57		0.72	0.52	0.52
Control Delay	6.8	5.3		18.1	24.4	21.9
Queue Delay	0.0	0.0		0.0	0.0	0.0
Total Delay	6.8	5.3		18.1	24.4	21.9
Queue Length 50th (ft)	176	140		290	153	131
Queue Length 95th (ft)	176	m236		336	237	186
Internal Link Dist (ft)	362			355	226	
Turn Bay Length (ft)					200	
Base Capacity (vph)	2656	1051		3346	688	1105
Starvation Cap Reductn	0	0		0	0	0
Spillback Cap Reductn	0	0		0	0	0
Storage Cap Reductn	0	0		0	0	0
Reduced v/c Ratio	0.57	0.57		0.72	0.52	0.52

Intersection Summary	
Area Type:	Other

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	250		100	200		0	0		0
Storage Lanes	1		0	2		0	1		1	0		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50	50	50	50	
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		355			505			201			312	
Travel Time (s)		6.1			8.6			4.6			7.1	
Lane Group Flow (vph)	16	1264	0	368	1084	0	142	242	232	0	143	0
v/c Ratio	0.19	0.78		0.80	0.51		0.66	0.62	0.60		0.74	
Control Delay	46.8	24.6		56.4	14.4		53.5	14.0	12.4		60.1	
Queue Delay	0.0	0.0		0.0	0.2		0.0	0.0	0.0		0.0	
Total Delay	46.8	24.6		56.4	14.6		53.5	14.0	12.4		60.1	
Queue Length 50th (ft)	9	306		112	295		78	6	0		75	
Queue Length 95th (ft)	30	394		m#173	379		#156	80	69		#162	
Internal Link Dist (ft)		275			425			121			232	
Turn Bay Length (ft)	100			250			200					
Base Capacity (vph)	85	1612		458	2123		216	388	387		202	
Starvation Cap Reductn	0	0		0	375		0	0	0		0	
Spillback Cap Reductn	0	0		0	0		0	0	0		0	
Storage Cap Reductn	0	0		0	0		0	0	0		0	
Reduced v/c Ratio	0.19	0.78		0.80	0.62		0.66	0.62	0.60		0.71	

Intersection Summary

Area Type: Other

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		150	0		0	0		0	0		250
Storage Lanes	0		1	2		0	0		0	2		1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)		250	10	50	250					50		50
Trailing Detector (ft)		244	0	0	244					0		0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		499			411			485			414	
Travel Time (s)		8.5			7.0			11.0			9.4	
Lane Group Flow (vph)	0	926	200	989	716	0	0	0	0	1063	0	358
v/c Ratio		0.72	0.43	1.00	0.41					0.93		0.58
Control Delay		24.5	10.6	37.9	4.6					34.1		11.1
Queue Delay		2.3	0.0	0.0	0.0					0.0		0.0
Total Delay		26.8	10.6	37.9	4.6					34.1		11.1
Queue Length 50th (ft)		144	52	85	45					154		44
Queue Length 95th (ft)		182	117	m#370	m86					#281		89
Internal Link Dist (ft)		419			331			405			334	
Turn Bay Length (ft)			150									250
Base Capacity (vph)		1282	462	992	1730					1144		618
Starvation Cap Reductn		0	0	0	0					0		0
Spillback Cap Reductn		226	0	0	0					0		0
Storage Cap Reductn		0	0	0	0					0		0
Reduced v/c Ratio		0.88	0.43	1.00	0.41					0.93		0.58

Intersection Summary	
Area Type:	Other

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		400	0		0	0		0
Storage Lanes	1		0	0		1	1		1	0		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	250			250	10	50		50			
Trailing Detector (ft)	0	244			244	0	0		0			
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		411			535			399			497	
Travel Time (s)		7.0			9.1			9.1			11.3	
Volume (vph)	230	1660	0	0	1420	1140	200	0	690	0	0	0
Confl. Peds. (#/hr)						20			20			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Lane Group Flow (vph)	242	1747	0	0	1495	1200	211	0	726	0	0	0
v/c Ratio	0.26	0.63			0.85	0.77	0.43		0.97			
Control Delay	0.6	7.1			36.6	3.8	16.7		45.0			
Queue Delay	0.0	0.0			0.0	0.0	0.0		0.0			
Total Delay	0.6	7.1			36.6	3.8	16.7		45.0			
Queue Length 50th (ft)	0	147			232	0	45		101			
Queue Length 95th (ft)	m0	m168			277	0	75		#236			
Internal Link Dist (ft)		331			455			319			417	
Turn Bay Length (ft)						400						
Base Capacity (vph)	954	2825			1780	1555	486		749			
Starvation Cap Reductn	0	0			0	0	0		0			
Spillback Cap Reductn	0	0			0	0	0		0			
Storage Cap Reductn	0	0			0	0	0		0			
Reduced v/c Ratio	0.25	0.62			0.84	0.77	0.43		0.97			

Intersection Summary

Area Type: Other

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		150	200		100	200		0	0		0
Storage Lanes	1		0	2		0	1		1	0		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50	50	50	50	
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		355			499			201			312	
Travel Time (s)		6.1			8.5			4.6			7.1	
Lane Group Flow (vph)	11	1031	0	105	969	0	16	57	49	0	48	0
v/c Ratio	0.14	0.54		0.46	0.45		0.05	0.17	0.15		0.31	
Control Delay	45.4	15.8		40.9	6.0		31.3	14.1	10.9		36.7	
Queue Delay	0.0	0.0		0.0	0.1		0.0	0.0	0.0		0.0	
Total Delay	45.4	15.8		40.9	6.1		31.3	14.1	10.9		36.7	
Queue Length 50th (ft)	6	207		32	78		8	5	0		20	
Queue Length 95th (ft)	23	287		m55	190		25	40	31		53	
Internal Link Dist (ft)		275			419			121			232	
Turn Bay Length (ft)	100			200			200					
Base Capacity (vph)	79	1917		229	2172		346	341	334		322	
Starvation Cap Reductn	0	0		0	350		0	0	0		0	
Spillback Cap Reductn	0	0		0	0		0	0	0		0	
Storage Cap Reductn	0	0		0	0		0	0	0		0	
Reduced v/c Ratio	0.14	0.54		0.46	0.53		0.05	0.17	0.15		0.15	

Intersection Summary	
Area Type:	Other

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		150	0		0	0		0	0		250
Storage Lanes	0		1	2		0	0		0	2		1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)		250	10	50	250					50		50
Trailing Detector (ft)		244	0	0	244					0		0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		510			407			472			394	
Travel Time (s)		8.7			6.9			10.7			9.0	
Volume (vph)	0	1310	330	750	1150	0	0	0	0	870	0	300
Confl. Peds. (#/hr)			20									20
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Lane Group Flow (vph)	0	1379	347	789	1211	0	0	0	0	916	0	316
v/c Ratio		1.02	0.65	0.70	0.59					0.79		0.56
Control Delay		53.0	8.2	14.6	13.2					35.2		25.3
Queue Delay		0.0	0.0	1.2	2.3					0.1		0.0
Total Delay		53.0	8.2	15.8	15.4					35.3		25.3
Queue Length 50th (ft)		~274	57	282	384					263		127
Queue Length 95th (ft)		#338	m61	m288	m392					339		214
Internal Link Dist (ft)		430			327			392			314	
Turn Bay Length (ft)			150									250
Base Capacity (vph)		1346	534	1135	2054					1202		580
Starvation Cap Reductn		0	0	161	673					0		0
Spillback Cap Reductn		0	0	0	0					11		0
Storage Cap Reductn		0	0	0	0					0		0
Reduced v/c Ratio		1.02	0.65	0.81	0.88					0.77		0.54

Intersection Summary

Area Type: Other

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		400	0		320	0		0
Storage Lanes	1		0	0		1	1		1	0		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	250			250	10	50		50			
Trailing Detector (ft)	0	244			244	0	0		0			
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		407			583			506			476	
Travel Time (s)		6.9			9.9			11.5			10.8	
Volume (vph)	550	1630	0	0	1610	980	290	0	970	0	0	0
Confl. Peds. (#/hr)						20			20			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Lane Group Flow (vph)	579	1716	0	0	1695	1032	305	0	1021	0	0	0
v/c Ratio	0.90	0.68			0.98	0.66	0.41		0.90			
Control Delay	16.0	6.1			54.2	2.3	21.9		38.8			
Queue Delay	0.0	0.7			5.9	0.0	0.2		0.0			
Total Delay	16.0	6.8			60.1	2.3	22.1		38.8			
Queue Length 50th (ft)	207	204			311	0	131		328			
Queue Length 95th (ft)	m202	m214			#397	0	201		#473			
Internal Link Dist (ft)		327			503			426			396	
Turn Bay Length (ft)						400			320			
Base Capacity (vph)	641	2525			1730	1555	761		1148			
Starvation Cap Reductn	0	439			0	0	0		0			
Spillback Cap Reductn	0	0			48	0	85		0			
Storage Cap Reductn	0	0			0	0	0		0			
Reduced v/c Ratio	0.90	0.82			1.01	0.66	0.45		0.89			

Intersection Summary

Area Type: Other

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		150	200		0	200		0	0		0
Storage Lanes	1		0	2		0	1		1	0		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50	50	50	50	
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		333			510			201			368	
Travel Time (s)		5.7			8.7			4.6			8.4	
Lane Group Flow (vph)	16	1306	0	368	1158	0	142	242	232	0	143	0
v/c Ratio	0.23	0.85		0.68	0.54		0.66	0.62	0.60		0.67	
Control Delay	54.2	33.0		61.3	6.7		56.2	14.1	12.4		54.9	
Queue Delay	0.0	0.0		0.0	0.1		0.0	0.0	0.0		0.0	
Total Delay	54.2	33.0		61.3	6.8		56.2	14.1	12.4		54.9	
Queue Length 50th (ft)	10	398		128	78		86	6	0		83	
Queue Length 95th (ft)	32	#595		176	175		150	82	71		146	
Internal Link Dist (ft)		253			430			121			288	
Turn Bay Length (ft)	100			200			200					
Base Capacity (vph)	71	1543		652	2140		248	411	410		252	
Starvation Cap Reductn	0	0		0	183		0	0	0		0	
Spillback Cap Reductn	0	0		0	0		0	0	0		0	
Storage Cap Reductn	0	0		0	0		0	0	0		0	
Reduced v/c Ratio	0.23	0.85		0.56	0.59		0.57	0.59	0.57		0.57	

Intersection Summary

Area Type: Other

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		150	0		0	0		0	0		250
Storage Lanes	0		1	2		0	0		0	2		1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)		250	10	50	250					50		50
Trailing Detector (ft)		244	0	0	244					0		0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		499			411			485			414	
Travel Time (s)		8.5			7.0			11.0			9.4	
Lane Group Flow (vph)	0	926	200	989	716	0	0	0	0	1063	0	358
v/c Ratio		0.82	0.41	0.92	0.35					0.94		0.56
Control Delay		27.0	9.7	32.3	13.2					45.4		13.1
Queue Delay		0.0	0.0	0.0	0.0					0.0		0.0
Total Delay		27.0	9.7	32.3	13.2					45.4		13.1
Queue Length 50th (ft)		184	53	284	170					297		59
Queue Length 95th (ft)		235	110	#405	226					#425		146
Internal Link Dist (ft)		419			331			405			334	
Turn Bay Length (ft)			150									250
Base Capacity (vph)		1132	492	1076	2054					1144		648
Starvation Cap Reductn		0	0	0	0					0		0
Spillback Cap Reductn		0	0	0	0					0		0
Storage Cap Reductn		0	0	0	0					0		0
Reduced v/c Ratio		0.82	0.41	0.92	0.35					0.93		0.55

Intersection Summary	
Area Type:	Other

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0	0		200	0
Storage Lanes		1	0		1	2
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)		9	15		15	9
Right Turn on Red		Yes				Yes
Link Speed (mph)	40			40	30	
Link Distance (ft)	442			446	306	
Travel Time (s)	7.5			7.6	7.0	
Lane Group Flow (vph)	1747	242	0	2695	211	726
v/c Ratio	0.58	0.25		0.71	0.37	0.79
Control Delay	1.5	0.4		14.5	25.8	34.0
Queue Delay	0.0	0.0		0.0	0.0	0.0
Total Delay	1.5	0.4		14.5	25.8	34.0
Queue Length 50th (ft)	0	0		291	92	202
Queue Length 95th (ft)	m0	m0		334	153	280
Internal Link Dist (ft)	362			366	226	
Turn Bay Length (ft)					200	
Base Capacity (vph)	2995	962		3774	570	919
Starvation Cap Reductn	0	0		0	0	0
Spillback Cap Reductn	0	0		0	0	0
Storage Cap Reductn	0	0		0	0	0
Reduced v/c Ratio	0.58	0.25		0.71	0.37	0.79

Intersection Summary	
Area Type:	Other

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	250		100	200		0	0		0
Storage Lanes	1		0	2		0	1		1	0		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50	50	50	50	
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		355			499			201			312	
Travel Time (s)		6.1			8.5			4.6			7.1	
Lane Group Flow (vph)	11	1031	0	105	969	0	16	11	95	0	48	0
v/c Ratio	0.14	0.54		0.46	0.45		0.05	0.03	0.25		0.31	
Control Delay	45.4	15.8		43.3	5.4		31.3	31.1	8.9		36.7	
Queue Delay	0.0	0.0		0.0	0.1		0.0	0.0	0.0		0.0	
Total Delay	45.4	15.8		43.3	5.4		31.3	31.1	8.9		36.7	
Queue Length 50th (ft)	6	207		32	64		8	5	0		20	
Queue Length 95th (ft)	23	287		m59	112		26	21	40		53	
Internal Link Dist (ft)		275			419			121			232	
Turn Bay Length (ft)	100			250			200					
Base Capacity (vph)	79	1917		229	2172		329	346	386		322	
Starvation Cap Reductn	0	0		0	232		0	0	0		0	
Spillback Cap Reductn	0	0		0	0		0	0	0		0	
Storage Cap Reductn	0	0		0	0		0	0	0		0	
Reduced v/c Ratio	0.14	0.54		0.46	0.50		0.05	0.03	0.25		0.15	

Intersection Summary	
Area Type:	Other

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		150	0		0	0		0	0		250
Storage Lanes	0		1	2		0	0		0	2		1
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)		250	10	50	250					50		50
Trailing Detector (ft)		244	0	0	244					0		0
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		505			411			485			414	
Travel Time (s)		8.6			7.0			11.0			9.4	
Lane Group Flow (vph)	0	1379	347	789	1211	0	0	0	0	916	0	316
v/c Ratio		0.87	0.52	0.89	0.55					0.91		0.63
Control Delay		23.6	5.0	23.2	12.3					44.3		26.8
Queue Delay		0.0	0.0	0.0	0.0					0.0		0.0
Total Delay		23.6	5.0	23.2	12.4					44.3		26.8
Queue Length 50th (ft)		293	39	186	356					255		115
Queue Length 95th (ft)		m350	m43	m198	m393					#365		206
Internal Link Dist (ft)		425			331			405			334	
Turn Bay Length (ft)			150									250
Base Capacity (vph)		1594	666	887	2182					1030		508
Starvation Cap Reductn		0	0	0	0					0		0
Spillback Cap Reductn		0	0	0	85					0		2
Storage Cap Reductn		0	0	0	0					0		0
Reduced v/c Ratio		0.87	0.52	0.89	0.58					0.89		0.62

Intersection Summary	
Area Type:	Other

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0	0		200	0
Storage Lanes		1	0		1	2
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Turning Speed (mph)		9	15		15	9
Right Turn on Red		Yes				Yes
Link Speed (mph)	40			40	30	
Link Distance (ft)	442			435	306	
Travel Time (s)	7.5			7.4	7.0	
Lane Group Flow (vph)	1716	579	0	2726	305	1021
v/c Ratio	0.74	0.59		0.93	0.38	0.80
Control Delay	10.3	5.9		30.8	17.9	26.7
Queue Delay	0.0	0.0		0.0	0.0	0.0
Total Delay	10.3	5.9		30.8	17.9	26.7
Queue Length 50th (ft)	238	149		411	110	271
Queue Length 95th (ft)	m273	m180		#479	174	364
Internal Link Dist (ft)	362			355	226	
Turn Bay Length (ft)					200	
Base Capacity (vph)	2317	982		2919	806	1275
Starvation Cap Reductn	0	0		0	0	0
Spillback Cap Reductn	0	0		0	0	0
Storage Cap Reductn	0	0		0	0	0
Reduced v/c Ratio	0.74	0.59		0.93	0.38	0.80

Intersection Summary

Area Type: Other

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	250		100	200		0	0		0
Storage Lanes	1		0	2		0	1		1	0		0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Leading Detector (ft)	50	50		50	50		50	50	50	50	50	
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	
Turning Speed (mph)	15		9	15		9	15		9	15		9
Right Turn on Red			Yes			Yes			Yes			Yes
Link Speed (mph)		40			40			30			30	
Link Distance (ft)		355			505			201			312	
Travel Time (s)		6.1			8.6			4.6			7.1	
Lane Group Flow (vph)	16	1306	0	368	1158	0	142	232	242	0	143	0
v/c Ratio	0.13	0.88		0.80	0.57		0.55	0.57	0.57		0.64	
Control Delay	41.3	33.2		44.0	7.1		45.0	12.1	10.8		48.5	
Queue Delay	0.0	0.0		0.0	0.1		0.0	0.0	0.0		0.0	
Total Delay	41.3	33.2		44.0	7.2		45.0	12.1	10.8		48.5	
Queue Length 50th (ft)	9	354		117	67		76	6	0		73	
Queue Length 95th (ft)	28	#509		#180	382		136	74	69		132	
Internal Link Dist (ft)		275			425			121			232	
Turn Bay Length (ft)	100			250			200					
Base Capacity (vph)	236	1476		458	2020		256	408	424		261	
Starvation Cap Reductn	0	0		0	119		0	0	0		0	
Spillback Cap Reductn	0	0		0	0		0	0	0		0	
Storage Cap Reductn	0	0		0	0		0	0	0		0	
Reduced v/c Ratio	0.07	0.88		0.80	0.61		0.55	0.57	0.57		0.55	

Intersection Summary

Area Type: Other

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

APPENDIX O

RAMP METER QUEUE WORKSHEETS -– AVENIDA PICO INTERCHANGE

PM PEAK HOUR QUEUE CALCULATION
(Avenida Pico NB)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	4.30%	4.3%	126	126	165	0	0	0	0
2	4.70%	9.0%	138	264	165	0	0	0	0.00
3	4.80%	13.8%	141	405	165	0	0	0	0.00
4	4.90%	18.7%	144	549	165	0	0	0	0.00
5	4.80%	23.5%	141	689	165	0	0	0	0.00
6	4.90%	28.4%	144	833	165	0	0	0	0.00
7	5.00%	33.4%	147	980	165	0	0	0	0.00
8	5.10%	38.5%	150	1130	165	0	0	0	0.00
9	5.20%	43.7%	153	1282	165	0	0	0	0.00
10	5.30%	49.0%	156	1438	165	0	0	0	0.00
11	5.50%	54.5%	161	1599	165	0	0	0	0.00
12	5.70%	60.2%	167	1766	165	2	2	167	0.00
13	5.90%	66.1%	173	1939	165	8	10	340	1.03
14	5.80%	71.9%	170	2110	165	5	16	511	1.55
15	5.50%	77.4%	161	2271	165	0	12	672	1.19
16	5.20%	82.6%	153	2423	165	0	0	0	0.00
17	4.80%	87.4%	141	2564	165	0	0	0	0.00
18	4.60%	92.0%	135	2699	165	0	0	0	0.00
19	4.20%	96.2%	123	2823	165	0	0	0	0.00
20	3.80%	100.0%	111	2934	165	0	0	0	0.00
Peak Period Volume =			2934	PH Cap. =	550	Max Q =	16	672	3.77
Maximum 1-hour volume =			1590	Lanes =	3	Average Delay =		0.34	Mins/Veh
Maximum Queue Length (vehicles) =				5					
Maximum Queue Length (feet) =				155					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

PM PEAK HOUR QUEUE CALCULATION
(Avenida Pico SB)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	4.30%	4.3%	75	75	100	0	0	0	0
2	4.70%	9.0%	82	158	100	0	0	0	0.00
3	4.80%	13.8%	84	242	100	0	0	0	0.00
4	4.90%	18.7%	86	328	100	0	0	0	0.00
5	4.80%	23.5%	84	412	100	0	0	0	0.00
6	4.90%	28.4%	86	498	100	0	0	0	0.00
7	5.00%	33.4%	88	586	100	0	0	0	0.00
8	5.10%	38.5%	89	675	100	0	0	0	0.00
9	5.20%	43.7%	91	766	100	0	0	0	0.00
10	5.30%	49.0%	93	859	100	0	0	0	0.00
11	5.50%	54.5%	96	955	100	0	0	0	0.00
12	5.70%	60.2%	100	1055	100	0	0	0	0.00
13	5.90%	66.1%	103	1159	100	3	3	103	0.00
14	5.80%	71.9%	102	1260	100	2	5	205	0.51
15	5.50%	77.4%	96	1357	100	0	2	302	0.15
16	5.20%	82.6%	91	1448	100	0	0	0	0.00
17	4.80%	87.4%	84	1532	100	0	0	0	0.00
18	4.60%	92.0%	81	1613	100	0	0	0	0.00
19	4.20%	96.2%	74	1686	100	0	0	0	0.00
20	3.80%	100.0%	67	1753	100	0	0	0	0.00
Peak Period Volume =			1753	PH Cap. =	500	Max Q =	5	302	0.66
Maximum 1-hour volume =			950	Lanes =	2	Average Delay =		0.13	Mins/Veh
Maximum Queue Length (vehicles) =				3					
Maximum Queue Length (feet) =				77					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

AM PEAK HOUR QUEUE CALCULATION
(2018 DV-A, NB, AM)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	3.40%	3.4%	71	71	120	0	0	0	0
2	4.50%	7.9%	94	165	120	0	0	0	0.00
3	5.40%	13.3%	113	278	120	0	0	0	0.00
4	5.70%	19.0%	119	397	120	0	0	0	0.00
5	5.90%	24.9%	123	521	120	3	3	123	0.00
6	5.90%	30.8%	123	644	120	3	7	247	0.69
7	5.90%	36.7%	123	768	120	3	10	370	1.03
8	5.80%	42.5%	121	889	120	1	12	492	1.16
9	5.70%	48.2%	119	1008	120	0	11	611	1.09
10	5.60%	53.8%	117	1125	120	0	8	728	0.80
11	5.40%	59.2%	113	1238	120	0	1	841	0.10
12	5.10%	64.3%	107	1345	120	0	0	0	0.00
13	5.00%	69.3%	105	1450	120	0	0	0	0.00
14	4.90%	74.2%	103	1552	120	0	0	0	0.00
15	4.50%	78.7%	94	1646	120	0	0	0	0.00
16	4.40%	83.1%	92	1738	120	0	0	0	0.00
17	4.30%	87.4%	90	1828	120	0	0	0	0.00
18	4.20%	91.6%	88	1916	120	0	0	0	0.00
19	4.20%	95.8%	88	2004	120	0	0	0	0.00
20	4.20%	100.0%	88	2092	120	0	0	0	0.00
Peak Period Volume =			2092	PH Cap. =	400	Max Q =	12	841	4.86
Maximum 1-hour volume =			1180	Lanes =	3	Average Delay =		0.35	Mins/Veh
Maximum Queue Length (vehicles) =				4					
Maximum Queue Length (feet) =				116					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

PM PEAK HOUR QUEUE CALCULATION
(2018 DV-A, NB, PM)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	4.30%	4.3%	112	112	150	0	0	0	0
2	4.70%	9.0%	122	234	150	0	0	0	0.00
3	4.80%	13.8%	125	359	150	0	0	0	0.00
4	4.90%	18.7%	127	487	150	0	0	0	0.00
5	4.80%	23.5%	125	611	150	0	0	0	0.00
6	4.90%	28.4%	127	739	150	0	0	0	0.00
7	5.00%	33.4%	130	869	150	0	0	0	0.00
8	5.10%	38.5%	133	1002	150	0	0	0	0.00
9	5.20%	43.7%	135	1137	150	0	0	0	0.00
10	5.30%	49.0%	138	1275	150	0	0	0	0.00
11	5.50%	54.5%	143	1418	150	0	0	0	0.00
12	5.70%	60.2%	148	1566	150	0	0	0	0.00
13	5.90%	66.1%	154	1720	150	4	4	154	0.00
14	5.80%	71.9%	151	1871	150	1	4	304	0.44
15	5.50%	77.4%	143	2014	150	0	0	0	0.00
16	5.20%	82.6%	135	2149	150	0	0	0	0.00
17	4.80%	87.4%	125	2274	150	0	0	0	0.00
18	4.60%	92.0%	120	2394	150	0	0	0	0.00
19	4.20%	96.2%	109	2503	150	0	0	0	0.00
20	3.80%	100.0%	99	2602	150	0	0	0	0.00
Peak Period Volume =			2602	PH Cap. =	500	Max Q =	4	304	0.44
Maximum 1-hour volume =			1410	Lanes =	3	Average Delay =		0.09	Mins/Veh
Maximum Queue Length (vehicles) =				1					
Maximum Queue Length (feet) =				44					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

AM PEAK HOUR QUEUE CALCULATION
(2018 DV-A, SB, AM)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	3.40%	3.4%	48	48	80	0	0	0	0
2	4.50%	7.9%	63	111	80	0	0	0	0.00
3	5.40%	13.3%	76	186	80	0	0	0	0.00
4	5.70%	19.0%	80	266	80	0	0	0	0.00
5	5.90%	24.9%	83	349	80	3	3	83	0.00
6	5.90%	30.8%	83	431	80	3	5	165	0.52
7	5.90%	36.7%	83	514	80	3	8	248	0.78
8	5.80%	42.5%	81	595	80	1	9	329	0.90
9	5.70%	48.2%	80	675	80	0	9	409	0.88
10	5.60%	53.8%	78	753	80	0	7	487	0.72
11	5.40%	59.2%	76	829	80	0	3	563	0.28
12	5.10%	64.3%	71	900	80	0	0	0	0.00
13	5.00%	69.3%	70	970	80	0	0	0	0.00
14	4.90%	74.2%	69	1039	80	0	0	0	0.00
15	4.50%	78.7%	63	1102	80	0	0	0	0.00
16	4.40%	83.1%	62	1163	80	0	0	0	0.00
17	4.30%	87.4%	60	1224	80	0	0	0	0.00
18	4.20%	91.6%	59	1282	80	0	0	0	0.00
19	4.20%	95.8%	59	1341	80	0	0	0	0.00
20	4.20%	100.0%	59	1400	80	0	0	0	0.00
Peak Period Volume =			1400	PH Cap. =	400	Max Q =	9	563	4.08
Maximum 1-hour volume =			790	Lanes =	2	Average Delay =		0.43	Mins/Veh
Maximum Queue Length (vehicles) =				4					
Maximum Queue Length (feet) =				135					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

PM PEAK HOUR QUEUE CALCULATION
(2018 DV-A, SB, PM)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	4.30%	4.3%	71	71	90	0	0	0	0
2	4.70%	9.0%	77	148	90	0	0	0	0.00
3	4.80%	13.8%	79	227	90	0	0	0	0.00
4	4.90%	18.7%	80	307	90	0	0	0	0.00
5	4.80%	23.5%	79	386	90	0	0	0	0.00
6	4.90%	28.4%	80	466	90	0	0	0	0.00
7	5.00%	33.4%	82	548	90	0	0	0	0.00
8	5.10%	38.5%	84	632	90	0	0	0	0.00
9	5.20%	43.7%	85	718	90	0	0	0	0.00
10	5.30%	49.0%	87	805	90	0	0	0	0.00
11	5.50%	54.5%	90	895	90	0	0	90	0.00
12	5.70%	60.2%	94	988	90	4	4	184	0.39
13	5.90%	66.1%	97	1085	90	7	11	281	1.08
14	5.80%	71.9%	95	1181	90	5	16	376	1.60
15	5.50%	77.4%	90	1271	90	0	16	466	1.63
16	5.20%	82.6%	85	1356	90	0	12	552	1.17
17	4.80%	87.4%	79	1435	90	0	1	631	0.05
18	4.60%	92.0%	76	1511	90	0	0	0	0.00
19	4.20%	96.2%	69	1580	90	0	0	0	0.00
20	3.80%	100.0%	62	1642	90	0	0	0	0.00
Peak Period Volume =			1642	PH Cap. =	450	Max Q =	16	631	5.93
Maximum 1-hour volume =			890	Lanes =	2	Average Delay =		0.56	Mins/Veh
Maximum Queue Length (vehicles) =				8					
Maximum Queue Length (feet) =				245					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

AM PEAK HOUR QUEUE CALCULATION
(2018 DV-A, NB, AM)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	3.40%	3.4%	71	71	120	0	0	0	0
2	4.50%	7.9%	94	165	120	0	0	0	0.00
3	5.40%	13.3%	113	278	120	0	0	0	0.00
4	5.70%	19.0%	119	397	120	0	0	0	0.00
5	5.90%	24.9%	123	521	120	3	3	123	0.00
6	5.90%	30.8%	123	644	120	3	7	247	0.69
7	5.90%	36.7%	123	768	120	3	10	370	1.03
8	5.80%	42.5%	121	889	120	1	12	492	1.16
9	5.70%	48.2%	119	1008	120	0	11	611	1.09
10	5.60%	53.8%	117	1125	120	0	8	728	0.80
11	5.40%	59.2%	113	1238	120	0	1	841	0.10
12	5.10%	64.3%	107	1345	120	0	0	0	0.00
13	5.00%	69.3%	105	1450	120	0	0	0	0.00
14	4.90%	74.2%	103	1552	120	0	0	0	0.00
15	4.50%	78.7%	94	1646	120	0	0	0	0.00
16	4.40%	83.1%	92	1738	120	0	0	0	0.00
17	4.30%	87.4%	90	1828	120	0	0	0	0.00
18	4.20%	91.6%	88	1916	120	0	0	0	0.00
19	4.20%	95.8%	88	2004	120	0	0	0	0.00
20	4.20%	100.0%	88	2092	120	0	0	0	0.00
Peak Period Volume =			2092	PH Cap. =	400	Max Q =	12	841	4.86
Maximum 1-hour volume =			1180	Lanes =	3	Average Delay =		0.35	Mins/Veh
Maximum Queue Length (vehicles) =				4					
Maximum Queue Length (feet) =				116					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

PM PEAK HOUR QUEUE CALCULATION
(2018 DV-A, NB, PM)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	4.30%	4.3%	112	112	150	0	0	0	0
2	4.70%	9.0%	122	234	150	0	0	0	0.00
3	4.80%	13.8%	125	359	150	0	0	0	0.00
4	4.90%	18.7%	127	487	150	0	0	0	0.00
5	4.80%	23.5%	125	611	150	0	0	0	0.00
6	4.90%	28.4%	127	739	150	0	0	0	0.00
7	5.00%	33.4%	130	869	150	0	0	0	0.00
8	5.10%	38.5%	133	1002	150	0	0	0	0.00
9	5.20%	43.7%	135	1137	150	0	0	0	0.00
10	5.30%	49.0%	138	1275	150	0	0	0	0.00
11	5.50%	54.5%	143	1418	150	0	0	0	0.00
12	5.70%	60.2%	148	1566	150	0	0	0	0.00
13	5.90%	66.1%	154	1720	150	4	4	154	0.00
14	5.80%	71.9%	151	1871	150	1	4	304	0.44
15	5.50%	77.4%	143	2014	150	0	0	0	0.00
16	5.20%	82.6%	135	2149	150	0	0	0	0.00
17	4.80%	87.4%	125	2274	150	0	0	0	0.00
18	4.60%	92.0%	120	2394	150	0	0	0	0.00
19	4.20%	96.2%	109	2503	150	0	0	0	0.00
20	3.80%	100.0%	99	2602	150	0	0	0	0.00
Peak Period Volume =			2602	PH Cap. =	500	Max Q =	4	304	0.44
Maximum 1-hour volume =			1410	Lanes =	3	Average Delay =		0.09	Mins/Veh
Maximum Queue Length (vehicles) =				1					
Maximum Queue Length (feet) =				44					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

AM PEAK HOUR QUEUE CALCULATION
(2018 DV-A, SB, AM)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	3.40%	3.4%	48	48	80	0	0	0	0
2	4.50%	7.9%	63	111	80	0	0	0	0.00
3	5.40%	13.3%	76	186	80	0	0	0	0.00
4	5.70%	19.0%	80	266	80	0	0	0	0.00
5	5.90%	24.9%	83	349	80	3	3	83	0.00
6	5.90%	30.8%	83	431	80	3	5	165	0.52
7	5.90%	36.7%	83	514	80	3	8	248	0.78
8	5.80%	42.5%	81	595	80	1	9	329	0.90
9	5.70%	48.2%	80	675	80	0	9	409	0.88
10	5.60%	53.8%	78	753	80	0	7	487	0.72
11	5.40%	59.2%	76	829	80	0	3	563	0.28
12	5.10%	64.3%	71	900	80	0	0	0	0.00
13	5.00%	69.3%	70	970	80	0	0	0	0.00
14	4.90%	74.2%	69	1039	80	0	0	0	0.00
15	4.50%	78.7%	63	1102	80	0	0	0	0.00
16	4.40%	83.1%	62	1163	80	0	0	0	0.00
17	4.30%	87.4%	60	1224	80	0	0	0	0.00
18	4.20%	91.6%	59	1282	80	0	0	0	0.00
19	4.20%	95.8%	59	1341	80	0	0	0	0.00
20	4.20%	100.0%	59	1400	80	0	0	0	0.00
Peak Period Volume =			1400	PH Cap. =	400	Max Q =	9	563	4.08
Maximum 1-hour volume =			790	Lanes =	2	Average Delay =		0.43	Mins/Veh
Maximum Queue Length (vehicles) =				4					
Maximum Queue Length (feet) =				135					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

PM PEAK HOUR QUEUE CALCULATION
(2018 DV-A, SB, PM)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	4.30%	4.3%	71	71	90	0	0	0	0
2	4.70%	9.0%	77	148	90	0	0	0	0.00
3	4.80%	13.8%	79	227	90	0	0	0	0.00
4	4.90%	18.7%	80	307	90	0	0	0	0.00
5	4.80%	23.5%	79	386	90	0	0	0	0.00
6	4.90%	28.4%	80	466	90	0	0	0	0.00
7	5.00%	33.4%	82	548	90	0	0	0	0.00
8	5.10%	38.5%	84	632	90	0	0	0	0.00
9	5.20%	43.7%	85	718	90	0	0	0	0.00
10	5.30%	49.0%	87	805	90	0	0	0	0.00
11	5.50%	54.5%	90	895	90	0	0	90	0.00
12	5.70%	60.2%	94	988	90	4	4	184	0.39
13	5.90%	66.1%	97	1085	90	7	11	281	1.08
14	5.80%	71.9%	95	1181	90	5	16	376	1.60
15	5.50%	77.4%	90	1271	90	0	16	466	1.63
16	5.20%	82.6%	85	1356	90	0	12	552	1.17
17	4.80%	87.4%	79	1435	90	0	1	631	0.05
18	4.60%	92.0%	76	1511	90	0	0	0	0.00
19	4.20%	96.2%	69	1580	90	0	0	0	0.00
20	3.80%	100.0%	62	1642	90	0	0	0	0.00
Peak Period Volume =			1642	PH Cap. =	450	Max Q =	16	631	5.93
Maximum 1-hour volume =			890	Lanes =	2	Average Delay =		0.56	Mins/Veh
Maximum Queue Length (vehicles) =				8					
Maximum Queue Length (feet) =				245					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

AM PEAK HOUR QUEUE CALCULATION
(2018 DV-B, SB, AM)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	3.40%	3.4%	48	48	80	0	0	0	0
2	4.50%	7.9%	63	111	80	0	0	0	0.00
3	5.40%	13.3%	76	186	80	0	0	0	0.00
4	5.70%	19.0%	80	266	80	0	0	0	0.00
5	5.90%	24.9%	83	349	80	3	3	83	0.00
6	5.90%	30.8%	83	431	80	3	5	165	0.52
7	5.90%	36.7%	83	514	80	3	8	248	0.78
8	5.80%	42.5%	81	595	80	1	9	329	0.90
9	5.70%	48.2%	80	675	80	0	9	409	0.88
10	5.60%	53.8%	78	753	80	0	7	487	0.72
11	5.40%	59.2%	76	829	80	0	3	563	0.28
12	5.10%	64.3%	71	900	80	0	0	0	0.00
13	5.00%	69.3%	70	970	80	0	0	0	0.00
14	4.90%	74.2%	69	1039	80	0	0	0	0.00
15	4.50%	78.7%	63	1102	80	0	0	0	0.00
16	4.40%	83.1%	62	1163	80	0	0	0	0.00
17	4.30%	87.4%	60	1224	80	0	0	0	0.00
18	4.20%	91.6%	59	1282	80	0	0	0	0.00
19	4.20%	95.8%	59	1341	80	0	0	0	0.00
20	4.20%	100.0%	59	1400	80	0	0	0	0.00
Peak Period Volume =			1400	PH Cap. =	400	Max Q =	9	563	4.08
Maximum 1-hour volume =			790	Lanes =	2	Average Delay =		0.43	Mins/Veh
Maximum Queue Length (vehicles) =				4					
Maximum Queue Length (feet) =				135					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

PM PEAK HOUR QUEUE CALCULATION
(2018 DV-B, SB, PM)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	4.30%	4.3%	71	71	90	0	0	0	0
2	4.70%	9.0%	77	148	90	0	0	0	0.00
3	4.80%	13.8%	79	227	90	0	0	0	0.00
4	4.90%	18.7%	80	307	90	0	0	0	0.00
5	4.80%	23.5%	79	386	90	0	0	0	0.00
6	4.90%	28.4%	80	466	90	0	0	0	0.00
7	5.00%	33.4%	82	548	90	0	0	0	0.00
8	5.10%	38.5%	84	632	90	0	0	0	0.00
9	5.20%	43.7%	85	718	90	0	0	0	0.00
10	5.30%	49.0%	87	805	90	0	0	0	0.00
11	5.50%	54.5%	90	895	90	0	0	90	0.00
12	5.70%	60.2%	94	988	90	4	4	184	0.39
13	5.90%	66.1%	97	1085	90	7	11	281	1.08
14	5.80%	71.9%	95	1181	90	5	16	376	1.60
15	5.50%	77.4%	90	1271	90	0	16	466	1.63
16	5.20%	82.6%	85	1356	90	0	12	552	1.17
17	4.80%	87.4%	79	1435	90	0	1	631	0.05
18	4.60%	92.0%	76	1511	90	0	0	0	0.00
19	4.20%	96.2%	69	1580	90	0	0	0	0.00
20	3.80%	100.0%	62	1642	90	0	0	0	0.00
Peak Period Volume =			1642	PH Cap. =	450	Max Q =	16	631	5.93
Maximum 1-hour volume =			890	Lanes =	2	Average Delay =		0.56	Mins/Veh
Maximum Queue Length (vehicles) =				8					
Maximum Queue Length (feet) =				245					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

AM PEAK HOUR QUEUE CALCULATION
(2018 DV-B, NB, AM, DIRECT)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	3.40%	3.4%	60	60	100	0	0	0	0
2	4.50%	7.9%	79	139	100	0	0	0	0.00
3	5.40%	13.3%	95	233	100	0	0	0	0.00
4	5.70%	19.0%	100	333	100	0	0	100	0.00
5	5.90%	24.9%	104	437	100	4	4	204	0.36
6	5.90%	30.8%	104	541	100	4	7	307	0.71
7	5.90%	36.7%	104	644	100	4	11	411	1.07
8	5.80%	42.5%	102	746	100	2	12	512	1.25
9	5.70%	48.2%	100	846	100	0	12	612	1.25
10	5.60%	53.8%	98	944	100	0	11	711	1.08
11	5.40%	59.2%	95	1039	100	0	6	806	0.55
12	5.10%	64.3%	90	1128	100	0	0	0	0.00
13	5.00%	69.3%	88	1216	100	0	0	0	0.00
14	4.90%	74.2%	86	1302	100	0	0	0	0.00
15	4.50%	78.7%	79	1381	100	0	0	0	0.00
16	4.40%	83.1%	77	1458	100	0	0	0	0.00
17	4.30%	87.4%	75	1534	100	0	0	0	0.00
18	4.20%	91.6%	74	1608	100	0	0	0	0.00
19	4.20%	95.8%	74	1681	100	0	0	0	0.00
20	4.20%	100.0%	74	1755	100	0	0	0	0.00
Peak Period Volume =			1755	PH Cap. =	500	Max Q =	12	806	6.26
Maximum 1-hour volume =			990	Lanes =	2	Average Delay =		0.47	Mins/Veh
Maximum Queue Length (vehicles) =				6					
Maximum Queue Length (feet) =				187					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

PM PEAK HOUR QUEUE CALCULATION
(2018 DV-B, NB, PM, DIRECT)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	4.30%	4.3%	69	69	90	0	0	0	0
2	4.70%	9.0%	75	144	90	0	0	0	0.00
3	4.80%	13.8%	77	221	90	0	0	0	0.00
4	4.90%	18.7%	79	300	90	0	0	0	0.00
5	4.80%	23.5%	77	377	90	0	0	0	0.00
6	4.90%	28.4%	79	456	90	0	0	0	0.00
7	5.00%	33.4%	80	536	90	0	0	0	0.00
8	5.10%	38.5%	82	618	90	0	0	0	0.00
9	5.20%	43.7%	83	701	90	0	0	0	0.00
10	5.30%	49.0%	85	786	90	0	0	0	0.00
11	5.50%	54.5%	88	875	90	0	0	0	0.00
12	5.70%	60.2%	91	966	90	1	1	91	0.00
13	5.90%	66.1%	95	1061	90	5	6	186	0.62
14	5.80%	71.9%	93	1154	90	3	9	279	0.93
15	5.50%	77.4%	88	1242	90	0	8	368	0.75
16	5.20%	82.6%	83	1326	90	0	1	451	0.10
17	4.80%	87.4%	77	1403	90	0	0	0	0.00
18	4.60%	92.0%	74	1477	90	0	0	0	0.00
19	4.20%	96.2%	67	1544	90	0	0	0	0.00
20	3.80%	100.0%	61	1605	90	0	0	0	0.00
Peak Period Volume =			1605	PH Cap. =	450	Max Q =	9	451	2.40
Maximum 1-hour volume =			870	Lanes =	2	Average Delay =		0.32	Mins/Veh
Maximum Queue Length (vehicles) =				5					
Maximum Queue Length (feet) =				139					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

AM PEAK HOUR QUEUE CALCULATION
(2018 DV-B, NB, AM, LOOP)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	3.40%	3.4%	13	13	80	0	0	0	0
2	4.50%	7.9%	18	31	80	0	0	0	0.00
3	5.40%	13.3%	21	52	80	0	0	0	0.00
4	5.70%	19.0%	22	74	80	0	0	0	0.00
5	5.90%	24.9%	23	97	80	0	0	0	0.00
6	5.90%	30.8%	23	120	80	0	0	0	0.00
7	5.90%	36.7%	23	143	80	0	0	0	0.00
8	5.80%	42.5%	23	166	80	0	0	0	0.00
9	5.70%	48.2%	22	188	80	0	0	0	0.00
10	5.60%	53.8%	22	210	80	0	0	0	0.00
11	5.40%	59.2%	21	231	80	0	0	0	0.00
12	5.10%	64.3%	20	251	80	0	0	0	0.00
13	5.00%	69.3%	20	270	80	0	0	0	0.00
14	4.90%	74.2%	19	289	80	0	0	0	0.00
15	4.50%	78.7%	18	307	80	0	0	0	0.00
16	4.40%	83.1%	17	324	80	0	0	0	0.00
17	4.30%	87.4%	17	341	80	0	0	0	0.00
18	4.20%	91.6%	16	357	80	0	0	0	0.00
19	4.20%	95.8%	16	374	80	0	0	0	0.00
20	4.20%	100.0%	16	390	80	0	0	0	0.00
Peak Period Volume =			390	PH Cap. =	400	Max Q =	0	0	0.00
Maximum 1-hour volume =			220	Lanes =	2	Average Delay =		#DIV/0!	Mins/Veh
Maximum Queue Length (vehicles) =				0					
Maximum Queue Length (feet) =				0					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

PM PEAK HOUR QUEUE CALCULATION
(2018 DV-B, NB, PM, LOOP)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	4.30%	4.3%	43	43	80	0	0	0	0
2	4.70%	9.0%	47	90	80	0	0	0	0.00
3	4.80%	13.8%	48	137	80	0	0	0	0.00
4	4.90%	18.7%	49	186	80	0	0	0	0.00
5	4.80%	23.5%	48	234	80	0	0	0	0.00
6	4.90%	28.4%	49	283	80	0	0	0	0.00
7	5.00%	33.4%	50	333	80	0	0	0	0.00
8	5.10%	38.5%	51	383	80	0	0	0	0.00
9	5.20%	43.7%	52	435	80	0	0	0	0.00
10	5.30%	49.0%	53	488	80	0	0	0	0.00
11	5.50%	54.5%	55	543	80	0	0	0	0.00
12	5.70%	60.2%	57	600	80	0	0	0	0.00
13	5.90%	66.1%	59	658	80	0	0	0	0.00
14	5.80%	71.9%	58	716	80	0	0	0	0.00
15	5.50%	77.4%	55	771	80	0	0	0	0.00
16	5.20%	82.6%	52	823	80	0	0	0	0.00
17	4.80%	87.4%	48	871	80	0	0	0	0.00
18	4.60%	92.0%	46	916	80	0	0	0	0.00
19	4.20%	96.2%	42	958	80	0	0	0	0.00
20	3.80%	100.0%	38	996	80	0	0	0	0.00
Peak Period Volume =			996	PH Cap. =	400	Max Q =	0	0	0.00
Maximum 1-hour volume =			540	Lanes =	2	Average Delay =		#DIV/0!	Mins/Veh
Maximum Queue Length (vehicles) =				0					
Maximum Queue Length (feet) =				0					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

AM PEAK HOUR QUEUE CALCULATION
(2040 DV-A, NB, AM, Direct)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	3.40%	3.4%	78	78	135	0	0	0	0
2	4.50%	7.9%	103	181	135	0	0	0	0.00
3	5.40%	13.3%	124	304	135	0	0	0	0.00
4	5.70%	19.0%	130	435	135	0	0	0	0.00
5	5.90%	24.9%	135	570	135	0	0	0	0.00
6	5.90%	30.8%	135	705	135	0	0	0	0.00
7	5.90%	36.7%	135	840	135	0	0	0	0.00
8	5.80%	42.5%	133	972	135	0	0	0	0.00
9	5.70%	48.2%	130	1103	135	0	0	0	0.00
10	5.60%	53.8%	128	1231	135	0	0	0	0.00
11	5.40%	59.2%	124	1354	135	0	0	0	0.00
12	5.10%	64.3%	117	1471	135	0	0	0	0.00
13	5.00%	69.3%	114	1586	135	0	0	0	0.00
14	4.90%	74.2%	112	1698	135	0	0	0	0.00
15	4.50%	78.7%	103	1801	135	0	0	0	0.00
16	4.40%	83.1%	101	1901	135	0	0	0	0.00
17	4.30%	87.4%	98	2000	135	0	0	0	0.00
18	4.20%	91.6%	96	2096	135	0	0	0	0.00
19	4.20%	95.8%	96	2192	135	0	0	0	0.00
20	4.20%	100.0%	96	2288	135	0	0	0	0.00
Peak Period Volume =			2288	PH Cap. =	450	Max Q =	0	0	0.00
Maximum 1-hour volume =			1290	Lanes =	3	Average Delay =		#DIV/0!	Mins/Veh
Maximum Queue Length (vehicles) =				0					
Maximum Queue Length (feet) =				0					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

PM PEAK HOUR QUEUE CALCULATION
(2040 DV-A, NB, PM, Direct)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	4.30%	4.3%	126	126	165	0	0	0	0
2	4.70%	9.0%	138	264	165	0	0	0	0.00
3	4.80%	13.8%	141	405	165	0	0	0	0.00
4	4.90%	18.7%	144	549	165	0	0	0	0.00
5	4.80%	23.5%	141	689	165	0	0	0	0.00
6	4.90%	28.4%	144	833	165	0	0	0	0.00
7	5.00%	33.4%	147	980	165	0	0	0	0.00
8	5.10%	38.5%	150	1130	165	0	0	0	0.00
9	5.20%	43.7%	153	1282	165	0	0	0	0.00
10	5.30%	49.0%	156	1438	165	0	0	0	0.00
11	5.50%	54.5%	161	1599	165	0	0	0	0.00
12	5.70%	60.2%	167	1766	165	2	2	167	0.00
13	5.90%	66.1%	173	1939	165	8	10	340	1.03
14	5.80%	71.9%	170	2110	165	5	16	511	1.55
15	5.50%	77.4%	161	2271	165	0	12	672	1.19
16	5.20%	82.6%	153	2423	165	0	0	0	0.00
17	4.80%	87.4%	141	2564	165	0	0	0	0.00
18	4.60%	92.0%	135	2699	165	0	0	0	0.00
19	4.20%	96.2%	123	2823	165	0	0	0	0.00
20	3.80%	100.0%	111	2934	165	0	0	0	0.00
Peak Period Volume =			2934	PH Cap. =	550	Max Q =	16	672	3.77
Maximum 1-hour volume =			1590	Lanes =	3	Average Delay =		0.34	Mins/Veh
Maximum Queue Length (vehicles) =				5					
Maximum Queue Length (feet) =				155					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

AM PEAK HOUR QUEUE CALCULATION
(2040 DV-A, SB, AM)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	3.40%	3.4%	44	44	80	0	0	0	0
2	4.50%	7.9%	58	102	80	0	0	0	0.00
3	5.40%	13.3%	70	172	80	0	0	0	0.00
4	5.70%	19.0%	74	246	80	0	0	0	0.00
5	5.90%	24.9%	76	322	80	0	0	0	0.00
6	5.90%	30.8%	76	399	80	0	0	0	0.00
7	5.90%	36.7%	76	475	80	0	0	0	0.00
8	5.80%	42.5%	75	550	80	0	0	0	0.00
9	5.70%	48.2%	74	624	80	0	0	0	0.00
10	5.60%	53.8%	72	696	80	0	0	0	0.00
11	5.40%	59.2%	70	766	80	0	0	0	0.00
12	5.10%	64.3%	66	832	80	0	0	0	0.00
13	5.00%	69.3%	65	897	80	0	0	0	0.00
14	4.90%	74.2%	63	960	80	0	0	0	0.00
15	4.50%	78.7%	58	1018	80	0	0	0	0.00
16	4.40%	83.1%	57	1075	80	0	0	0	0.00
17	4.30%	87.4%	56	1131	80	0	0	0	0.00
18	4.20%	91.6%	54	1185	80	0	0	0	0.00
19	4.20%	95.8%	54	1240	80	0	0	0	0.00
20	4.20%	100.0%	54	1294	80	0	0	0	0.00
Peak Period Volume =			1294	PH Cap. =	400	Max Q =	0	0	0.00
Maximum 1-hour volume =			730	Lanes =	2	Average Delay =		#DIV/0!	Mins/Veh
Maximum Queue Length (vehicles) =				0					
Maximum Queue Length (feet) =				0					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

PM PEAK HOUR QUEUE CALCULATION
(2040 DV-A, SB, PM)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	4.30%	4.3%	75	75	100	0	0	0	0
2	4.70%	9.0%	82	158	100	0	0	0	0.00
3	4.80%	13.8%	84	242	100	0	0	0	0.00
4	4.90%	18.7%	86	328	100	0	0	0	0.00
5	4.80%	23.5%	84	412	100	0	0	0	0.00
6	4.90%	28.4%	86	498	100	0	0	0	0.00
7	5.00%	33.4%	88	585	100	0	0	0	0.00
8	5.10%	38.5%	89	675	100	0	0	0	0.00
9	5.20%	43.7%	91	766	100	0	0	0	0.00
10	5.30%	49.0%	93	858	100	0	0	0	0.00
11	5.50%	54.5%	96	955	100	0	0	0	0.00
12	5.70%	60.2%	100	1055	100	0	0	0	0.00
13	5.90%	66.1%	103	1158	100	3	3	103	0.00
14	5.80%	71.9%	102	1260	100	2	5	205	0.50
15	5.50%	77.4%	96	1356	100	0	1	301	0.13
16	5.20%	82.6%	91	1447	100	0	0	0	0.00
17	4.80%	87.4%	84	1531	100	0	0	0	0.00
18	4.60%	92.0%	81	1612	100	0	0	0	0.00
19	4.20%	96.2%	74	1685	100	0	0	0	0.00
20	3.80%	100.0%	67	1752	100	0	0	0	0.00
Peak Period Volume =			1752	PH Cap. =	500	Max Q =	5	301	0.63
Maximum 1-hour volume =			950	Lanes =	2	Average Delay =		0.13	Mins/Veh
Maximum Queue Length (vehicles) =				2					
Maximum Queue Length (feet) =				75					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

AM PEAK HOUR QUEUE CALCULATION
(2040 DV-B, NB, AM, DIRECT)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	3.40%	3.4%	64	64	110	0	0	0	0
2	4.50%	7.9%	85	149	110	0	0	0	0.00
3	5.40%	13.3%	102	250	110	0	0	0	0.00
4	5.70%	19.0%	107	357	110	0	0	0	0.00
5	5.90%	24.9%	111	468	110	1	1	111	0.00
6	5.90%	30.8%	111	579	110	1	2	222	0.18
7	5.90%	36.7%	111	690	110	1	3	333	0.28
8	5.80%	42.5%	109	799	110	0	2	442	0.18
9	5.70%	48.2%	107	906	110	0	0	0	0.00
10	5.60%	53.8%	105	1011	110	0	0	0	0.00
11	5.40%	59.2%	102	1113	110	0	0	0	0.00
12	5.10%	64.3%	96	1209	110	0	0	0	0.00
13	5.00%	69.3%	94	1303	110	0	0	0	0.00
14	4.90%	74.2%	92	1395	110	0	0	0	0.00
15	4.50%	78.7%	85	1480	110	0	0	0	0.00
16	4.40%	83.1%	83	1562	110	0	0	0	0.00
17	4.30%	87.4%	81	1643	110	0	0	0	0.00
18	4.20%	91.6%	79	1722	110	0	0	0	0.00
19	4.20%	95.8%	79	1801	110	0	0	0	0.00
20	4.20%	100.0%	79	1880	110	0	0	0	0.00
Peak Period Volume =			1880	PH Cap. =	550	Max Q =	3	442	0.64
Maximum 1-hour volume =			1060	Lanes =	2	Average Delay =		0.09	Mins/Veh
Maximum Queue Length (vehicles) =				1					
Maximum Queue Length (feet) =				41					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

PM PEAK HOUR QUEUE CALCULATION
(2040 DV-B, NB, PM, DIRECT)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	4.30%	4.3%	81	81	100	0	0	0	0
2	4.70%	9.0%	88	169	100	0	0	0	0.00
3	4.80%	13.8%	90	260	100	0	0	0	0.00
4	4.90%	18.7%	92	352	100	0	0	0	0.00
5	4.80%	23.5%	90	442	100	0	0	0	0.00
6	4.90%	28.4%	92	534	100	0	0	0	0.00
7	5.00%	33.4%	94	628	100	0	0	0	0.00
8	5.10%	38.5%	96	724	100	0	0	0	0.00
9	5.20%	43.7%	98	822	100	0	0	0	0.00
10	5.30%	49.0%	100	922	100	0	0	0	0.00
11	5.50%	54.5%	103	1025	100	3	3	103	0.00
12	5.70%	60.2%	107	1132	100	7	11	211	1.07
13	5.90%	66.1%	111	1243	100	11	22	322	2.17
14	5.80%	71.9%	109	1352	100	9	31	431	3.07
15	5.50%	77.4%	103	1456	100	3	34	534	3.42
16	5.20%	82.6%	98	1554	100	0	32	632	3.20
17	4.80%	87.4%	90	1644	100	0	22	722	2.23
18	4.60%	92.0%	87	1731	100	0	9	809	0.88
19	4.20%	96.2%	79	1810	100	0	0	0	0.00
20	3.80%	100.0%	71	1881	100	0	0	0	0.00
Peak Period Volume =			1881	PH Cap. =	500	Max Q =	34	809	16.04
Maximum 1-hour volume =			1020	Lanes =	2	Average Delay =		1.19	Mins/Veh
Maximum Queue Length (vehicles) =				17					
Maximum Queue Length (feet) =				513					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

AM PEAK HOUR QUEUE CALCULATION
(2040 DV-B, NB, PM, Loop)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	3.40%	3.4%	14	14	80	0	0	0	0
2	4.50%	7.9%	18	32	80	0	0	0	0.00
3	5.40%	13.3%	22	54	80	0	0	0	0.00
4	5.70%	19.0%	23	78	80	0	0	0	0.00
5	5.90%	24.9%	24	102	80	0	0	0	0.00
6	5.90%	30.8%	24	126	80	0	0	0	0.00
7	5.90%	36.7%	24	150	80	0	0	0	0.00
8	5.80%	42.5%	24	173	80	0	0	0	0.00
9	5.70%	48.2%	23	197	80	0	0	0	0.00
10	5.60%	53.8%	23	220	80	0	0	0	0.00
11	5.40%	59.2%	22	242	80	0	0	0	0.00
12	5.10%	64.3%	21	262	80	0	0	0	0.00
13	5.00%	69.3%	20	283	80	0	0	0	0.00
14	4.90%	74.2%	20	303	80	0	0	0	0.00
15	4.50%	78.7%	18	321	80	0	0	0	0.00
16	4.40%	83.1%	18	339	80	0	0	0	0.00
17	4.30%	87.4%	18	357	80	0	0	0	0.00
18	4.20%	91.6%	17	374	80	0	0	0	0.00
19	4.20%	95.8%	17	391	80	0	0	0	0.00
20	4.20%	100.0%	17	408	80	0	0	0	0.00
Peak Period Volume =			408	PH Cap. =	400	Max Q =	0	0	0.00
Maximum 1-hour volume =			230	Lanes =	2	Average Delay =		#DIV/0!	Mins/Veh
Maximum Queue Length (vehicles) =				0					
Maximum Queue Length (feet) =				0					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

PM PEAK HOUR QUEUE CALCULATION
(2040 DV-B, NB, PM, Loop)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	4.30%	4.3%	45	45	80	0	0	0	0
2	4.70%	9.0%	49	95	80	0	0	0	0.00
3	4.80%	13.8%	50	145	80	0	0	0	0.00
4	4.90%	18.7%	52	197	80	0	0	0	0.00
5	4.80%	23.5%	50	247	80	0	0	0	0.00
6	4.90%	28.4%	52	299	80	0	0	0	0.00
7	5.00%	33.4%	53	351	80	0	0	0	0.00
8	5.10%	38.5%	54	405	80	0	0	0	0.00
9	5.20%	43.7%	55	460	80	0	0	0	0.00
10	5.30%	49.0%	56	515	80	0	0	0	0.00
11	5.50%	54.5%	58	573	80	0	0	0	0.00
12	5.70%	60.2%	60	633	80	0	0	0	0.00
13	5.90%	66.1%	62	695	80	0	0	0	0.00
14	5.80%	71.9%	61	756	80	0	0	0	0.00
15	5.50%	77.4%	58	814	80	0	0	0	0.00
16	5.20%	82.6%	55	869	80	0	0	0	0.00
17	4.80%	87.4%	50	919	80	0	0	0	0.00
18	4.60%	92.0%	48	968	80	0	0	0	0.00
19	4.20%	96.2%	44	1012	80	0	0	0	0.00
20	3.80%	100.0%	40	1052	80	0	0	0	0.00
Peak Period Volume =			1052	PH Cap. =	400	Max Q =	0	0	0.00
Maximum 1-hour volume =			570	Lanes =	2	Average Delay =		#DIV/0!	Mins/Veh
Maximum Queue Length (vehicles) =				0					
Maximum Queue Length (feet) =				0					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

AM PEAK HOUR QUEUE CALCULATION
(2040 DV-B, SB, AM)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	3.40%	3.4%	44	44	80	0	0	0	0
2	4.50%	7.9%	58	102	80	0	0	0	0.00
3	5.40%	13.3%	70	172	80	0	0	0	0.00
4	5.70%	19.0%	74	246	80	0	0	0	0.00
5	5.90%	24.9%	76	322	80	0	0	0	0.00
6	5.90%	30.8%	76	399	80	0	0	0	0.00
7	5.90%	36.7%	76	475	80	0	0	0	0.00
8	5.80%	42.5%	75	550	80	0	0	0	0.00
9	5.70%	48.2%	74	624	80	0	0	0	0.00
10	5.60%	53.8%	72	696	80	0	0	0	0.00
11	5.40%	59.2%	70	766	80	0	0	0	0.00
12	5.10%	64.3%	66	832	80	0	0	0	0.00
13	5.00%	69.3%	65	897	80	0	0	0	0.00
14	4.90%	74.2%	63	960	80	0	0	0	0.00
15	4.50%	78.7%	58	1018	80	0	0	0	0.00
16	4.40%	83.1%	57	1075	80	0	0	0	0.00
17	4.30%	87.4%	56	1131	80	0	0	0	0.00
18	4.20%	91.6%	54	1185	80	0	0	0	0.00
19	4.20%	95.8%	54	1240	80	0	0	0	0.00
20	4.20%	100.0%	54	1294	80	0	0	0	0.00
Peak Period Volume =			1294	PH Cap. =	400	Max Q =	0	0	0.00
Maximum 1-hour volume =			730	Lanes =	2	Average Delay =		#DIV/0!	Mins/Veh
Maximum Queue Length (vehicles) =				0					
Maximum Queue Length (feet) =				0					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles

PM PEAK HOUR QUEUE CALCULATION
(2040 DV-B, SB, PM)

Interval	PP %	Cum. %	Volume	Cum. Vol.	Capacity	Backup	Queue	Delayed	Delay (hrs)
1	4.30%	4.3%	75	75	100	0	0	0	0
2	4.70%	9.0%	82	158	100	0	0	0	0.00
3	4.80%	13.8%	84	242	100	0	0	0	0.00
4	4.90%	18.7%	86	328	100	0	0	0	0.00
5	4.80%	23.5%	84	412	100	0	0	0	0.00
6	4.90%	28.4%	86	498	100	0	0	0	0.00
7	5.00%	33.4%	88	585	100	0	0	0	0.00
8	5.10%	38.5%	89	675	100	0	0	0	0.00
9	5.20%	43.7%	91	766	100	0	0	0	0.00
10	5.30%	49.0%	93	858	100	0	0	0	0.00
11	5.50%	54.5%	96	955	100	0	0	0	0.00
12	5.70%	60.2%	100	1055	100	0	0	0	0.00
13	5.90%	66.1%	103	1158	100	3	3	103	0.00
14	5.80%	71.9%	102	1260	100	2	5	205	0.50
15	5.50%	77.4%	96	1356	100	0	1	301	0.13
16	5.20%	82.6%	91	1447	100	0	0	0	0.00
17	4.80%	87.4%	84	1531	100	0	0	0	0.00
18	4.60%	92.0%	81	1612	100	0	0	0	0.00
19	4.20%	96.2%	74	1685	100	0	0	0	0.00
20	3.80%	100.0%	67	1752	100	0	0	0	0.00
Peak Period Volume =			1752	PH Cap. =	500	Max Q =	5	301	0.63
Maximum 1-hour volume =			950	Lanes =	2	Average Delay =		0.13	Mins/Veh
Maximum Queue Length (vehicles) =				2					
Maximum Queue Length (feet) =				75					

Notes:

Interval - time increment in 0.1 hours

PP% - percent of the two-hour peak period in this time increment

Cum. - cumulative percent in this time interval from time interval #1

Capacity - maximum total ramp meter discharge volume for 0.1 hours (PH Cap. = Peak Hour Capacity)

Queue - queue length (in vehicles) at this time interval (total queued vehicles for all lanes)

Delayed - number of vehicles that have been delayed since beginning of queue formation

Delay - delay to queued vehicles during each time interval

Max Q - Maximum number of queued vehicles (total for all storage lanes)

Ave. Del = Average delay for all delayed vehicles