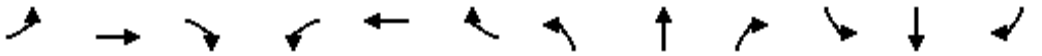
Appendix A

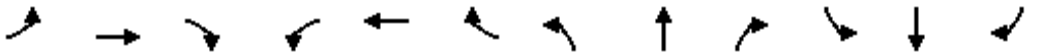
Alternative G Modified

Interchange Evaluation Worksheets



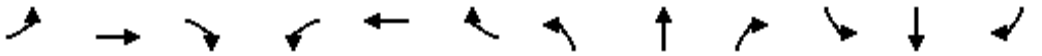
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	385	0	855	125	0	90	685	105	115	135	80	405
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	10.0		10.0	10.0		10.0	10.0	9.5	10.0	10.0	9.5	10.0
Lane Util. Factor	0.97		1.00	1.00		1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00		0.85	1.00		0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433		1583	1770		1583	3433	1863	1583	1770	1863	1583
Flt Permitted	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433		1583	1770		1583	3433	1863	1583	1770	1863	1583
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)	405	0	900	132	0	95	721	111	121	142	84	426
RTOR Reduction (vph)	0	0	211	0	0	39	0	0	82	0	0	63
Lane Group Flow (vph)	405	0	689	132	0	56	721	111	39	142	84	363
Turn Type	Prot		custom	Prot		custom	Prot		custom	Prot		custom
Protected Phases	1			1			5	6		5	6	
Permitted Phases			5 6			5 6			1 6			1 6
Actuated Green, G (s)	17.8		52.7	17.8		52.7	31.5	11.2	38.5	31.5	11.2	38.5
Effective Green, g (s)	17.8		52.7	17.8		52.7	31.5	11.2	29.0	31.5	11.2	29.0
Actuated g/C Ratio	0.20		0.59	0.20		0.59	0.35	0.12	0.32	0.35	0.12	0.32
Clearance Time (s)	10.0			10.0			10.0	9.5		10.0	9.5	
Vehicle Extension (s)	3.0			3.0			3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	679		927	350		927	1202	232	510	620	232	510
v/s Ratio Prot	0.12			0.07			0.21	0.06		0.08	0.05	
v/s Ratio Perm			c0.44			0.04			0.02			c0.23
v/c Ratio	0.60		0.74	0.38		0.06	0.60	0.48	0.08	0.23	0.36	0.71
Uniform Delay, d1	32.8		13.7	31.3		8.0	24.1	36.7	21.2	20.7	36.1	26.8
Progression Factor	0.95		1.27	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4		3.3	0.7		0.0	0.8	6.9	0.1	0.2	4.3	4.7
Delay (s)	32.5		20.7	32.0		8.0	24.9	43.6	21.3	20.9	40.5	31.5
Level of Service	C		C	C		A	C	D	C	C	D	C
Approach Delay (s)		24.3			22.0			26.6			30.3	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	26.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	87.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



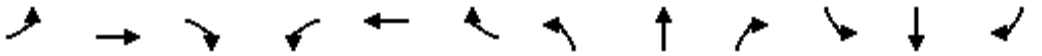
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	260	0	350	70	0	70	685	55	65	50	40	255
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	9.0		9.0	9.0		9.0	9.0	8.5	9.0	9.0	8.5	9.0
Lane Util. Factor	0.97		1.00	1.00		1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00		0.85	1.00		0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433		1583	1770		1583	3433	1863	1583	1770	1863	1583
Flt Permitted	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433		1583	1770		1583	3433	1863	1583	1770	1863	1583
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	0	368	74	0	74	721	58	68	53	42	268
RTOR Reduction (vph)	0	0	123	0	0	25	0	0	41	0	0	91
Lane Group Flow (vph)	274	0	245	74	0	49	721	58	27	53	42	178
Turn Type	Prot		custom	Prot		custom	Prot		custom	Prot		custom
Protected Phases	1			1			5	6		5	6	
Permitted Phases			5 6			5 6			1 6			1 6
Actuated Green, G (s)	12.5		60.0	12.5		60.0	27.8	23.2	44.2	27.8	23.2	44.2
Effective Green, g (s)	12.5		60.0	12.5		60.0	27.8	23.2	35.7	27.8	23.2	35.7
Actuated g/C Ratio	0.14		0.67	0.14		0.67	0.31	0.26	0.40	0.31	0.26	0.40
Clearance Time (s)	9.0			9.0			9.0	8.5		9.0	8.5	
Vehicle Extension (s)	3.0			3.0			3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	477		1055	246		1055	1060	480	628	547	480	628
v/s Ratio Prot	c0.08			0.04			c0.21	0.03		0.03	0.02	
v/s Ratio Perm			0.15			0.03			0.02			c0.11
v/c Ratio	0.57		0.23	0.30		0.05	0.68	0.12	0.04	0.10	0.09	0.28
Uniform Delay, d1	36.3		5.9	34.8		5.2	27.2	25.6	16.7	22.2	25.4	18.4
Progression Factor	1.25		1.91	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.7		0.1	0.7		0.0	1.8	0.5	0.0	0.1	0.4	0.2
Delay (s)	46.9		11.4	35.5		5.2	29.0	26.1	16.7	22.2	25.7	18.7
Level of Service	D		B	D		A	C	C	B	C	C	B
Approach Delay (s)		26.6			20.3			27.8			20.0	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	25.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	27.0
Intersection Capacity Utilization	51.8%	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												
Volume (vph)	385	0	855	125	0	90	685	105	115	135	80	405
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	10.0		10.0	10.0		10.0	10.0	9.5	10.0	10.0	9.5	10.0
Lane Util. Factor	0.97		1.00	1.00		1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00		0.85	1.00		0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433		1583	1770		1583	3433	1863	1583	1770	1863	1583
Flt Permitted	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433		1583	1770		1583	3433	1863	1583	1770	1863	1583
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)	405	0	900	132	0	95	721	111	121	142	84	426
RTOR Reduction (vph)	0	0	209	0	0	39	0	0	84	0	0	65
Lane Group Flow (vph)	405	0	691	132	0	56	721	111	37	142	84	361
Turn Type	Prot		custom	Prot		custom	Prot		custom	Prot		custom
Protected Phases	1			1			5	6		5	6	
Permitted Phases			5 6			5 6			1 6			1 6
Actuated Green, G (s)	17.5		53.0	17.5		53.0	33.3	9.7	36.7	33.3	9.7	36.7
Effective Green, g (s)	17.5		53.0	17.5		53.0	33.3	9.7	27.2	33.3	9.7	27.2
Actuated g/C Ratio	0.19		0.59	0.19		0.59	0.37	0.11	0.30	0.37	0.11	0.30
Clearance Time (s)	10.0			10.0			10.0	9.5		10.0	9.5	
Vehicle Extension (s)	3.0			3.0			3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	668		932	344		932	1270	201	478	655	201	478
v/s Ratio Prot	0.12			0.07			0.21	0.06		0.08	0.05	
v/s Ratio Perm			c0.44			0.04			0.02			c0.23
v/c Ratio	0.61		0.74	0.38		0.06	0.57	0.55	0.08	0.22	0.42	0.76
Uniform Delay, d1	33.1		13.5	31.6		7.9	22.6	38.1	22.4	19.4	37.5	28.4
Progression Factor	0.96		1.27	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6		3.2	0.7		0.0	0.6	10.5	0.1	0.2	6.3	6.7
Delay (s)	33.3		20.3	32.3		7.9	23.2	48.6	22.5	19.6	43.8	35.1
Level of Service	C		C	C		A	C	D	C	B	D	D
Approach Delay (s)		24.4			22.1			26.1			32.8	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	26.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	87.8%	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												
Volume (vph)	735	0	355	95	0	195	180	60	50	145	60	555
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	9.0		9.0	9.0		9.0	9.0	8.5	9.0	9.0	8.5	9.0
Lane Util. Factor	0.97		1.00	1.00		1.00	0.97	1.00	1.00	0.97	1.00	1.00
Frt	1.00		0.85	1.00		0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433		1583	1770		1583	3433	1863	1583	3433	1863	1583
Flt Permitted	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433		1583	1770		1583	3433	1863	1583	3433	1863	1583
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)	774	0	374	100	0	205	189	63	53	153	63	584
RTOR Reduction (vph)	0	0	294	0	0	72	0	0	27	0	0	0
Lane Group Flow (vph)	774	0	80	100	0	133	189	63	26	153	63	584
Turn Type	Prot		custom	Prot		custom	Prot		custom	Prot		custom
Protected Phases	1			1			5	6		5	6	
Permitted Phases			5			5			1 6			1 5 6
Actuated Green, G (s)	23.5		19.3	23.5		19.3	19.3	20.7	52.7	19.3	20.7	90.0
Effective Green, g (s)	23.5		19.3	23.5		19.3	19.3	20.7	44.2	19.3	20.7	81.5
Actuated g/C Ratio	0.26		0.21	0.26		0.21	0.21	0.23	0.49	0.21	0.23	0.91
Clearance Time (s)	9.0		9.0	9.0		9.0	9.0	8.5		9.0	8.5	
Vehicle Extension (s)	3.0		3.0	3.0		3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	896		339	462		339	736	428	777	736	428	1433
v/s Ratio Prot	c0.23			0.06			0.06	0.03		0.04	0.03	
v/s Ratio Perm			0.05			0.08			0.02			c0.37
v/c Ratio	0.86		0.24	0.22		0.39	0.26	0.15	0.03	0.21	0.15	0.41
Uniform Delay, d1	31.7		29.3	26.0		30.3	29.4	27.6	11.8	29.1	27.6	0.6
Progression Factor	1.00		1.00	0.57		0.94	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	8.7		0.4	0.2		0.7	0.2	0.7	0.0	0.1	0.7	0.2
Delay (s)	40.4		29.6	15.0		29.2	29.6	28.3	11.9	29.2	28.3	0.8
Level of Service	D		C	B		C	C	C	B	C	C	A
Approach Delay (s)		36.9			24.5			26.2			8.4	
Approach LOS		D			C			C			A	

Intersection Summary			
HCM Average Control Delay	25.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	59.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2	SEH Inc.	Freeway/Dir of Travel	US 160 Eastbound
Agency or Company		Junction	CR 223 On Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	Year 2030

Project Description Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Rolling

S_{FF} = 60.0 mph S_{FR} = 40.0 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	$v=V/PHF\ f_{HV}\ f_p$
Freeway	1560	0.95	Rolling	5	0	0.930	1.00	1765
Ramp	195	0.95	Rolling	2	0	0.971	1.00	211
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 1765 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	1976	See Exhibit 25-7	No
V_{R12}	1976	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 = 11.6 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.232 (Exibit 25-19)

S_R= 55.8 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 55.8 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

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SEH Inc.	Freeway/Dir of Travel	US 160 Eastbound
Agency or Company		Junction	CR 233 Off Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Year 2030
Project Description	Year 2030 Traffic Operations Analysis of the US 160 FEIS		

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 60.0 mph S_{FR} = 40.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D,V_R,V_f)	VD = 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 f_{HV} f_p
Freeway	3460	0.95	Rolling	5	0	0.930	1.00	3915
Ramp	1065	0.95	Rolling	2	0	0.971	1.00	1155
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

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 Estimation

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} =0.609 using Equation 5

V_{12} = 2836 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{Fl}=V_F$	3915	6900	No
V_{12}	2836	4400:All	No
$V_{FO} = V_F - V_R$	2760	6900	No
V_R	1155	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 19.6 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

D_s = 0.467 (Exhibit 25-19)

S_R= 51.6 mph (Exhibit 25-19)

S_0= 65.5 mph (Exhibit 25-19)

S = 54.8 mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SEH Inc.	Freeway/Dir of Travel	US 160 Eastbound
Agency or Company		Junction	CR 233 Off Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	Year 2030
Project Description	Year 2030 Traffic Operations Analysis of the US 160 FEIS		

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 60.0 mph S_{FR} = 40.0 mph Sketch (show lanes, L_A, L_D,V_R,V_f)	VD = 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 f_{HV} f_p
Freeway	2650	0.95	Rolling	5	0	0.930	1.00	2999
Ramp	1090	0.95	Rolling	2	0	0.971	1.00	1182
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

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 Estimation

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} =0.631 using Equation 5

V_{12} = 2328 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{Fl}=V_F$	2999	6900	No
V_{12}	2328	4400:All	No
$V_{FO} = V_F - V_R$	1817	6900	No
V_R	1182	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 15.3 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

D_s = 0.469 (Exhibit 25-19)

S_R= 51.6 mph (Exhibit 25-19)

S_0= 65.8 mph (Exhibit 25-19)

S = 54.2 mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2	SEH Inc.	Freeway/Dir of Travel	US 160 Westbound
Agency or Company		Junction	SH 172 On Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Year 2030

Project Description Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Rolling

S_{FF} = 60.0 mph S_{FR} = 40.0 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	$v=V/PHF\ f_{HV}\ f_p$
Freeway	1505	0.95	Rolling	5	0	0.930	1.00	1703
Ramp	1090	0.95	Rolling	2	0	0.971	1.00	1182
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 1703 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	2885	See Exhibit 25-7	No
V_{R12}	2885	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 = 18.2 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.273 (Exibit 25-19)

S_R= 55.1 mph (Exhibit 25-19)

S_0= N/A 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

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2	SEH Inc.	Freeway/Dir of Travel	US 160 Westbound
Agency or Company		Junction	SH 172 On Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	Year 2030

Project Description: Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☐ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Rolling

S_{FF} = 60.0 mph S_{FR} = 40.0 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	$v=V/PHF\ f_{HV}\ f_p$
Freeway	935	0.95	Rolling	5	0	0.930	1.00	1058
Ramp	940	0.95	Rolling	2	0	0.971	1.00	1019
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 1058 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	2077	See Exhibit 25-7	No
V_{R12}	2077	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 = 12.0 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.235 (Exibit 25-19)

S_R= 55.8 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 55.8 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

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SEH Inc.	Freeway/Dir of Travel	US 160 Westbound
Agency or Company		Junction	SH 172 Off Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Year 2030
Project Description	Year 2030 Traffic Operations Analysis of the US 160 FEIS		

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 60.0 mph S_{FR} = 40.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D,V_R,V_f)	VD = 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 f_{HV} f_p
Freeway	1720	0.95	Rolling	5	0	0.930	1.00	1946
Ramp	215	0.95	Rolling	2	0	0.971	1.00	233
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

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 Estimation

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} =1.000 using Equation 0

V_{12} = 1946 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	1946	4600	No
V_{12}	1946	4400:All	No
$V_{FO} = V_F - V_R$	1713	4600	No
V_R	233	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = 12.0 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

D_s = 0.384 (Exhibit 25-19)

S_R= 53.1 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 53.1 mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SEH Inc.	Freeway/Dir of Travel	US 160 Westbound
Agency or Company		Junction	SH 172 Off Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	Year 2030
Project Description	Year 2030 Traffic Operations Analysis of the US 160 FEIS		

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 60.0 mph S_{FR} = 40.0 mph Sketch (show lanes, L_A, L_D,V_R,V_f)	VD = 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 f_{HV} f_p
Freeway	1075	0.95	Rolling	5	0	0.930	1.00	1216
Ramp	140	0.95	Rolling	2	0	0.971	1.00	152
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

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 Estimation

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} =1.000 using Equation 0

V_{12} = 1216 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{Fl}=V_F$	1216	4600	No
V_{12}	1216	4400:All	No
$V_{FO} = V_F - V_R$	1064	4600	No
V_R	152	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = 5.7 (pc/ mi /ln)

LOS= A (Exhibit 25-4)

Speed Estimation

D_s = 0.377 (Exhibit 25-19)

S_R= 53.2 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 53.2 mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2	SEH Inc.	Freeway/Dir of Travel	US 160 Eastbound
Agency or Company		Junction	SH 172 On Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Year 2030

Project Description Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Rolling

S_{FF} = 60.0 mph S_{FR} = 40.0 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	$v=V/PHF\ f_{HV}\ f_p$
Freeway	1555	0.95	Rolling	5	0	0.930	1.00	1760
Ramp	250	0.95	Rolling	2	0	0.971	1.00	271
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 1760 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	2031	See Exhibit 25-7	No
V_{R12}	2031	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 = 12.0 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.233 (Exibit 25-19)

S_R= 55.8 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 55.8 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

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2	SEH Inc.	Freeway/Dir of Travel	US 160 Eastbound
Agency or Company		Junction	SH 172 On Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	Year 2030

Project Description Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Rolling

S_{FF} = 60.0 mph S_{FR} = 40.0 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	$v=V/PHF\ f_{HV}\ f_p$
Freeway	1145	0.95	Rolling	5	0	0.930	1.00	1296
Ramp	115	0.95	Rolling	2	0	0.971	1.00	125
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 1296 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	1421	See Exhibit 25-7	No
V_{R12}	1421	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 = 7.3 (pc/ m/ln)

LOS = A (Exhibit 25-4)

Speed Estimation

M_S = 0.220 (Exibit 25-19)

S_R= 56.0 mph (Exhibit 25-19)

S_0= N/A 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

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SEH Inc.	Freeway/Dir of Travel	US 160 Eastbound
Agency or Company		Junction	SH 172 Off Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Year 2030

Project Description: Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 60.0 mph S_{FR} = 40.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D,V_R,V_f)	VD = 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 f_{HV} f_p
Freeway	2795	0.95	Rolling	5	0	0.930	1.00	3163
Ramp	1240	0.95	Rolling	2	0	0.971	1.00	1344
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

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 Estimation

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} = 1.000 using Equation 0

V_{12} = 3163 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{Fl}=V_F$	3163	4600	No
V_{12}	3163	4400:All	No
$V_{FO} = V_F - V_R$	1819	4600	No
V_R	1344	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 22.5 (pc/ mi /ln)

LOS= C (Exhibit 25-4)

Speed Estimation

D_s = 0.484 (Exhibit 25-19)

S_R= 51.3 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 51.3 mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SEH Inc.	Freeway/Dir of Travel	US 160 Eastbound
Agency or Company		Junction	SH 172 Off Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	Year 2030
Project Description	Year 2030 Traffic Operations Analysis of the US 160 FEIS		

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 60.0 mph S_{FR} = 40.0 mph Sketch (show lanes, L_A, L_D,V_R,V_f)	VD = 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 f_{HV} f_p
Freeway	1755	0.95	Rolling	5	0	0.930	1.00	1986
Ramp	610	0.95	Rolling	2	0	0.971	1.00	661
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

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 Estimation

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} =1.000 using Equation 0

V_{12} = 1986 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	1986	4600	No
V_{12}	1986	4400:All	No
$V_{FO} = V_F - V_R$	1325	4600	No
V_R	661	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = 12.3 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

D_s = 0.422 (Exhibit 25-19)

S_R= 52.4 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 52.4 mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2	SEH Inc.	Freeway/Dir of Travel	US 160 Westbound
Agency or Company		Junction	Grandview Ramp E
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Year 2030

Project Description: Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{up} = 1700 ft

V_u = 565 veh/h

Terrain: Rolling

S_{FF} = 60.0 mph S_{FR} = 40.0 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	$v=V/PHF\ f_{HV}\ f_p$
Freeway	4030	0.95	Rolling	5	0	0.930	1.00	4560
Ramp	590	0.95	Rolling	2	0	0.971	1.00	640
UpStream	565	0.95	Rolling	2	0	0.971	1.00	613
DownStream								

Merge Areas

Estimation of v_{12}

$$V_{12} = V_F (P_{FM})$$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.619 using Equation 1

V_{12}= 2821 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	5200	See Exhibit 25-7	No
V_{R12}	3461	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 = 23.0 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.328 (Exibit 25-19)

S_R= 54.1 mph (Exhibit 25-19)

S_0= 55.5 mph (Exhibit 25-19)

S= 54.6 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

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2	SEH Inc.	Freeway/Dir of Travel	US 160 Westbound
Agency or Company		Junction	Grandview Ramp e
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	Year 2030

Project Description: Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp

☑ Yes ☑ On

☐ No ☐ Off

L_{up} = 1700 ft

V_u = 945 veh/h

Terrain: Rolling

S_{FF} = 60.0 mph S_{FR} = 40.0 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	$v=V/PHF\ f_{HV}\ f_p$
Freeway	2940	0.95	Rolling	5	0	0.930	1.00	3327
Ramp	385	0.95	Rolling	2	0	0.971	1.00	417
UpStream	945	0.95	Rolling	2	0	0.971	1.00	1025
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.619 using Equation 1

V_{12}= 2058 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	3744	See Exhibit 25-7	No
V_{R12}	2475	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 = 15.4 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.250 (Exibit 25-19)

S_R= 55.5 mph (Exhibit 25-19)

S_0= 57.2 mph (Exhibit 25-19)

S= 56.1 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

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2	SEH Inc.	Freeway/Dir of Travel	US 160 Westbound
Agency or Company		Junction	Grandview Ramp C
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Year 2030

Project Description: Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp
☐ Yes ☐ On
☐ No ☐ Off
L_{up} = ft
V_u = veh/h

Terrain: Rolling

S_{FF} = 60.0 mph S_{FR} = 40.0 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	$v=V/PHF\ f_{HV}\ f_p$
Freeway	3440	0.95	Rolling	5	0	0.930	1.00	3893
Ramp	590	0.95	Rolling	2	0	0.971	1.00	640
UpStream								
DownStream								

Merge Areas | Diverge Areas

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.631 using Equation 1

V_{12}= 2455 pc/h

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

V_{12} = pc/h

Capacity Checks — Merge Areas

	Actual	Maximum	LOS F?
V_{FO}	4533	See Exhibit 25-7	No
V_{R12}	3095	4600:All	No

Capacity Checks — Diverge Areas

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F) — Merge Areas

$D_R = 5.475 + 0.00734\ v_R + 0.0078\ V_{12} - 0.00627\ L_A$

D_R = 17.4 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Level of Service Determination (if not F) — Diverge Areas

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation — Merge Areas

M_S = 0.255 (Exibit 25-19)

S_R= 55.4 mph (Exhibit 25-19)

S_0= 56.6 mph (Exhibit 25-19)

S= 55.8 mph (Exhibit 25-14)

Speed Estimation — Diverge Areas

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2	SEH Inc.	Freeway/Dir of Travel	US 160 Westbound
Agency or Company		Junction	Grandview Ramp C
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	Year 2030

Project Description: Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Rolling

S_{FF} = 60.0 mph S_{FR} = 40.0 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	$v=V/PHF\ f_{HV}\ f_p$
Freeway	1940	0.95	Rolling	5	0	0.930	1.00	2195
Ramp	1000	0.95	Rolling	2	0	0.971	1.00	1084
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.631 using Equation 1

V_{12}= 1384 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	3279	See Exhibit 25-7	No
V_{R12}	2468	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 = 12.3 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.215 (Exibit 25-19)

S_R= 56.1 mph (Exhibit 25-19)

S_0= 58.9 mph (Exhibit 25-19)

S= 56.8 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

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2	SEH Inc.	Freeway/Dir of Travel	US 160 Eastbound
Agency or Company		Junction	Grandview Ramp B
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Year 2030

Project Description: Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Rolling

S_{FF} = 60.0 mph S_{FR} = 40.0 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	$v=V/PHF\ f_{HV}\ f_p$
Freeway	2980	0.95	Rolling	5	0	0.930	1.00	3372
Ramp	480	0.95	Rolling	2	0	0.971	1.00	520
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.619 using Equation 1

V_{12}= 2086 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	3892	See Exhibit 25-7	No
V_{R12}	2606	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 = 16.3 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.256 (Exibit 25-19)

S_R= 55.4 mph (Exhibit 25-19)

S_0= 57.2 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

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2	SEH Inc.	Freeway/Dir of Travel	US 160 Eastbound
Agency or Company		Junction	Grandview Ramp B
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	Year 2030

Project Description: Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Rolling

S_{FF} = 60.0 mph S_{FR} = 40.0 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	$v=V/PHF\ f_{HV}\ f_p$
Freeway	2030	0.95	Rolling	5	0	0.930	1.00	2297
Ramp	620	0.95	Rolling	2	0	0.971	1.00	672
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 0.619 using Equation 1

V_{12}= 1421 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	2969	See Exhibit 25-7	No
V_{R12}	2093	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 = 12.3 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.235 (Exibit 25-19)

S_R= 55.8 mph (Exhibit 25-19)

S_0= 58.6 mph (Exhibit 25-19)

S= 56.6 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

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SEH Inc.	Freeway/Dir of Travel	US 160 Eastbound
Agency or Company		Junction	Grandview Ramp A
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Year 2030
Project Description	Year 2030 Traffic Operations Analysis of the US 160 FEIS		

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 60.0 mph S_{FR} = 40.0 mph Sketch (show lanes, L_A, L_D,V_R,V_f)	VD = 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 f_{HV} f_p
Freeway	4525	0.95	Rolling	5	0	0.930	1.00	5120
Ramp	1545	0.95	Rolling	2	0	0.971	1.00	1675
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

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 Estimation

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} =0.555 using Equation 5

V_{12} = 3587 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{Fl}=V_F$	5120	6900	No
V_{12}	3587	4400:All	No
$V_{FO} = V_F - V_R$	3445	6900	No
V_R	1675	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 26.1 (pc/ mi /ln)

LOS= C (Exhibit 25-4)

Speed Estimation

D_s = 0.514 (Exhibit 25-19)

S_R= 50.8 mph (Exhibit 25-19)

S_0= 63.7 mph (Exhibit 25-19)

S = 54.1 mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SEH Inc.	Freeway/Dir of Travel	US 160 Eastbound
Agency or Company		Junction	Grandview Ramp A
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	Year 2030
Project Description	Year 2030 Traffic Operations Analysis of the US 160 FEIS		

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 60.0 mph S_{FR} = 40.0 mph Sketch (show lanes, L_A, L_D,V_R,V_f)	VD = 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 f_{HV} f_p
Freeway	2830	0.95	Rolling	5	0	0.930	1.00	3202
Ramp	800	0.95	Rolling	2	0	0.971	1.00	867
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

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 Estimation

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} =0.640 using Equation 5

V_{12} = 2362 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{Fl}=V_F$	3202	6900	No
V_{12}	2362	4400:All	No
$V_{FO} = V_F - V_R$	2335	6900	No
V_R	867	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 15.6 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

D_s = 0.441 (Exhibit 25-19)

S_R= 52.1 mph (Exhibit 25-19)

S_0= 65.8 mph (Exhibit 25-19)

S = 55.1 mph (Exhibit 25-15)

HCS2000: Freeway Weaving Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency/Co.:	
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak
Freeway/Dir of Travel:	US 160 Westbound
Weaving Location:	CR 233 On US 550 Off
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Freeway free-flow speed, SFF	60	mph
Weaving number of lanes, N	4	
Weaving segment length, L	2070	ft
Terrain type	Rolling	
Grade		%
Length		mi
Weaving type	A	Multilane or C-D
Volume ratio, VR	0.47	
Weaving ratio, R	0.19	

Conversion to pc/h Under Base Conditions

	Non-Weaving		Weaving		
	V A-C	V B-D	V A-D	V B-C	
Volume, V	1975	40	340	1460	veh/h
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	
Peak 15-min volume, v15	520	11	89	384	v
Trucks and buses	5	5	5	5	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.930	0.930	0.930	0.930	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	2234	45	384	1652	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.00
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	1.59	0.27
Weaving and non-weaving speeds, Si	34.27	54.43
Number of lanes required for unconstrained operation, Nw (Exhibit 24-7)		2.18
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	42.61	mph
Weaving segment density, D	25.32	pc/mi/ln
Level of service, LOS	C	
Capacity of base condition, cb	7176	pc/h
Capacity as a 15-minute flow rate, c	6675	pc/h
Capacity as a full-hour volume, ch	6341	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	2036	2800	a
Average flow rate (pcphpl)	1078	2300	b
Volume ratio, VR	0.47	0.35	c
Weaving ratio, R	0.19	N/A	d
Weaving length (ft)	2070	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.

HCS2000: Freeway Weaving Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency/Co.:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Dir of Travel:	US 160 Westbound
Weaving Location:	CR 233 On US 550 Off
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Freeway free-flow speed, SFF	60	mph
Weaving number of lanes, N	4	
Weaving segment length, L	2070	ft
Terrain type	Rolling	
Grade		%
Length		mi
Weaving type	A	Multilane or C-D
Volume ratio, VR	0.45	
Weaving ratio, R	0.33	

Conversion to pc/h Under Base Conditions

	Non-Weaving V A-C	Non-Weaving V B-D	Weaving V A-D	Weaving V B-C	
Volume, V	1240	40	345	695	veh/h
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	
Peak 15-min volume, v15	326	11	91	183	v
Trucks and buses	5	5	5	5	%
Recreational vehicles	0	0	0	0	%
Trucks and buses PCE, ET	2.5	2.5	2.5	2.5	
Recreational vehicle PCE, ER	2.0	2.0	2.0	2.0	
Heavy vehicle adjustment, fHV	0.930	0.930	0.930	0.930	
Driver population adjustment, fP	1.00	1.00	1.00	1.00	
Flow rate, v	1403	45	390	786	pc/h

Weaving and Non-Weaving Speeds

	Weaving	Non-Weaving
a (Exhibit 24-6)	0.15	0.00
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	0.95	0.13
Weaving and non-weaving speeds, Si	40.65	59.18
Number of lanes required for unconstrained operation, Nw (Exhibit 24-7)		2.00
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	49.14	mph
Weaving segment density, D	13.35	pc/mi/ln
Level of service, LOS	B	
Capacity of base condition, cb	7176	pc/h
Capacity as a 15-minute flow rate, c	6675	pc/h
Capacity as a full-hour volume, ch	6341	pc/h

Limitations on Weaving Segments

	Analyzed	If Max Exceeded Maximum	See Note Note
Weaving flow rate, Vw	1176	2800	a
Average flow rate (pcphpl)	656	2300	b
Volume ratio, VR	0.45	0.35	c
Weaving ratio, R	0.33	N/A	d
Weaving length (ft)	2070	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.

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SEH Inc.	Freeway/Dir of Travel	US 160 Westbound
Agency or Company		Junction	CR 233 Off Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Year 2030
Project Description	Year 2030 Traffic Operations Analysis of the US 160 FEIS		

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 60.0 mph S_{FR} = 40.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D,V_R,V_f)	VD = 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 f_{HV} f_p
Freeway	2595	0.95	Rolling	5	0	0.930	1.00	2936
Ramp	280	0.95	Rolling	2	0	0.971	1.00	304
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

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 Estimation

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} =1.000 using Equation 0

V_{12} = 2936 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{Fl}=V_F$	2936	4600	No
V_{12}	2936	4400:All	No
$V_{FO} = V_F - V_R$	2632	4600	No
V_R	304	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 20.5 (pc/ mi /ln)

LOS= C (Exhibit 25-4)

Speed Estimation

D_s = 0.390 (Exhibit 25-19)

S_R= 53.0 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 53.0 mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SEH Inc.	Freeway/Dir of Travel	US 160 Westbound
Agency or Company		Junction	CR 233 Off Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	Year 2030
Project Description	Year 2030 Traffic Operations Analysis of the US 160 FEIS		

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft		L_{down} = ft
Vu = veh/h	S_{FF} = 60.0 mph S_{FR} = 40.0 mph Sketch (show lanes, L_A, L_D,V_R,V_f)	VD = 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 f_{HV} f_p
Freeway	1875	0.95	Rolling	5	0	0.930	1.00	2122
Ramp	290	0.95	Rolling	2	0	0.971	1.00	314
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

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 Estimation

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} =1.000 using Equation 0

V_{12} = 2122 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{Fl}=V_F$	2122	4600	No
V_{12}	2122	4400:All	No
$V_{FO} = V_F - V_R$	1808	4600	No
V_R	314	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 13.5 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

D_s = 0.391 (Exhibit 25-19)

S_R= 53.0 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 53.0 mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2	SEH Inc.	Freeway/Dir of Travel	US 160 Eastbound
Agency or Company		Junction	CR 223 On Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Year 2030

Project Description Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Rolling

S_{FF} = 60.0 mph S_{FR} = 40.0 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	$v=V/PHF\ f_{HV}\ f_p$
Freeway	2395	0.95	Rolling	5	0	0.930	1.00	2710
Ramp	400	0.95	Rolling	2	0	0.971	1.00	434
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 2710 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	3144	See Exhibit 25-7	No
V_{R12}	3144	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 = 20.6 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.294 (Exibit 25-19)

S_R= 54.7 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 54.7 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

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Westbound
From/To:	SH 172 to CR 233
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	1875	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	493	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1061	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1061	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	17.7	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak
Freeway/Direction:	Eastbound
From/To:	US 550/CR 233 to SH 172
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	2795	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	736	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1581	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1581	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	26.4	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Eastbound
From/To:	CR 233 to SH 172
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	1755	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	462	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	993	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	993	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	16.5	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak
Freeway/Direction:	Westbound
From/To:	Between CR 233 Ramps
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	2315	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	609	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1310	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1310	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	21.8	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Westbound
From/To:	Between CR 233 Ramps
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	1585	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	417	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	897	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	897	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	14.9	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak
Freeway/Direction:	Eastbound
From/To:	Between CR 233 Ramps
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	2395	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	630	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1355	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1355	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	22.6	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Eastbound
From/To:	Between CR 233 Ramps
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	1560	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	411	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	883	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	883	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	14.7	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak
Freeway/Direction:	Westbound
From/To:	CR 233 to Grandview
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	3815	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1004	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1439	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1439	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	3	
Density, D	24.0	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Westbound
From/To:	CR 233 to Grandview
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	2320	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	611	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	875	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	875	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	3	
Density, D	14.6	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak
Freeway/Direction:	Eastbound
From/To:	Grandview to CR 233
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	3460	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	911	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1305	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1305	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	3	
Density, D	21.8	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Eastbound
From/To:	Grandview to CR 233
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	2650	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	697	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1000	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1000	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	3	
Density, D	16.7	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak
Freeway/Direction:	Westbound
From/To:	Between ramp C and D
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	3440	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	905	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1298	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1298	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	3	
Density, D	21.6	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Westbound
From/To:	Between ramp C and D
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	1940	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	511	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	732	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	732	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	3	
Density, D	12.2	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Eastbound
From/To:	Between Ramp A & B
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	3460	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	911	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1305	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1305	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	3	
Density, D	21.8	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Eastbound
From/To:	Between Ramp A & B
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	2650	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	697	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1000	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1000	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	3	
Density, D	16.7	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak
Freeway/Direction:	Westbound
From/To:	Between ramp C and E
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	4030	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1061	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1520	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1520	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	3	
Density, D	25.3	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Westbound
From/To:	Between ramp C and E
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	2940	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	774	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1109	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1109	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	3	
Density, D	18.5	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak
Freeway/Direction:	Eastbound
From/To:	Between Ramp A & B
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	2980	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	784	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1124	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1124	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	3	
Density, D	18.7	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Eastbound
From/To:	Between Ramp A & B
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	2030	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	534	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	766	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	766	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	3	
Density, D	12.8	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak
Freeway/Direction:	Westbound
From/To:	West of Grandview
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	4620	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1216	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1743	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1743	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.9	mi/h
Number of lanes, N	3	
Density, D	29.1	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Westbound
From/To:	West of Grandview
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	3325	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	875	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1254	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1254	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	3	
Density, D	20.9	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak
Freeway/Direction:	Eastbound
From/To:	West of Grandview
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	4525	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1191	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1707	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1707	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.9	mi/h
Number of lanes, N	3	
Density, D	28.5	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Eastbound
From/To:	West of Grandview
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	2830	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	745	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1067	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1067	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	3	
Density, D	17.8	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak
Freeway/Direction:	Westbound
From/To:	Between SH 172 Ramps
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	1505	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	396	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	852	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	852	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	14.2	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Westbound
From/To:	Between SH 172 Ramps
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	935	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	246	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	529	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	529	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	8.8	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak
Freeway/Direction:	Eastbound
From/To:	Between SH 172 Ramps
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	1555	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	409	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	880	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	880	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	14.7	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Eastbound
From/To:	Between SH 172 Ramps
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	1145	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	301	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	648	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	648	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	10.8	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak
Freeway/Direction:	Westbound
From/To:	SH 172 to CR 233
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	2595	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	683	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1468	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

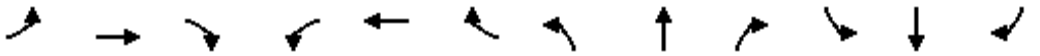
Flow rate, vp	1468	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	24.5	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

Appendix B

Alternative G Modified

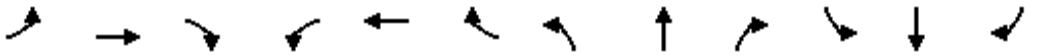
At-Grade Intersection Evaluation Worksheets



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	385	1555	855	125	1505	90	685	105	115	135	80	405
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	4.0	4.0	5.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	1863	1583	1770	1863	1583
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)	405	1637	900	132	1584	95	721	111	121	142	84	426
RTOR Reduction (vph)	0	0	352	0	0	40	0	0	0	0	0	0
Lane Group Flow (vph)	405	1637	548	132	1584	55	721	111	121	142	84	426
Turn Type	Prot		Perm	Prot		Perm	Prot		Free	Prot		Free
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			Free			Free
Actuated Green, G (s)	17.0	70.0	70.0	11.0	64.0	64.0	30.0	26.0	145.0	20.0	16.0	145.0
Effective Green, g (s)	17.0	70.0	70.0	11.0	64.0	64.0	30.0	26.0	145.0	20.0	16.0	145.0
Actuated g/C Ratio	0.12	0.48	0.48	0.08	0.44	0.44	0.21	0.18	1.00	0.14	0.11	1.00
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0		4.0	5.0	
Lane Grp Cap (vph)	402	1708	764	134	1562	699	710	334	1583	244	206	1583
v/s Ratio Prot	c0.12	0.46		0.07	c0.45		c0.21	0.06		0.08	c0.05	
v/s Ratio Perm			0.35			0.03			0.08			0.27
v/c Ratio	1.01	0.96	0.72	0.99	1.01	0.08	1.02	0.33	0.08	0.58	0.41	0.27
Uniform Delay, d1	64.0	36.1	29.7	66.9	40.5	23.4	57.5	51.9	0.0	58.6	60.1	0.0
Progression 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
Incremental Delay, d2	46.8	13.9	5.7	73.9	26.3	0.2	37.7	2.7	0.1	9.8	5.9	0.4
Delay (s)	110.8	50.0	35.4	140.8	66.8	23.7	95.2	54.6	0.1	68.3	66.0	0.4
Level of Service	F	D	D	F	E	C	F	D	A	E	E	A
Approach Delay (s)		53.9			69.9			78.4			23.7	
Approach LOS		D			E			E			C	

Intersection Summary					
HCM Average Control Delay	59.0	HCM Level of Service		E	
HCM Volume to Capacity ratio	0.94				
Actuated Cycle Length (s)	145.0	Sum of lost time (s)		18.0	
Intersection Capacity Utilization	90.5%	ICU Level of Service		E	
Analysis Period (min)	15				

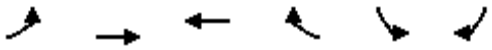
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	720	2395	345	90	2315	190	570	85	150	250	85	930
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	4.0	4.0	5.0	5.0	4.0	5.0	4.0	4.0	5.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	1863	1583	3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	1863	1583	3433	1863	1583
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)	758	2521	363	95	2437	200	600	89	158	263	89	979
RTOR Reduction (vph)	0	0	0	0	0	60	0	0	0	0	0	0
Lane Group Flow (vph)	758	2521	363	95	2437	140	600	89	158	263	89	979
Turn Type	Prot		Free	Prot		Perm	Prot		Free	Prot		Free
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			Free			8			Free			Free
Actuated Green, G (s)	23.0	88.0	150.0	12.0	77.0	77.0	20.0	14.0	150.0	18.0	12.0	150.0
Effective Green, g (s)	23.0	88.0	150.0	12.0	77.0	77.0	20.0	14.0	150.0	18.0	12.0	150.0
Actuated g/C Ratio	0.15	0.59	1.00	0.08	0.51	0.51	0.13	0.09	1.00	0.12	0.08	1.00
Clearance Time (s)	4.0	5.0		4.0	5.0	5.0	4.0	5.0		4.0	5.0	
Lane Grp Cap (vph)	526	2076	1583	142	1817	813	458	174	1583	412	149	1583
v/s Ratio Prot	c0.22	0.71		0.05	c0.69		c0.17	0.05		0.08	0.05	
v/s Ratio Perm			0.23			0.09			0.10			c0.62
v/c Ratio	1.44	1.21	0.23	0.67	1.34	0.17	1.31	0.51	0.10	0.64	0.60	0.62
Uniform Delay, d1	63.5	31.0	0.0	67.1	36.5	19.5	65.0	64.7	0.0	62.9	66.7	0.0
Progression Factor	0.94	1.11	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	199.5	96.9	0.0	22.3	157.3	0.5	154.5	10.3	0.1	7.4	16.4	1.8
Delay (s)	259.1	131.3	0.0	89.4	193.8	19.9	219.5	75.1	0.1	70.3	83.1	1.8
Level of Service	F	F	A	F	F	B	F	E	A	E	F	A
Approach Delay (s)		144.8			177.5			163.4			20.8	
Approach LOS		F			F			F			C	

Intersection Summary					
HCM Average Control Delay	137.8	HCM Level of Service		F	
HCM Volume to Capacity ratio	1.27				
Actuated Cycle Length (s)	150.0	Sum of lost time (s)		13.0	
Intersection Capacity Utilization	119.1%	ICU Level of Service		H	
Analysis Period (min)	15				

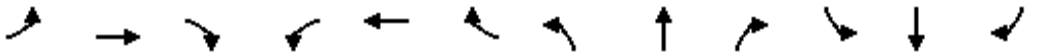
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	550	3290	3675	135	170	590
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	5.0	4.0	4.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	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	3539	3539	1583	3433	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	3539	3539	1583	3433	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	579	3463	3868	142	179	621
RTOR Reduction (vph)	0	0	0	28	0	0
Lane Group Flow (vph)	579	3463	3868	114	179	621
Turn Type	Prot			Perm		Free
Protected Phases	7	4	8		1	
Permitted Phases				8		Free
Actuated Green, G (s)	18.0	129.0	107.0	107.0	12.0	150.0
Effective Green, g (s)	18.0	129.0	107.0	107.0	12.0	150.0
Actuated g/C Ratio	0.12	0.86	0.71	0.71	0.08	1.00
Clearance Time (s)	4.0	5.0	5.0	5.0	4.0	
Lane Grp Cap (vph)	412	3044	2524	1129	275	1583
v/s Ratio Prot	c0.17	0.98	c1.09		c0.05	
v/s Ratio Perm				0.07		0.39
v/c Ratio	1.41	1.14	1.53	0.10	0.65	0.39
Uniform Delay, d1	66.0	10.5	21.5	6.6	67.0	0.0
Progression Factor	1.00	1.00	1.15	2.08	1.00	1.00
Incremental Delay, d2	196.5	66.5	239.8	0.0	11.4	0.7
Delay (s)	262.5	77.0	264.5	13.8	78.3	0.7
Level of Service	F	E	F	B	E	A
Approach Delay (s)		103.6	255.6		18.1	
Approach LOS		F	F		B	

Intersection Summary			
HCM Average Control Delay	164.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.44		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	136.4%	ICU Level of Service	H
Analysis Period (min)	15		

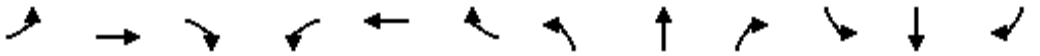
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	260	1145	350	70	935	70	685	55	65	50	40	255
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0	4.0	4.0	5.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	1863	1583	1770	1863	1583
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	1205	368	74	984	74	721	58	68	53	42	268
RTOR Reduction (vph)	0	0	245	0	0	49	0	0	0	0	0	0
Lane Group Flow (vph)	274	1205	123	74	984	25	721	58	68	53	42	268
Turn Type	Prot		Perm	Prot		Perm	Prot		Free	Prot		Free
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			Free			Free
Actuated Green, G (s)	10.0	33.5	33.5	10.0	33.5	33.5	22.5	28.5	100.0	10.0	16.0	100.0
Effective Green, g (s)	10.0	33.5	33.5	10.0	33.5	33.5	22.5	28.5	100.0	10.0	16.0	100.0
Actuated g/C Ratio	0.10	0.34	0.34	0.10	0.34	0.34	0.22	0.28	1.00	0.10	0.16	1.00
Clearance Time (s)	4.0	5.0	5.0	4.0	5.0	5.0	4.0	5.0		4.0	5.0	
Lane Grp Cap (vph)	343	1186	530	177	1186	530	772	531	1583	177	298	1583
v/s Ratio Prot	c0.08	c0.34		0.04	0.28		c0.21	0.03		0.03	0.02	
v/s Ratio Perm			0.08			0.02			0.04			c0.17
v/c Ratio	0.80	1.02	0.23	0.42	0.83	0.05	0.93	0.11	0.04	0.30	0.14	0.17
Uniform Delay, d1	44.0	33.2	24.0	42.3	30.6	22.5	38.0	26.4	0.0	41.8	36.1	0.0
Progression 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
Incremental Delay, d2	17.5	30.2	1.0	7.1	6.8	0.2	19.8	0.4	0.1	4.3	1.0	0.2
Delay (s)	61.5	63.4	25.0	49.4	37.4	22.6	57.8	26.8	0.1	46.0	37.1	0.2
Level of Service	E	E	C	D	D	C	E	C	A	D	D	A
Approach Delay (s)		55.5			37.2			51.0			11.2	
Approach LOS		E			D			D			B	

Intersection Summary			
HCM Average Control Delay	45.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	77.9%	ICU Level of Service	D
Analysis Period (min)	15		

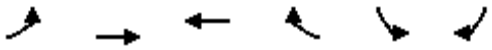
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	735	1560	355	95	1585	195	180	60	50	145	60	555
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	4.0	4.0	5.0	5.0	4.0	5.0	4.0	4.0	5.0	4.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	1863	1583	3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	1863	1583	3433	1863	1583
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)	774	1642	374	100	1668	205	189	63	53	153	63	584
RTOR Reduction (vph)	0	0	0	0	0	96	0	0	0	0	0	0
Lane Group Flow (vph)	774	1642	374	100	1668	109	189	63	53	153	63	584
Turn Type	Prot		Free	Prot		Perm	Prot		Free	Prot		Free
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			Free			8			Free			Free
Actuated Green, G (s)	31.0	74.0	140.0	22.0	65.0	65.0	10.0	16.0	140.0	10.0	16.0	140.0
Effective Green, g (s)	31.0	74.0	140.0	22.0	65.0	65.0	10.0	16.0	140.0	10.0	16.0	140.0
Actuated g/C Ratio	0.22	0.53	1.00	0.16	0.46	0.46	0.07	0.11	1.00	0.07	0.11	1.00
Clearance Time (s)	4.0	5.0		4.0	5.0	5.0	4.0	5.0		4.0	5.0	
Lane Grp Cap (vph)	760	1871	1583	278	1643	735	245	213	1583	245	213	1583
v/s Ratio Prot	c0.23	0.46		0.06	c0.47		c0.06	0.03		0.04	0.03	
v/s Ratio Perm			0.24			0.07			0.03			c0.37
v/c Ratio	1.02	0.88	0.24	0.36	1.02	0.15	0.77	0.30	0.03	0.62	0.30	0.37
Uniform Delay, d1	54.5	29.0	0.0	52.7	37.5	21.6	63.9	56.8	0.0	63.2	56.8	0.0
Progression 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
Incremental Delay, d2	37.4	6.2	0.4	3.6	26.1	0.4	20.7	3.5	0.0	11.4	3.5	0.7
Delay (s)	91.9	35.2	0.4	56.3	63.6	22.0	84.5	60.3	0.0	74.6	60.3	0.7
Level of Service	F	D	A	E	E	C	F	E	A	E	E	A
Approach Delay (s)		46.3			58.9			64.9			19.5	
Approach LOS		D			E			E			B	

Intersection Summary					
HCM Average Control Delay	47.8	HCM Level of Service		D	
HCM Volume to Capacity ratio	0.89				
Actuated Cycle Length (s)	140.0	Sum of lost time (s)		13.0	
Intersection Capacity Utilization	88.3%	ICU Level of Service		E	
Analysis Period (min)	15				

c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	550	2535	2175	140	110	385
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	5.0	5.0	5.0	4.0	4.0
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	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	3539	3539	1583	3433	1583
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	3539	3539	1583	3433	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	579	2668	2289	147	116	405
RTOR Reduction (vph)	0	0	0	55	0	0
Lane Group Flow (vph)	579	2668	2289	92	116	405
Turn Type	Prot			Perm		Free
Protected Phases	7	4	8		1	
Permitted Phases				8		Free
Actuated Green, G (s)	18.0	91.0	69.0	69.0	10.0	110.0
Effective Green, g (s)	18.0	91.0	69.0	69.0	10.0	110.0
Actuated g/C Ratio	0.16	0.83	0.63	0.63	0.09	1.00
Clearance Time (s)	4.0	5.0	5.0	5.0	4.0	
Lane Grp Cap (vph)	562	2928	2220	993	312	1583
v/s Ratio Prot	c0.17	0.75	c0.65		c0.03	
v/s Ratio Perm				0.06		0.26
v/c Ratio	1.03	0.91	1.03	0.09	0.37	0.26
Uniform Delay, d1	46.0	6.7	20.5	8.1	47.0	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	45.9	5.5	27.6	0.2	3.4	0.4
Delay (s)	91.9	12.2	48.1	8.3	50.4	0.4
Level of Service	F	B	D	A	D	A
Approach Delay (s)		26.4	45.7		11.5	
Approach LOS		C	D		B	

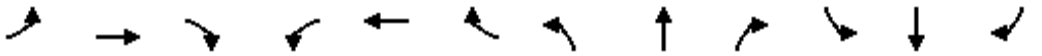
Intersection Summary			
HCM Average Control Delay	32.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.0
Intersection Capacity Utilization	95.0%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Appendix C

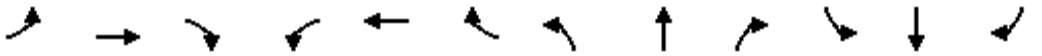
Alternative F Modified

Interchange Evaluation Worksheets



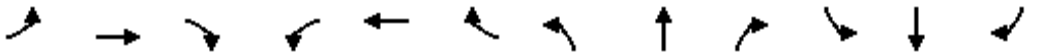
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	625	0	855	125	0	155	685	105	115	220	120	700
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	9.0		9.0	9.0		9.0	9.0	8.5	9.0	9.0	8.5	9.0
Lane Util. Factor	0.97		1.00	1.00		1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00		0.85	1.00		0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433		1583	1770		1583	3433	1863	1583	1770	1863	1583
Flt Permitted	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433		1583	1770		1583	3433	1863	1583	1770	1863	1583
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)	658	0	900	132	0	163	721	111	121	232	126	737
RTOR Reduction (vph)	0	0	267	0	0	23	0	0	65	0	0	37
Lane Group Flow (vph)	658	0	633	132	0	140	721	111	56	232	126	700
Turn Type	Prot		custom	Prot		custom	Prot		custom	Prot		custom
Protected Phases	1			1			5	6		5	6	
Permitted Phases			5 6			5 6			1 6			1 6
Actuated Green, G (s)	35.0		67.5	35.0		67.5	37.7	20.8	64.3	37.7	20.8	64.3
Effective Green, g (s)	35.0		67.5	35.0		67.5	37.7	20.8	55.8	37.7	20.8	55.8
Actuated g/C Ratio	0.29		0.56	0.29		0.56	0.31	0.17	0.46	0.31	0.17	0.46
Clearance Time (s)	9.0			9.0			9.0	8.5		9.0	8.5	
Vehicle Extension (s)	3.0			3.0			3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	1001		890	516		890	1079	323	736	556	323	736
v/s Ratio Prot	0.19			0.07			0.21	0.06		0.13	0.07	
v/s Ratio Perm			c0.40			0.09			0.04			c0.44
v/c Ratio	0.66		0.71	0.26		0.16	0.67	0.34	0.08	0.42	0.39	0.95
Uniform Delay, d1	37.2		19.1	32.5		12.6	35.7	43.6	17.8	32.5	44.0	30.8
Progression Factor	0.94		0.87	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.5		2.7	0.3		0.1	1.6	2.9	0.0	0.5	3.5	21.8
Delay (s)	36.6		19.3	32.8		12.7	37.3	46.5	17.9	33.0	47.5	52.6
Level of Service	D		B	C		B	D	D	B	C	D	D
Approach Delay (s)		26.6			21.7			35.9			47.9	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	34.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	27.0
Intersection Capacity Utilization	86.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			



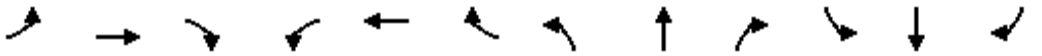
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	500	0	350	70	0	140	685	55	65	105	65	445
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	0.97		1.00	1.00		1.00	0.97	1.00	1.00	1.00	1.00	1.00
Frt	1.00		0.85	1.00		0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433		1583	1770		1583	3433	1863	1583	1770	1863	1583
Flt Permitted	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433		1583	1770		1583	3433	1863	1583	1770	1863	1583
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)	526	0	368	74	0	147	721	58	68	111	68	468
RTOR Reduction (vph)	0	0	254	0	0	102	0	0	29	0	0	39
Lane Group Flow (vph)	526	0	114	74	0	45	721	58	39	111	68	429
Turn Type	Prot		custom	Prot		custom	Prot		custom	Prot		custom
Protected Phases	1			1			5	6		5	6	
Permitted Phases			5			5			1 6			1 6
Actuated Green, G (s)	22.3		27.8	22.3		27.8	27.8	24.9	52.2	27.8	24.9	52.2
Effective Green, g (s)	22.3		27.8	22.3		27.8	27.8	24.9	52.2	27.8	24.9	52.2
Actuated g/C Ratio	0.25		0.31	0.25		0.31	0.31	0.28	0.58	0.31	0.28	0.58
Clearance Time (s)	5.0		5.0	5.0		5.0	5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0		3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	851		489	439		489	1060	515	918	547	515	918
v/s Ratio Prot	c0.15			0.04			c0.21	0.03		0.06	0.04	
v/s Ratio Perm			0.07			0.03			0.02			c0.27
v/c Ratio	0.62		0.23	0.17		0.09	0.68	0.11	0.04	0.20	0.13	0.47
Uniform Delay, d1	30.1		23.2	26.6		22.1	27.2	24.3	8.1	22.9	24.4	10.9
Progression Factor	1.02		0.88	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.3		0.2	0.2		0.1	1.8	0.4	0.0	0.2	0.5	0.4
Delay (s)	32.0		20.6	26.8		22.2	29.0	24.7	8.2	23.1	25.0	11.3
Level of Service	C		C	C		C	C	C	A	C	C	B
Approach Delay (s)		27.3			23.7			27.1			14.7	
Approach LOS		C			C			C			B	

Intersection Summary			
HCM Average Control Delay	23.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	55.4%	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												
Volume (vph)	960	0	1410	330	0	260	1160	190	460	335	130	1225
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	9.0		9.0	9.0		9.0	9.0	8.5	9.0	9.0	8.5	9.0
Lane Util. Factor	0.97		0.88	0.97		1.00	0.97	1.00	1.00	0.97	1.00	1.00
Frt	1.00		0.85	1.00		0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433		2787	3433		1583	3433	1863	1583	3433	1863	1583
Flt Permitted	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433		2787	3433		1583	3433	1863	1583	3433	1863	1583
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)	1011	0	1484	347	0	274	1221	200	484	353	137	1289
RTOR Reduction (vph)	0	0	189	0	0	5	0	0	168	0	0	0
Lane Group Flow (vph)	1011	0	1295	347	0	269	1221	200	316	353	137	1289
Turn Type	Prot		custom	Prot		custom	Prot		custom	Prot		custom
Protected Phases	1			1			5	6		5	6	
Permitted Phases			5 6			5 6			1 6			1 5 6
Actuated Green, G (s)	36.0		66.5	36.0		66.5	42.0	15.5	60.0	42.0	15.5	120.0
Effective Green, g (s)	36.0		66.5	36.0		66.5	42.0	15.5	51.5	42.0	15.5	111.5
Actuated g/C Ratio	0.30		0.55	0.30		0.55	0.35	0.13	0.43	0.35	0.13	0.93
Clearance Time (s)	9.0			9.0			9.0	8.5		9.0	8.5	
Vehicle Extension (s)	3.0			3.0			3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	1030		1544	1030		877	1202	241	679	1202	241	1471
v/s Ratio Prot	0.29			0.10			0.36	0.11		0.10	0.07	
v/s Ratio Perm			0.46			0.17			0.20			c0.81
v/c Ratio	0.98		0.84	0.34		0.31	1.02	0.83	0.46	0.29	0.57	0.88
Uniform Delay, d1	41.7		22.3	32.7		14.4	39.0	51.0	24.4	28.3	49.1	1.6
Progression Factor	1.00		1.00	0.90		0.75	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	23.5		4.2	0.2		0.2	30.0	26.9	0.5	0.1	9.4	6.2
Delay (s)	65.2		26.4	29.6		10.9	69.0	77.9	24.9	28.4	58.5	7.8
Level of Service	E		C	C		B	E	E	C	C	E	A
Approach Delay (s)		42.1			21.4			58.7			15.8	
Approach LOS		D			C			E			B	

Intersection Summary			
HCM Average Control Delay	38.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	123.5%	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												
Volume (vph)	976	0	675	335	0	265	1180	165	560	200	90	750
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	0.97		0.88	0.97		1.00	0.97	1.00	1.00	0.97	1.00	1.00
Frt	1.00		0.85	1.00		0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433		2787	3433		1583	3433	1863	1583	3433	1863	1583
Flt Permitted	0.95		1.00	0.95		1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433		2787	3433		1583	3433	1863	1583	3433	1863	1583
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)	1027	0	711	353	0	279	1242	174	589	211	95	789
RTOR Reduction (vph)	0	0	200	0	0	6	0	0	261	0	0	0
Lane Group Flow (vph)	1027	0	511	353	0	273	1242	174	328	211	95	789
Turn Type	Prot		custom	Prot		custom	Prot		custom	Prot		custom
Protected Phases	1			1			5	6		5	6	
Permitted Phases			5 6			5 6			1 6			1 5 6
Actuated Green, G (s)	29.0		51.0	29.0		51.0	34.0	12.0	46.0	34.0	12.0	90.0
Effective Green, g (s)	29.0		51.0	29.0		51.0	34.0	12.0	46.0	34.0	12.0	90.0
Actuated g/C Ratio	0.32		0.57	0.32		0.57	0.38	0.13	0.51	0.38	0.13	1.00
Clearance Time (s)	5.0			5.0			5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0			3.0			3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	1106		1579	1106		897	1297	248	809	1297	248	1583
v/s Ratio Prot	c0.30			0.10			c0.36	0.09		0.06	0.05	
v/s Ratio Perm			0.18			0.17			0.21			c0.50
v/c Ratio	0.93		0.32	0.32		0.30	0.96	0.70	0.41	0.16	0.38	0.50
Uniform Delay, d1	29.5		10.3	23.0		10.2	27.3	37.3	13.6	18.6	35.6	0.0
Progression Factor	1.00		1.00	0.74		1.38	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	13.1		0.1	0.1		0.2	15.8	15.3	0.3	0.1	4.4	0.2
Delay (s)	42.6		10.5	17.2		14.3	43.1	52.6	13.9	18.6	40.1	0.2
Level of Service	D		B	B		B	D	D	B	B	D	A
Approach Delay (s)		29.5			15.9			35.3			7.2	
Approach LOS		C			B			D			A	

Intersection Summary			
HCM Average Control Delay	25.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	88.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2	SEH Inc.	Freeway/Dir of Travel	US 160 Eastbound
Agency or Company		Junction	SH 172 On Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Year 2030

Project Description Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Rolling

S_{FF} = 60.0 mph S_{FR} = 40.0 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	$v=V/PHF\ f_{HV}\ f_p$
Freeway	1470	0.95	Rolling	5	0	0.930	1.00	1663
Ramp	335	0.95	Rolling	2	0	0.971	1.00	363
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 1663 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	2026	See Exhibit 25-7	No
V_{R12}	2026	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 = 11.9 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.233 (Exibit 25-19)

S_R= 55.8 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 55.8 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

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2	SEH Inc.	Freeway/Dir of Travel	US 160 Eastbound
Agency or Company		Junction	SH 172 On Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	Year 2030

Project Description Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Rolling

S_{FF} = 60.0 mph S_{FR} = 40.0 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	$v=V/PHF\ f_{HV}\ f_p$
Freeway	1090	0.95	Rolling	5	0	0.930	1.00	1233
Ramp	170	0.95	Rolling	2	0	0.971	1.00	184
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 1233 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	1417	See Exhibit 25-7	No
V_{R12}	1417	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 = 7.2 (pc/ m/ln)

LOS = A (Exhibit 25-4)

Speed Estimation

M_S = 0.219 (Exibit 25-19)

S_R= 56.0 mph (Exhibit 25-19)

S_0= N/A 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

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SEH Inc.	Freeway/Dir of Travel	US 160 Eastbound
Agency or Company		Junction	SH 172 Off Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Year 2030

Project Description: Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 60.0 mph S_{FR} = 40.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D,V_R,V_f)	VD = 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 f_{HV} f_p
Freeway	2950	0.95	Rolling	5	0	0.930	1.00	3338
Ramp	1480	0.95	Rolling	2	0	0.971	1.00	1605
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

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 Estimation

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} =1.000 using Equation 0

V_{12} = 3338 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{Fl}=V_F$	3338	4600	No
V_{12}	3338	4400:All	No
$V_{FO} = V_F - V_R$	1733	4600	No
V_R	1605	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 24.0 (pc/ mi /ln)

LOS= C (Exhibit 25-4)

Speed Estimation

D_s = 0.507 (Exhibit 25-19)

S_R= 50.9 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 50.9 mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SEH Inc.	Freeway/Dir of Travel	US 160 Eastbound
Agency or Company		Junction	SH 172 Off Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	Year 2030
Project Description	Year 2030 Traffic Operations Analysis of the US 160 FEIS		

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 60.0 mph S_{FR} = 40.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D,V_R,V_f)	VD = 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 f_{HV} f_p
Freeway	1940	0.95	Rolling	5	0	0.930	1.00	2195
Ramp	850	0.95	Rolling	2	0	0.971	1.00	922
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

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 Estimation

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} =1.000 using Equation 0

V_{12} = 2195 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{Fl}=V_F$	2195	4600	No
V_{12}	2195	4400:All	No
$V_{FO} = V_F - V_R$	1273	4600	No
V_R	922	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = 14.1 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

D_s = 0.446 (Exhibit 25-19)

S_R= 52.0 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 52.0 mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2	SEH Inc.	Freeway/Dir of Travel	US 160 Westbound
Agency or Company		Junction	US 550/CR 233 On Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Year 2030

Project Description Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Rolling

S_{FF} = 60.0 mph S_{FR} = 40.0 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	$v=V/PHF\ f_{HV}\ f_p$
Freeway	2235	0.95	Rolling	5	0	0.930	1.00	2529
Ramp	2385	0.95	Rolling	2	0	0.971	1.00	2586
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 2529 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	5115	See Exhibit 25-7	Yes
V_{R12}	5115	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 = 21.4 (pc/ m/ln)

LOS = F (Exhibit 25-4)

Speed Estimation

M_S = 0.679 (Exibit 25-19)

S_R= 47.8 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 47.8 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

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2	SEH Inc.	Freeway/Dir of Travel	US 160 Westbound
Agency or Company		Junction	US 550/CR 233 On Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	Year 2030

Project Description Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Rolling

S_{FF} = 60.0 mph S_{FR} = 40.0 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	$v=V/PHF\ f_{HV}\ f_p$
Freeway	1395	0.95	Rolling	5	0	0.930	1.00	1579
Ramp	1930	0.95	Rolling	2	0	0.971	1.00	2093
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 1579 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	3672	See Exhibit 25-7	No
V_{R12}	3672	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 = 10.3 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.183 (Exibit 25-19)

S_R= 56.7 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 56.7 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

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SEH Inc.	Freeway/Dir of Travel	US 160 Westbound
Agency or Company		Junction	US 550/CR 233 Off Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Year 2030

Project Description: Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 60.0 mph S_{FR} = 40.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D,V_R,V_f)	VD = veh/h

Conversion to pc/h Under Base Conditions

	V (Veh/hr)	PHF	Terrain	Truck	%Rv	f_{HV}	f_p	v=V/PHF f_{HV} f_p
Freeway	2825	0.95	Rolling	5	0	0.930	1.00	3197
Ramp	590	0.95	Rolling	2	0	0.971	1.00	640
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

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 Estimation

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} =1.000 using Equation 0

V_{12} = 3197 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{Fl}=V_F$	3197	4600	No
V_{12}	3197	4400:All	No
$V_{FO} = V_F - V_R$	2557	4600	No
V_R	640	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = 22.7 (pc/ mi /ln)

LOS= C (Exhibit 25-4)

Speed Estimation

D_s = 0.421 (Exhibit 25-19)

S_R= 52.4 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 52.4 mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SEH Inc.	Freeway/Dir of Travel	US 160 Westbound
Agency or Company		Junction	US 500/CR 233 Off Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	Year 2030

Project Description: Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 60.0 mph S_{FR} = 40.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D,V_R,V_f)	VD = 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 f_{HV} f_p
Freeway	1995	0.95	Rolling	5	0	0.930	1.00	2257
Ramp	600	0.95	Rolling	2	0	0.971	1.00	651
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

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 Estimation

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} =1.000 using Equation 0

V_{12} = 2257 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	2257	4600	No
V_{12}	2257	4400:All	No
$V_{FO} = V_F - V_R$	1606	4600	No
V_R	651	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = 14.7 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

D_s = 0.422 (Exhibit 25-19)

S_R= 52.4 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 52.4 mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2	SEH Inc.	Freeway/Dir of Travel	US 160 Eastbound
Agency or Company		Junction	US 550/CR 223 On Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Year 2030

Project Description Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Rolling

S_{FF} = 60.0 mph S_{FR} = 40.0 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	$v=V/PHF\ f_{HV}\ f_p$
Freeway	2155	0.95	Rolling	5	0	0.930	1.00	2439
Ramp	795	0.95	Rolling	2	0	0.971	1.00	862
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 2439 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	3301	See Exhibit 25-7	No
V_{R12}	3301	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 = 21.6 (pc/ m/ln)

LOS = C (Exhibit 25-4)

Speed Estimation

M_S = 0.309 (Exibit 25-19)

S_R= 54.4 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 54.4 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

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2	SEH Inc.	Freeway/Dir of Travel	US 160 Eastbound
Agency or Company		Junction	US 550/CR 223 On Ramp
Date Performed	11/18/2009	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	Year 2030

Project Description: Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain: Rolling

S_{FF} = 60.0 mph S_{FR} = 40.0 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	$v=V/PHF\ f_{HV}\ f_p$
Freeway	1180	0.95	Rolling	5	0	0.930	1.00	1335
Ramp	760	0.95	Rolling	2	0	0.971	1.00	824
UpStream								
DownStream								

Merge Areas | Diverge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 1335 pc/h

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

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	2159	See Exhibit 25-7	No
V_{R12}	2159	4600:All	No

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

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 = 12.7 (pc/ m/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/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

M_S = 0.237 (Exibit 25-19)

S_R= 55.7 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 55.7 mph (Exhibit 25-14)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SEH Inc.	Freeway/Dir of Travel	US 160 Eastbound
Agency or Company		Junction	US 550/CR 233 Off Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Year 2030

Project Description: Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 60.0 mph S_{FR} = 40.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D,V_R,V_f)	VD = 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 f_{HV} f_p
Freeway	4525	0.95	Rolling	5	0	0.930	1.00	5120
Ramp	2370	0.95	Rolling	2	0	0.971	1.00	2570
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

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 Estimation

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} =0.450 using Equation 0

V_{12} = 3717 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	5120	6900	No
V_{12}	3717	4400:All	No
$V_{FO} = V_F - V_R$	2550	6900	No
V_R	2570	4100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = 13.7 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

D_s = 0.594 (Exhibit 25-19)

S_R= 49.3 mph (Exhibit 25-19)

S_0= 64.2 mph (Exhibit 25-19)

S = 52.7 mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SEH Inc.	Freeway/Dir of Travel	US 160 Eastbound
Agency or Company		Junction	US 550/CR 233 Off Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	Year 2030

Project Description: Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 60.0 mph S_{FR} = 40.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D,V_R,V_f)	VD = 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 f_{HV} f_p
Freeway	2830	0.95	Rolling	5	0	0.930	1.00	3202
Ramp	1650	0.95	Rolling	2	0	0.971	1.00	1789
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

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 Estimation

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} =0.450 using Equation 0

V_{12} = 2425 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$	3202	6900	No
V_{12}	2425	4400:All	No
$V_{FO} = V_F - V_R$	1413	6900	No
V_R	1789	4100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = 2.6 (pc/ mi /ln)

LOS= A (Exhibit 25-4)

Speed Estimation

D_s = 0.524 (Exhibit 25-19)

S_R= 50.6 mph (Exhibit 25-19)

S_0= 65.8 mph (Exhibit 25-19)

S = 53.6 mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2	SEH Inc.	Freeway/Dir of Travel	US 160 Westbound
Agency or Company		Junction	SH 172 On Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Year 2030

Project Description Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Rolling

S_{FF} = 60.0 mph S_{FR} = 40.0 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	$v=V/PHF\ f_{HV}\ f_p$
Freeway	1440	0.95	Rolling	5	0	0.930	1.00	1629
Ramp	1385	0.95	Rolling	2	0	0.971	1.00	1502
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 1629 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	3131	See Exhibit 25-7	No
V_{R12}	3131	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 = 20.0 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.293 (Exibit 25-19)

S_R= 54.7 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 54.7 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

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst2	SEH Inc.	Freeway/Dir of Travel	US 160 Westbound
Agency or Company		Junction	SH 172 On Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	Year 2030

Project Description Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☐ No ☐ Off

L_{up} = ft

V_u = veh/h

Terrain Rolling

S_{FF} = 60.0 mph S_{FR} = 40.0 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	$v=V/PHF\ f_{HV}\ f_p$
Freeway	865	0.95	Rolling	5	0	0.930	1.00	979
Ramp	1130	0.95	Rolling	2	0	0.971	1.00	1225
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM}= 1.000 using Equation 0

V_{12}= 979 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}	2204	See Exhibit 25-7	No
V_{R12}	2204	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 = 12.9 (pc/ m/ln)

LOS = B (Exhibit 25-4)

Speed Estimation

M_S = 0.239 (Exibit 25-19)

S_R= 55.7 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S= 55.7 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

V_{12} = pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{FI}=V_F$		See Exhibit 25-14	
V_{12}		4400:All	
$V_{FO} = V_F - V_R$		See Exhibit 25-14	
V_R		See Exhibit 25-3	

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\ V_{12} - 0.009\ L_D$

D_R = (pc/ m/ln)

LOS= (Exhibit 25-4)

Speed Estimation

D_s = (Exhibit 25-19)

S_R= mph (Exhibit 25-19)

S_0= mph (Exhibit 25-19)

S = mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SEH Inc.	Freeway/Dir of Travel	US 160 Westbound
Agency or Company		Junction	SH 172 Off Ramp
Date Performed	11/12/2009	Jurisdiction	
Analysis Time Period	PM Peak	Analysis Year	Year 2030
Project Description	Year 2030 Traffic Operations Analysis of the US 160 FEIS		

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 60.0 mph S_{FR} = 40.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D,V_R,V_f)	VD = 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 f_{HV} f_p
Freeway	1720	0.95	Rolling	5	0	0.930	1.00	1946
Ramp	280	0.95	Rolling	2	0	0.971	1.00	304
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

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 Estimation

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} =1.000 using Equation 0

V_{12} = 1946 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{Fl}=V_F$	1946	4600	No
V_{12}	1946	4400:All	No
$V_{FO} = V_F - V_R$	1642	4600	No
V_R	304	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = 12.0 (pc/ mi /ln)

LOS= B (Exhibit 25-4)

Speed Estimation

D_s = 0.390 (Exhibit 25-19)

S_R= 53.0 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 53.0 mph (Exhibit 25-15)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst	SEH Inc.	Freeway/Dir of Travel	US 160 Westbound
Agency or Company		Junction	SH 172 Off Ramp
Date Performed	11/13/2009	Jurisdiction	
Analysis Time Period	AM Peak	Analysis Year	Year 2030

Project Description: Year 2030 Traffic Operations Analysis of the US 160 FEIS

Inputs

Upstream Adj Ramp	Terrain	Downstream Adj Ramp
☐ Yes ☐ On		☐ Yes ☐ On
☐ No ☐ Off		☐ No ☐ Off
L_{up} = ft	S_{FF} = 60.0 mph S_{FR} = 40.0 mph	L_{down} = ft
Vu = veh/h	Sketch (show lanes, L_A, L_D,V_R,V_f)	VD = 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 f_{HV} f_p
Freeway	1075	0.95	Rolling	5	0	0.930	1.00	1216
Ramp	210	0.95	Rolling	2	0	0.971	1.00	228
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

V_{12}= pc/h

Capacity Checks

	Actual	Maximum	LOS F?
V_{FO}		See Exhibit 25-7	
V_{R12}		4600:All	

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 Estimation

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} =1.000 using Equation 0

V_{12} = 1216 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$V_{Fl}=V_F$	1216	4600	No
V_{12}	1216	4400:All	No
$V_{FO} = V_F - V_R$	988	4600	No
V_R	228	2100	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$

D_R = 5.7 (pc/ mi /ln)

LOS= A (Exhibit 25-4)

Speed Estimation

D_s = 0.384 (Exhibit 25-19)

S_R= 53.1 mph (Exhibit 25-19)

S_0= N/A mph (Exhibit 25-19)

S = 53.1 mph (Exhibit 25-15)

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak
Freeway/Direction:	Eastbound
From/To:	West of US 550/CR 233
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	4525	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1191	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1707	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1707	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.9	mi/h
Number of lanes, N	3	
Density, D	28.5	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Eastbound
From/To:	West of US 550/CR 233
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	2830	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	745	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1067	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1067	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	3	
Density, D	17.8	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak
Freeway/Direction:	Westbound
From/To:	Between SH 172 Ramps
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	1440	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	379	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	815	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	815	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	13.6	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Westbound
From/To:	Between SH 172 Ramps
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	865	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	228	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	489	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	489	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	8.1	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak
Freeway/Direction:	Eastbound
From/To:	Between SH 172 Ramps
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	1470	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	387	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	832	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	832	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	13.9	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Eastbound
From/To:	Between SH 172 Ramps
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	1090	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	287	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	617	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	617	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	10.3	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak
Freeway/Direction:	Westbound
From/To:	SH 172 to US 550/CR 233
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	2825	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	743	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1598	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1598	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	26.6	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Westbound
From/To:	SH 172 to US 550/CR 233
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	1995	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	525	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1129	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1129	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	18.8	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak
Freeway/Direction:	Eastbound
From/To:	US 550/CR 233 to SH 172
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	2950	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	776	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1669	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1669	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	27.8	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Eastbound
From/To:	US 550/CR 233 to SH 172
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	1940	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	511	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1098	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1098	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	18.3	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak
Freeway/Direction:	Westbound
From/To:	Between CR 233/US 550 Ramps
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	2235	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	588	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1265	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1265	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	21.1	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Westbound
From/To:	Between CR 233/US 550 Ramps
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	1395	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	367	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	789	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	789	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	13.1	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak
Freeway/Direction:	Eastbound
From/To:	Between CR 233/US 550 Ramps
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	2155	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	567	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1219	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1219	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	20.3	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Eastbound
From/To:	Between CR 233/US 550 Ramps
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	1180	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	311	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	668	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	2	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	4.5	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	668	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	2	
Density, D	11.1	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	PM Peak
Freeway/Direction:	Westbound
From/To:	West of US 550/CR 233
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	4620	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	1216	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1743	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1743	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	59.9	mi/h
Number of lanes, N	3	
Density, D	29.1	pc/mi/ln
Level of service, LOS	D	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS2000: Basic Freeway Segments Release 4.1f

Operational Analysis

Analyst:	SEH Inc.
Agency or Company:	
Date Performed:	11/13/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	Westbound
From/To:	West of US 550/CR 233
Jurisdiction:	
Analysis Year:	Year 2030
Description:	Year 2030 Traffic Operations Analysis of the US 160 FEIS

Flow Inputs and Adjustments

Volume, V	3325	veh/h
Peak-hour factor, PHF	0.95	
Peak 15-min volume, v15	875	v
Trucks and buses	5	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.930	
Driver population factor, fp	1.00	
Flow rate, vp	1254	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	3	
Free-flow speed:	Measured	
FFS or BFFS	60.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	3.0	mi/h
Free-flow speed, FFS	60.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1254	pc/h/ln
Free-flow speed, FFS	60.0	mi/h
Average passenger-car speed, S	60.0	mi/h
Number of lanes, N	3	
Density, D	20.9	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.