APPENDIX K

2020 & 2040 Build 1 Freeway HCS Operational Analysis

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-95 NB
Weaving Segment Location	Seg 1-Bet Copans & Sample
Analysis Year	2020 Build 1

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2380ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4435	0.95	3	0	1.5	1.2	0.985	1.00	4738
V_{RF}	345	0.92	2	0	1.5	1.2	0.990	1.00	379
V_{FR}	810	0.92	2	0	1.5	1.2	0.990	1.00	889
V_{RR}	0	0.95	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	4738							V =	6006
V_W	1268								
VR	0.211								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1268 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	1703 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1496 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	3199 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	789

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	5924 veh/h	Weaving intensity factor, W	0.285
Weaving segment capacity, c_w	8772 veh/h	Weaving segment speed, S	54.5 mph
Weaving segment v/c ratio	0.675	Average weaving speed, S_W	57.8 mph
Weaving segment density, D	27.6 pc/mi/ln	Average non-weaving speed, S_{NW}	53.7 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	4650 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 2-Bet On & On from Sample*
Jurisdiction	
Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*4780*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1702*	pc/h/ln
S	*67.1*	mph
D = v_p / S	*25.4*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

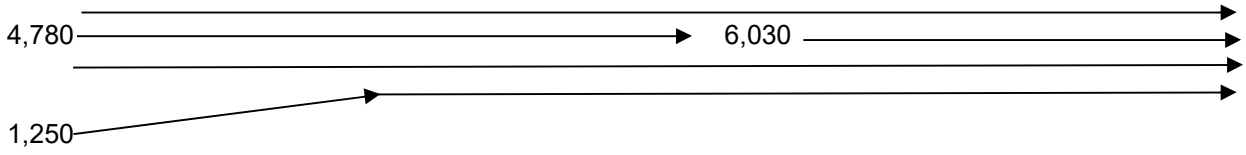
N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 10-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 3: I-95 Northbound On-Ramp from WB Sample Road**
Analysis Period: **AM Peak Hour**
Analysis Year: **2020 Build 1**



	PHF =	**0.95**		
	v_{fr} =	**6,030**	vph	
	v_r =	**1,250**	vph	
	v_f =	**4,780**		
Upstream Freeway	**Tr % =**	**3%**		
Ramp	**Tr % =**	**2%**		
Downstream Freeway	**Tr % =**	**3%**		
Freeway	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.985**
Ramp	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.9901**
flat terrain	**E_T =**	1.5		
	RV % =	0		
Driver Population adj.	**f_P =**	1.000		
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	**6,443**	**pc/h**
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	**1,329**	**pc/h**
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	**5,107**	**pc/h**
No. lanes upstream of ramp	**N =**	**3**		

No. Ln	Capacity Check (see Exhibits 25-3 and 25-7):	Maximum	Actual	V/c	LOS F?
4	Fwy downstream of ramp (assume 70 mph free-flow speed) =	9,600	6,443	0.67	No
3	Fwy upstream of ramp (assume 70 mph free-flow speed) =	7,200	5,107	0.71	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,329	0.63	No

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 4-Bet On from Sample & Exp*
Jurisdiction	
Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*6030*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade 0.00% Length	*0.00mi*
			Up/Down %	*0.00*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1611*	pc/h/ln
S	*68.0*	mph
D = v_p / S	*23.7*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 5-On from Exp
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2020 Build 1

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☑ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A	1500	☐ No	☑ Off
L_{up} =	ft	Deceleration Lane Length L_D		L_{down} =	6200 ft
V_u =	veh/h	Freeway Volume, V_F	6030	V_D =	1070 veh/h
		Ramp Volume, V_R	890		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6030	0.95	Level	3	0	0.985	1.00	6443
Ramp	890	0.92	Level	2	0	0.990	1.00	977
UpStream								
DownStream	1070	0.92	Level	2	0	0.990	1.00	1175

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.096 using Equation (Exhibit 13-6)

V_{12} = 616 pc/h

V_3 or V_{av34} 2913 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2577 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7420	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3863	Exhibit 13-8	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 = 27.4 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.357 (Exibit 13-11)

S_R= 60.0 mph (Exhibit 13-11)

S_0= 65.8 mph (Exhibit 13-11)

S = 62.6 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

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

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 6-Bet Exp On & Off to 10th*
Jurisdiction	
Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*6920*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*		E_R	*1.2*
E_T	*1.5*		$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2464*	pc/h/ln
S	*51.5*	mph
D = v_p / S	*47.9*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

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

Glossary

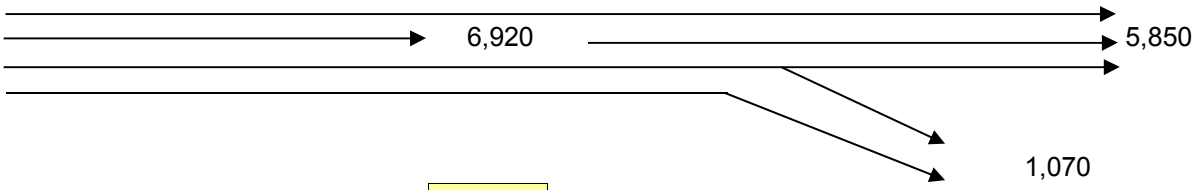
N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 7: I-95 NB Off-Ramp to SW 10th St EB & WB**
Analysis Period: **AM Peak Hour**
Analysis Year: **2020 Build 1**



	PHF =	**0.95**		
	v_{fr} =	**6,920**	vph	
	v_r =	**1,070**	vph	
	v_f =	**5,850**		
Upstream Freeway	**Tr % =**	**3%**		
Ramp	**Tr % =**	**2%**		
Downstream Freeway	**Tr % =**	**3%**		
Freeway	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.985**
Ramp	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.990099**
flat terrain	**E_T =**	1.5		
	RV % =	0		
Driver Population adj.	**f_P =**	1.000		
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	**7,393**	**pc/h**
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	**1,138**	**pc/h**
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	**6,250**	**pc/h**
No. lanes upstream of ramp	**N =**	**4**		

Average Freeway Density Upstream of Diverge (see Equation 13-26):

D = 0.0175 (V_{fr}/N) = **32.3** **pc/ln**

LOS in the Diverge Area (from Density and Exhibit 13-2) =

D

No. Ln	Capacity Check (see Exhibits 13-2, 13-8 and 13.10)	Maximum	Actual	LOS F?
4	Fwy upstream of ramp (assume 70 mph free-flow speed) =	9,600	7,393	No
3	Fwy downstream of ramp (assume 70 mph free-flow speed) =	7,200	6,250	No
1	Capacity on Off-Ramp (assume 45 mph free-flow speed) =	2,100	1,138	No

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 8-Bet Off & Off Ramps*
Jurisdiction	
Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*5850*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2083*	pc/h/ln
S	*61.0*	mph
D = v_p / S	*34.2*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 9-Off to Hillsboro EB&WB
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2020 Build 1

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☑ Yes	☑ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☐ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	200	L_{down} =	2800 ft
V_u =	veh/h	Freeway Volume, V_F	5850	V_D =	1460 veh/h
		Ramp Volume, V_R	1310		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5850	0.95	Level	3	0	0.985	1.00	6250
Ramp	1310	0.92	Level	2	0	0.990	1.00	1438
UpStream								
DownStream	1460	0.92	Level	2	0	0.990	1.00	1603

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

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 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R = mph (Exhibit 13-11)

S_0 = mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.538 using Equation (Exhibit 13-7)

V_{12} = 4025 pc/h

V_3 or V_{av34} 2225 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6250	Exhibit 13-8	7200	No
$V_{FO} = V_F - V_R$	4812	Exhibit 13-8	7200	No
V_R	1438	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4025	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

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

D_R = 37.1 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

D_s = 0.427 (Exhibit 13-12)

S_R = 58.0 mph (Exhibit 13-12)

S_0 = 72.0 mph (Exhibit 13-12)

S = 62.3 mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information			Site Information	
Analyst			Highway/Direction of Travel	*I-95 NB*
Agency or Company	*AECOM*		From/To	*Seg 10-Bet Off & On Ramps*
Date Performed			Jurisdiction	
Analysis Time Period	*AM*		Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*4540*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1617*	pc/h/ln	Design LOS	
S	*68.0*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*23.8*	pc/mi/ln	S	mph
LOS	*C*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 11-On Ramp 10th St EB & WB
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2020 Build 1

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☑ Off	Acceleration Lane Length, L_A	1200	☑ No	☐ Off
L_{up} =	2800 ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	1310 veh/h	Freeway Volume, V_F	4540	V_D =	veh/h
		Ramp Volume, V_R	1460		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4540	0.95	Level	3	0	0.985	1.00	4851
Ramp	1460	0.92	Level	2	0	0.990	1.00	1603
UpStream	1310	0.92	Level	2	0	0.990	1.00	1438
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = 2126.96 (Equation 13-6 or 13-7)

P_{FM} = 0.611 using Equation (Exhibit 13-6)

V_{12} = 2964 pc/h

V_3 or V_{av34} 1887 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2964 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6454	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4567	Exhibit 13-8	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 = 32.8 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.576 (Exibit 13-11)

S_R= 53.9 mph (Exhibit 13-11)

S_0= 65.0 mph (Exhibit 13-11)

S = 56.7 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

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

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 12-Bet On Ramps*
Jurisdiction	
Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*6000*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2137*	pc/h/ln
S	*59.8*	mph
D = v_p / S	*35.7*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-95 NB
Weaving Segment Location	Seg 13-Bet On & Off to Exp
Analysis Year	2020 Build 1

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	Two-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	4600ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4765	0.95	3	0	1.5	1.2	0.985	1.00	5091
V_{RF}	1145	0.92	2	0	1.5	1.2	0.990	1.00	1257
V_{FR}	1235	0.92	2	0	1.5	1.2	0.990	1.00	1356
V_{RR}	125	0.92	2	0	1.5	1.2	0.990	1.00	137
V_{NW}	7704							V =	7841
V_W	137								
VR	0.017								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	0 lc	Minimum weaving lane changes, LC_{MIN}	411 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	1037 lc/h
Minimum RF lane changes, LC_{RF}	0 lc/pc	Non-weaving lane changes, LC_{NW}	3407 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	4444 lc/h
Minimum RR lane changes, LC_{RR}	3 lc/pc	Non-weaving vehicle index, I_{NW}	2481

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	7739 veh/h	Weaving intensity factor, W	0.220
Weaving segment capacity, c_w	9068 veh/h	Weaving segment speed, S	57.7 mph
Weaving segment v/c ratio	0.853	Average weaving speed, S_W	60.1 mph
Weaving segment density, D	34.0 pc/mi/ln	Average non-weaving speed, S_{NW}	57.6 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	5889 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 14-North of Hillsboro*
Jurisdiction	
Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*5910*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*4*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.980*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1586*	pc/h/ln
S	*68.3*	mph
D = v_p / S	*23.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-95 NB
Weaving Segment Location	Seg 1-Bet Copans & Sample
Analysis Year	2020 Build 1

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2380ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4400	0.95	3	0	1.5	1.2	0.985	1.00	4701
V_{RF}	410	0.92	2	0	1.5	1.2	0.990	1.00	450
V_{FR}	1570	0.92	2	0	1.5	1.2	0.990	1.00	1724
V_{RR}	0	0.95	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	4701							V =	6875
V_W	2174								
VR	0.316								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	2174 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	2609 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1488 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	4097 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	783

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6784 veh/h	Weaving intensity factor, W	0.347
Weaving segment capacity, c_w	7478 veh/h	Weaving segment speed, S	48.8 mph
Weaving segment v/c ratio	0.907	Average weaving speed, S_W	55.8 mph
Weaving segment density, D	35.2 pc/mi/ln	Average non-weaving speed, S_{NW}	46.1 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	5759 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-95 NB*
Agency or Company	*AECOM*	From/To	*Seg 2-Bet On & On from Sample*
Date Performed		Jurisdiction	
Analysis Time Period	*PM*	Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*4810*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1713*	pc/h/ln
S	*66.9*	mph
D = v_p / S	*25.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

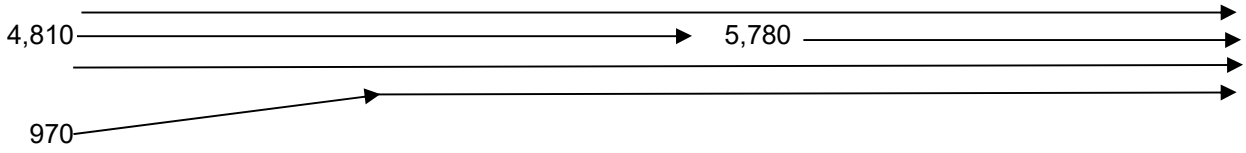
N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 10-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 3: I-95 Northbound On-Ramp from WB Sample Road**
Analysis Period: **PM Peak Hour**
Analysis Year: **2020 Build 1**



	PHF =	**0.95**		
	v_{fr} =	**5,780**	vph	
	v_r =	**970**	vph	
	v_f =	**4,810**		
Upstream Freeway	**Tr % =**	**3%**		
Ramp	**Tr % =**	**2%**		
Downstream Freeway	**Tr % =**	**3%**		
Freeway	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =	**0.985**	
Ramp	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =	**0.9901**	
flat terrain	**E_T =**	1.5		
	RV % =	0		
Driver Population adj.	**f_P =**	1.000		
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	**6,175**	**pc/h**
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	**1,031**	**pc/h**
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	**5,139**	**pc/h**
No. lanes upstream of ramp	**N =**	**3**		

No. Ln	Capacity Check (see Exhibits 25-3 and 25-7):	Maximum	Actual	V/c	LOS F?
4	Fwy downstream of ramp (assume 70 mph free-flow speed) =	9,600	6,175	0.64	No
3	Fwy upstream of ramp (assume 70 mph free-flow speed) =	7,200	5,139	0.71	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,031	0.49	No

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 4-Bet On from Sample & Exp*
Jurisdiction	
Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*5780*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade 0.00% Length	*0.00mi*
			Up/Down %	*0.00*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1544*	pc/h/ln
S	*68.6*	mph
D = v_p / S	*22.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 5-On from Exp
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2020 Build 1

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☑ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A	1500	☐ No	☑ Off
L_{up} =	ft	Deceleration Lane Length L_D		L_{down} =	6200 ft
V_u =	veh/h	Freeway Volume, V_F	5780	V_D =	1300 veh/h
		Ramp Volume, V_R	730		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5780	0.95	Level	3	0	0.985	1.00	6175
Ramp	730	0.92	Level	2	0	0.990	1.00	801
UpStream								
DownStream	1300	0.92	Level	2	0	0.990	1.00	1427

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.118 using Equation (Exhibit 13-6)

V_{12} = 727 pc/h

V_3 or V_{av34} 2724 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2470 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6976	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3567	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

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

D_R = 25.1 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.309 (Exibit 13-11)

S_R= 61.3 mph (Exhibit 13-11)

S_0= 66.0 mph (Exhibit 13-11)

S = 63.5 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

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

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 6-Bet Exp On & Off to 10th*
Jurisdiction	
Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*6510*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2318*	pc/h/ln
S	*55.5*	mph
D = v_p / S	*41.8*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

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

Glossary

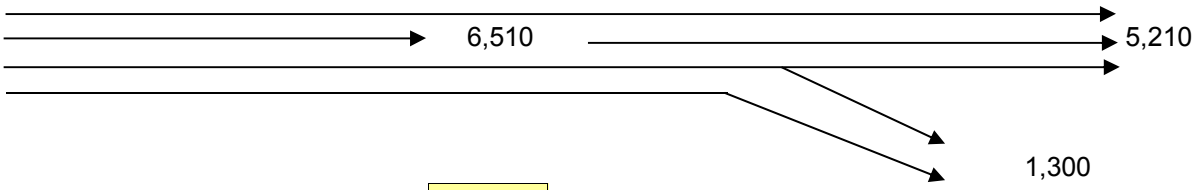
N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 7: I-95 NB Off-Ramp to SW 10th St EB & WB**
Analysis Period: **PM Peak Hour**
Analysis Year: **2020 Build 1**



	PHF =	**0.95**	
	v_{fr} =	**6,510**	vph
	v_r =	**1,300**	vph
	v_f =	**5,210**	
Upstream Freeway	**Tr % =**	**3%**	
Ramp	**Tr % =**	**2%**	
Downstream Freeway	**Tr % =**	**3%**	
Freeway	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =	**0.985**
Ramp	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =	**0.990099**
flat terrain	**E_T =**	1.5	
	RV % =	0	
Driver Population adj.	**f_P =**	1.000	
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	**6,955 pc/h**
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	**1,382 pc/h**
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	**5,566 pc/h**
No. lanes upstream of ramp	**N =**	**4**	

Average Freeway Density Upstream of Diverge (see Equation 13-26):

D = 0.0175 (V_{fr}/N) = 30.4 pc/ln

LOS in the Diverge Area (from Density and Exhibit 13-2) =

D

No. Ln	Capacity Check (see Exhibits 13-2, 13-8 and 13.10)	Maximum	Actual	LOS F?
4	Fwy upstream of ramp (assume 70 mph free-flow speed) =	9,600	6,955	No
3	Fwy downstream of ramp (assume 70 mph free-flow speed) =	7,200	5,566	No
1	Capacity on Off-Ramp (assume 45 mph free-flow speed) =	2,100	1,382	No

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 8-Bet Off & Off Ramps*
Jurisdiction	
Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*5210*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1855*	pc/h/ln
S	*65.0*	mph
D = v_p / S	*28.5*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 9-Off to Hillsboro EB&WB
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2020 Build 1

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☑ Yes	☑ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☐ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	200	L_{down} =	2800 ft
V_u =	veh/h	Freeway Volume, V_F	5210	V_D =	1160 veh/h
		Ramp Volume, V_R	1310		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5210	0.95	Level	3	0	0.985	1.00	5566
Ramp	1310	0.92	Level	2	0	0.990	1.00	1438
UpStream								
DownStream	1160	0.92	Level	2	0	0.990	1.00	1273

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

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 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.555 using Equation (Exhibit 13-7)

V_{12} = 3728 pc/h

V_3 or V_{av34} 1838 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5566	Exhibit 13-8	7200	No
$V_{FO} = V_F - V_R$	4128	Exhibit 13-8	7200	No
V_R	1438	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3728	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

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

D_R = 34.5 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.427 (Exhibit 13-12)

S_R= 58.0 mph (Exhibit 13-12)

S_0= 73.5 mph (Exhibit 13-12)

S = 62.4 mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-95 NB*
Agency or Company	*AECOM*	From/To	*Seg 10-Bet Off & On Ramps*
Date Performed		Jurisdiction	
Analysis Time Period	*PM*	Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*3900*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1389*	pc/h/ln
S	*69.6*	mph
D = v_p / S	*20.0*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 11-On Ramp 10th St EB & WB
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2020 Build 1

Project Description SW 10th Street SIMR

Site Information

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☑ Off	Acceleration Lane Length, L_A	1200	☑ No	☐ Off
L_{up} =	2800 ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	1310 veh/h	Freeway Volume, V_F	3900	V_D =	veh/h
		Ramp Volume, V_R	1160		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3900	0.95	Level	3	0	0.985	1.00	4167
Ramp	1160	0.92	Level	2	0	0.990	1.00	1273
UpStream	1310	0.92	Level	2	0	0.990	1.00	1438
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = 1909.96 (Equation 13-6 or 13-7)

P_{FM} = 0.611 using Equation (Exhibit 13-6)

V_{12} = 2546 pc/h

V_3 or V_{av34} 1621 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2546 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5440	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3819	Exhibit 13-8	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 = 27.2 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.379 (Exibit 13-11)

S_R= 59.4 mph (Exhibit 13-11)

S_0= 66.0 mph (Exhibit 13-11)

S = 61.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

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

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 12-Bet On Ramps*
Jurisdiction	
Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*5060*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1802*	pc/h/ln
S	*65.8*	mph
D = v_p / S	*27.4*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-95 NB
Weaving Segment Location	Seg 13-Bet On & Off to Exp
Analysis Year	2020 Build 1

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	Two-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	4600ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4095	0.95	3	0	1.5	1.2	0.985	1.00	4375
V_{RF}	1145	0.92	2	0	1.5	1.2	0.990	1.00	1257
V_{FR}	965	0.92	2	0	1.5	1.2	0.990	1.00	1059
V_{RR}	125	0.92	2	0	1.5	1.2	0.990	1.00	137
V_{NW}	6691							V =	6828
V_W	137								
VR	0.020								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	0 lc	Minimum weaving lane changes, LC_{MIN}	411 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	1037 lc/h
Minimum RF lane changes, LC_{RF}	0 lc/pc	Non-weaving lane changes, LC_{NW}	3181 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	4218 lc/h
Minimum RR lane changes, LC_{RR}	3 lc/pc	Non-weaving vehicle index, I_{NW}	2155

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6740 veh/h	Weaving intensity factor, W	0.211
Weaving segment capacity, c_w	9064 veh/h	Weaving segment speed, S	58.9 mph
Weaving segment v/c ratio	0.744	Average weaving speed, S_W	60.4 mph
Weaving segment density, D	29.0 pc/mi/ln	Average non-weaving speed, S_{NW}	58.8 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	5913 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-95 NB*
Agency or Company	*AECOM*	From/To	*Seg 14-North of Hillsboro*
Date Performed		Jurisdiction	
Analysis Time Period	*AM*	Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*5240*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.980*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1407*	pc/h/ln
S	*69.5*	mph
D = v_p / S	*20.2*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 1-Bet Hillsboro & Palmetto*
Jurisdiction	
Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*4540*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*		E_R	*1.2*
E_T	*1.5*		$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1213*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*17.3*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I95/SB
Weaving Segment Location	Seg 2-Bet On from Exp & Off
Analysis Year	2020 Build 1

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	Two-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	5200ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	3440	0.95	3	0	1.5	1.2	0.985	1.00	3675
V_{RF}	1070	0.92	2	0	1.5	1.2	0.990	1.00	1175
V_{FR}	1100	0.92	2	0	1.5	1.2	0.990	1.00	1208
V_{RR}	120	0.92	2	0	1.5	1.2	0.990	1.00	132
V_{NW}	6058							V =	6190
V_W	132								
VR	0.021								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	0 lc	Minimum weaving lane changes, LC_{MIN}	396 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	1064 lc/h
Minimum RF lane changes, LC_{RF}	0 lc/pc	Non-weaving lane changes, LC_{NW}	3040 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	4104 lc/h
Minimum RR lane changes, LC_{RR}	3 lc/pc	Non-weaving vehicle index, I_{NW}	2205

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6111 veh/h	Weaving intensity factor, W	0.188
Weaving segment capacity, c_w	9241 veh/h	Weaving segment speed, S	59.8 mph
Weaving segment v/c ratio	0.661	Average weaving speed, S_W	61.3 mph
Weaving segment density, D	25.9 pc/mi/ln	Average non-weaving speed, S_{NW}	59.7 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	5925 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 3-Bet Off & On Ramp*
Jurisdiction	
Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*4510*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1606*	pc/h/ln
S	*68.1*	mph
D = v_p / S	*23.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 4-Diverge to SW 10th St
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2020 Build 1

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☑ Yes	☑ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☐ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	200	L_{down} =	1200 ft
V_u =	veh/h	Freeway Volume, V_F	4510	V_D =	1370 veh/h
		Ramp Volume, V_R	1180		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4510	0.95	Level	3	0	0.985	1.00	4819
Ramp	1180	0.92	Level	2	0	0.990	1.00	1295
UpStream								
DownStream	1370	0.92	Level	2	0	0.990	1.00	1504

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

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 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.580 using Equation (Exhibit 13-7)

V_{12} = 3339 pc/h

V_3 or V_{av34} 1480 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	4819	Exhibit 13-8	7200	No
$V_{FO} = V_F - V_R$	3524	Exhibit 13-8	7200	No
V_R	1295	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3339	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

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

D_R = 31.2 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.415 (Exhibit 13-12)

S_R= 58.4 mph (Exhibit 13-12)

S_0= 74.9 mph (Exhibit 13-12)

S = 62.6 mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-95 SB*
Agency or Company	*AECOM*	From/To	*Seg 5-Bet Off & On Ramps*
Date Performed		Jurisdiction	
Analysis Time Period	*AM*	Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*3300*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1175*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*16.8*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 6-Merge from Hillsboro E&W
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2020 Build 1

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☑ Off	Acceleration Lane Length, L_A	1100	☑ No	☐ Off
L_{up} =	1200 ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	1180 veh/h	Freeway Volume, V_F	3300	V_D =	veh/h
		Ramp Volume, V_R	1370		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3300	0.95	Level	3	0	0.985	1.00	3526
Ramp	1370	0.92	Level	2	0	0.990	1.00	1504
UpStream	1180	0.92	Level	2	0	0.990	1.00	1295
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = 1777.82 (Equation 13-6 or 13-7)

P_{FM} = 0.572 using Equation (Exhibit 13-6)

V_{12} = 2016 pc/h

V_3 or V_{av34} 1510 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2016 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5030	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3520	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

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

D_R = 25.3 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.343 (Exibit 13-11)

S_R= 60.4 mph (Exhibit 13-11)

S_0= 66.4 mph (Exhibit 13-11)

S = 62.1 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

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

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 7-Bet On Ramps*
Jurisdiction	
Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*4700*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1674*	pc/h/ln
S	*67.4*	mph
D = v_p / S	*24.8*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

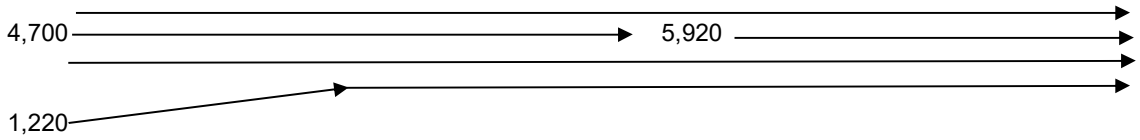
N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 8: I-95 Southbound On-Ramp from SW 10th Street EB & WB**
Analysis Period: **AM Peak Hour**
Analysis Year: **2020 Build 1**



	PHF =	**0.95**		
	v_{fr} =	**5,920**	vph	
	v_r =	**1,220**	vph	
	v_f =	**4,700**		
Upstream Freeway	**Tr % =**	**3%**		
Ramp	**Tr % =**	**2%**		
Downstream Freeway	**Tr % =**	**3%**		
Freeway	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =	**0.985**	
Ramp	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =	**0.9901**	
flat terrain	**E_T =**	1.5		
	RV % =	0		
Driver Population adj.	**f_P =**	1.000		
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	**6,325**	**pc/h**
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	**1,297**	**pc/h**
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	**5,022**	**pc/h**
No. lanes upstream of ramp	**N =**	**3**		

No. Ln	**Capacity Check (see Exhibits 25-3 and 25-7):**	Maximum	Actual	V/c	LOS F?
4	Fwy downstream of ramp (assume 70 mph free-flow speed) =	9,600	6,325	0.66	No
3	Fwy upstream of ramp (assume 70 mph free-flow speed) =	7,200	5,022	0.70	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,297	0.62	No

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 9-Bet 10th & Exit to Exp*
Jurisdiction	
Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*5920*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1581*	pc/h/ln
S	*68.3*	mph
D = v_p / S	*23.1*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 10- Diverge to Express
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2020 Build 1

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☑ Yes	☑ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	4500 ft	Deceleration Lane Length L_D	300	L_{down} =	ft
V_u =	1220 veh/h	Freeway Volume, V_F	5920	V_D =	veh/h
		Ramp Volume, V_R	860		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5920	0.95	Level	3	0	0.985	1.00	6325
Ramp	860	0.92	Level	2	0	0.990	1.00	944
UpStream	1220	0.92	Level	2	0	0.990	1.00	1339
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

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 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 3290 pc/h

V_3 or V_{av34} 1517 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6325	Exhibit 13-8	9600	No
$V_{FO} = V_F - V_R$	5381	Exhibit 13-8	9600	No
V_R	944	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3290	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

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

D_R = 32.7 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.383 (Exhibit 13-12)

S_R= 59.3 mph (Exhibit 13-12)

S_0= 75.4 mph (Exhibit 13-12)

S = 65.3 mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-95 SB*
Agency or Company	*AECOM*	From/To	*Seg 11-Bet Off Exp Off Sample*
Date Performed		Jurisdiction	
Analysis Time Period	*AM*	Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*5060*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1352*	pc/h/ln
S	*69.7*	mph
D = v_p / S	*19.4*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

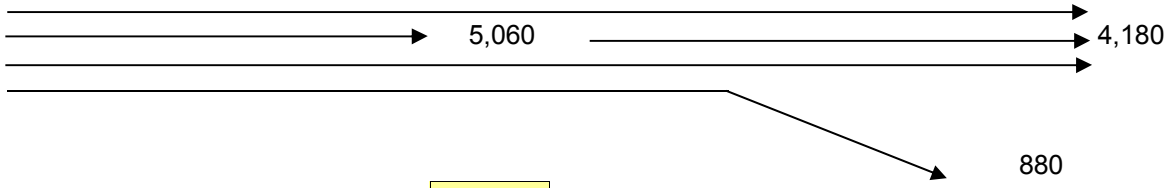
N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 12: I-95 SB Off-Ramp to Sample Road EB & WB**
Analysis Period: **AM Peak Hour**
Analysis Year: **2020 Build 1**



	PHF =	**0.95**		
	v_{fr} =	**5,060**	vph	
	v_r =	**880**	vph	
	v_f =	**4,180**		
Upstream Freeway	**Tr % =**	**3%**		
Ramp	**Tr % =**	**2%**		
Downstream Freeway	**Tr % =**	**3%**		
Freeway	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.985**
Ramp	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.9901**
flat terrain	**E_T =**	1.5		
	RV % =	0		
Driver Population adj.	**f_P =**	1.000		
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	**5,406**	**pc/h**
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	**936**	**pc/h**
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	**4,466**	**pc/h**
No. lanes upstream of ramp	**N =**	**4**		

Average Freeway Density Upstream of Diverge (see Equation 13-26):

D = 0.0175 (V_{fr}/N) = 23.7 pc/ln

LOS in the Diverge Area (from Density and Exhibit 13-2) =

C

No. Ln	Capacity Check (see Exhibits 13-2, 13-8 and 13.10)	Maximum	Actual	LOS F?
4	Fwy upstream of ramp (assume 70 mph free-flow speed) =	9,600	5,406	No
3	Fwy downstream of ramp (assume 70 mph free-flow speed) =	7,200	4,466	No
1	Capacity on Off-Ramp (assume 45 mph free-flow speed) =	2,100	936	No

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 13-Bet Off & On Ramps*
Jurisdiction	
Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*4180*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1489*	pc/h/ln
S	*69.0*	mph
D = v_p / S	*21.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-95 SB
Weaving Segment Location	Seg 14- Bet Sample & Copans
Analysis Year	2020 Build 1

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2520ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	3575	0.95	3	0	1.5	1.2	0.985	1.00	3820
V_{RF}	1790	0.92	2	0	1.5	1.2	0.990	1.00	1965
V_{FR}	605	0.92	2	0	1.5	1.2	0.990	1.00	664
V_{RR}	0	0.95	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	3820							V =	6449
V_W	2629								
VR	0.408								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	792

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6367 veh/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	5800 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.098	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	6767 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-95 SB*
Agency or Company	*AECOM*	From/To	*Seg 1-Bet Hillsboro & Palmetto*
Date Performed		Jurisdiction	
Analysis Time Period	*PM*	Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*4990*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1333*	pc/h/ln
S	*69.8*	mph
D = v_p / S	*19.1*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I95/SB
Weaving Segment Location	Seg 2-Bet On from Exp & Off
Analysis Year	2020 Build 1

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	Two-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	5200ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4055	0.95	3	0	1.5	1.2	0.985	1.00	4332
V_{RF}	1105	0.92	2	0	1.5	1.2	0.990	1.00	1213
V_{FR}	935	0.92	2	0	1.5	1.2	0.990	1.00	1026
V_{RR}	125	0.92	2	0	1.5	1.2	0.990	1.00	137
V_{NW}	6571							V =	6708
V_W	137								
VR	0.020								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	0 lc	Minimum weaving lane changes, LC_{MIN}	411 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	1079 lc/h
Minimum RF lane changes, LC_{RF}	0 lc/pc	Non-weaving lane changes, LC_{NW}	3154 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	4233 lc/h
Minimum RR lane changes, LC_{RR}	3 lc/pc	Non-weaving vehicle index, I_{NW}	2392

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6622 veh/h	Weaving intensity factor, W	0.192
Weaving segment capacity, c_w	9241 veh/h	Weaving segment speed, S	59.0 mph
Weaving segment v/c ratio	0.717	Average weaving speed, S_W	61.1 mph
Weaving segment density, D	28.4 pc/mi/ln	Average non-weaving speed, S_{NW}	59.0 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	5916 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 3-Bet Off & On Ramp*
Jurisdiction	
Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*5160*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1838*	pc/h/ln
S	*65.3*	mph
D = v_p / S	*28.2*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 4-Diverge to SW 10th St
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2020 Build 1

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☑ Yes	☑ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☐ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	200	L_{down} =	1200 ft
V_u =	veh/h	Freeway Volume, V_F	5160	V_D =	1500 veh/h
		Ramp Volume, V_R	1250		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5160	0.95	Level	3	0	0.985	1.00	5513
Ramp	1250	0.92	Level	2	0	0.990	1.00	1372
UpStream								
DownStream	1500	0.92	Level	2	0	0.990	1.00	1647

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

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 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.559 using Equation (Exhibit 13-7)

V_{12} = 3687 pc/h

V_3 or V_{av34} 1826 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5513	Exhibit 13-8	7200	No
$V_{FO} = V_F - V_R$	4141	Exhibit 13-8	7200	No
V_R	1372	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3687	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

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

D_R = 34.2 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.421 (Exhibit 13-12)

S_R= 58.2 mph (Exhibit 13-12)

S_0= 73.6 mph (Exhibit 13-12)

S = 62.5 mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 5-Bet Off & On Ramps*
Jurisdiction	
Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*3910*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1393*	pc/h/ln
S	*69.6*	mph
D = v_p / S	*20.0*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 6-Merge from Hillsboro E&W
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2020 Build 1

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☑ Off	Acceleration Lane Length, L_A	1100	☑ No	☐ Off
L_{up} =	1200 ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	1250 veh/h	Freeway Volume, V_F	3910	V_D =	veh/h
		Ramp Volume, V_R	1500		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3910	0.95	Level	3	0	0.985	1.00	4178
Ramp	1500	0.92	Level	2	0	0.990	1.00	1647
UpStream	1250	0.92	Level	2	0	0.990	1.00	1372
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = 1947.95 (Equation 13-6 or 13-7)

P_{FM} = 0.561 using Equation (Exhibit 13-6)

V_{12} = 2344 pc/h

V_3 or V_{av34} 1834 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2387 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5825	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4034	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

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

D_R = 29.3 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.431 (Exibit 13-11)

S_R= 57.9 mph (Exhibit 13-11)

S_0= 65.4 mph (Exhibit 13-11)

S = 60.0 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

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

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 7-Bet On Ramps*
Jurisdiction	
Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*5410*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1927*	pc/h/ln
S	*63.9*	mph
D = v_p / S	*30.2*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

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

Glossary

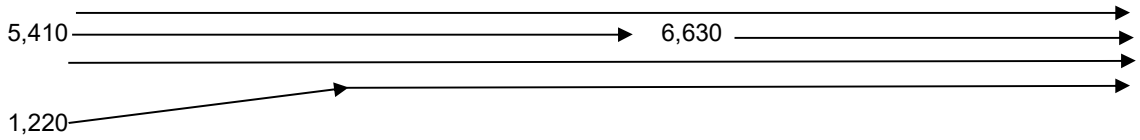
N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 8: I-95 Southbound On-Ramp from SW 10th Street EB & WB**
Analysis Period: **PM Peak Hour**
Analysis Year: **2020 Build 1**



	PHF =	**0.95**		
	v_{fr} =	**6,630**	vph	
	v_r =	**1,220**	vph	
	v_f =	**5,410**		
Upstream Freeway	**Tr % =**	**3%**		
Ramp	**Tr % =**	**2%**		
Downstream Freeway	**Tr % =**	**3%**		
Freeway	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =	**0.985**	
Ramp	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =	**0.9901**	
flat terrain	**E_T =**	1.5		
	RV % =	0		
Driver Population adj.	**f_P =**	1.000		
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	**7,084**	**pc/h**
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	**1,297**	**pc/h**
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	**5,780**	**pc/h**
No. lanes upstream of ramp	**N =**	**3**		

No. Ln	**Capacity Check (see Exhibits 25-3 and 25-7):**	Maximum	Actual	V/c	LOS F?
4	Fwy downstream of ramp (assume 70 mph free-flow speed) =	9,600	7,084	0.74	No
3	Fwy upstream of ramp (assume 70 mph free-flow speed) =	7,200	5,780	0.80	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,297	0.62	No

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 9-Bet 10th & Exit to Exp*
Jurisdiction	
Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*6630*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1771*	pc/h/ln
S	*66.2*	mph
D = v_p / S	*26.7*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 10-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 10- Diverge to Express
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2020 Build 1

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☑ Yes	☑ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	4500 ft	Deceleration Lane Length L_D	300	L_{down} =	ft
V_u =	1220 veh/h	Freeway Volume, V_F	6630	V_D =	veh/h
		Ramp Volume, V_R	720		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6630	0.95	Level	3	0	0.985	1.00	7084
Ramp	720	0.92	Level	2	0	0.990	1.00	790
UpStream	1220	0.92	Level	2	0	0.990	1.00	1339
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

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 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 3534 pc/h

V_3 or V_{av34} 1775 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7084	Exhibit 13-8	9600	No
$V_{FO} = V_F - V_R$	6294	Exhibit 13-8	9600	No
V_R	790	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3534	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

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

D_R = 35.0 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.369 (Exhibit 13-12)

S_R= 59.7 mph (Exhibit 13-12)

S_0= 74.5 mph (Exhibit 13-12)

S = 65.5 mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 11-Bet Off Exp Off Sample*
Jurisdiction	
Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*5910*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1579*	pc/h/ln
S	*68.3*	mph
D = v_p / S	*23.1*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

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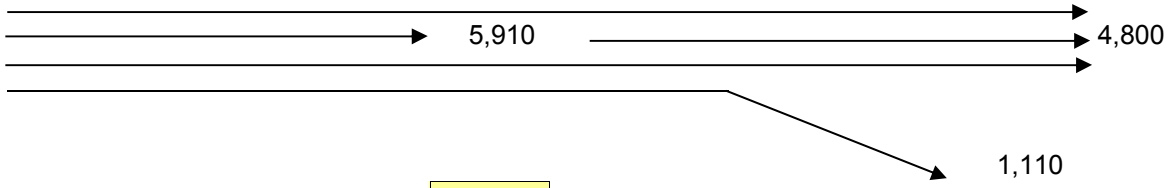
Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 12: I-95 SB Off-Ramp to Sample Road EB & WB**
Analysis Period: **PM Peak Hour**
Analysis Year: **2020 Build 1**



	PHF =	**0.95**		
	v_{fr} =	**5,910**	vph	
	v_r =	**1,110**	vph	
	v_f =	**4,800**		
Upstream Freeway	**Tr % =**	**3%**		
Ramp	**Tr % =**	**2%**		
Downstream Freeway	**Tr % =**	**3%**		
Freeway	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.985**
Ramp	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.9901**
flat terrain	**E_T =**	1.5		
	RV % =	0		
Driver Population adj.	**f_P =**	1.000		
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	**6,314**	**pc/h**
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	**1,180**	**pc/h**
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	**5,128**	**pc/h**
No. lanes upstream of ramp	**N =**	**4**		

Average Freeway Density Upstream of Diverge (see Equation 13-26):

D = 0.0175 (V_{fr}/N) = 27.6 pc/ln

LOS in the Diverge Area (from Density and Exhibit 13-2) =

C

No. Ln	Capacity Check (see Exhibits 13-2, 13-8 and 13.10)	Maximum	Actual	LOS F?
4	Fwy upstream of ramp (assume 70 mph free-flow speed) =	9,600	6,314	No
3	Fwy downstream of ramp (assume 70 mph free-flow speed) =	7,200	5,128	No
1	Capacity on Off-Ramp (assume 45 mph free-flow speed) =	2,100	1,180	No

BASIC FREEWAY SEGMENTS WORKSHEET

General Information			Site Information	
Analyst			Highway/Direction of Travel	*I-95 SB*
Agency or Company	*AECOM*		From/To	*Seg 13-Bet Off & On Ramps*
Date Performed			Jurisdiction	
Analysis Time Period	*PM*		Analysis Year	*2020 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*4800*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1709*	pc/h/ln
S	*67.0*	mph
D = v_p / S	*25.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

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FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-95 SB
Weaving Segment Location	Seg 14- Bet Sample & Copans
Analysis Year	2020 Build 1

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2520ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4170	0.95	3	0	1.5	1.2	0.985	1.00	4455
V_{RF}	1420	0.92	2	0	1.5	1.2	0.990	1.00	1559
V_{FR}	630	0.92	2	0	1.5	1.2	0.990	1.00	692
V_{RR}	0	0.95	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	4455							V =	6706
V_W	2251								
VR	0.336								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	2251 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	2700 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1513 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	4213 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	786

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6618 veh/h	Weaving intensity factor, W	0.339
Weaving segment capacity, c_w	7044 veh/h	Weaving segment speed, S	48.8 mph
Weaving segment v/c ratio	0.939	Average weaving speed, S_W	56.1 mph
Weaving segment density, D	34.4 pc/mi/ln	Average non-weaving speed, S_{NW}	45.7 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	5970 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-95 NB
Weaving Segment Location	Seg 1-Bet Copans & Sample
Analysis Year	2040 Build 1

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2380ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4755	0.95	3	0	1.5	1.2	0.985	1.00	5080
V_{RF}	405	0.92	2	0	1.5	1.2	0.990	1.00	445
V_{FR}	970	0.92	2	0	1.5	1.2	0.990	1.00	1065
V_{RR}	0	0.95	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	5080							V =	6590
V_W	1510								
VR	0.229								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1510 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	1945 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1566 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	3511 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	846

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6500 veh/h	Weaving intensity factor, W	0.307
Weaving segment capacity, c_w	8717 veh/h	Weaving segment speed, S	52.5 mph
Weaving segment v/c ratio	0.746	Average weaving speed, S_W	57.1 mph
Weaving segment density, D	31.4 pc/mi/ln	Average non-weaving speed, S_{NW}	51.2 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	4836 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-95 NB*
Agency or Company	*AECOM*	From/To	*Seg 2-Bet Off & On from Sample*
Date Performed		Jurisdiction	
Analysis Time Period	*AM*	Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*5160*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1838*	pc/h/ln
S	*65.3*	mph
D = v_p / S	*28.2*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

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

Glossary

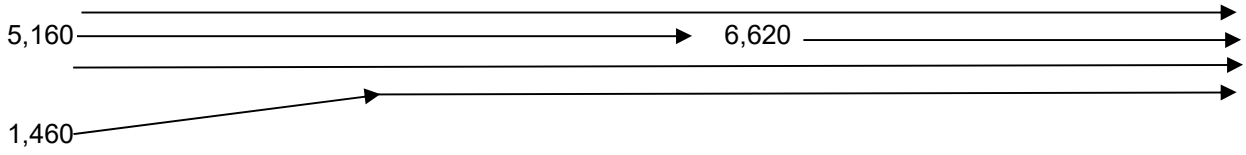
N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 3: I-95 Northbound On-Ramp from WB Sample Road**
Analysis Period: **AM Peak Hour**
Analysis Year: **2040 Build 1**



	PHF =	**0.95**		
	v_{fr} =	**6,620**	vph	
	v_r =	**1,460**	vph	
	v_f =	**5,160**		
Upstream Freeway	**Tr % =**	**3%**		
Ramp	**Tr % =**	**2%**		
Downstream Freeway	**Tr % =**	**3%**		
Freeway	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.985**
Ramp	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.9901**
flat terrain	**E_T =**	1.5		
	RV % =	0		
Driver Population adj.	**f_P =**	1.000		
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	**7,073**	**pc/h**
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	**1,552**	**pc/h**
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	**5,513**	**pc/h**
No. lanes upstream of ramp	**N =**	**3**		

No. Ln	Capacity Check (see Exhibits 25-3 and 25-7):	Maximum	Actual	V/c	LOS F?
4	Fwy downstream of ramp (assume 70 mph free-flow speed) =	9,600	7,073	0.74	No
3	Fwy upstream of ramp (assume 70 mph free-flow speed) =	7,200	5,513	0.77	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,552	0.74	No

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 4-Bet On from Sample & Exp*
Jurisdiction	
Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*6620*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade 0.00% Length	*0.00mi*
			Up/Down %	*0.00*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1768*	pc/h/ln
S	*66.3*	mph
D = v_p / S	*26.7*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 10-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 5-On from Exp
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2040 Build 1

Project Description SW 10th Street SIMR

Site Information

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Freeway Number of Lanes, N	4
Ramp Number of Lanes, N	1
Acceleration Lane Length, L_A	1500
Deceleration Lane Length L_D	
Freeway Volume, V_F	6620
Ramp Volume, V_R	920
Freeway Free-Flow Speed, S_{FF}	70.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☑ Yes ☐ On

☐ No ☑ Off

L_{down} = 6200 ft

V_D = 1320 veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6620	0.95	Level	3	0	0.985	1.00	7073
Ramp	920	0.92	Level	2	0	0.990	1.00	1010
UpStream								
DownStream	1320	0.92	Level	2	0	0.990	1.00	1449

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.092 using Equation (Exhibit 13-6)

V_{12} = 648 pc/h

V_3 or V_{av34} 3212 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2829 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	8083	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4178	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

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

D_R = 30.0 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.425 (Exibit 13-11)

S_R= 58.1 mph (Exhibit 13-11)

S_0= 65.2 mph (Exhibit 13-11)

S = 61.2 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

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

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information			Site Information	
Analyst			Highway/Direction of Travel	*I-95 NB*
Agency or Company	*AECOM*		From/To	*Seg 6-Bet Exp On & Off to 10th*
Date Performed			Jurisdiction	
Analysis Time Period	*AM*		Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*7540*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length	*mi*
			Up/Down %	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f_{LW}		mph
Number of Lanes, N	*3*		f_{LC}		mph
Total Ramp Density, TRD		ramps/mi	TRD Adjustment		mph
FFS (measured)	*70.0*	mph	FFS	*70.0*	mph
Base free-flow Speed, BFFS		mph			

LOS and Performance Measures			Design (N)	
Operational (LOS)			Design (N)	
v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2685*	pc/h/ln	Design LOS	
S	*44.4*	mph	v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	pc/h/ln
D = v_p / S	*60.4*	pc/mi/ln	S	mph
LOS	*F*		D = v_p / S	pc/mi/ln
			Required Number of Lanes, N	

Glossary		Factor Location	
N - Number of lanes	S - Speed	E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
V - Hourly volume	D - Density	E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
v_p - Flow rate	FFS - Free-flow speed	f_p - Page 11-18	TRD - Page 11-11
LOS - Level of service	BFFS - Base free-flow speed	LOS, S, FFS, v_p - Exhibits 11-2, 11-3	
DDHV - Directional design hour volume			

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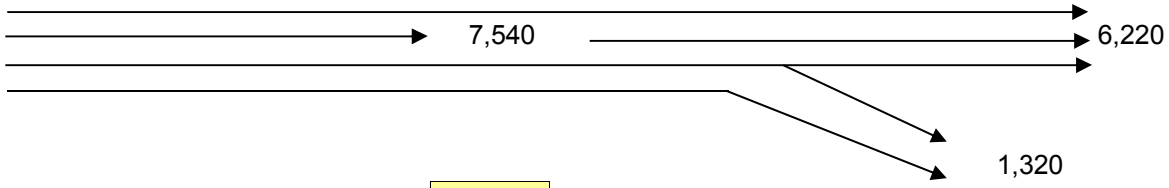
Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 7: I-95 NB Off-Ramp to SW 10th St EB & WB**
Analysis Period: **AM Peak Hour**
Analysis Year: **2040 Build 1**



	PHF =	**0.95**		
	v_{fr} =	**7,540**	vph	
	v_r =	**1,320**	vph	
	v_f =	**6,220**		
Upstream Freeway	**Tr % =**	**3%**		
Ramp	**Tr % =**	**2%**		
Downstream Freeway	**Tr % =**	**3%**		
Freeway	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.985**
Ramp	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.9901**
flat terrain	**E_T =**	1.5		
	RV % =	0		
Driver Population adj.	**f_P =**	1.000		
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	**8,056**	**pc/h**
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	**1,403**	**pc/h**
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	**6,646**	**pc/h**
No. lanes upstream of ramp	**N =**	**4**		

Average Freeway Density Upstream of Diverge (see Equation 13-26):

D = 0.0175 (V_{fr}/N) = 35.2 pc/ln

LOS in the Diverge Area (from Density and Exhibit 13-2) =

E

No. Ln	Capacity Check (see Exhibits 13-2, 13-8 and 13.10)	Maximum	Actual	LOS F?
4	Fwy upstream of ramp (assume 70 mph free-flow speed) =	9,600	8,056	No
3	Fwy downstream of ramp (assume 70 mph free-flow speed) =	7,200	6,646	No
1	Capacity on Off-Ramp (assume 45 mph free-flow speed) =	2,100	1,403	No

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 8-Bet Off & Off Ramps*
Jurisdiction	
Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*6220*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2215*	pc/h/ln
S	*58.0*	mph
D = v_p / S	*38.2*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 9-Off to Hillsboro EB&WB
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2040 Build 1

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☑ Yes	☑ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☐ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	200	L_{down} =	2800 ft
V_u =	veh/h	Freeway Volume, V_F	6220	V_D =	1660 veh/h
		Ramp Volume, V_R	1450		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6220	0.95	Level	3	0	0.985	1.00	6646
Ramp	1450	0.92	Level	2	0	0.990	1.00	1592
UpStream								
DownStream	1660	0.92	Level	2	0	0.990	1.00	1822

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

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 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.521 using Equation (Exhibit 13-7)

V_{12} = 4223 pc/h

V_3 or V_{av34} 2423 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	6646	Exhibit 13-8	7200	No
$V_{FO} = V_F - V_R$	5054	Exhibit 13-8	7200	No
V_R	1592	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4223	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

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

D_R = 38.8 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

D_s = 0.441 (Exhibit 13-12)

S_R= 57.6 mph (Exhibit 13-12)

S_0= 71.2 mph (Exhibit 13-12)

S = 62.0 mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 10-Bet Off & On Ramps*
Jurisdiction	
Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*4770*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1699*	pc/h/ln
S	*67.1*	mph
D = v_p / S	*25.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 11-On Ramp 10th St EB & WB
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2040 Build 1

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☑ Off	Acceleration Lane Length, L_A	1200	☑ No	☐ Off
L_{up} =	2800 ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	1450 veh/h	Freeway Volume, V_F	4770	V_D =	veh/h
		Ramp Volume, V_R	1660		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4770	0.95	Level	3	0	0.985	1.00	5096
Ramp	1660	0.92	Level	2	0	0.990	1.00	1822
UpStream	1450	0.92	Level	2	0	0.990	1.00	1592
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = 2226.25 (Equation 13-6 or 13-7)

P_{FM} = 0.611 using Equation (Exhibit 13-6)

V_{12} = 3114 pc/h

V_3 or V_{av34} 1982 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 3114 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6918	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4936	Exhibit 13-8	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 = 35.6 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

M_S = 0.744 (Exibit 13-11)

S_R= 49.2 mph (Exhibit 13-11)

S_0= 64.7 mph (Exhibit 13-11)

S = 52.8 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

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

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 12-Bet On Ramps*
Jurisdiction	
Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*6430*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2290*	pc/h/ln
S	*56.2*	mph
D = v_p / S	*40.7*	pc/mi/ln
LOS	*E*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-95 NB
Weaving Segment Location	Seg 13-Bet On & Off to Exp
Analysis Year	2040 Build 1

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	Two-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	4600ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	5010	0.95	3	0	1.5	1.2	0.985	1.00	5353
V_{RF}	1150	0.92	2	0	1.5	1.2	0.990	1.00	1263
V_{FR}	1420	0.92	2	0	1.5	1.2	0.990	1.00	1559
V_{RR}	320	0.92	2	0	1.5	1.2	0.990	1.00	351
V_{NW}	8175							V =	8526
V_W	351								
VR	0.041								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	0 lc	Minimum weaving lane changes, LC_{MIN}	1053 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	1679 lc/h
Minimum RF lane changes, LC_{RF}	0 lc/pc	Non-weaving lane changes, LC_{NW}	3512 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	5191 lc/h
Minimum RR lane changes, LC_{RR}	3 lc/pc	Non-weaving vehicle index, I_{NW}	2632

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	8415 veh/h	Weaving intensity factor, W	0.249
Weaving segment capacity, c_w	9001 veh/h	Weaving segment speed, S	52.4 mph
Weaving segment v/c ratio	0.935	Average weaving speed, S_W	59.0 mph
Weaving segment density, D	40.6 pc/mi/ln	Average non-weaving speed, S_{NW}	52.2 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	6110 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 14-North of Hillsboro*
Jurisdiction	
Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*6160*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*4*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.980*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1653*	pc/h/ln
S	*67.6*	mph
D = v_p / S	*24.4*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-95 NB
Weaving Segment Location	Seg 1-Bet Copans & Sample
Analysis Year	2040 Build 1

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2380ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4770	0.95	3	0	1.5	1.2	0.985	1.00	5096
V_{RF}	480	0.92	2	0	1.5	1.2	0.990	1.00	527
V_{FR}	1810	0.92	2	0	1.5	1.2	0.990	1.00	1987
V_{RR}	0	0.95	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	5096							V =	7610
V_W	2514								
VR	0.330								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	7511 veh/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	7158 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.049	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	5912 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-95 NB*
Agency or Company	*AECOM*	From/To	*Seg 2-Bet On & On from Sample*
Date Performed		Jurisdiction	
Analysis Time Period	*PM*	Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*5250*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1870*	pc/h/ln
S	*64.8*	mph
D = v_p / S	*28.9*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

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

Glossary

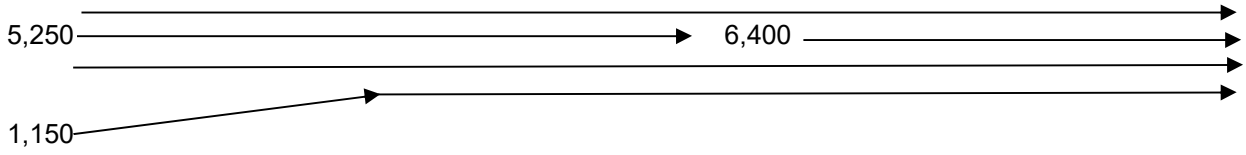
N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 3: I-95 Northbound On-Ramp from WB Sample Road**
Analysis Period: **PM Peak Hour**
Analysis Year: **2040 Build 1**



	PHF =	**0.95**		
	v_{fr} =	**6,400**	vph	
	v_r =	**1,150**	vph	
	v_f =	**5,250**		
Upstream Freeway	**Tr % =**	**3%**		
Ramp	**Tr % =**	**2%**		
Downstream Freeway	**Tr % =**	**3%**		
Freeway	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.985**
Ramp	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.9901**
flat terrain	**E_T =**	1.5		
	RV % =	0		
Driver Population adj.	**f_P =**	1.000		
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	**6,838**	**pc/h**
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	**1,223**	**pc/h**
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	**5,609**	**pc/h**
No. lanes upstream of ramp	**N =**	**3**		

No. Ln	Capacity Check (see Exhibits 25-3 and 25-7):	Maximum	Actual	V/c	LOS F?
4	Fwy downstream of ramp (assume 70 mph free-flow speed) =	9,600	6,838	0.71	No
3	Fwy upstream of ramp (assume 70 mph free-flow speed) =	7,200	5,609	0.78	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,223	0.58	No

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 4-Bet On from Sample & Exp*
Jurisdiction	
Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*6400*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Grade*
DDHV = AADT x K x D		veh/h	Grade 0.00% Length	*0.00mi*
			Up/Down %	*0.00*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1709*	pc/h/ln
S	*67.0*	mph
D = v_p / S	*25.5*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 5-On from Exp
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2040 Build 1

Project Description SW 10th Street SIMR

Site Information

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☑ Yes	☐ On
☑ No	☐ Off	Acceleration Lane Length, L_A	1500	☐ No	☑ Off
L_{up} =	ft	Deceleration Lane Length L_D		L_{down} =	6200 ft
V_u =	veh/h	Freeway Volume, V_F	6400	V_D =	1590 veh/h
		Ramp Volume, V_R	770		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6400	0.95	Level	3	0	0.985	1.00	6838
Ramp	770	0.92	Level	2	0	0.990	1.00	845
UpStream								
DownStream	1590	0.92	Level	2	0	0.990	1.00	1746

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.112 using Equation (Exhibit 13-6)

V_{12} = 767 pc/h

V_3 or V_{av34} 3035 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2735 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7683	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3908	Exhibit 13-8	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 = 27.9 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = 0.365 (Exibit 13-11)

S_R= 59.8 mph (Exhibit 13-11)

S_0= 65.4 mph (Exhibit 13-11)

S = 62.3 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

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

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 6-Bet Exp On & Off to 10th*
Jurisdiction	
Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*7170*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2554*	pc/h/ln
S	*48.7*	mph
D = v_p / S	*52.4*	pc/mi/ln
LOS	*F*	

Design (N)

Design (N)

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

Glossary

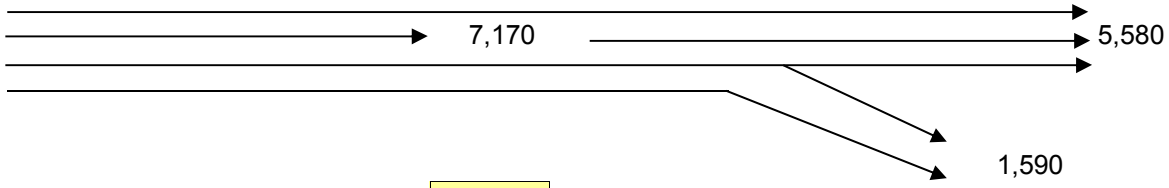
N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 7: I-95 NB Off-Ramp to SW 10th St EB & WB**
Analysis Period: **PM Peak Hour**
Analysis Year: **2040 Build 1**



	PHF =	**0.95**		
	v_{fr} =	**7,170**	vph	
	v_r =	**1,590**	vph	
	v_f =	**5,580**		
Upstream Freeway	**Tr % =**	**3%**		
Ramp	**Tr % =**	**2%**		
Downstream Freeway	**Tr % =**	**3%**		
Freeway	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.985**
Ramp	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.9901**
flat terrain	**E_T =**	1.5		
	RV % =	0		
Driver Population adj.	**f_P =**	1.000		
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	**7,661**	**pc/h**
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	**1,690**	**pc/h**
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	**5,962**	**pc/h**
No. lanes upstream of ramp	**N =**	**4**		

Average Freeway Density Upstream of Diverge (see Equation 13-26):

D = 0.0175 (V_{fr}/N) = 33.5 pc/ln

LOS in the Diverge Area (from Density and Exhibit 13-2) =

D

No. Ln	Capacity Check (see Exhibits 13-2, 13-8 and 13.10)	Maximum	Actual	LOS F?
4	Fwy upstream of ramp (assume 70 mph free-flow speed) =	9,600	7,661	No
3	Fwy downstream of ramp (assume 70 mph free-flow speed) =	7,200	5,962	No
1	Capacity on Off-Ramp (assume 45 mph free-flow speed) =	2,100	1,690	No

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 8-Bet Off & Off Ramps*
Jurisdiction	
Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*5580*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*		E_R	*1.2*
E_T	*1.5*		$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1987*	pc/h/ln
S	*62.8*	mph
D = v_p / S	*31.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 9-Off to Hillsboro EB&WB
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2040 Build 1

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☑ Yes	☑ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☐ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	200	L_{down} =	2800 ft
V_u =	veh/h	Freeway Volume, V_F	5580	V_D =	1320 veh/h
		Ramp Volume, V_R	1440		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5580	0.95	Level	3	0	0.985	1.00	5962
Ramp	1440	0.92	Level	2	0	0.990	1.00	1581
UpStream								
DownStream	1320	0.92	Level	2	0	0.990	1.00	1449

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

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 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.538 using Equation (Exhibit 13-7)

V_{12} = 3939 pc/h

V_3 or V_{av34} 2023 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5962	Exhibit 13-8	7200	No
$V_{FO} = V_F - V_R$	4381	Exhibit 13-8	7200	No
V_R	1581	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3939	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

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

D_R = 36.3 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

D_s = 0.440 (Exhibit 13-12)

S_R= 57.7 mph (Exhibit 13-12)

S_0= 72.8 mph (Exhibit 13-12)

S = 62.0 mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 10-Bet Off & On Ramps*
Jurisdiction	
Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*4140*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1474*	pc/h/ln
S	*69.1*	mph
D = v_p / S	*21.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 10-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 11-On Ramp 10th St EB & WB
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2040 Build 1

Project Description SW 10th Street SIMR

Site Information

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☑ Off	Acceleration Lane Length, L_A	1200	☑ No	☐ Off
L_{up} =	2800 ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	1440 veh/h	Freeway Volume, V_F	4140	V_D =	veh/h
		Ramp Volume, V_R	1320		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4140	0.95	Level	3	0	0.985	1.00	4423
Ramp	1320	0.92	Level	2	0	0.990	1.00	1449
UpStream	1440	0.92	Level	2	0	0.990	1.00	1581
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = 2002.41 (Equation 13-6 or 13-7)

P_{FM} = 0.611 using Equation (Exhibit 13-6)

V_{12} = 2703 pc/h

V_3 or V_{av34} 1720 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2703 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5872	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4152	Exhibit 13-8	4600:All	No

Level of Service Determination (if not F)

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

D_R = 29.7 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.449 (Exibit 13-11)

S_R= 57.4 mph (Exhibit 13-11)

S_0= 65.6 mph (Exhibit 13-11)

S = 59.6 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

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

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 NB*
From/To	*Seg 12-Bet On Ramps*
Jurisdiction	
Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*5460*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*		E_R	*1.2*
E_T	*1.5*		$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1945*	pc/h/ln
S	*63.6*	mph
D = v_p / S	*30.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-95 NB
Weaving Segment Location	Seg 13-Bet On & Off to Exp
Analysis Year	2040 Build 1

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	Two-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	4600ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4440	0.95	3	0	1.5	1.2	0.985	1.00	4744
V_{RF}	1210	0.92	2	0	1.5	1.2	0.990	1.00	1328
V_{FR}	1020	0.92	2	0	1.5	1.2	0.990	1.00	1120
V_{RR}	260	0.92	2	0	1.5	1.2	0.990	1.00	285
V_{NW}	7192							V =	7477
V_W	285								
VR	0.038								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	0 lc	Minimum weaving lane changes, LC_{MIN}	855 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	1481 lc/h
Minimum RF lane changes, LC_{RF}	0 lc/pc	Non-weaving lane changes, LC_{NW}	3293 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	4774 lc/h
Minimum RR lane changes, LC_{RR}	3 lc/pc	Non-weaving vehicle index, I_{NW}	2316

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	7381 veh/h	Weaving intensity factor, W	0.233
Weaving segment capacity, c_w	9013 veh/h	Weaving segment speed, S	55.0 mph
Weaving segment v/c ratio	0.819	Average weaving speed, S_W	59.6 mph
Weaving segment density, D	34.0 pc/mi/ln	Average non-weaving speed, S_{NW}	54.9 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	6081 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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BASIC FREEWAY SEGMENTS WORKSHEET

General Information			Site Information	
Analyst			Highway/Direction of Travel	*I-95 NB*
Agency or Company	*AECOM*		From/To	*Seg 14-North of Hillsboro*
Date Performed			Jurisdiction	
Analysis Time Period	*PM*		Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*5650*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*4*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.980*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1517*	pc/h/ln
S	*68.8*	mph
D = v_p / S	*22.0*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 10-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 1-Bet Hillsboro & Palmetto*
Jurisdiction	
Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*4870*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*		E_R	*1.2*
E_T	*1.5*		$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1301*	pc/h/ln
S	*69.9*	mph
D = v_p / S	*18.6*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I95/SB
Weaving Segment Location	Seg 2-Bet On from Exp & Off
Analysis Year	2040 Build 1

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	Two-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	5200ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	3585	0.95	3	0	1.5	1.2	0.985	1.00	3830
V_{RF}	1265	0.92	2	0	1.5	1.2	0.990	1.00	1389
V_{FR}	1285	0.92	2	0	1.5	1.2	0.990	1.00	1411
V_{RR}	145	0.92	2	0	1.5	1.2	0.990	1.00	159
V_{NW}	6630							V =	6789
V_W	159								
VR	0.023								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	0 lc	Minimum weaving lane changes, LC_{MIN}	477 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	1145 lc/h
Minimum RF lane changes, LC_{RF}	0 lc/pc	Non-weaving lane changes, LC_{NW}	3167 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	4312 lc/h
Minimum RR lane changes, LC_{RR}	3 lc/pc	Non-weaving vehicle index, I_{NW}	2413

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6704 veh/h	Weaving intensity factor, W	0.195
Weaving segment capacity, c_w	9233 veh/h	Weaving segment speed, S	58.5 mph
Weaving segment v/c ratio	0.726	Average weaving speed, S_W	61.0 mph
Weaving segment density, D	29.0 pc/mi/ln	Average non-weaving speed, S_{NW}	58.4 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	5944 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 3-Bet Off & On Ramp*
Jurisdiction	
Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*4850*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1727*	pc/h/ln
S	*66.8*	mph
D = v_p / S	*25.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 4-Diverge to SW 10th St
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2040 Build 1

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Ramp Number of Lanes, N	1	☑ Yes	☑ On
☑ No	☐ Off	Acceleration Lane Length, L_A		☐ No	☐ Off
L_{up} =	ft	Deceleration Lane Length L_D	200	L_{down} =	1200 ft
V_u =	veh/h	Freeway Volume, V_F	4850	V_D =	1640 veh/h
		Ramp Volume, V_R	1420		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4850	0.95	Level	3	0	0.985	1.00	5182
Ramp	1420	0.92	Level	2	0	0.990	1.00	1559
UpStream								
DownStream	1640	0.92	Level	2	0	0.990	1.00	1800

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

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 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.559 using Equation (Exhibit 13-7)

V_{12} = 3583 pc/h

V_3 or V_{av34} 1599 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5182	Exhibit 13-8	7200	No
$V_{FO} = V_F - V_R$	3623	Exhibit 13-8	7200	No
V_R	1559	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3583	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

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

D_R = 33.3 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.438 (Exhibit 13-12)

S_R= 57.7 mph (Exhibit 13-12)

S_0= 74.5 mph (Exhibit 13-12)

S = 62.0 mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 5-Bet Off & On Ramps*
Jurisdiction	
Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*3430*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1222*	pc/h/ln
S	*70.0*	mph
D = v_p / S	*17.5*	pc/mi/ln
LOS	*B*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 6-Merge from Hillsboro E&W
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2040 Build 1

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☑ Off	Acceleration Lane Length, L_A	1100	☑ No	☐ Off
L_{up} =	1200 ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	1420 veh/h	Freeway Volume, V_F	3430	V_D =	veh/h
		Ramp Volume, V_R	1640		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3430	0.95	Level	3	0	0.985	1.00	3665
Ramp	1640	0.92	Level	2	0	0.990	1.00	1800
UpStream	1420	0.92	Level	2	0	0.990	1.00	1559
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = 1870.91 (Equation 13-6 or 13-7)

P_{FM} = 0.566 using Equation (Exhibit 13-6)

V_{12} = 2074 pc/h

V_3 or V_{av34} 1591 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2094 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5465	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3894	Exhibit 13-8	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 = 28.1 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.403 (Exibit 13-11)

S_R= 58.7 mph (Exhibit 13-11)

S_0= 66.1 mph (Exhibit 13-11)

S = 60.7 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

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

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 7-Bet On Ramps*
Jurisdiction	
Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*5070*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1806*	pc/h/ln
S	*65.7*	mph
D = v_p / S	*27.5*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

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

Glossary

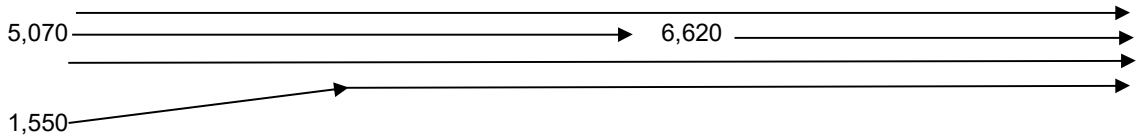
N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 8: I-95 Southbound On-Ramp from SW 10th Street EB & WB**
Analysis Period: **AM Peak Hour**
Analysis Year: **2040 Build 1**



	PHF =	**0.95**		
	v_{fr} =	**6,620**	vph	
	v_r =	**1,550**	vph	
	v_f =	**5,070**		
Upstream Freeway	**Tr % =**	**3%**		
Ramp	**Tr % =**	**2%**		
Downstream Freeway	**Tr % =**	**3%**		
Freeway	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =	**0.985**	
Ramp	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =	**0.9901**	
flat terrain	**E_T =**	1.5		
	RV % =	0		
Driver Population adj.	**f_P =**	1.000		
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	**7,073**	**pc/h**
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	**1,648**	**pc/h**
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	**5,417**	**pc/h**
No. lanes upstream of ramp	**N =**	**3**		

No. Ln	**Capacity Check (see Exhibits 25-3 and 25-7):**	Maximum	Actual	V/c	LOS F?
4	Fwy downstream of ramp (assume 70 mph free-flow speed) =	9,600	7,073	0.74	No
3	Fwy upstream of ramp (assume 70 mph free-flow speed) =	7,200	5,417	0.75	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,648	0.78	No

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 9-Bet 10th & Exit to Exp*
Jurisdiction	
Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*6620*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1768*	pc/h/ln
S	*66.3*	mph
D = v_p / S	*26.7*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 10- Diverge to Express
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2040 Build 1

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☑ Yes	☑ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	4500 ft	Deceleration Lane Length L_D	300	L_{down} =	ft
V_u =	1550 veh/h	Freeway Volume, V_F	6620	V_D =	veh/h
		Ramp Volume, V_R	950		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	6620	0.95	Level	3	0	0.985	1.00	7073
Ramp	950	0.92	Level	2	0	0.990	1.00	1043
UpStream	1550	0.92	Level	2	0	0.990	1.00	1702
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

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 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 3672 pc/h

V_3 or V_{av34} 1700 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7073	Exhibit 13-8	9600	No
$V_{FO} = V_F - V_R$	6030	Exhibit 13-8	9600	No
V_R	1043	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3672	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

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

D_R = 36.3 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

D_s = 0.392 (Exhibit 13-12)

S_R= 59.0 mph (Exhibit 13-12)

S_0= 74.8 mph (Exhibit 13-12)

S = 64.9 mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*AM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 11-Bet Off Exp Off Sample*
Jurisdiction	
Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*5670*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1514*	pc/h/ln
S	*68.9*	mph
D = v_p / S	*22.0*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

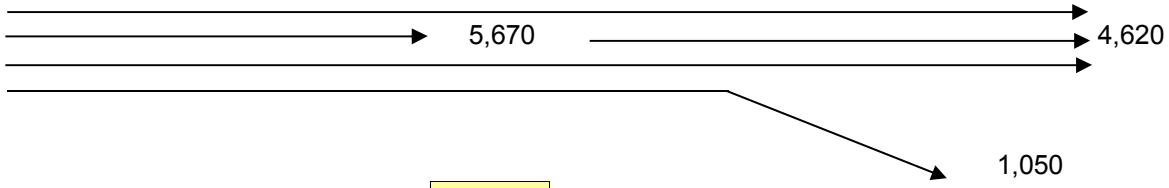
N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 12: I-95 SB Off-Ramp to Sample Road EB & WB**
Analysis Period: **AM Peak Hour**
Analysis Year: **2040 Build 1**



	PHF =	**0.95**		
	v_{fr} =	**5,670**	vph	
	v_r =	**1,050**	vph	
	v_f =	**4,620**		
Upstream Freeway	**Tr % =**	**3%**		
Ramp	**Tr % =**	**2%**		
Downstream Freeway	**Tr % =**	**3%**		
Freeway	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.985**
Ramp	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.9901**
flat terrain	**E_T =**	1.5		
	RV % =	0		
Driver Population adj.	**f_P =**	1.000		
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	**6,058**	**pc/h**
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	**1,116**	**pc/h**
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	**4,936**	**pc/h**
No. lanes upstream of ramp	**N =**	**4**		

Average Freeway Density Upstream of Diverge (see Equation 13-26):

D = 0.0175 (V_{fr}/N) = 26.5 pc/ln

LOS in the Diverge Area (from Density and Exhibit 13-2) =

C

No. Ln	Capacity Check (see Exhibits 13-2, 13-8 and 13.10)	Maximum	Actual	LOS F?
4	Fwy upstream of ramp (assume 70 mph free-flow speed) =	9,600	6,058	No
3	Fwy downstream of ramp (assume 70 mph free-flow speed) =	7,200	4,936	No
1	Capacity on Off-Ramp (assume 45 mph free-flow speed) =	2,100	1,116	No

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-95 SB*
Agency or Company	*AECOM*	From/To	*Seg 13-Bet Off & On Ramps*
Date Performed		Jurisdiction	
Analysis Time Period	*AM*	Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*4620*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1645*	pc/h/ln
S	*67.7*	mph
D = v_p / S	*24.3*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	AM

Site Information

Freeway/Dir of Travel	I-95 SB
Weaving Segment Location	Seg 14- Bet Sample & Copans
Analysis Year	2040 Build 1

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2520ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	3915	0.95	3	0	1.5	1.2	0.985	1.00	4183
V_{RF}	1970	0.92	2	0	1.5	1.2	0.990	1.00	2163
V_{FR}	705	0.92	2	0	1.5	1.2	0.990	1.00	774
V_{RR}	0	0.95	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	4183							V =	7120
V_W	2937								
VR	0.412								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	893

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	7029 veh/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	5732 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.226	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	6822 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	*I-95 SB*
Agency or Company	*AECOM*	From/To	*Seg 1-Bet Hillsboro & Palmetto*
Date Performed		Jurisdiction	
Analysis Time Period	*PM*	Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*5150*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1376*	pc/h/ln
S	*69.6*	mph
D = v_p / S	*19.8*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 10-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I95/SB
Weaving Segment Location	Seg 2-Bet On from Exp & Off
Analysis Year	2040 Build 1

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	Two-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	5200ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4010	0.95	3	0	1.5	1.2	0.985	1.00	4284
V_{RF}	1460	0.92	2	0	1.5	1.2	0.990	1.00	1603
V_{FR}	1140	0.92	2	0	1.5	1.2	0.990	1.00	1252
V_{RR}	130	0.92	2	0	1.5	1.2	0.990	1.00	143
V_{NW}	7139							V =	7282
V_W	143								
VR	0.020								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	0 lc	Minimum weaving lane changes, LC_{MIN}	429 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	1097 lc/h
Minimum RF lane changes, LC_{RF}	0 lc/pc	Non-weaving lane changes, LC_{NW}	3281 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	4378 lc/h
Minimum RR lane changes, LC_{RR}	3 lc/pc	Non-weaving vehicle index, I_{NW}	2599

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	7189 veh/h	Weaving intensity factor, W	0.197
Weaving segment capacity, c_w	9245 veh/h	Weaving segment speed, S	58.2 mph
Weaving segment v/c ratio	0.778	Average weaving speed, S_W	60.9 mph
Weaving segment density, D	31.3 pc/mi/ln	Average non-weaving speed, S_{NW}	58.2 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	5909 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 3-Bet Off & On Ramp*
Jurisdiction	
Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*5470*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1948*	pc/h/ln
S	*63.5*	mph
D = v_p / S	*30.7*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 4-Diverge to SW 10th St
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2040 Build 1

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp			Downstream Adj Ramp	
☐ Yes	☐ On	Freeway Number of Lanes, N: 3	☑ Yes	☑ On
☑ No	☐ Off	Ramp Number of Lanes, N: 1	☐ No	☐ Off
L_{up} =	ft	Acceleration Lane Length, L_A:	L_{down} =	1200 ft
V_u =	veh/h	Deceleration Lane Length L_D: 200	V_D =	1720 veh/h
		Freeway Volume, V_F: 5470		
		Ramp Volume, V_R: 1500		
		Freeway Free-Flow Speed, S_{FF}: 70.0		
		Ramp Free-Flow Speed, S_{FR}: 45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	5470	0.95	Level	3	0	0.985	1.00	5844
Ramp	1500	0.92	Level	2	0	0.990	1.00	1647
UpStream								
DownStream	1720	0.92	Level	2	0	0.990	1.00	1888

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

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 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.538 using Equation (Exhibit 13-7)

V_{12} = 3906 pc/h

V_3 or V_{av34} 1938 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5844	Exhibit 13-8	7200	No
$V_{FO} = V_F - V_R$	4197	Exhibit 13-8	7200	No
V_R	1647	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3906	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

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

D_R = 36.0 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

D_s = 0.446 (Exhibit 13-12)

S_R= 57.5 mph (Exhibit 13-12)

S_0= 73.1 mph (Exhibit 13-12)

S = 61.9 mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 5-Bet Off & On Ramps*
Jurisdiction	
Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*3970*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1414*	pc/h/ln
S	*69.5*	mph
D = v_p / S	*20.4*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information

Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 6-Merge from Hillsboro E&W
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2040 Build 1

Project Description SW 10th Street SIMR

Site Information

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	3	Downstream Adj Ramp	
☑ Yes	☐ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☑ Off	Acceleration Lane Length, L_A	1100	☑ No	☐ Off
L_{up} =	1200 ft	Deceleration Lane Length L_D		L_{down} =	ft
V_u =	1500 veh/h	Freeway Volume, V_F	3970	V_D =	veh/h
		Ramp Volume, V_R	1720		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	3970	0.95	Level	3	0	0.985	1.00	4242
Ramp	1720	0.92	Level	2	0	0.990	1.00	1888
UpStream	1500	0.92	Level	2	0	0.990	1.00	1647
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = 2013.22 (Equation 13-6 or 13-7)

P_{FM} = 0.557 using Equation (Exhibit 13-6)

V_{12} = 2363 pc/h

V_3 or V_{av34} 1879 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes,V_{12a} = 2424 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6130	Exhibit 13-8		No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4312	Exhibit 13-8	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 = 31.3 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = 0.502 (Exibit 13-11)

S_R= 55.9 mph (Exhibit 13-11)

S_0= 65.3 mph (Exhibit 13-11)

S = 58.4 mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

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

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 7-Bet On Ramps*
Jurisdiction	
Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*5690*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*2026*	pc/h/ln
S	*62.1*	mph
D = v_p / S	*32.6*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

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

Glossary

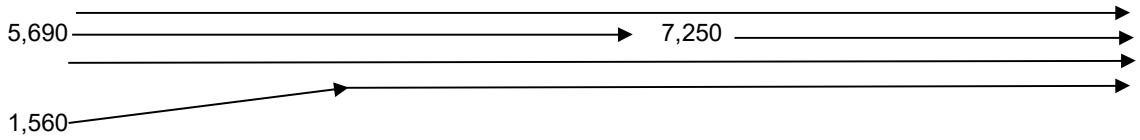
N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 8: I-95 Southbound On-Ramp from SW 10th Street EB & WB**
Analysis Period: **PM Peak Hour**
Analysis Year: **2040 Build 1**



	PHF =	**0.95**		
	v_{fr} =	**7,250**	vph	
	v_r =	**1,560**	vph	
	v_f =	**5,690**		
Upstream Freeway	**Tr % =**	**3%**		
Ramp	**Tr % =**	**2%**		
Downstream Freeway	**Tr % =**	**3%**		
Freeway	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =	**0.985**	
Ramp	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =	**0.9901**	
flat terrain	**E_T =**	1.5		
	RV % =	0		
Driver Population adj.	**f_P =**	1.000		
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	**7,746**	**pc/h**
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	**1,659**	**pc/h**
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	**6,079**	**pc/h**
No. lanes upstream of ramp	**N =**	**3**		

No. Ln	**Capacity Check (see Exhibits 25-3 and 25-7):**	Maximum	Actual	V/c	LOS F?
4	Fwy downstream of ramp (assume 70 mph free-flow speed) =	9,600	7,746	0.81	No
3	Fwy upstream of ramp (assume 70 mph free-flow speed) =	7,200	6,079	0.84	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,659	0.79	No

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 9-Bet 10th & Exit to Exp*
Jurisdiction	
Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*7250*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1937*	pc/h/ln
S	*63.7*	mph
D = v_p / S	*30.4*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 10- Diverge to Express
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2040 Build 1

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp		Freeway Number of Lanes, N	4	Downstream Adj Ramp	
☑ Yes	☑ On	Ramp Number of Lanes, N	1	☐ Yes	☐ On
☐ No	☐ Off	Acceleration Lane Length, L_A		☑ No	☐ Off
L_{up} =	4500 ft	Deceleration Lane Length L_D	300	L_{down} =	ft
V_u =	1560 veh/h	Freeway Volume, V_F	7250	V_D =	veh/h
		Ramp Volume, V_R	770		
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	7250	0.95	Level	3	0	0.985	1.00	7746
Ramp	770	0.92	Level	2	0	0.990	1.00	845
UpStream	1560	0.92	Level	2	0	0.990	1.00	1713
DownStream								

Merge Areas

Estimation of v_{12}

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

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

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 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 3854 pc/h

V_3 or V_{av34} 1946 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes,V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7746	Exhibit 13-8	9600	No
$V_{FO} = V_F - V_R$	6901	Exhibit 13-8	9600	No
V_R	845	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3854	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

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

D_R = 38.0 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

D_s = 0.374 (Exhibit 13-12)

S_R= 59.5 mph (Exhibit 13-12)

S_0= 73.9 mph (Exhibit 13-12)

S = 65.3 mph (Exhibit 13-13)

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 11-Bet Off Exp Off Sample*
Jurisdiction	
Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*6480*	veh/h	Peak-Hour Factor, PHF	*0.95*	
AADT		veh/day	%Trucks and Buses, P_T	*3*	
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*	
Peak-Hr Direction Prop, D			General Terrain:	*Level*	
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*	

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*4*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1731*	pc/h/ln
S	*66.7*	mph
D = v_p / S	*25.9*	pc/mi/ln
LOS	*C*	

Design (N)

Design (N)

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

Glossary

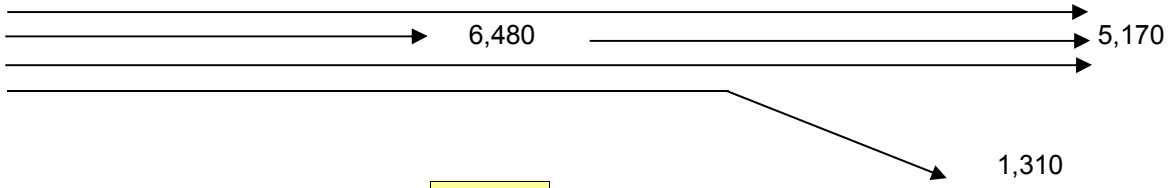
N - Number of lanes	S - Speed
V - Hourly volume	D - Density
v_p - Flow rate	FFS - Free-flow speed
LOS - Level of service	BFFS - Base free-flow speed
DDHV - Directional design hour volume	

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

Job: SW 10th Street SIMR
Analyst: AECOM

Location: **Seg 12: I-95 SB Off-Ramp to Sample Road EB & WB**
Analysis Period: **PM Peak Hour**
Analysis Year: **2040 Build 1**



	PHF =	**0.95**		
	v_{fr} =	**6,480**	vph	
	v_r =	**1,310**	vph	
	v_f =	**5,170**		
Upstream Freeway	**Tr % =**	**3%**		
Ramp	**Tr % =**	**2%**		
Downstream Freeway	**Tr % =**	**3%**		
Freeway	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.985**
Ramp	**f_{HV} =**	$1/(1+P_T(E_T-1)+P_R(E_R-1))$ =		**0.9901**
flat terrain	**E_T =**	1.5		
	RV % =	0		
Driver Population adj.	**f_P =**	1.000		
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P)$ =	**6,923**	**pc/h**
	V_r =	$=v_r/(PHF)(f_{HV})(f_P)$ =	**1,393**	**pc/h**
	V_f =	$=v_f/(PHF)(f_{HV})(f_P)$ =	**5,524**	**pc/h**
No. lanes upstream of ramp	**N =**	**4**		

Average Freeway Density Upstream of Diverge (see Equation 13-26):

D = 0.0175 (V_{fr}/N) = 30.3 pc/ln

LOS in the Diverge Area (from Density and Exhibit 13-2) =

D

No. Ln	Capacity Check (see Exhibits 13-2, 13-8 and 13.10)	Maximum	Actual	LOS F?
4	Fwy upstream of ramp (assume 70 mph free-flow speed) =	9,600	6,923	No
3	Fwy downstream of ramp (assume 70 mph free-flow speed) =	7,200	5,524	No
1	Capacity on Off-Ramp (assume 45 mph free-flow speed) =	2,100	1,393	No

BASIC FREEWAY SEGMENTS WORKSHEET

General Information

Analyst	
Agency or Company	*AECOM*
Date Performed	
Analysis Time Period	*PM*

Site Information

Highway/Direction of Travel	*I-95 SB*
From/To	*Seg 13-Bet Off & On Ramps*
Jurisdiction	
Analysis Year	*2040 Build 1*

Project Description *SW 10th Street SIMR*

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

Flow Inputs

Volume, V	*5170*	veh/h	Peak-Hour Factor, PHF	*0.95*
AADT		veh/day	%Trucks and Buses, P_T	*3*
Peak-Hr Prop. of AADT, K			%RVs, P_R	*0*
Peak-Hr Direction Prop, D			General Terrain:	*Level*
DDHV = AADT x K x D		veh/h	Grade % Length Up/Down %	*mi*

Calculate Flow Adjustments

f_p	*1.00*	E_R	*1.2*
E_T	*1.5*	$f_{HV} = 1/[1+P_T(E_T - 1) + P_R(E_R - 1)]$	*0.985*

Speed Inputs

Lane Width		ft
Rt-Side Lat. Clearance		ft
Number of Lanes, N	*3*	
Total Ramp Density, TRD		ramps/mi
FFS (measured)	*70.0*	mph
Base free-flow Speed, BFFS		mph

Calc Speed Adj and FFS

f_{LW}		mph
f_{LC}		mph
TRD Adjustment		mph
FFS	*70.0*	mph

LOS and Performance Measures

Operational (LOS)

v_p = (V or DDHV) / (PHF x N x f_{HV} x f_p)	*1841*	pc/h/ln
S	*65.2*	mph
D = v_p / S	*28.2*	pc/mi/ln
LOS	*D*	

Design (N)

Design (N)

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

Glossary

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

Factor Location

E_R - Exhibits 11-10, 11-12	f_{LW} - Exhibit 11-8
E_T - Exhibits 11-10, 11-11, 11-13	f_{LC} - Exhibit 11-9
f_p - Page 11-18	TRD - Page 11-11
LOS, S, FFS, v_p - Exhibits 11-2, 11-3	

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	AECOM
Date Performed	
Analysis Time Period	PM

Site Information

Freeway/Dir of Travel	I-95 SB
Weaving Segment Location	Seg 14- Bet Sample & Copans
Analysis Year	2040 Build 1

Project Description SW 10th Street SIMR

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2520ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Level

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4430	0.95	3	0	1.5	1.2	0.985	1.00	4733
V_{RF}	1580	0.92	2	0	1.5	1.2	0.990	1.00	1735
V_{FR}	740	0.92	2	0	1.5	1.2	0.990	1.00	812
V_{RR}	0	0.95	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	4733							V =	7280
V_W	2547								
VR	0.350								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	1055

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	7185 veh/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	6758 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.063	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	6125 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".