



APPENDIX M

2020 & 2040 Build 2 Freeway HCS Operational Analysis

FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 NB
Agency/Company	AECOM	Weaving Segment Location	Seg 1-Bet Copans & Sample
Date Performed		Analysis Year	2020 Build 2
Analysis Time Period	AM		

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}	4565	0.95	3	0	1.5	1.2	0.985	1.00	4877
V_{RF}	355	0.92	2	0	1.5	1.2	0.990	1.00	390
V_{FR}	800	0.92	2	0	1.5	1.2	0.990	1.00	878
V_{RR}	0	0.95	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	4877							V =	6145
V_W	1268								
VR	0.206								

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}	1524 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	3227 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	813

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

Weaving segment flow rate, v	6061 veh/h	Weaving intensity factor, W	0.287
Weaving segment capacity, c_w	8788 veh/h	Weaving segment speed, S	54.3 mph
Weaving segment v/c ratio	0.690	Average weaving speed, S_W	57.7 mph
Weaving segment density, D	28.3 pc/mi/ln	Average non-weaving speed, S_{NW}	53.5 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	4601 ft

Notes

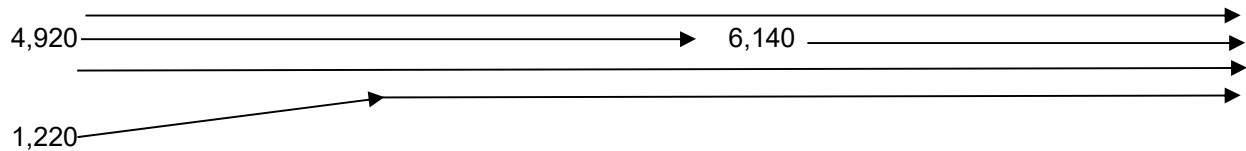
- a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
- b. For volumes that exceed the weaving segment capacity, the level of service is "F".

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	<i>I-95 NB</i>
Agency or Company	<i>AECOM</i>	From/To	<i>Seg 2-Bet Off & On from Sample</i>
Date Performed		Jurisdiction	
Analysis Time Period	<i>AM</i>	Analysis Year	<i>2020 Build 2</i>
Project Description <i>SW 10th Street SIMR</i>			
<input checked="" type="checkbox"/> Oper.(LOS)		<input type="checkbox"/> Des.(N)	
<input type="checkbox"/> Planning Data			
Flow Inputs			
Volume, V	<i>4920</i>	veh/h	Peak-Hour Factor, PHF <i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T <i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R <i>0</i>
Peak-Hr Direction Prop, D			General Terrain: <i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length <i>mi</i>
			Up/Down %
Calculate Flow Adjustments			
f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>
Speed Inputs		Calc Speed Adj and FFS	
Lane Width	ft	f _{LV}	mph
Rt-Side Lat. Clearance	ft	f _{LC}	mph
Number of Lanes, N	<i>3</i>	TRD Adjustment	mph
Total Ramp Density, TRD		FFS	<i>70.0</i> mph
FFS (measured)	<i>70.0</i>		
Base free-flow Speed, BFFS			
LOS and Performance Measures		Design (N)	
Operational (LOS)		Design (N)	
v _p = (V or DDHV) / (PHF x N x f _{HV} x f _p)	<i>1752</i> pc/h/ln	Design LOS	
S	<i>66.5</i> mph	v _p = (V or DDHV) / (PHF x N x f _{HV} x f _p)	pc/h/ln
D = v _p / S	<i>26.4</i> pc/mi/ln	S	mph
LOS	<i>D</i>	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 _{LV} - 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			

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 2



	PHF =	0.95	
	v_{fr} =	6,140	vph
	v_r =	1,220	vph
	v_f =	4,920	
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} =	$=v_{fr}/(PHF)(f_{HV})(f_P) =$	6,560 pc/h
	V_r =	$=v_r/(PHF)(f_{HV})(f_P) =$	1,297 pc/h
	V_f =	$=v_f/(PHF)(f_{HV})(f_P) =$	5,257 pc/h
No. lanes upstream of ramp	N =	3	

<u>No. Ln</u>	<u>Capacity Check (see Exhibits 25-3 and 25-7):</u>	Maximum	Actual	V/c	LOS F?
4	Fwy downstream of ramp (assume 70 mph free-flow speed) =	9,600	6,560	0.68	No
3	Fwy upstream of ramp (assume 70 mph free-flow speed) =	7,200	5,257	0.73	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,297	0.62	No

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 4-On from Exp
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2020 Build 2
Project Description SW 10th Street SIMR			

Inputs

Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> 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 6140 Ramp Volume, V_R 690 Freeway Free-Flow Speed, S_{FF} 70.0 Ramp Free-Flow Speed, S_{FR} 50.0	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off $L_{down} =$ 2950 ft $V_D =$ 140 veh/h
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Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6140	0.95	Level	3	0	0.985	1.00	6560
Ramp	690	0.92	Level	2	0	0.990	1.00	757
UpStream								
DownStream	140	0.92	Level	2	0	0.990	1.00	154

Merge Areas

Diverge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
 (Equation 13-6 or 13-7)
 $L_{EQ} =$
 $P_{FM} =$ 0.123 using Equation (Exhibit 13-6)
 $V_{12} =$ 808 pc/h
 V_3 or V_{av34} 2876 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, $V_{12a} =$ 2624 pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
 (Equation 13-12 or 13-13)
 $L_{EQ} =$
 $P_{FD} =$ 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?		Actual	Capacity	LOS F?
V_{FO}	7317	Exhibit 13-8	No	V_F		Exhibit 13-8	
				$V_{FO} = V_F - V_R$		Exhibit 13-8	
				V_R		Exhibit 13-10	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
V_{R12}	3695	Exhibit 13-8 4600:All	No

Flow Entering Diverge Influence Area

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

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 V_R + 0.0078 V_{12} - 0.00627 L_A$
 $D_R =$ 26.2 (pc/mi/ln)
 LOS = C (Exhibit 13-2)

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

$M_S =$ 0.328 (Exhibit 13-11)
 $S_R =$ 60.8 mph (Exhibit 13-11)
 $S_0 =$ 65.7 mph (Exhibit 13-11)
 $S =$ 63.0 mph (Exhibit 13-13)

Speed Determination

$D_s =$ (Exhibit 13-12)
 $S_R =$ mph (Exhibit 13-12)
 $S_0 =$ mph (Exhibit 13-12)
 $S =$ mph (Exhibit 13-13)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 5-Off to Exp from GPL
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2020 Build 2

Project Description SW 10th Street SIMR

Inputs			
Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L _{up} = 2950 ft V _u = 690 veh/h	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Freeway Number of Lanes, N 4 Ramp Number of Lanes, N 1 Acceleration Lane Length, L_A Deceleration Lane Length L_D 200 Freeway Volume, V_F 6830 Ramp Volume, V_R 140 Freeway Free-Flow Speed, S_{FF} 70.0 Ramp Free-Flow Speed, S_{FR} 45.0 </td> <td style="width: 50%;"> Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L_{down} = ft V_D = veh/h </td> </tr> </table>	Freeway Number of Lanes, N 4 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 6830 Ramp Volume, V _R 140 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L _{down} = ft V _D = veh/h
Freeway Number of Lanes, N 4 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 6830 Ramp Volume, V _R 140 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L _{down} = ft V _D = veh/h		

Conversion to pc/h Under Base Conditions								
(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f _{HV}	f _p	v = V/PHF x f _{HV} x f _p
Freeway	6830	0.95	Level	3	0	0.985	1.00	7297
Ramp	140	0.92	Level	2	0	0.990	1.00	154
UpStream	690	0.92	Level	2	0	0.990	1.00	757
DownStream								

Merge Areas	Diverge Areas
Estimation of v₁₂ $V_{12} = V_F (P_{FM})$ 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? <input type="checkbox"/> Yes <input type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)	Estimation of v₁₂ $V_{12} = V_R + (V_F - V_R)P_{FD}$ L _{EQ} = (Equation 13-12 or 13-13) P _{FD} = 0.436 using Equation (Exhibit 13-7) V ₁₂ = 3268 pc/h V ₃ or V _{av34} 2014 pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks				Capacity Checks			
	Actual	Capacity	LOS F?		Actual	Capacity	LOS F?
V _{FO}		Exhibit 13-8		V _F	7297	Exhibit 13-8	9600 No
				V _{FO} = V _F - V _R	7143	Exhibit 13-8	9600 No
				V _R	154	Exhibit 13-10	2100 No

Flow Entering Merge Influence Area				Flow Entering Diverge Influence Area			
	Actual	Max Desirable	Violation?		Actual	Max Desirable	Violation?
V _{R12}		Exhibit 13-8		V ₁₂	3268	Exhibit 13-8	4400:All No

Level of Service Determination (if not F)	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)	$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$ D _R = 30.6 (pc/mi/ln) LOS = D (Exhibit 13-2)

Speed Determination	Speed Determination
M _S = (Exhibit 13-11)	D _s = 0.312 (Exhibit 13-12)
S _R = mph (Exhibit 13-11)	S _R = 61.3 mph (Exhibit 13-12)
S ₀ = mph (Exhibit 13-11)	S ₀ = 72.8 mph (Exhibit 13-12)
S = mph (Exhibit 13-13)	S = 67.2 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-South of Off to 10th*
 Jurisdiction
 Analysis Year *2020 Build 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>6690</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1787* pc/h/ln
 S *66.0* mph
 $D = v_p / S$ *27.1* pc/mi/ln
 LOS *D*

Design (N)

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

Glossary

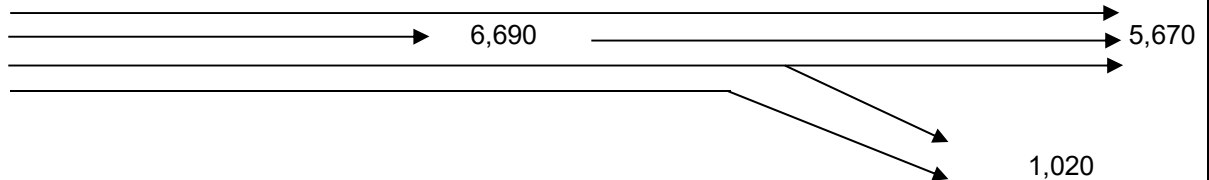
N - Number of lanes
 V - Hourly volume
 v_p - Flow rate
 LOS - Level of service
 DDHV - Directional design hour volume
 S - Speed
 D - Density
 FFS - Free-flow speed
 BFFS - Base free-flow speed

Factor Location

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

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 2



PHF =	0.95	
$V_{fr} =$	6,690	vph
$V_r =$	1,020	vph
$V_f =$	5,670	
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	
$V_{fr} =$	$=V_{fr}/(PHF)(f_{HV})(f_p) =$	7,148 pc/h
$V_r =$	$=V_r/(PHF)(f_{HV})(f_p) =$	1,084 pc/h
$V_f =$	$=V_f/(PHF)(f_{HV})(f_p) =$	6,058 pc/h
No. lanes upstream of ramp $N =$	4	

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

$D = 0.0175 (V_{fr}/N) = 31.3 \text{ pc/ln}$

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	7,148	No
3	Fwy downstream of ramp (assume 70 mph free-flow speed) =	7,200	6,058	No
1	Capacity on Off-Ramp (assume 45 mph free-flow speed) =	2,100	1,084	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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>5670</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ 2019 pc/h/ln
 S *62.2* mph
 D = v_p / S *32.4* pc/mi/ln
 LOS *D*

Design (N)

Design (N)
 Design LOS
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ 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 2

Project Description SW 10th Street SIMR

Inputs			
Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L _{up} = ft V _u = veh/h	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Freeway Number of Lanes, N 3 Ramp Number of Lanes, N 1 Acceleration Lane Length, L_A Deceleration Lane Length L_D 200 Freeway Volume, V_F 5670 Ramp Volume, V_R 1250 Freeway Free-Flow Speed, S_{FF} 70.0 Ramp Free-Flow Speed, S_{FR} 45.0 </td> <td style="width: 50%;"> Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L_{down} = 2100 ft V_D = 1060 veh/h </td> </tr> </table>	Freeway Number of Lanes, N 3 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 5670 Ramp Volume, V _R 1250 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L _{down} = 2100 ft V _D = 1060 veh/h
Freeway Number of Lanes, N 3 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 5670 Ramp Volume, V _R 1250 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L _{down} = 2100 ft V _D = 1060 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	5670	0.95	Level	3	0	0.985	1.00	6058
Ramp	1250	0.92	Level	2	0	0.990	1.00	1372
UpStream								
DownStream	1060	0.92	Level	2	0	0.990	1.00	1164

Merge Areas	Diverge Areas
Estimation of v₁₂ $V_{12} = V_F (P_{FM})$ 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? <input type="checkbox"/> Yes <input type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)	Estimation of v₁₂ $V_{12} = V_R + (V_F - V_R)P_{FD}$ L _{EQ} = (Equation 13-12 or 13-13) P _{FD} = 0.545 using Equation (Exhibit 13-7) V ₁₂ = 3928 pc/h V ₃ or V _{av34} 2130 pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks				Capacity Checks			
	Actual	Capacity	LOS F?		Actual	Capacity	LOS F?
V _{FO}		Exhibit 13-8		V _F	6058	Exhibit 13-8	7200 No
				V _{FO} = V _F - V _R	4686	Exhibit 13-8	7200 No
				V _R	1372	Exhibit 13-10	2100 No

Flow Entering Merge Influence Area				Flow Entering Diverge Influence Area			
	Actual	Max Desirable	Violation?		Actual	Max Desirable	Violation?
V _{R12}		Exhibit 13-8		V ₁₂	3928	Exhibit 13-8	4400:All No

Level of Service Determination (if not F)	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)	$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$ D _R = 36.2 (pc/mi/ln) LOS = E (Exhibit 13-2)

Speed Determination	Speed Determination
M _S = (Exhibit 13-11)	D _s = 0.421 (Exhibit 13-12)
S _R = mph (Exhibit 13-11)	S _R = 58.2 mph (Exhibit 13-12)
S ₀ = mph (Exhibit 13-11)	S ₀ = 72.4 mph (Exhibit 13-12)
S = mph (Exhibit 13-13)	S = 62.5 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 *2020 Build 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>4420</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1574* pc/h/ln
 S *68.4* mph
 $D = v_p / S$ *23.0* pc/mi/ln
 LOS *C*

Design (N)

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

Glossary

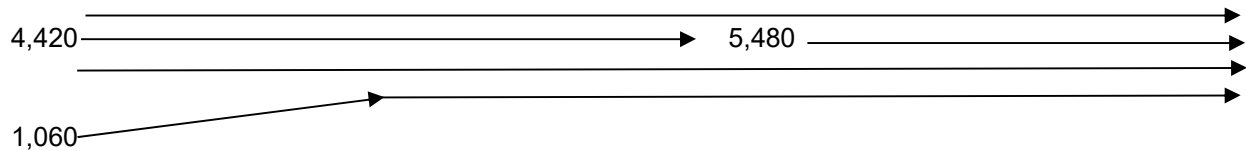
N - Number of lanes
 V - Hourly volume
 v_p - Flow rate
 LOS - Level of service
 DDHV - Directional design hour volume
 S - Speed
 D - Density
 FFS - Free-flow speed
 BFFS - Base free-flow speed

Factor Location

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

Job: SW 10th Street SIMR
Analyst: AECOM

Location: Seg 11: I-95 Northbound On-Ramp from EB & WB SW 10th St
Analysis Period: AM Peak Hour
Analysis Year: 2020 Build 2



	PHF =	0.95	
	$V_{fr} =$	5,480	vph
	$V_r =$	1,060	vph
	$V_f =$	4,420	
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	
	$V_{fr} = v_{fr}/(PHF)(f_{HV})(f_P) =$		5,855 pc/h
	$V_r = v_r/(PHF)(f_{HV})(f_P) =$		1,127 pc/h
	$V_f = v_f/(PHF)(f_{HV})(f_P) =$		4,722 pc/h
No. lanes upstream of ramp	$N =$	3	

<u>No. Ln</u>	<u>Capacity Check (see Exhibits 25-3 and 25-7):</u>	Maximum	Actual	V/c	LOS F?
4	Fwy downstream of ramp (assume 70 mph free-flow speed) =	9,600	5,855	0.61	No
3	Fwy upstream of ramp (assume 70 mph free-flow speed) =	7,200	4,722	0.66	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,127	0.54	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 12-Bet On Ramps*
 Jurisdiction
 Analysis Year *2020 Build 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>5480</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1464* pc/h/ln
 S *69.2* mph
 $D = v_p / S$ *21.2* pc/mi/ln
 LOS *C*

Design (N)

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

Glossary

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

Factor Location

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

FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 NB
Agency/Company	AECOM	Weaving Segment Location	Seg 13-Bet On & Off to Exp
Date Performed		Analysis Year	2020 Build 2
Analysis Time Period	AM		

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}	4615	0.95	3	0	1.5	1.2	0.985	1.00	4931
V_{RF}	1125	0.92	2	0	1.5	1.2	0.990	1.00	1235
V_{FR}	865	0.92	2	0	1.5	1.2	0.990	1.00	950
V_{RR}	125	0.92	2	0	1.5	1.2	0.990	1.00	137
V_{NW}	7116							V =	7253
V_W	137								
VR	0.019								

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}	3276 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	4313 lc/h
Minimum RR lane changes, LC_{RR}	3 lc/pc	Non-weaving vehicle index, I_{NW}	2291

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

Weaving segment flow rate, v	7157 veh/h	Weaving intensity factor, W	0.215
Weaving segment capacity, c_w	9064 veh/h	Weaving segment speed, S	58.4 mph
Weaving segment v/c ratio	0.790	Average weaving speed, S_W	60.3 mph
Weaving segment density, D	31.1 pc/mi/ln	Average non-weaving speed, S_{NW}	58.3 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	5902 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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>5740</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1533* pc/h/ln
 S *68.7* mph
 $D = v_p / S$ *22.3* pc/mi/ln
 LOS *C*

Design (N)

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

Glossary

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

Factor Location

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

FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 NB
Agency/Company	AECOM	Weaving Segment Location	Seg 1-Bet Copans & Sample
Date Performed		Analysis Year	2020 Build 2
Analysis Time Period	PM		

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}	4265	0.95	3	0	1.5	1.2	0.985	1.00	4557
V_{RF}	415	0.92	2	0	1.5	1.2	0.990	1.00	456
V_{FR}	1560	0.92	2	0	1.5	1.2	0.990	1.00	1713
V_{RR}	0	0.95	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	4557							V =	6726
V_W	2169								
VR	0.322								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	2169 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	2604 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1458 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	4062 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	759

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

Weaving segment flow rate, v	6637 veh/h	Weaving intensity factor, W	0.345
Weaving segment capacity, c_w	7332 veh/h	Weaving segment speed, S	49.0 mph
Weaving segment v/c ratio	0.905	Average weaving speed, S_W	55.9 mph
Weaving segment density, D	34.3 pc/mi/ln	Average non-weaving speed, S_{NW}	46.3 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	5826 ft

Notes

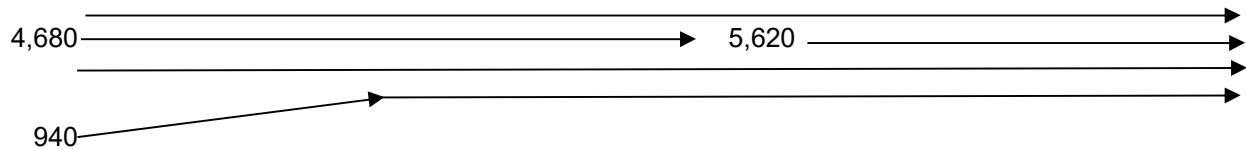
- a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
- b. For volumes that exceed the weaving segment capacity, the level of service is "F".

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	<i>I-95 NB</i>
Agency or Company	<i>AECOM</i>	From/To	<i>Seg 2-Bet Off & On from Sample</i>
Date Performed		Jurisdiction	
Analysis Time Period	<i>PM</i>	Analysis Year	<i>2020 Build 2</i>
Project Description <i>SW 10th Street SIMR</i>			
<input checked="" type="checkbox"/> Oper.(LOS)		<input type="checkbox"/> Des.(N)	
<input type="checkbox"/> Planning Data			
Flow Inputs			
Volume, V	<i>4680</i>	veh/h	Peak-Hour Factor, PHF
AADT		veh/day	%Trucks and Buses, P _T
Peak-Hr Prop. of AADT, K			%RVs, P _R
Peak-Hr Direction Prop, D			General Terrain:
DDHV = AADT x K x D		veh/h	Grade % Length
			Up/Down %
			<i>0.95</i>
			<i>3</i>
			<i>0</i>
			<i>Level</i>
			<i>mi</i>
Calculate Flow Adjustments			
f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>
Speed Inputs		Calc Speed Adj and FFS	
Lane Width	ft	f _{LW}	mph
Rt-Side Lat. Clearance	ft	f _{LC}	mph
Number of Lanes, N	<i>3</i>	TRD Adjustment	mph
Total Ramp Density, TRD	ramps/mi	FFS	<i>70.0</i>
FFS (measured)	<i>70.0</i>	mph	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)	<i>1667</i> pc/h/ln	Design LOS	
S	<i>67.5</i> mph	v _p = (V or DDHV) / (PHF x N x f _{HV} x f _p)	pc/h/ln
D = v _p / S	<i>24.7</i> pc/mi/ln	S	mph
LOS	<i>C</i>	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			

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 2



PHF =	0.95	
$V_{fr} =$	5,620	vph
$V_r =$	940	vph
$V_f =$	4,680	
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	
$V_{fr} =$	$=V_r/(PHF)(f_{HV})(f_P) =$	6,005 pc/h
$V_r =$	$=V_r/(PHF)(f_{HV})(f_P) =$	999 pc/h
$V_f =$	$=V_f/(PHF)(f_{HV})(f_P) =$	5,000 pc/h
No. lanes upstream of ramp $N =$	3	

<u>No. Ln</u>	<u>Capacity Check (see Exhibits 25-3 and 25-7):</u>	Maximum	Actual	V/c	LOS F?
4	Fwy downstream of ramp (assume 70 mph free-flow speed) =	9,600	6,005	0.63	No
3	Fwy upstream of ramp (assume 70 mph free-flow speed) =	7,200	5,000	0.69	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	999	0.48	No

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 4-On from Exp
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2020 Build 2
Project Description SW 10th Street SIMR			

Inputs

Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> 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 5620 Ramp Volume, V _R 610 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 50.0	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off L _{down} = 2950 ft V _D = 230 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	5620	0.95	Level	3	0	0.985	1.00	6005
Ramp	610	0.92	Level	2	0	0.990	1.00	670
UpStream								
DownStream	230	0.92	Level	2	0	0.990	1.00	252

Merge Areas

Diverge Areas

Estimation of v₁₂

$V_{12} = V_F (P_{FM})$
 (Equation 13-6 or 13-7)
 P_{FM} = 0.134 using Equation (Exhibit 13-6)
 V₁₂ = 805 pc/h
 V₃ or V_{av34} = 2600 pc/h (Equation 13-14 or 13-17)
 Is V₃ or V_{av34} > 2,700 pc/h? Yes No
 Is V₃ or V_{av34} > 1.5 * V₁₂/2 Yes No
 If Yes, V_{12a} = 2402 pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v₁₂

$V_{12} = V_R + (V_F - V_R)P_{FD}$
 (Equation 13-12 or 13-13)
 P_{FD} = using Equation (Exhibit 13-7)
 V₁₂ = pc/h
 V₃ or V_{av34} = pc/h (Equation 13-14 or 13-17)
 Is V₃ or V_{av34} > 2,700 pc/h? Yes No
 Is V₃ or V_{av34} > 1.5 * V₁₂/2 Yes No
 If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity	LOS F?
V _{FO}	6675	Exhibit 13-8	No

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 Merge Influence Area

	Actual	Max Desirable	Violation?
V _{R12}	3360	Exhibit 13-8	4600:All No

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
V ₁₂		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 = 23.5 (pc/mi/ln)
 LOS = C (Exhibit 13-2)

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

M_S = 0.283 (Exhibit 13-11)
 S_R = 62.1 mph (Exhibit 13-11)
 S₀ = 66.2 mph (Exhibit 13-11)
 S = 64.0 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)
 S_R = mph (Exhibit 13-12)
 S₀ = mph (Exhibit 13-12)
 S = mph (Exhibit 13-13)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 5-Off to Exp from GPL
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2020 Build 2

Project Description SW 10th Street SIMR

Inputs			
Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L _{up} = 2950 ft V _u = 610 veh/h	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Freeway Number of Lanes, N 4 Ramp Number of Lanes, N 1 Acceleration Lane Length, L_A Deceleration Lane Length L_D 200 Freeway Volume, V_F 6230 Ramp Volume, V_R 230 Freeway Free-Flow Speed, S_{FF} 70.0 Ramp Free-Flow Speed, S_{FR} 45.0 </td> <td style="width: 50%;"> Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L_{down} = ft V_D = veh/h </td> </tr> </table>	Freeway Number of Lanes, N 4 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 6230 Ramp Volume, V _R 230 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L _{down} = ft V _D = veh/h
Freeway Number of Lanes, N 4 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 6230 Ramp Volume, V _R 230 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L _{down} = ft V _D = veh/h		

Conversion to pc/h Under Base Conditions								
(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f _{HV}	f _p	v = V/PHF x f _{HV} x f _p
Freeway	6230	0.95	Level	3	0	0.985	1.00	6656
Ramp	230	0.92	Level	2	0	0.990	1.00	252
UpStream	610	0.92	Level	2	0	0.990	1.00	670
DownStream								

Merge Areas	Diverge Areas
Estimation of v₁₂ $V_{12} = V_F (P_{FM})$ 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? <input type="checkbox"/> Yes <input type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)	Estimation of v₁₂ $V_{12} = V_R + (V_F - V_R)P_{FD}$ L _{EQ} = (Equation 13-12 or 13-13) P _{FD} = 0.436 using Equation (Exhibit 13-7) V ₁₂ = 3044 pc/h V ₃ or V _{av34} 1806 pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks				Capacity Checks			
	Actual	Capacity	LOS F?		Actual	Capacity	LOS F?
V _{FO}		Exhibit 13-8		V _F	6656	Exhibit 13-8	9600 No
				V _{FO} = V _F - V _R	6404	Exhibit 13-8	9600 No
				V _R	252	Exhibit 13-10	2100 No

Flow Entering Merge Influence Area				Flow Entering Diverge Influence Area			
	Actual	Max Desirable	Violation?		Actual	Max Desirable	Violation?
V _{R12}		Exhibit 13-8		V ₁₂	3044	Exhibit 13-8	4400:All No

Level of Service Determination (if not F)	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)	$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$ D _R = 28.6 (pc/mi/ln) LOS = D (Exhibit 13-2)

Speed Determination	Speed Determination
M _S = (Exhibit 13-11)	D _s = 0.321 (Exhibit 13-12)
S _R = mph (Exhibit 13-11)	S _R = 61.0 mph (Exhibit 13-12)
S ₀ = mph (Exhibit 13-11)	S ₀ = 73.6 mph (Exhibit 13-12)
S = mph (Exhibit 13-13)	S = 67.3 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 NB*
 From/To *Seg 6-South of Off to 10th*
 Jurisdiction
 Analysis Year *2020 Build 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

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

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1603* pc/h/ln
 S *68.1* mph
 $D = v_p / S$ *23.5* pc/mi/ln
 LOS *C*

Design (N)

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

Glossary

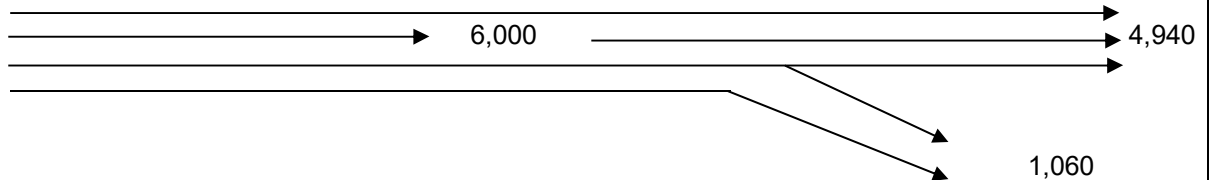
N - Number of lanes
 V - Hourly volume
 v_p - Flow rate
 LOS - Level of service
 DDHV - Directional design hour volume
 S - Speed
 D - Density
 FFS - Free-flow speed
 BFFS - Base free-flow speed

Factor Location

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

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 2



PHF =	0.95	
$V_{fr} =$	6,000	vph
$V_r =$	1,060	vph
$V_f =$	4,940	
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	
$V_{fr} =$	$=V_{fr}/(PHF)(f_{HV})(f_p) =$	6,411 pc/h
$V_r =$	$=V_r/(PHF)(f_{HV})(f_p) =$	1,127 pc/h
$V_f =$	$=V_f/(PHF)(f_{HV})(f_p) =$	5,278 pc/h
No. lanes upstream of ramp N =	4	

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

$D = 0.0175 (V_{fr}/N) = 28.0 \text{ pc/ln}$

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	6,411	No
3	Fwy downstream of ramp (assume 70 mph free-flow speed) =	7,200	5,278	No
1	Capacity on Off-Ramp (assume 45 mph free-flow speed) =	2,100	1,127	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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>4940</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1759* pc/h/ln
 S *66.4* mph
 $D = v_p / S$ *26.5* pc/mi/ln
 LOS *D*

Design (N)

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

Glossary

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

Factor Location

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

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 2

Project Description SW 10th Street SIMR

Inputs			
Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L _{up} = ft V _u = veh/h	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"> Freeway Number of Lanes, N 3 Ramp Number of Lanes, N 1 Acceleration Lane Length, L_A Deceleration Lane Length L_D 200 Freeway Volume, V_F 4940 Ramp Volume, V_R 1250 Freeway Free-Flow Speed, S_{FF} 70.0 Ramp Free-Flow Speed, S_{FR} 45.0 </td> <td style="width: 50%; vertical-align: top;"> Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L_{down} = 2100 ft V_D = 1200 veh/h </td> </tr> </table>	Freeway Number of Lanes, N 3 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 4940 Ramp Volume, V _R 1250 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L _{down} = 2100 ft V _D = 1200 veh/h
Freeway Number of Lanes, N 3 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 4940 Ramp Volume, V _R 1250 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L _{down} = 2100 ft V _D = 1200 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	4940	0.95	Level	3	0	0.985	1.00	5278
Ramp	1250	0.92	Level	2	0	0.990	1.00	1372
UpStream								
DownStream	1200	0.92	Level	2	0	0.990	1.00	1317

Merge Areas	Diverge Areas
Estimation of v₁₂ $V_{12} = V_F (P_{FM})$ 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? <input type="checkbox"/> Yes <input type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)	Estimation of v₁₂ $V_{12} = V_R + (V_F - V_R)P_{FD}$ L _{EQ} = (Equation 13-12 or 13-13) P _{FD} = 0.565 using Equation (Exhibit 13-7) V ₁₂ = 3579 pc/h V ₃ or V _{av34} 1699 pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks				Capacity Checks			
	Actual	Capacity	LOS F?		Actual	Capacity	LOS F?
V _{FO}		Exhibit 13-8		V _F	5278	Exhibit 13-8	7200 No
				V _{FO} = V _F - V _R	3906	Exhibit 13-8	7200 No
				V _R	1372	Exhibit 13-10	2100 No

Flow Entering Merge Influence Area				Flow Entering Diverge Influence Area			
	Actual	Max Desirable	Violation?		Actual	Max Desirable	Violation?
V _{R12}		Exhibit 13-8		V ₁₂	3579	Exhibit 13-8	4400:All No

Level of Service Determination (if not F)	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)	$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$ D _R = 33.2 (pc/mi/ln) LOS = D (Exhibit 13-2)

Speed Determination	Speed Determination
M _S = (Exhibit 13-11)	D _S = 0.421 (Exhibit 13-12)
S _R = mph (Exhibit 13-11)	S _R = 58.2 mph (Exhibit 13-12)
S ₀ = mph (Exhibit 13-11)	S ₀ = 74.1 mph (Exhibit 13-12)
S = mph (Exhibit 13-13)	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 NB*
 From/To *Seg 10-Bet Off & On Ramps*
 Jurisdiction
 Analysis Year *2020 Build 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>3690</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1314* pc/h/ln
 S *69.8* mph
 $D = v_p / S$ *18.8* pc/mi/ln
 LOS *C*

Design (N)

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

Glossary

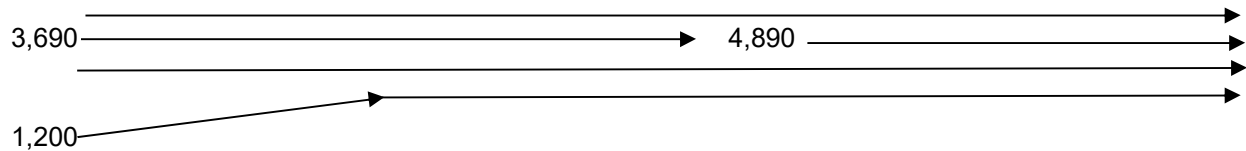
N - Number of lanes
 V - Hourly volume
 v_p - Flow rate
 LOS - Level of service
 DDHV - Directional design hour volume
 S - Speed
 D - Density
 FFS - Free-flow speed
 BFFS - Base free-flow speed

Factor Location

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

Job: SW 10th Street SIMR
Analyst: AECOM

Location: Seg 11: I-95 Northbound On-Ramp from EB & WB SW 10th St
Analysis Period: PM Peak Hour
Analysis Year: 2020 Build 2



PHF =	0.95	
$V_{fr} =$	4,890	vph
$V_r =$	1,200	vph
$V_f =$	3,690	
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	
$V_{fr} =$	$=V_r/(PHF)(f_{HV})(f_P) =$	5,225 pc/h
$V_r =$	$=V_r/(PHF)(f_{HV})(f_P) =$	1,276 pc/h
$V_f =$	$=V_f/(PHF)(f_{HV})(f_P) =$	3,942 pc/h
No. lanes upstream of ramp $N =$	3	

<u>No. Ln</u>	<u>Capacity Check (see Exhibits 25-3 and 25-7):</u>	Maximum	Actual	V/c	LOS F?
4	Fwy downstream of ramp (assume 70 mph free-flow speed) =	9,600	5,225	0.54	No
3	Fwy upstream of ramp (assume 70 mph free-flow speed) =	7,200	3,942	0.55	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,276	0.61	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 12-Bet On Ramps*
 Jurisdiction
 Analysis Year *2020 Build 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>4890</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1306* pc/h/ln
 S *69.9* mph
 $D = v_p / S$ *18.7* pc/mi/ln
 LOS *C*

Design (N)

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

Glossary

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

Factor Location

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

FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 NB
Agency/Company	AECOM	Weaving Segment Location	Seg 13-Bet On & Off to Exp
Date Performed		Analysis Year	2020 Build 2
Analysis Time Period	PM		

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}	4200	0.95	3	0	1.5	1.2	0.985	1.00	4487
V_{RF}	1130	0.92	2	0	1.5	1.2	0.990	1.00	1241
V_{FR}	690	0.92	2	0	1.5	1.2	0.990	1.00	758
V_{RR}	130	0.92	2	0	1.5	1.2	0.990	1.00	143
V_{NW}	6486							V =	6629
V_W	143								
VR	0.022								

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	1055 lc/h
Minimum RF lane changes, LC_{RF}	0 lc/pc	Non-weaving lane changes, LC_{NW}	3135 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	4190 lc/h
Minimum RR lane changes, LC_{RR}	3 lc/pc	Non-weaving vehicle index, I_{NW}	2088

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

Weaving segment flow rate, v	6541 veh/h	Weaving intensity factor, W	0.210
Weaving segment capacity, c_w	9056 veh/h	Weaving segment speed, S	59.0 mph
Weaving segment v/c ratio	0.722	Average weaving speed, S_W	60.5 mph
Weaving segment density, D	28.1 pc/mi/ln	Average non-weaving speed, S_{NW}	59.0 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	5927 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 NB*
 From/To *Seg 14-North of Hillsboro*
 Jurisdiction
 Analysis Year *2020 Build 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>5330</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1424* pc/h/ln
 S *69.4* mph
 $D = v_p / S$ *20.5* pc/mi/ln
 LOS *C*

Design (N)

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

Glossary

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

Factor Location

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

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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>4580</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1223* pc/h/ln
 S *70.0* mph
 $D = v_p / S$ *17.5* pc/mi/ln
 LOS *B*

Design (N)

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

Glossary

N - Number of lanes
 V - Hourly volume
 v_p - Flow rate
 LOS - Level of service
 DDHV - Directional design hour volume

S - Speed
 D - Density
 FFS - Free-flow speed
 BFFS - Base free-flow speed

Factor Location

E_R - Exhibits 11-10, 11-12
 E_T - Exhibits 11-10, 11-11, 11-13
 f_p - Page 11-18
 LOS, S, FFS, v_p - Exhibits 11-2, 11-3

f_{LW} - Exhibit 11-8
 f_{LC} - Exhibit 11-9
 TRD - Page 11-11

FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	195/SB
Agency/Company	AECOM	Weaving Segment Location	Seg 2-Bet On from Exp & Off
Date Performed		Analysis Year	2020 Build 2
Analysis Time Period	AM		

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}	3460	0.95	3	0	1.5	1.2	0.985	1.00	3697
V_{RF}	850	0.92	2	0	1.5	1.2	0.990	1.00	933
V_{FR}	1120	0.92	2	0	1.5	1.2	0.990	1.00	1230
V_{RR}	90	0.92	2	0	1.5	1.2	0.990	1.00	99
V_{NW}	5860							V =	5959
V_W	99								
VR	0.017								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	0 lc	Minimum weaving lane changes, LC_{MIN}	297 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	965 lc/h
Minimum RF lane changes, LC_{RF}	0 lc/pc	Non-weaving lane changes, LC_{NW}	2996 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	3961 lc/h
Minimum RR lane changes, LC_{RR}	3 lc/pc	Non-weaving vehicle index, I_{NW}	2133

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

Weaving segment flow rate, v	5882 veh/h	Weaving intensity factor, W	0.182
Weaving segment capacity, c_w	9253 veh/h	Weaving segment speed, S	60.7 mph
Weaving segment v/c ratio	0.636	Average weaving speed, S_W	61.5 mph
Weaving segment density, D	24.5 pc/mi/ln	Average non-weaving speed, S_{NW}	60.7 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	5881 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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>4310</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1535* pc/h/ln
 S *68.7* mph
 $D = v_p / S$ *22.3* pc/mi/ln
 LOS *C*

Design (N)

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

Glossary

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

Factor Location

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

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 *2020 Build 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	3210	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:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			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

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ 1143 pc/h/ln
 S 70.0 mph
 $D = v_p / S$ 16.3 pc/mi/ln
 LOS B

Design (N)

Design (N)
 Design LOS
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ 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	2020 Build 2
Project Description SW 10th Street SIMR			

Inputs

Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off	Freeway Number of Lanes, N 3 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A 300 Deceleration Lane Length L _D Freeway Volume, V _F 3210 Ramp Volume, V _R 1290 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 50.0	Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L _{down} = ft V _D = veh/h
L _{up} = 2400 ft V _u = 1100 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	3210	0.95	Level	3	0	0.985	1.00	3430
Ramp	1290	0.92	Level	2	0	0.990	1.00	1416
UpStream	1100	0.92	Level	2	0	0.990	1.00	1208
DownStream								

Merge Areas	Diverge Areas
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Estimation of v₁₂

$V_{12} = V_F (P_{FM})$ L _{EQ} = 1383.24 (Equation 13-6 or 13-7) P _{FM} = 0.586 using Equation (Exhibit 13-6) V ₁₂ = 2010 pc/h V ₃ or V _{av34} = 1420 pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = 2010 pc/h (Equation 13-16, 13-18, or 13-19)	$V_{12} = V_R + (V_F - V_R)P_{FD}$ 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? <input type="checkbox"/> Yes <input type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)
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Estimation of v₁₂

$V_{12} = V_F (P_{FM})$ L _{EQ} = 1383.24 (Equation 13-6 or 13-7) P _{FM} = 0.586 using Equation (Exhibit 13-6) V ₁₂ = 2010 pc/h V ₃ or V _{av34} = 1420 pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = 2010 pc/h (Equation 13-16, 13-18, or 13-19)	$V_{12} = V_R + (V_F - V_R)P_{FD}$ 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? <input type="checkbox"/> Yes <input type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)
--	--

Capacity Checks

	Actual	Capacity	LOS F?
V _{FO}	4846	Exhibit 13-8	No

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 Merge Influence Area

	Actual	Max Desirable	Violation?
V _{R12}	3426	Exhibit 13-8 4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
V ₁₂		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 = 29.7 (pc/mi/ln) LOS = D (Exhibit 13-2)	$D_R = 4.252 + 0.0086 v_{12} - 0.009 L_D$ D _R = (pc/mi/ln) LOS = (Exhibit 13-2)
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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)	$D_R = 4.252 + 0.0086 v_{12} - 0.009 L_D$ D _R = (pc/mi/ln) LOS = (Exhibit 13-2)
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Speed Determination

M _S = 0.411 (Exhibit 13-11)
S _R = 58.5 mph (Exhibit 13-11)
S ₀ = 66.7 mph (Exhibit 13-11)
S = 60.7 mph (Exhibit 13-13)

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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	4500	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:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			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	f _{LW}	mph
Rt-Side Lat. Clearance		ft	f _{LC}	mph
Number of Lanes, N	3		TRD Adjustment	mph
Total Ramp Density, TRD		ramps/mi	FFS	70.0
FFS (measured)	70.0	mph		mph
Base free-flow Speed, BFFS		mph		

LOS and Performance Measures

Design (N)

<u>Operational (LOS)</u>			<u>Design (N)</u>	
v _p = (V or DDHV) / (PHF x N x f _{HV} x f _p)	1603	pc/h/ln	Design LOS	
S	68.1	mph	v _p = (V or DDHV) / (PHF x N x f _{HV} x f _p)	pc/h/ln
D = v _p / S	23.5	pc/mi/ln	S	mph
LOS	C		D = v _p / S	pc/mi/ln
			Required Number of Lanes, N	

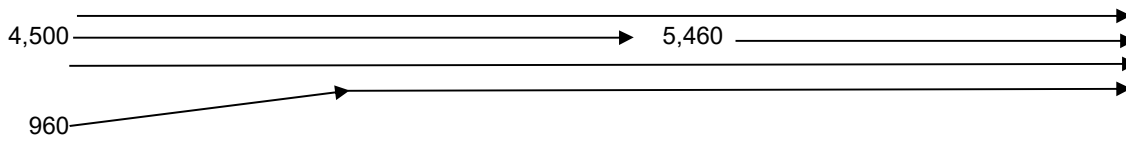
Glossary

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			

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 2



	PHF =	0.95	
	v_{fr} =	5,460	vph
	v_r =	960	vph
	v_f =	4,500	
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} =	$=v_{fr}/(PHF)(f_{HV})(f_P) =$	5,834 pc/h
	V_r =	$=v_r/(PHF)(f_{HV})(f_P) =$	1,021 pc/h
	V_f =	$=v_f/(PHF)(f_{HV})(f_P) =$	4,808 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	5,834	0.61	No
3	Fwy upstream of ramp (assume 70 mph free-flow speed) =	7,200	4,808	0.67	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,021	0.49	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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>5460</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1458* pc/h/ln
 S *69.2* mph
 $D = v_p / S$ *21.1* pc/mi/ln
 LOS *C*

Design (N)

Design (N)
 Design LOS
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ 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

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 10-Merge from Ex to GP
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2020 Build 2

Project Description SW 10th Street SIMR

Inputs

Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off	Freeway Number of Lanes, N Ramp Number of Lanes, N Acceleration Lane Length, L _A Deceleration Lane Length L _D Freeway Volume, V _F Ramp Volume, V _R Freeway Free-Flow Speed, S _{FF} Ramp Free-Flow Speed, S _{FR}	4 1 600 5460 270 70.0 50.0	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off L _{down} = 1150 ft V _D = 650 veh/h
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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	5460	0.95	Level	3	0	0.985	1.00	5834
Ramp	270	0.92	Level	2	0	0.990	1.00	296
UpStream								
DownStream	650	0.92	Level	2	0	0.990	1.00	714

Merge Areas **Diverge Areas**

Estimation of v₁₂ **Estimation of v₁₂**

$V_{12} = V_F (P_{FM})$ (Equation 13-6 or 13-7) P _{FM} = 0.181 using Equation (Exhibit 13-6) V ₁₂ = 1055 pc/h V ₃ or V _{av34} = 2389 pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = 2333 pc/h (Equation 13-16, 13-18, or 13-19)	$V_{12} = V_R + (V_F - V_R)P_{FD}$ (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? <input type="checkbox"/> Yes <input type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)
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Capacity Checks **Capacity Checks**

	Actual	Capacity	LOS F?		Actual	Capacity	LOS F?
V _{FO}	6130	Exhibit 13-8	No	V _F		Exhibit 13-8	
				V _{FO} = V _F - V _R		Exhibit 13-8	
				V _R		Exhibit 13-10	

Flow Entering Merge Influence Area **Flow Entering Diverge Influence Area**

	Actual	Max Desirable	Violation?		Actual	Max Desirable	Violation?
V _{R12}	2629	Exhibit 13-8	4600:All	No	V ₁₂	Exhibit 13-8	

Level of Service Determination (if not F) **Level of Service Determination (if not F)**

$D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ D _R = 22.1 (pc/mi/ln) LOS = C (Exhibit 13-2)	$D_R = 4.252 + 0.0086 v_{12} - 0.009 L_D$ D _R = (pc/mi/ln) LOS = (Exhibit 13-2)
--	---

Speed Determination **Speed Determination**

M _S = 0.315 (Exhibit 13-11) S _R = 61.2 mph (Exhibit 13-11) S ₀ = 65.5 mph (Exhibit 13-11) S = 63.6 mph (Exhibit 13-13)	D _S = (Exhibit 13-12) S _R = mph (Exhibit 13-12) S ₀ = mph (Exhibit 13-12) S = mph (Exhibit 13-13)
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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 11- Diverge to Express
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2020 Build 2

Project Description SW 10th Street SIMR

Inputs			
Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L _{up} = 1150 ft V _u = 270 veh/h	Freeway Number of Lanes, N 4 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 5730 Ramp Volume, V _R 650 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L _{down} = ft V _D = veh/h	

Conversion to pc/h Under Base Conditions								
(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f _{HV}	f _p	v = V/PHF x f _{HV} x f _p
Freeway	5730	0.95	Level	3	0	0.985	1.00	6122
Ramp	650	0.92	Level	2	0	0.990	1.00	714
UpStream	270	0.92	Level	2	0	0.990	1.00	296
DownStream								

Merge Areas	Diverge Areas
Estimation of v₁₂ $V_{12} = V_F (P_{FM})$ 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? <input type="checkbox"/> Yes <input type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)	Estimation of v₁₂ $V_{12} = V_R + (V_F - V_R)P_{FD}$ L _{EQ} = (Equation 13-12 or 13-13) P _{FD} = 0.436 using Equation (Exhibit 13-7) V ₁₂ = 3072 pc/h V ₃ or V _{av34} 1525 pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks				Capacity Checks			
	Actual	Capacity	LOS F?		Actual	Capacity	LOS F?
V _{FO}		Exhibit 13-8		V _F	6122	Exhibit 13-8	9600 No
				V _{FO} = V _F - V _R	5408	Exhibit 13-8	9600 No
				V _R	714	Exhibit 13-10	2100 No

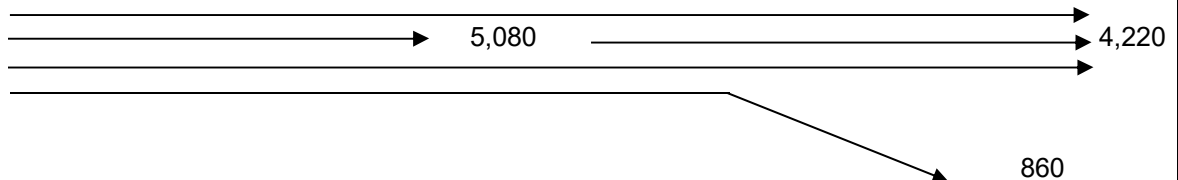
Flow Entering Merge Influence Area				Flow Entering Diverge Influence Area			
	Actual	Max Desirable	Violation?		Actual	Max Desirable	Violation?
V _{R12}		Exhibit 13-8		V ₁₂	3072	Exhibit 13-8	4400:All No

Level of Service Determination (if not F)	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)	$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$ D _R = 31.5 (pc/mi/ln) LOS = D (Exhibit 13-2)

Speed Determination	Speed Determination
M _S = (Exhibit 13-11)	D _s = 0.362 (Exhibit 13-12)
S _R = mph (Exhibit 13-11)	S _R = 59.9 mph (Exhibit 13-12)
S ₀ = mph (Exhibit 13-11)	S ₀ = 75.3 mph (Exhibit 13-12)
S = mph (Exhibit 13-13)	S = 65.9 mph (Exhibit 13-13)

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 2



PHF =	0.95	
v_{fr} =	5,080	vph
v_r =	860	vph
v_f =	4,220	
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} =	$=v_{fr}/(PHF)(f_{HV})(f_P) =$	5,428 pc/h
V_r =	$=v_r/(PHF)(f_{HV})(f_P) =$	914 pc/h
V_f =	$=v_f/(PHF)(f_{HV})(f_P) =$	4,509 pc/h
No. lanes upstream of ramp N =	4	

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

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

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	5,428	No
3	Fwy downstream of ramp (assume 70 mph free-flow speed) =	7,200	4,509	No
1	Capacity on Off-Ramp (assume 45 mph free-flow speed) =	2,100	914	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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	4220	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:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			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

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ 1503 pc/h/ln
 S 68.9 mph
 $D = v_p / S$ 21.8 pc/mi/ln
 LOS C

Design (N)

Design (N)
 Design LOS
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ 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		Site Information	
Analyst		Freeway/Dir of Travel	I-95 SB
Agency/Company	AECOM	Weaving Segment Location	Seg 14- Bet Sample & Copans
Date Performed		Analysis Year	2020 Build 2
Analysis Time Period	AM		

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}	3605	0.95	3	0	1.5	1.2	0.985	1.00	3852
V_{RF}	1780	0.92	2	0	1.5	1.2	0.990	1.00	1954
V_{FR}	615	0.92	2	0	1.5	1.2	0.990	1.00	675
V_{RR}	0	0.95	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	3852							V =	6481
V_W	2629								
VR	0.406								

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	6398 veh/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	5829 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}	6745 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 1-Bet Hillsboro & Palmetto*
 Jurisdiction
 Analysis Year *2020 Build 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>4680</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1250* pc/h/ln
 S *70.0* mph
 $D = v_p / S$ *17.9* pc/mi/ln
 LOS *B*

Design (N)

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

Glossary

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

Factor Location

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

FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	195/SB
Agency/Company	AECOM	Weaving Segment Location	Seg 2-Bet On from Exp & Off
Date Performed		Analysis Year	2020 Build 2
Analysis Time Period	PM		

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}	3730	0.95	3	0	1.5	1.2	0.985	1.00	3985
V_{RF}	870	0.92	2	0	1.5	1.2	0.990	1.00	955
V_{FR}	950	0.92	2	0	1.5	1.2	0.990	1.00	1043
V_{RR}	100	0.92	2	0	1.5	1.2	0.990	1.00	110
V_{NW}	5983							V =	6093
V_W	110								
VR	0.018								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	0 lc	Minimum weaving lane changes, LC_{MIN}	330 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	998 lc/h
Minimum RF lane changes, LC_{RF}	0 lc/pc	Non-weaving lane changes, LC_{NW}	3023 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	4021 lc/h
Minimum RR lane changes, LC_{RR}	3 lc/pc	Non-weaving vehicle index, I_{NW}	2178

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

Weaving segment flow rate, v	6014 veh/h	Weaving intensity factor, W	0.185
Weaving segment capacity, c_w	9249 veh/h	Weaving segment speed, S	60.3 mph
Weaving segment v/c ratio	0.650	Average weaving speed, S_W	61.4 mph
Weaving segment density, D	25.2 pc/mi/ln	Average non-weaving speed, S_{NW}	60.3 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	5894 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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>4600</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1638* pc/h/ln
 S *67.8* mph
 $D = v_p / S$ *24.2* pc/mi/ln
 LOS *C*

Design (N)

Design (N)
 Design LOS
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ 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 2

Project Description SW 10th Street SIMR

Inputs			
Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L _{up} = ft V _u = veh/h	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"> Freeway Number of Lanes, N 3 Ramp Number of Lanes, N 1 Acceleration Lane Length, L_A Deceleration Lane Length L_D 200 Freeway Volume, V_F 4600 Ramp Volume, V_R 840 Freeway Free-Flow Speed, S_{FF} 70.0 Ramp Free-Flow Speed, S_{FR} 45.0 </td> <td style="width: 50%;"> Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L_{down} = 2400 ft V_D = 1410 veh/h </td> </tr> </table>	Freeway Number of Lanes, N 3 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 4600 Ramp Volume, V _R 840 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L _{down} = 2400 ft V _D = 1410 veh/h
Freeway Number of Lanes, N 3 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 4600 Ramp Volume, V _R 840 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L _{down} = 2400 ft V _D = 1410 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	4600	0.95	Level	3	0	0.985	1.00	4915
Ramp	840	0.92	Level	2	0	0.990	1.00	922
UpStream								
DownStream	1410	0.92	Level	2	0	0.990	1.00	1548

Merge Areas	Diverge Areas
Estimation of v₁₂ $V_{12} = V_F (P_{FM})$ 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? <input type="checkbox"/> Yes <input type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)	Estimation of v₁₂ $V_{12} = V_R + (V_F - V_R)P_{FD}$ L _{EQ} = (Equation 13-12 or 13-13) P _{FD} = 0.595 using Equation (Exhibit 13-7) V ₁₂ = 3297 pc/h V ₃ or V _{av34} 1618 pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks				Capacity Checks			
	Actual	Capacity	LOS F?		Actual	Capacity	LOS F?
V _{FO}		Exhibit 13-8		V _F	4915	Exhibit 13-8	7200 No
				V _{FO} = V _F - V _R	3993	Exhibit 13-8	7200 No
				V _R	922	Exhibit 13-10	2100 No

Flow Entering Merge Influence Area				Flow Entering Diverge Influence Area			
	Actual	Max Desirable	Violation?		Actual	Max Desirable	Violation?
V _{R12}		Exhibit 13-8		V ₁₂	3297	Exhibit 13-8	4400:All No

Level of Service Determination (if not F)	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)	$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$ D _R = 30.8 (pc/mi/ln) LOS = D (Exhibit 13-2)

Speed Determination	Speed Determination
M _S = (Exhibit 13-11)	D _s = 0.381 (Exhibit 13-12)
S _R = mph (Exhibit 13-11)	S _R = 59.3 mph (Exhibit 13-12)
S ₀ = mph (Exhibit 13-11)	S ₀ = 74.4 mph (Exhibit 13-12)
S = mph (Exhibit 13-13)	S = 63.6 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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>3760</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1339* pc/h/ln
 S *69.8* mph
 $D = v_p / S$ *19.2* pc/mi/ln
 LOS *C*

Design (N)

Design (N)
 Design LOS
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ 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 2
Project Description SW 10th Street SIMR			

Inputs

Upstream Adj Ramp	Freeway Number of Lanes, N	3	Downstream Adj Ramp
<input checked="" type="checkbox"/> Yes <input type="checkbox"/> On	Ramp Number of Lanes, N	1	<input type="checkbox"/> Yes <input type="checkbox"/> On
<input type="checkbox"/> No <input checked="" type="checkbox"/> Off	Acceleration Lane Length, L _A	300	<input checked="" type="checkbox"/> No <input type="checkbox"/> Off
L _{up} = 2400 ft	Deceleration Lane Length L _D		L _{down} = ft
V _u = 840 veh/h	Freeway Volume, V _F	3760	V _D = veh/h
	Ramp Volume, V _R	1410	
	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	3760	0.95	Level	3	0	0.985	1.00	4017
Ramp	1410	0.92	Level	2	0	0.990	1.00	1548
UpStream	840	0.92	Level	2	0	0.990	1.00	922
DownStream								

Merge Areas	Diverge Areas
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Estimation of v₁₂

V ₁₂ = V _F (P _{FM})
L _{EQ} = 1537.11 (Equation 13-6 or 13-7)
P _{FM} = 0.586 using Equation (Exhibit 13-6)
V ₁₂ = 2354 pc/h
V ₃ or V _{av34} = 1663 pc/h (Equation 13-14 or 13-17)
Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
If Yes, V _{12a} = 2354 pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v₁₂

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? <input type="checkbox"/> Yes <input type="checkbox"/> No
Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No
If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity	LOS F?
V _{FO}	5565	Exhibit 13-8	No

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 Merge Influence Area

	Actual	Max Desirable	Violation?
V _{R12}	3902	Exhibit 13-8	4600:All
			No

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
V ₁₂		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 = 33.3 (pc/mi/ln)
LOS = D (Exhibit 13-2)

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

M _S = 0.484 (Exhibit 13-11)
S _R = 56.4 mph (Exhibit 13-11)
S ₀ = 65.8 mph (Exhibit 13-11)
S = 59.0 mph (Exhibit 13-13)

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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>5170</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *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
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ pc/h/ln
 S mph
 $D = v_p / S$ pc/mi/ln
 Required Number of Lanes, N

Glossary

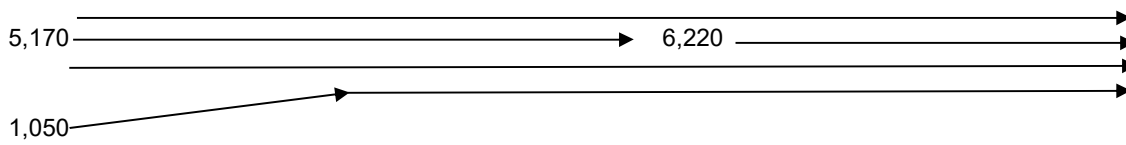
N - Number of lanes S - Speed
 V - Hourly volume D - Density
 v_p - Flow rate FFS - Free-flow speed
 LOS - Level of service BFFS - Base free-flow speed
 DDHV - Directional design hour volume

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 2



	PHF =	0.95	
	v_{fr} =	6,220	vph
	v_r =	1,050	vph
	v_f =	5,170	
Upstream Freeway	Tr % =	3%	
Ramp	Tr % =	2%	
Downstream Freeway	Tr % =	3%	
Freeway	f_{HV} =	$1/(1+P_T(E_T-1)+P_R(E_R-1)) =$	<u>0.985</u>
Ramp	f_{HV} =	$1/(1+P_T(E_T-1)+P_R(E_R-1)) =$	<u>0.9901</u>
flat terrain	E_T =	1.5	
	RV % =	0	
Driver Population adj.	f_p =	1.000	
	V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_p) =$	6,646 pc/h
	V_r =	$=v_r/(PHF)(f_{HV})(f_p) =$	1,116 pc/h
	V_f =	$=v_f/(PHF)(f_{HV})(f_p) =$	5,524 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	6,646	0.69	No
3	Fwy upstream of ramp (assume 70 mph free-flow speed) =	7,200	5,524	0.77	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,116	0.53	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 2*

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:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			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

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1661* pc/h/ln
 S *67.5* mph
 $D = v_p / S$ *24.6* pc/mi/ln
 LOS *C*

Design (N)

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

Glossary

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

Factor Location

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

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 10-Merge from Ex to GP
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2020 Build 2
Project Description SW 10th Street SIMR			

Inputs

Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> 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 600 Deceleration Lane Length L _D Freeway Volume, V _F 6220 Ramp Volume, V _R 190 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 50.0	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off L _{down} = 1150 ft V _D = 700 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	6220	0.95	Level	3	0	0.985	1.00	6646
Ramp	190	0.92	Level	2	0	0.990	1.00	209
UpStream								
DownStream	700	0.92	Level	2	0	0.990	1.00	768

Merge Areas

Diverge Areas

Estimation of v₁₂

$V_{12} = V_F (P_{FM})$
 (Equation 13-6 or 13-7)
 P_{FM} = 0.192 using Equation (Exhibit 13-6)
 V₁₂ = 1274 pc/h
 V₃ or V_{av34} = 2686 pc/h (Equation 13-14 or 13-17)
 Is V₃ or V_{av34} > 2,700 pc/h? Yes No
 Is V₃ or V_{av34} > 1.5 * V₁₂/2 Yes No
 If Yes, V_{12a} = 2658 pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v₁₂

$V_{12} = V_R + (V_F - V_R)P_{FD}$
 (Equation 13-12 or 13-13)
 P_{FD} = using Equation (Exhibit 13-7)
 V₁₂ = pc/h
 V₃ or V_{av34} = pc/h (Equation 13-14 or 13-17)
 Is V₃ or V_{av34} > 2,700 pc/h? Yes No
 Is V₃ or V_{av34} > 1.5 * V₁₂/2 Yes No
 If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity	LOS F?
V _{FO}	6855	Exhibit 13-8	No

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 Merge Influence Area

	Actual	Max Desirable	Violation?
V _{R12}	2867	Exhibit 13-8	4600:All No

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
V ₁₂		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 = 24.0 (pc/mi/ln)
 LOS = C (Exhibit 13-2)

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

M_S = 0.330 (Exhibit 13-11)
 S_R = 60.8 mph (Exhibit 13-11)
 S₀ = 64.6 mph (Exhibit 13-11)
 S = 63.0 mph (Exhibit 13-13)

Speed Determination

D_S = (Exhibit 13-12)
 S_R = mph (Exhibit 13-12)
 S₀ = mph (Exhibit 13-12)
 S = mph (Exhibit 13-13)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 11- Diverge to Express
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2020 Build 2
Project Description SW 10th Street SIMR			

Inputs

Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L _{up} = 1150 ft V _u = 190 veh/h	Freeway Number of Lanes, N 4 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 6410 Ramp Volume, V _R 700 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L _{down} = ft V _D = veh/h
--	---	--

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f _{HV}	f _p	v = V/PHF x f _{HV} x f _p
Freeway	6410	0.95	Level	3	0	0.985	1.00	6849
Ramp	700	0.92	Level	2	0	0.990	1.00	768
UpStream	190	0.92	Level	2	0	0.990	1.00	209
DownStream								

Merge Areas

Diverge Areas

Estimation of v₁₂

$V_{12} = V_F (P_{FM})$
 (Equation 13-6 or 13-7)
 L_{EQ} =
 P_{FM} = using Equation (Exhibit 13-6)
 V₁₂ = pc/h
 V₃ or V_{av34} pc/h (Equation 13-14 or 13-17)
 Is V₃ or V_{av34} > 2,700 pc/h? Yes No
 Is V₃ or V_{av34} > 1.5 * V₁₂/2 Yes No
 If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v₁₂

$V_{12} = V_R + (V_F - V_R)P_{FD}$
 (Equation 13-12 or 13-13)
 L_{EQ} =
 P_{FD} = 0.436 using Equation (Exhibit 13-7)
 V₁₂ = 3419 pc/h
 V₃ or V_{av34} 1715 pc/h (Equation 13-14 or 13-17)
 Is V₃ or V_{av34} > 2,700 pc/h? Yes No
 Is V₃ or V_{av34} > 1.5 * V₁₂/2 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	

Capacity Checks

	Actual	Capacity	LOS F?
V _F	6849	Exhibit 13-8	No
V _{FO} = V _F - V _R	6081	Exhibit 13-8	No
V _R	768	Exhibit 13-10	No

Flow Entering Merge Influence Area

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

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
V ₁₂	3419	Exhibit 13-8	4400:All No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
 D_R = (pc/mi/ln)
 LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
 D_R = 34.8 (pc/mi/ln)
 LOS = D (Exhibit 13-2)

Speed Determination

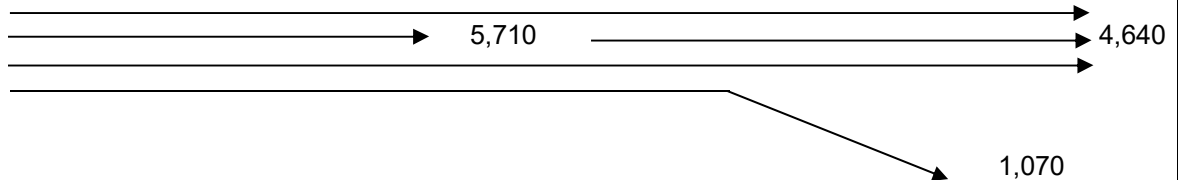
M_S = (Exhibit 13-11)
 S_R = mph (Exhibit 13-11)
 S₀ = mph (Exhibit 13-11)
 S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.367 (Exhibit 13-12)
 S_R = 59.7 mph (Exhibit 13-12)
 S₀ = 74.7 mph (Exhibit 13-12)
 S = 65.6 mph (Exhibit 13-13)

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 2



PHF =	0.95	
$v_{fr} =$	5,710	vph
$v_r =$	1,070	vph
$v_f =$	4,640	
Upstream Freeway Tr % =	3%	
Ramp Tr % =	2%	
Downstream Freeway Tr % =	3%	
Freeway $f_{HV} =$	$1/(1+P_T(E_T-1)+P_R(E_R-1)) =$	<u>0.985</u>
Ramp $f_{HV} =$	$1/(1+P_T(E_T-1)+P_R(E_R-1)) =$	<u>0.9901</u>
flat terrain $E_T =$	1.5	
RV % =	0	
Driver Population adj. $f_P =$	1.000	
$V_{fr} =$	$=v_{fr}/(PHF)(f_{HV})(f_P) =$	6,101 pc/h
$V_r =$	$=v_r/(PHF)(f_{HV})(f_P) =$	1,138 pc/h
$V_f =$	$=v_f/(PHF)(f_{HV})(f_P) =$	4,957 pc/h
No. lanes upstream of ramp $N =$	4	

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

$D = 0.0175 (V_{fr}/N) = 26.7 \text{ pc/ln}$

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	6,101	No
3	Fwy downstream of ramp (assume 70 mph free-flow speed) =	7,200	4,957	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 *PM*

Site Information

Highway/Direction of Travel *I-95 SB*
 From/To *Seg 13-Bet Off & On Ramps*
 Jurisdiction
 Analysis Year *2020 Build 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>4640</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1652* pc/h/ln
 S *67.6* mph
 $D = v_p / S$ *24.4* pc/mi/ln
 LOS *C*

Design (N)

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

Glossary

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

Factor Location

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

FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 SB
Agency/Company	AECOM	Weaving Segment Location	Seg 14- Bet Sample & Copans
Date Performed		Analysis Year	2020 Build 2
Analysis Time Period	PM		

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}	3995	0.95	3	0	1.5	1.2	0.985	1.00	4268
V_{RF}	1410	0.92	2	0	1.5	1.2	0.990	1.00	1548
V_{FR}	645	0.92	2	0	1.5	1.2	0.990	1.00	708
V_{RR}	0	0.95	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	4268							V =	6524
V_W	2256								
VR	0.346								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	2256 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	2705 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1475 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	4180 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	753

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

Weaving segment flow rate, v	6439 veh/h	Weaving intensity factor, W	0.337
Weaving segment capacity, c_w	6838 veh/h	Weaving segment speed, S	49.0 mph
Weaving segment v/c ratio	0.942	Average weaving speed, S_W	56.1 mph
Weaving segment density, D	33.3 pc/mi/ln	Average non-weaving speed, S_{NW}	45.9 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	6080 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		Site Information	
Analyst		Freeway/Dir of Travel	I-95 NB
Agency/Company	AECOM	Weaving Segment Location	Seg 1-Bet Copans & Sample
Date Performed		Analysis Year	2040 Build 2
Analysis Time Period	AM		

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}	4690	0.95	3	0	1.5	1.2	0.985	1.00	5011
V_{RF}	420	0.92	2	0	1.5	1.2	0.990	1.00	461
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}	5011							V =	6537
V_W	1526								
VR	0.233								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1526 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	1961 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1552 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	3513 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	835

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

Weaving segment flow rate, v	6448 veh/h	Weaving intensity factor, W	0.307
Weaving segment capacity, c_w	8705 veh/h	Weaving segment speed, S	52.4 mph
Weaving segment v/c ratio	0.741	Average weaving speed, S_W	57.1 mph
Weaving segment density, D	31.2 pc/mi/ln	Average non-weaving speed, S_{NW}	51.2 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	4881 ft

Notes

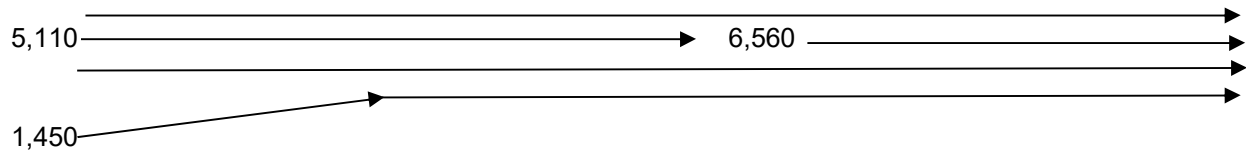
- a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
- b. For volumes that exceed the weaving segment capacity, the level of service is "F".

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	<i>I-95 NB</i>
Agency or Company	<i>AECOM</i>	From/To	<i>Seg 2-Bet Off & On from Sample</i>
Date Performed		Jurisdiction	
Analysis Time Period	<i>AM</i>	Analysis Year	<i>2040 Build 2</i>
Project Description <i>SW 10th Street SIMR</i>			
<input checked="" type="checkbox"/> Oper.(LOS)		<input type="checkbox"/> Des.(N)	
<input type="checkbox"/> Planning Data			
Flow Inputs			
Volume, V	<i>5110</i>	veh/h	Peak-Hour Factor, PHF
AADT		veh/day	%Trucks and Buses, P _T
Peak-Hr Prop. of AADT, K			%RVs, P _R
Peak-Hr Direction Prop, D			General Terrain:
DDHV = AADT x K x D		veh/h	Grade % Length
			Up/Down %
			<i>0.95</i>
			<i>3</i>
			<i>0</i>
			<i>Level</i>
			<i>mi</i>
Calculate Flow Adjustments			
f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>
Speed Inputs		Calc Speed Adj and FFS	
Lane Width	ft	f _{LW}	mph
Rt-Side Lat. Clearance	ft	f _{LC}	mph
Number of Lanes, N	<i>3</i>	TRD Adjustment	mph
Total Ramp Density, TRD	ramps/mi	FFS	<i>70.0</i>
FFS (measured)	<i>70.0</i>	mph	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)	<i>1820</i>	Design LOS	
S	<i>65.5</i>	v _p = (V or DDHV) / (PHF x N x f _{HV} x f _p)	pc/h/ln
D = v _p / S	<i>27.8</i>	S	mph
LOS	<i>D</i>	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			

Job: SW 10th Street SIMR
Analyst: AECOM

Location: Seg 3: I-95 Northbound On-Ramp from EB & WB Sample Road
Analysis Period: AM Peak Hour
Analysis Year: 2040 Build 2



PHF =	0.95	
$V_{fr} =$	6,560	vph
$V_r =$	1,450	vph
$V_f =$	5,110	
Upstream Freeway Tr % =	3%	
Ramp Tr % =	2%	
Downstream Freeway Tr % =	3%	
Freeway $f_{HV} =$	$1/(1+P_T(E_T-1)+P_R(E_R-1)) =$	<u>0.985</u>
Ramp $f_{HV} =$	$1/(1+P_T(E_T-1)+P_R(E_R-1)) =$	<u>0.9901</u>
flat terrain $E_T =$	1.5	
RV % =	0	
Driver Population adj. $f_P =$	1.000	
$V_{fr} =$	$=V_r/(PHF)(f_{HV})(f_P) =$	7,009 pc/h
$V_r =$	$=V_r/(PHF)(f_{HV})(f_P) =$	1,542 pc/h
$V_f =$	$=V_f/(PHF)(f_{HV})(f_P) =$	5,460 pc/h
No. lanes upstream of ramp $N =$	3	

<u>No. Ln</u>	<u>Capacity Check (see Exhibits 25-3 and 25-7):</u>	Maximum	Actual	V/c	LOS F?
4	Fwy downstream of ramp (assume 70 mph free-flow speed) =	9,600	7,009	0.73	No
3	Fwy upstream of ramp (assume 70 mph free-flow speed) =	7,200	5,460	0.76	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,542	0.73	No

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 4-On from Exp
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2040 Build 2
Project Description SW 10th Street SIMR			

Inputs

Upstream Adj Ramp	Freeway Number of Lanes, N	4	Downstream Adj Ramp
<input type="checkbox"/> Yes <input type="checkbox"/> On	Ramp Number of Lanes, N	1	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> On
<input checked="" type="checkbox"/> No <input type="checkbox"/> Off	Acceleration Lane Length, L _A	1500	<input type="checkbox"/> No <input checked="" type="checkbox"/> Off
L _{up} = ft	Deceleration Lane Length L _D		L _{down} = 2950 ft
V _u = veh/h	Freeway Volume, V _F	6560	V _D = 180 veh/h
	Ramp Volume, V _R	830	
	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	6560	0.95	Level	3	0	0.985	1.00	7009
Ramp	830	0.92	Level	2	0	0.990	1.00	911
UpStream								
DownStream	180	0.92	Level	2	0	0.990	1.00	198

Merge Areas

Diverge Areas

Estimation of v₁₂

$V_{12} = V_F (P_{FM})$
 (Equation 13-6 or 13-7)
 L_{EQ} =
 P_{FM} = 0.104 using Equation (Exhibit 13-6)
 V₁₂ = 728 pc/h
 V₃ or V_{av34} = 3140 pc/h (Equation 13-14 or 13-17)
 Is V₃ or V_{av34} > 2,700 pc/h? Yes No
 Is V₃ or V_{av34} > 1.5 * V₁₂/2 Yes No
 If Yes, V_{12a} = 2803 pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v₁₂

$V_{12} = V_R + (V_F - V_R)P_{FD}$
 (Equation 13-12 or 13-13)
 L_{EQ} =
 P_{FD} = using Equation (Exhibit 13-7)
 V₁₂ = pc/h
 V₃ or V_{av34} = pc/h (Equation 13-14 or 13-17)
 Is V₃ or V_{av34} > 2,700 pc/h? Yes No
 Is V₃ or V_{av34} > 1.5 * V₁₂/2 Yes No
 If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity	LOS F?		Actual	Capacity	LOS F?
V _{FO}	7920	Exhibit 13-8	No	V _F		Exhibit 13-8	
				V _{FO} = V _F - V _R		Exhibit 13-8	
				V _R		Exhibit 13-10	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
V _{R12}	4050	Exhibit 13-8 4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
V ₁₂		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 = 29.0 (pc/mi/ln)
 LOS = D (Exhibit 13-2)

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

M_S = 0.395 (Exhibit 13-11)
 S_R = 58.9 mph (Exhibit 13-11)
 S₀ = 65.2 mph (Exhibit 13-11)
 S = 61.8 mph (Exhibit 13-13)

Speed Determination

D_S = (Exhibit 13-12)
 S_R = mph (Exhibit 13-12)
 S₀ = mph (Exhibit 13-12)
 S = mph (Exhibit 13-13)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 5-Off to Exp from GPL
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2040 Build 2
Project Description SW 10th Street SIMR			

Inputs

Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L _{up} = 2950 ft V _u = 830 veh/h	Freeway Number of Lanes, N 4 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 7390 Ramp Volume, V _R 180 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L _{down} = ft V _D = veh/h
--	---	--

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f _{HV}	f _p	v = V/PHF x f _{HV} x f _p
Freeway	7390	0.95	Level	3	0	0.985	1.00	7896
Ramp	180	0.92	Level	2	0	0.990	1.00	198
UpStream	830	0.92	Level	2	0	0.990	1.00	911
DownStream								

Merge Areas

Diverge Areas

Estimation of v₁₂

$V_{12} = V_F (P_{FM})$
 L_{EQ} = (Equation 13-6 or 13-7)
 P_{FM} = using Equation (Exhibit 13-6)
 V₁₂ = pc/h
 V₃ or V_{av34} pc/h (Equation 13-14 or 13-17)
 Is V₃ or V_{av34} > 2,700 pc/h? Yes No
 Is V₃ or V_{av34} > 1.5 * V₁₂/2 Yes No
 If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v₁₂

$V_{12} = V_R + (V_F - V_R)P_{FD}$
 L_{EQ} = 3834.82 (Equation 13-12 or 13-13)
 P_{FD} = 0.436 using Equation (Exhibit 13-7)
 V₁₂ = 3554 pc/h
 V₃ or V_{av34} 2171 pc/h (Equation 13-14 or 13-17)
 Is V₃ or V_{av34} > 2,700 pc/h? Yes No
 Is V₃ or V_{av34} > 1.5 * V₁₂/2 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	

Capacity Checks

	Actual	Capacity	LOS F?
V _F	7896	Exhibit 13-8	9600 No
V _{FO} = V _F - V _R	7698	Exhibit 13-8	9600 No
V _R	198	Exhibit 13-10	2100 No

Flow Entering Merge Influence Area

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

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
V ₁₂	3554	Exhibit 13-8	4400:All No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$
 D_R = (pc/mi/ln)
 LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$
 D_R = 33.0 (pc/mi/ln)
 LOS = D (Exhibit 13-2)

Speed Determination

M_S = (Exhibit 13-11)
 S_R = mph (Exhibit 13-11)
 S₀ = mph (Exhibit 13-11)
 S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.316 (Exhibit 13-12)
 S_R = 61.2 mph (Exhibit 13-12)
 S₀ = 72.2 mph (Exhibit 13-12)
 S = 66.8 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-South of Off to 10th*
 Jurisdiction
 Analysis Year *2040 Build 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>7210</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1926* pc/h/ln
 S *63.9* mph
 $D = v_p / S$ *30.1* pc/mi/ln
 LOS *D*

Design (N)

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

Glossary

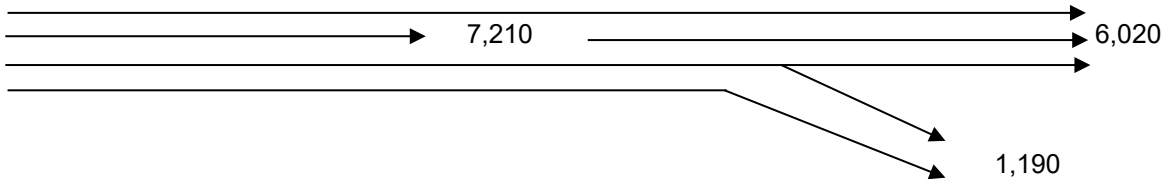
N - Number of lanes
 V - Hourly volume
 v_p - Flow rate
 LOS - Level of service
 DDHV - Directional design hour volume
 S - Speed
 D - Density
 FFS - Free-flow speed
 BFFS - Base free-flow speed

Factor Location

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

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 2



PHF =	0.95	
$V_{fr} =$	7,210	vph
$V_r =$	1,190	vph
$V_f =$	6,020	
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	
$V_{fr} =$	$=V_{fr}/(PHF)(f_{HV})(f_P) =$	7,703 pc/h
$V_r =$	$=V_r/(PHF)(f_{HV})(f_P) =$	1,265 pc/h
$V_f =$	$=V_f/(PHF)(f_{HV})(f_P) =$	6,432 pc/h
No. lanes upstream of ramp $N =$	4	

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

$D = 0.0175 (V_r/N) = 33.7 \text{ pc/ln}$

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	7,703	No
3	Fwy downstream of ramp (assume 70 mph free-flow speed) =	7,200	6,432	No
2	Capacity on Off-Ramp (assume 45 mph free-flow speed) =	4,200	1,265	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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>6020</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *2144* pc/h/ln
 S *59.7* mph
 $D = v_p / S$ *35.9* pc/mi/ln
 LOS *E*

Design (N)

Design (N)
 Design LOS
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ 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 2

Project Description SW 10th Street SIMR

Inputs			
Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L _{up} = ft V _u = veh/h	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Freeway Number of Lanes, N 3 Ramp Number of Lanes, N 1 Acceleration Lane Length, L_A Deceleration Lane Length L_D 200 Freeway Volume, V_F 6020 Ramp Volume, V_R 1330 Freeway Free-Flow Speed, S_{FF} 70.0 Ramp Free-Flow Speed, S_{FR} 45.0 </td> <td style="width: 50%;"> Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L_{down} = 2100 ft V_D = 1230 veh/h </td> </tr> </table>	Freeway Number of Lanes, N 3 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 6020 Ramp Volume, V _R 1330 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L _{down} = 2100 ft V _D = 1230 veh/h
Freeway Number of Lanes, N 3 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 6020 Ramp Volume, V _R 1330 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L _{down} = 2100 ft V _D = 1230 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	6020	0.95	Level	3	0	0.985	1.00	6432
Ramp	1330	0.92	Level	2	0	0.990	1.00	1460
UpStream								
DownStream	1230	0.92	Level	2	0	0.990	1.00	1350

Merge Areas	Diverge Areas
Estimation of v₁₂ $V_{12} = V_F (P_{FM})$ 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? <input type="checkbox"/> Yes <input type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)	Estimation of v₁₂ $V_{12} = V_R + (V_F - V_R)P_{FD}$ L _{EQ} = (Equation 13-12 or 13-13) P _{FD} = 0.532 using Equation (Exhibit 13-7) V ₁₂ = 4105 pc/h V ₃ or V _{av34} 2327 pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks				Capacity Checks			
	Actual	Capacity	LOS F?		Actual	Capacity	LOS F?
V _{FO}		Exhibit 13-8		V _F	6432	Exhibit 13-8	7200 No
				V _{FO} = V _F - V _R	4972	Exhibit 13-8	7200 No
				V _R	1460	Exhibit 13-10	2100 No

Flow Entering Merge Influence Area				Flow Entering Diverge Influence Area			
	Actual	Max Desirable	Violation?		Actual	Max Desirable	Violation?
V _{R12}		Exhibit 13-8		V ₁₂	4105	Exhibit 13-8	4400:All No

Level of Service Determination (if not F)	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)	$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$ D _R = 37.8 (pc/mi/ln) LOS = E (Exhibit 13-2)

Speed Determination	Speed Determination
M _S = (Exhibit 13-11)	D _s = 0.429 (Exhibit 13-12)
S _R = mph (Exhibit 13-11)	S _R = 58.0 mph (Exhibit 13-12)
S ₀ = mph (Exhibit 13-11)	S ₀ = 71.6 mph (Exhibit 13-12)
S = mph (Exhibit 13-13)	S = 62.3 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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>4690</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1670* pc/h/ln
 S *67.4* mph
 $D = v_p / S$ *24.8* pc/mi/ln
 LOS *C*

Design (N)

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

Glossary

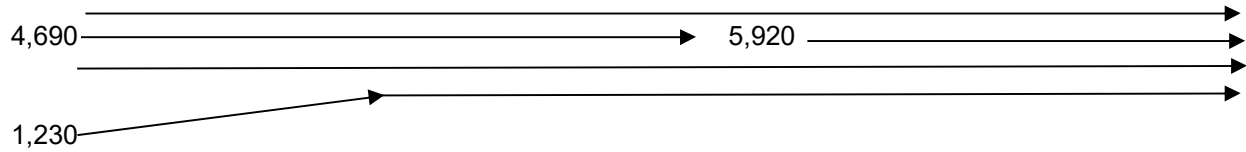
N - Number of lanes
 V - Hourly volume
 v_p - Flow rate
 LOS - Level of service
 DDHV - Directional design hour volume
 S - Speed
 D - Density
 FFS - Free-flow speed
 BFFS - Base free-flow speed

Factor Location

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

Job: SW 10th Street SIMR
Analyst: AECOM

Location: Seg 11: I-95 Northbound On-Ramp from EB & WB SW 10th Street
Analysis Period: AM Peak Hour
Analysis Year: 2040 Build 2



	PHF =	0.95	
	v_{fr} =	5,920	vph
	v_r =	1,230	vph
	v_f =	4,690	
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} =	$=v_{fr}/(PHF)(f_{HV})(f_P) =$	6,325 pc/h
	V_r =	$=v_r/(PHF)(f_{HV})(f_P) =$	1,308 pc/h
	V_f =	$=v_f/(PHF)(f_{HV})(f_P) =$	5,011 pc/h
No. lanes upstream of ramp	N =	3	

<u>No. Ln</u>	<u>Capacity Check (see Exhibits 25-3 and 25-7):</u>	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	5,011	0.70	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,308	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 NB*
 From/To *Seg 12-Bet On Ramps*
 Jurisdiction
 Analysis Year *2040 Build 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

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

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *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
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ pc/h/ln
 S mph
 $D = v_p / S$ pc/mi/ln
 Required Number of Lanes, N

Glossary

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

Factor Location

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

FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 NB
Agency/Company	AECOM	Weaving Segment Location	Seg 13-Bet On & Off to Exp
Date Performed		Analysis Year	2040 Build 2
Analysis Time Period	AM		

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}	4950	0.95	3	0	1.5	1.2	0.985	1.00	5289
V_{RF}	1090	0.92	2	0	1.5	1.2	0.990	1.00	1197
V_{FR}	970	0.92	2	0	1.5	1.2	0.990	1.00	1065
V_{RR}	300	0.92	2	0	1.5	1.2	0.990	1.00	329
V_{NW}	7551							V =	7880
V_W	329								
VR	0.042								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	0 lc	Minimum weaving lane changes, LC_{MIN}	987 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	1613 lc/h
Minimum RF lane changes, LC_{RF}	0 lc/pc	Non-weaving lane changes, LC_{NW}	3373 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	4986 lc/h
Minimum RR lane changes, LC_{RR}	3 lc/pc	Non-weaving vehicle index, I_{NW}	2431

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

Weaving segment flow rate, v	7776 veh/h	Weaving intensity factor, W	0.241
Weaving segment capacity, c_w	9001 veh/h	Weaving segment speed, S	53.7 mph
Weaving segment v/c ratio	0.864	Average weaving speed, S_W	59.3 mph
Weaving segment density, D	36.7 pc/mi/ln	Average non-weaving speed, S_{NW}	53.4 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	6115 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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>6040</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1613* pc/h/ln
 S *68.0* mph
 $D = v_p / S$ *23.7* pc/mi/ln
 LOS *C*

Design (N)

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

Glossary

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

Factor Location

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

FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 NB
Agency/Company	AECOM	Weaving Segment Location	Seg 1-Bet Copans & Sample
Date Performed		Analysis Year	2040 Build 2
Analysis Time Period	PM		

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}	4355	0.95	3	0	1.5	1.2	0.985	1.00	4653
V_{RF}	495	0.92	2	0	1.5	1.2	0.990	1.00	543
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}	4653							V =	7183
V_W	2530								
VR	0.352								

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	7090 veh/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	6713 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.056	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}	6151 ft

Notes

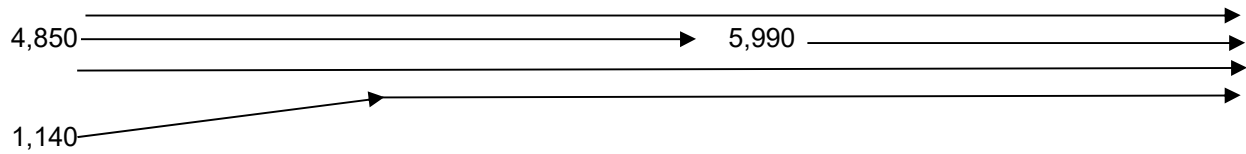
- a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
- b. For volumes that exceed the weaving segment capacity, the level of service is "F".

BASIC FREEWAY SEGMENTS WORKSHEET

General Information		Site Information	
Analyst		Highway/Direction of Travel	<i>I-95 NB</i>
Agency or Company	<i>AECOM</i>	From/To	<i>Seg 2-Bet Off & On from Sample</i>
Date Performed		Jurisdiction	
Analysis Time Period	<i>PM</i>	Analysis Year	<i>2040 Build 2</i>
Project Description <i>SW 10th Street SIMR</i>			
<input checked="" type="checkbox"/> Oper.(LOS)		<input type="checkbox"/> Des.(N)	
<input type="checkbox"/> Planning Data			
Flow Inputs			
Volume, V	<i>4850</i>	veh/h	Peak-Hour Factor, PHF
AADT		veh/day	%Trucks and Buses, P _T
Peak-Hr Prop. of AADT, K			%RVs, P _R
Peak-Hr Direction Prop, D			General Terrain:
DDHV = AADT x K x D		veh/h	Grade % Length
			Up/Down %
			<i>0.95</i>
			<i>3</i>
			<i>0</i>
			<i>Level</i>
			<i>mi</i>
Calculate Flow Adjustments			
f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>
Speed Inputs		Calc Speed Adj and FFS	
Lane Width	ft	f _{LW}	mph
Rt-Side Lat. Clearance	ft	f _{LC}	mph
Number of Lanes, N	<i>3</i>	TRD Adjustment	mph
Total Ramp Density, TRD	ramps/mi	FFS	<i>70.0</i>
FFS (measured)	<i>70.0</i>	mph	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)	<i>1727</i>	Design LOS	
S	<i>66.8</i>	v _p = (V or DDHV) / (PHF x N x f _{HV} x f _p)	pc/h/ln
D = v _p / S	<i>25.9</i>	S	mph
LOS	<i>C</i>	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			

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 2



PHF =	0.95	
$V_{fr} =$	5,990	vph
$V_r =$	1,140	vph
$V_f =$	4,850	
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 $f_{HV} =$	$1/(1+P_T(E_T-1)+P_R(E_R-1)) =$	0.9901
flat terrain $E_T =$	1.5	
RV % =	0	
Driver Population adj. $f_P =$	1.000	
$V_{fr} =$	$=V_r/(PHF)(f_{HV})(f_P) =$	6,400 pc/h
$V_r =$	$=V_r/(PHF)(f_{HV})(f_P) =$	1,212 pc/h
$V_f =$	$=V_f/(PHF)(f_{HV})(f_P) =$	5,182 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	6,400	0.67	No
3	Fwy upstream of ramp (assume 70 mph free-flow speed) =	7,200	5,182	0.72	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,212	0.58	No

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 4-On from Exp
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2040 Build 2
Project Description SW 10th Street SIMR			

Inputs

Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> 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 5990 Ramp Volume, V_R 670 Freeway Free-Flow Speed, S_{FF} 70.0 Ramp Free-Flow Speed, S_{FR} 50.0	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off $L_{down} =$ 2950 ft $V_D =$ 310 veh/h
--	--	--

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	5990	0.95	Level	3	0	0.985	1.00	6400
Ramp	670	0.92	Level	2	0	0.990	1.00	736
UpStream								
DownStream	310	0.92	Level	2	0	0.990	1.00	340

Merge Areas

Diverge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$
 (Equation 13-6 or 13-7)
 $L_{EQ} =$
 $P_{FM} =$ 0.126 using Equation (Exhibit 13-6)
 $V_{12} =$ 805 pc/h
 V_3 or V_{av34} 2797 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, $V_{12a} =$ 2560 pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$
 (Equation 13-12 or 13-13)
 $L_{EQ} =$
 $P_{FD} =$ 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_{FO}	7136	Exhibit 13-8	No

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 Merge Influence Area

	Actual	Max Desirable	Violation?
V_{R12}	3603	Exhibit 13-8	4600:All No

Flow Entering Diverge Influence Area

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

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 V_R + 0.0078 V_{12} - 0.00627 L_A$
 $D_R =$ 25.4 (pc/mi/ln)
 LOS = C (Exhibit 13-2)

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

$M_S =$ 0.314 (Exhibit 13-11)
 $S_R =$ 61.2 mph (Exhibit 13-11)
 $S_0 =$ 65.8 mph (Exhibit 13-11)
 $S =$ 63.3 mph (Exhibit 13-13)

Speed Determination

$D_s =$ (Exhibit 13-12)
 $S_R =$ mph (Exhibit 13-12)
 $S_0 =$ mph (Exhibit 13-12)
 $S =$ mph (Exhibit 13-13)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 NB
Agency or Company	AECOM	Junction	Seg 5-Off to Exp from GPL
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2040 Build 2

Project Description SW 10th Street SIMR

Inputs			
Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L _{up} = 2950 ft V _u = 670 veh/h	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Freeway Number of Lanes, N 4 Ramp Number of Lanes, N 1 Acceleration Lane Length, L_A Deceleration Lane Length L_D 200 Freeway Volume, V_F 6660 Ramp Volume, V_R 310 Freeway Free-Flow Speed, S_{FF} 70.0 Ramp Free-Flow Speed, S_{FR} 45.0 </td> <td style="width: 50%;"> Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L_{down} = ft V_D = veh/h </td> </tr> </table>	Freeway Number of Lanes, N 4 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 6660 Ramp Volume, V _R 310 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L _{down} = ft V _D = veh/h
Freeway Number of Lanes, N 4 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 6660 Ramp Volume, V _R 310 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L _{down} = ft V _D = veh/h		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f _{HV}	f _p	v = V/PHF x f _{HV} x f _p
Freeway	6660	0.95	Level	3	0	0.985	1.00	7116
Ramp	310	0.92	Level	2	0	0.990	1.00	340
UpStream	670	0.92	Level	2	0	0.990	1.00	736
DownStream								

Merge Areas	Diverge Areas
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Estimation of v ₁₂	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? <input type="checkbox"/> Yes <input type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)	$V_{12} = V_R + (V_F - V_R)P_{FD}$ L _{EQ} = 3524.43 (Equation 13-12 or 13-13) P _{FD} = 0.436 using Equation (Exhibit 13-7) V ₁₂ = 3294 pc/h V ₃ or V _{av34} 1911 pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

V _{FO}	Actual		Capacity		LOS F?
			Exhibit 13-8		
	V _F	7116	Exhibit 13-8	9600	No
	V _{FO} = V _F - V _R	6776	Exhibit 13-8	9600	No
	V _R	340	Exhibit 13-10	2100	No

Flow Entering Merge Influence Area	Flow Entering Diverge Influence Area
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	Actual	Max Desirable	Violation?		Actual	Max Desirable	Violation?
V _{R12}		Exhibit 13-8		V ₁₂	3294	Exhibit 13-8	4400:All No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$ D _R = (pc/mi/ln) LOS = (Exhibit 13-2)	$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$ D _R = 30.8 (pc/mi/ln) LOS = D (Exhibit 13-2)
---	--

Speed Determination

M _S = (Exhibit 13-11) S _R = mph (Exhibit 13-11) S ₀ = mph (Exhibit 13-11) S = mph (Exhibit 13-13)	D _s = 0.329 (Exhibit 13-12) S _R = 60.8 mph (Exhibit 13-12) S ₀ = 73.2 mph (Exhibit 13-12) S = 66.9 mph (Exhibit 13-13)
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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-South of Off to 10th*
 Jurisdiction
 Analysis Year *2040 Build 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	6350	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:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			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

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1696* pc/h/ln
 S *67.1* mph
 $D = v_p / S$ *25.3* pc/mi/ln
 LOS *C*

Design (N)

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

Glossary

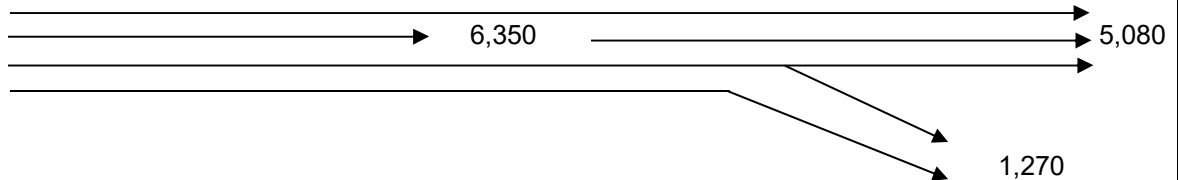
N - Number of lanes
 V - Hourly volume
 v_p - Flow rate
 LOS - Level of service
 DDHV - Directional design hour volume
 S - Speed
 D - Density
 FFS - Free-flow speed
 BFFS - Base free-flow speed

Factor Location

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

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 2



PHF =	0.95	
v_{fr} =	6,350	vph
v_r =	1,270	vph
v_f =	5,080	
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} =	$=v_{fr}/(PHF)(f_{HV})(f_P) =$	6,784 pc/h
V_r =	$=v_r/(PHF)(f_{HV})(f_P) =$	1,350 pc/h
V_f =	$=v_f/(PHF)(f_{HV})(f_P) =$	5,428 pc/h
No. lanes upstream of ramp N =	4	

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

$D = 0.0175 (V_{fr}/N) = 29.7 \text{ pc/ln}$

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	6,784	No
3	Fwy downstream of ramp (assume 70 mph free-flow speed) =	7,200	5,428	No
2	Capacity on Off-Ramp (assume 45 mph free-flow speed) =	4,200	1,350	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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>3760</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1339* pc/h/ln
 S *69.8* mph
 $D = v_p / S$ *19.2* pc/mi/ln
 LOS *C*

Design (N)

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

Glossary

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

Factor Location

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

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 2

Project Description SW 10th Street SIMR

Inputs			
Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L _{up} = ft V _u = veh/h	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Freeway Number of Lanes, N 3 Ramp Number of Lanes, N 1 Acceleration Lane Length, L_A Deceleration Lane Length L_D 200 Freeway Volume, V_F 5080 Ramp Volume, V_R 1320 Freeway Free-Flow Speed, S_{FF} 70.0 Ramp Free-Flow Speed, S_{FR} 45.0 </td> <td style="width: 50%;"> Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L_{down} = 2100 ft V_D = 1440 veh/h </td> </tr> </table>	Freeway Number of Lanes, N 3 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 5080 Ramp Volume, V _R 1320 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L _{down} = 2100 ft V _D = 1440 veh/h
Freeway Number of Lanes, N 3 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 5080 Ramp Volume, V _R 1320 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L _{down} = 2100 ft V _D = 1440 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	5080	0.95	Level	3	0	0.985	1.00	5428
Ramp	1320	0.92	Level	2	0	0.990	1.00	1449
UpStream								
DownStream	1440	0.92	Level	2	0	0.990	1.00	1581

Merge Areas	Diverge Areas
Estimation of v₁₂ $V_{12} = V_F (P_{FM})$ 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? <input type="checkbox"/> Yes <input type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)	Estimation of v₁₂ $V_{12} = V_R + (V_F - V_R)P_{FD}$ L _{EQ} = (Equation 13-12 or 13-13) P _{FD} = 0.558 using Equation (Exhibit 13-7) V ₁₂ = 3668 pc/h V ₃ or V _{av34} 1760 pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks				Capacity Checks			
	Actual	Capacity	LOS F?		Actual	Capacity	LOS F?
V _{FO}		Exhibit 13-8		V _F	5428	Exhibit 13-8	7200 No
				V _{FO} = V _F - V _R	3979	Exhibit 13-8	7200 No
				V _R	1449	Exhibit 13-10	2100 No

Flow Entering Merge Influence Area				Flow Entering Diverge Influence Area			
	Actual	Max Desirable	Violation?		Actual	Max Desirable	Violation?
V _{R12}		Exhibit 13-8		V ₁₂	3668	Exhibit 13-8	4400:All No

Level of Service Determination (if not F)	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)	$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$ D _R = 34.0 (pc/mi/ln) LOS = D (Exhibit 13-2)

Speed Determination	Speed Determination
M _S = (Exhibit 13-11)	D _s = 0.428 (Exhibit 13-12)
S _R = mph (Exhibit 13-11)	S _R = 58.0 mph (Exhibit 13-12)
S ₀ = mph (Exhibit 13-11)	S ₀ = 73.8 mph (Exhibit 13-12)
S = mph (Exhibit 13-13)	S = 62.3 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 NB*
 From/To *Seg 10-Bet Off & Off Ramps*
 Jurisdiction
 Analysis Year *2040 Build 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>3760</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1339* pc/h/ln
 S *69.8* mph
 $D = v_p / S$ *19.2* pc/mi/ln
 LOS *C*

Design (N)

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

Glossary

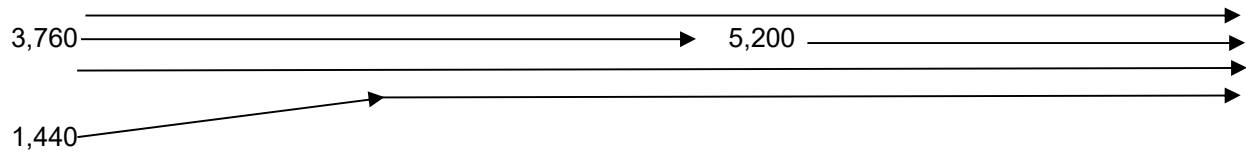
N - Number of lanes S - Speed
 V - Hourly volume D - Density
 v_p - Flow rate FFS - Free-flow speed
 LOS - Level of service BFFS - Base free-flow speed
 DDHV - Directional design hour volume

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 11: I-95 Northbound On-Ramp from EB & WB SW 10th Street
Analysis Period: PM Peak Hour
Analysis Year: 2040 Build 2



	PHF =	0.95	
	$V_{fr} =$	5,200	vph
	$V_r =$	1,440	vph
	$V_f =$	3,760	
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	
	$V_{fr} = v_{fr}/(PHF)(f_{HV})(f_P) =$		5,556 pc/h
	$V_r = v_r/(PHF)(f_{HV})(f_P) =$		1,531 pc/h
	$V_f = v_f/(PHF)(f_{HV})(f_P) =$		4,017 pc/h
No. lanes upstream of ramp	$N =$	3	

<u>No. Ln</u>	<u>Capacity Check (see Exhibits 25-3 and 25-7):</u>	Maximum	Actual	V/c	LOS F?
4	Fwy downstream of ramp (assume 70 mph free-flow speed) =	9,600	5,556	0.58	No
3	Fwy upstream of ramp (assume 70 mph free-flow speed) =	7,200	4,017	0.56	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,531	0.73	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 12-Bet On Ramps*
 Jurisdiction
 Analysis Year *2040 Build 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>5200</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *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
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ pc/h/ln
 S mph
 $D = v_p / S$ pc/mi/ln
 Required Number of Lanes, N

Glossary

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

Factor Location

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

FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 NB
Agency/Company	AECOM	Weaving Segment Location	Seg 13-Bet On & Off to Exp
Date Performed		Analysis Year	2040 Build 2
Analysis Time Period	PM		

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}	4395	0.95	3	0	1.5	1.2	0.985	1.00	4696
V_{RF}	1185	0.92	2	0	1.5	1.2	0.990	1.00	1301
V_{FR}	805	0.92	2	0	1.5	1.2	0.990	1.00	884
V_{RR}	255	0.92	2	0	1.5	1.2	0.990	1.00	280
V_{NW}	6881							V =	7161
V_W	280								
VR	0.039								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	0 lc	Minimum weaving lane changes, LC_{MIN}	840 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	1466 lc/h
Minimum RF lane changes, LC_{RF}	0 lc/pc	Non-weaving lane changes, LC_{NW}	3223 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	4689 lc/h
Minimum RR lane changes, LC_{RR}	3 lc/pc	Non-weaving vehicle index, I_{NW}	2216

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

Weaving segment flow rate, v	7067 veh/h	Weaving intensity factor, W	0.229
Weaving segment capacity, c_w	9009 veh/h	Weaving segment speed, S	55.5 mph
Weaving segment v/c ratio	0.784	Average weaving speed, S_W	59.7 mph
Weaving segment density, D	32.2 pc/mi/ln	Average non-weaving speed, S_{NW}	55.4 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	6091 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 NB*
 From/To *Seg 14-North of Hillsboro*
 Jurisdiction
 Analysis Year *2040 Build 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>5580</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1490* pc/h/ln
 S *69.0* mph
 $D = v_p / S$ *21.6* pc/mi/ln
 LOS *C*

Design (N)

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

Glossary

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

Factor Location

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

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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>4820</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1287* pc/h/ln
 S *69.9* mph
 $D = v_p / S$ *18.4* pc/mi/ln
 LOS *C*

Design (N)

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

Glossary

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

Factor Location

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

FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	195/SB
Agency/Company	AECOM	Weaving Segment Location	Seg 2-Bet On from Exp & Off
Date Performed		Analysis Year	2040 Build 2
Analysis Time Period	AM		

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}	3525	0.95	3	0	1.5	1.2	0.985	1.00	3766
V_{RF}	1065	0.92	2	0	1.5	1.2	0.990	1.00	1169
V_{FR}	1295	0.92	2	0	1.5	1.2	0.990	1.00	1422
V_{RR}	125	0.92	2	0	1.5	1.2	0.990	1.00	137
V_{NW}	6357							V =	6494
V_W	137								
VR	0.021								

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}	3107 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	4186 lc/h
Minimum RR lane changes, LC_{RR}	3 lc/pc	Non-weaving vehicle index, I_{NW}	2314

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

Weaving segment flow rate, v	6412 veh/h	Weaving intensity factor, W	0.190
Weaving segment capacity, c_w	9241 veh/h	Weaving segment speed, S	59.3 mph
Weaving segment v/c ratio	0.694	Average weaving speed, S_W	61.2 mph
Weaving segment density, D	27.4 pc/mi/ln	Average non-weaving speed, S_{NW}	59.2 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	5923 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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>4590</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1635* pc/h/ln
 S *67.8* mph
 $D = v_p / S$ *24.1* pc/mi/ln
 LOS *C*

Design (N)

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

Glossary

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

Factor Location

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

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 2

Project Description SW 10th Street SIMR

Inputs			
Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L _{up} = ft V _u = veh/h	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"> Freeway Number of Lanes, N 3 Ramp Number of Lanes, N 1 Acceleration Lane Length, L_A Deceleration Lane Length L_D 200 Freeway Volume, V_F 4590 Ramp Volume, V_R 1350 Freeway Free-Flow Speed, S_{FF} 70.0 Ramp Free-Flow Speed, S_{FR} 45.0 </td> <td style="width: 50%; vertical-align: top;"> Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L_{down} = 2400 ft V_D = 1600 veh/h </td> </tr> </table>	Freeway Number of Lanes, N 3 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 4590 Ramp Volume, V _R 1350 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L _{down} = 2400 ft V _D = 1600 veh/h
Freeway Number of Lanes, N 3 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 4590 Ramp Volume, V _R 1350 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L _{down} = 2400 ft V _D = 1600 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	4590	0.95	Level	3	0	0.985	1.00	4904
Ramp	1350	0.92	Level	2	0	0.990	1.00	1482
UpStream								
DownStream	1600	0.92	Level	2	0	0.990	1.00	1757

Merge Areas	Diverge Areas
Estimation of v₁₂ $V_{12} = V_F (P_{FM})$ 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? <input type="checkbox"/> Yes <input type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)	Estimation of v₁₂ $V_{12} = V_R + (V_F - V_R)P_{FD}$ L _{EQ} = (Equation 13-12 or 13-13) P _{FD} = 0.569 using Equation (Exhibit 13-7) V ₁₂ = 3430 pc/h V ₃ or V _{av34} 1474 pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks				Capacity Checks			
	Actual	Capacity	LOS F?		Actual	Capacity	LOS F?
V _{FO}		Exhibit 13-8		V _F	4904	Exhibit 13-8	7200 No
				V _{FO} = V _F - V _R	3422	Exhibit 13-8	7200 No
				V _R	1482	Exhibit 13-10	2100 No

Flow Entering Merge Influence Area				Flow Entering Diverge Influence Area			
	Actual	Max Desirable	Violation?		Actual	Max Desirable	Violation?
V _{R12}		Exhibit 13-8		V ₁₂	3430	Exhibit 13-8	4400:All No

Level of Service Determination (if not F)	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)	$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$ D _R = 32.0 (pc/mi/ln) LOS = D (Exhibit 13-2)

Speed Determination	Speed Determination
M _S = (Exhibit 13-11)	D _s = 0.431 (Exhibit 13-12)
S _R = mph (Exhibit 13-11)	S _R = 57.9 mph (Exhibit 13-12)
S ₀ = mph (Exhibit 13-11)	S ₀ = 74.9 mph (Exhibit 13-12)
S = mph (Exhibit 13-13)	S = 62.2 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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	3240	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:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			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

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1154* pc/h/ln
 S *70.0* mph
 $D = v_p / S$ *16.5* pc/mi/ln
 LOS *B*

Design (N)

Design (N)
 Design LOS
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ 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 2
Project Description SW 10th Street SIMR			

Inputs

Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off	Freeway Number of Lanes, N 3 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A 300 Deceleration Lane Length L _D Freeway Volume, V _F 3240 Ramp Volume, V _R 1600 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 50.0	Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L _{down} = ft V _D = veh/h
L _{up} = 2400 ft V _u = 1350 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	3240	0.95	Level	3	0	0.985	1.00	3462
Ramp	1600	0.92	Level	2	0	0.990	1.00	1757
UpStream	1350	0.92	Level	2	0	0.990	1.00	1482
DownStream								

Merge Areas	Diverge Areas
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Estimation of v₁₂

$V_{12} = V_F (P_{FM})$ L _{EQ} = 1463.07 (Equation 13-6 or 13-7) P _{FM} = 0.586 using Equation (Exhibit 13-6) V ₁₂ = 2028 pc/h V ₃ or V _{av34} 1434 pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = 2028 pc/h (Equation 13-16, 13-18, or 13-19)
--

Estimation of v₁₂

$V_{12} = V_R + (V_F - V_R)P_{FD}$ 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? <input type="checkbox"/> Yes <input type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)
--

Capacity Checks

	Actual	Capacity	LOS F?
V _{FO}	5219	Exhibit 13-8	No

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 Merge Influence Area

	Actual	Max Desirable	Violation?
V _{R12}	3785	Exhibit 13-8	4600:All No

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
V ₁₂		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 = 32.3 (pc/mi/ln) LOS = D (Exhibit 13-2)

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

M _S = 0.463 (Exhibit 13-11)
S _R = 57.0 mph (Exhibit 13-11)
S ₀ = 66.6 mph (Exhibit 13-11)
S = 59.4 mph (Exhibit 13-13)

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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>4840</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1724* pc/h/ln
 S *66.8* mph
 $D = v_p / S$ *25.8* pc/mi/ln
 LOS *C*

Design (N)

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

Glossary

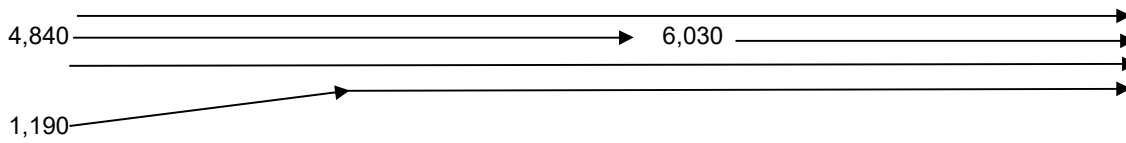
N - Number of lanes
 V - Hourly volume
 v_p - Flow rate
 LOS - Level of service
 DDHV - Directional design hour volume
 S - Speed
 D - Density
 FFS - Free-flow speed
 BFFS - Base free-flow speed

Factor Location

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

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 2



	PHF =	0.95	
	v_{fr} =	6,030	vph
	v_r =	1,190	vph
	v_f =	4,840	
Upstream Freeway	Tr % =	3%	
Ramp	Tr % =	2%	
Downstream Freeway	Tr % =	3%	
Freeway	f_{HV} =	$1/(1+P_T(E_T-1)+P_R(E_R-1)) =$	<u>0.985</u>
Ramp	f_{HV} =	$1/(1+P_T(E_T-1)+P_R(E_R-1)) =$	<u>0.9901</u>
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 =	$=v_r/(PHF)(f_{HV})(f_p) =$	1,265 pc/h
	V_f =	$=v_f/(PHF)(f_{HV})(f_p) =$	5,171 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	5,171	0.72	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,265	0.60	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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>6030</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *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
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ pc/h/ln
 S mph
 $D = v_p / S$ pc/mi/ln
 Required Number of Lanes, N

Glossary

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

Factor Location

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

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 10-Merge from Ex to GP
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2040 Build 2
Project Description SW 10th Street SIMR			

Inputs

Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off	Freeway Number of Lanes, N 4 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A 600 Deceleration Lane Length L _D Freeway Volume, V _F 6030 Ramp Volume, V _R 300 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 50.0	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off L _{down} = 1150 ft V _D = 780 veh/h
--	---	---

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f _{HV}	f _p	v = V/PHF x f _{HV} x f _p
Freeway	6030	0.95	Level	3	0	0.985	1.00	6443
Ramp	300	0.92	Level	2	0	0.990	1.00	329
UpStream								
DownStream	780	0.92	Level	2	0	0.990	1.00	856

Merge Areas

Diverge Areas

Estimation of v₁₂

$V_{12} = V_F (P_{FM})$
 (Equation 13-6 or 13-7)
 P_{FM} = 0.177 using Equation (Exhibit 13-6)
 V₁₂ = 1138 pc/h
 V₃ or V_{av34} = 2652 pc/h (Equation 13-14 or 13-17)
 Is V₃ or V_{av34} > 2,700 pc/h? Yes No
 Is V₃ or V_{av34} > 1.5 * V₁₂/2 Yes No
 If Yes, V_{12a} = 2577 pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v₁₂

$V_{12} = V_R + (V_F - V_R)P_{FD}$
 (Equation 13-12 or 13-13)
 P_{FD} = using Equation (Exhibit 13-7)
 V₁₂ = pc/h
 V₃ or V_{av34} = pc/h (Equation 13-14 or 13-17)
 Is V₃ or V_{av34} > 2,700 pc/h? Yes No
 Is V₃ or V_{av34} > 1.5 * V₁₂/2 Yes No
 If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity	LOS F?
V _{FO}	6772	Exhibit 13-8	No

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 Merge Influence Area

	Actual	Max Desirable	Violation?
V _{R12}	2906	Exhibit 13-8	4600:All No

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
V ₁₂		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 = 24.2 (pc/mi/ln)
 LOS = C (Exhibit 13-2)

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

M_S = 0.332 (Exhibit 13-11)
 S_R = 60.7 mph (Exhibit 13-11)
 S₀ = 64.8 mph (Exhibit 13-11)
 S = 63.0 mph (Exhibit 13-13)

Speed Determination

D_S = (Exhibit 13-12)
 S_R = mph (Exhibit 13-12)
 S₀ = mph (Exhibit 13-12)
 S = mph (Exhibit 13-13)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 11- Diverge to Express
Date Performed		Jurisdiction	
Analysis Time Period	AM	Analysis Year	2040 Build 2

Project Description SW 10th Street SIMR

Inputs			
Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L _{up} = 1150 ft V _u = 300 veh/h	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Freeway Number of Lanes, N 4 Ramp Number of Lanes, N 1 Acceleration Lane Length, L_A Deceleration Lane Length L_D 200 Freeway Volume, V_F 6330 Ramp Volume, V_R 780 Freeway Free-Flow Speed, S_{FF} 70.0 Ramp Free-Flow Speed, S_{FR} 45.0 </td> <td style="width: 50%;"> Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L_{down} = ft V_D = veh/h </td> </tr> </table>	Freeway Number of Lanes, N 4 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 6330 Ramp Volume, V _R 780 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L _{down} = ft V _D = veh/h
Freeway Number of Lanes, N 4 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 6330 Ramp Volume, V _R 780 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L _{down} = ft V _D = veh/h		

Conversion to pc/h Under Base Conditions								
(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f _{HV}	f _p	v = V/PHF x f _{HV} x f _p
Freeway	6330	0.95	Level	3	0	0.985	1.00	6763
Ramp	780	0.92	Level	2	0	0.990	1.00	856
UpStream	300	0.92	Level	2	0	0.990	1.00	329
DownStream								

Merge Areas	Diverge Areas
Estimation of v₁₂ $V_{12} = V_F (P_{FM})$ 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? <input type="checkbox"/> Yes <input type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)	Estimation of v₁₂ $V_{12} = V_R + (V_F - V_R)P_{FD}$ L _{EQ} = (Equation 13-12 or 13-13) P _{FD} = 0.436 using Equation (Exhibit 13-7) V ₁₂ = 3431 pc/h V ₃ or V _{av34} 1666 pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks				Capacity Checks			
	Actual	Capacity	LOS F?		Actual	Capacity	LOS F?
V _{FO}		Exhibit 13-8		V _F	6763	Exhibit 13-8	9600 No
				V _{FO} = V _F - V _R	5907	Exhibit 13-8	9600 No
				V _R	856	Exhibit 13-10	2100 No

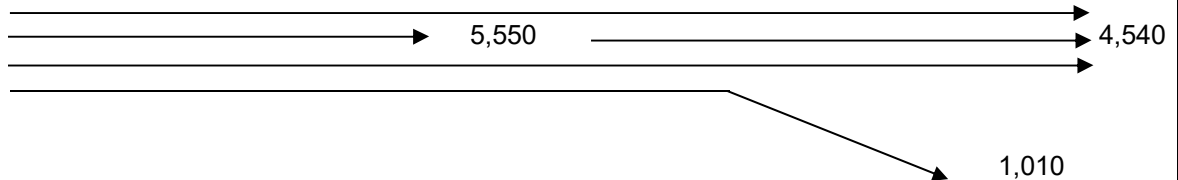
Flow Entering Merge Influence Area				Flow Entering Diverge Influence Area			
	Actual	Max Desirable	Violation?		Actual	Max Desirable	Violation?
V _{R12}		Exhibit 13-8		V ₁₂	3431	Exhibit 13-8	4400:All No

Level of Service Determination (if not F)	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)	$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$ D _R = 34.9 (pc/mi/ln) LOS = D (Exhibit 13-2)

Speed Determination	Speed Determination
M _S = (Exhibit 13-11)	D _s = 0.375 (Exhibit 13-12)
S _R = mph (Exhibit 13-11)	S _R = 59.5 mph (Exhibit 13-12)
S ₀ = mph (Exhibit 13-11)	S ₀ = 74.9 mph (Exhibit 13-12)
S = mph (Exhibit 13-13)	S = 65.4 mph (Exhibit 13-13)

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 2



PHF =	0.95	
v_{fr} =	5,550	vph
v_r =	1,010	vph
v_f =	4,540	
Upstream Freeway Tr % =	3%	
Ramp Tr % =	2%	
Downstream Freeway Tr % =	3%	
Freeway f_{HV} =	$1/(1+P_T(E_T-1)+P_R(E_R-1)) =$	<u>0.985</u>
Ramp f_{HV} =	$1/(1+P_T(E_T-1)+P_R(E_R-1)) =$	<u>0.9901</u>
flat terrain E_T =	1.5	
RV % =	0	
Driver Population adj. f_P =	1.000	
V_{fr} =	$=v_{fr}/(PHF)(f_{HV})(f_P) =$	5,930 pc/h
V_r =	$=v_r/(PHF)(f_{HV})(f_P) =$	1,074 pc/h
V_f =	$=v_f/(PHF)(f_{HV})(f_P) =$	4,851 pc/h
No. lanes upstream of ramp N =	4	

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

$D = 0.0175 (V_{fr}/N) = 25.9 \text{ pc/ln}$

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	5,930	No
3	Fwy downstream of ramp (assume 70 mph free-flow speed) =	7,200	4,851	No
1	Capacity on Off-Ramp (assume 45 mph free-flow speed) =	2,100	1,074	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 *2040 Build 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

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

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1617* pc/h/ln
 S *68.0* mph
 $D = v_p / S$ *23.8* pc/mi/ln
 LOS *C*

Design (N)

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

Glossary

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

Factor Location

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

FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 SB
Agency/Company	AECOM	Weaving Segment Location	Seg 14- Bet Sample & Copans
Date Performed		Analysis Year	2040 Build 2
Analysis Time Period	AM		

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}	3810	0.95	3	0	1.5	1.2	0.985	1.00	4071
V_{RF}	1980	0.92	2	0	1.5	1.2	0.990	1.00	2174
V_{FR}	730	0.92	2	0	1.5	1.2	0.990	1.00	801
V_{RR}	0	0.95	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	4071							V =	7046
V_W	2975								
VR	0.422								

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	6957 veh/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	5600 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.242	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}	6932 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 1-Bet Hillsboro & Palmetto*
 Jurisdiction
 Analysis Year *2040 Build 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>5000</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1336* pc/h/ln
 S *69.8* mph
 $D = v_p / S$ *19.1* pc/mi/ln
 LOS *C*

Design (N)

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

Glossary

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

Factor Location

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

FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	195/SB
Agency/Company	AECOM	Weaving Segment Location	Seg 2-Bet On from Exp & Off
Date Performed		Analysis Year	2040 Build 2
Analysis Time Period	PM		

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}	3835	0.95	3	0	1.5	1.2	0.985	1.00	4097
V_{RF}	1135	0.92	2	0	1.5	1.2	0.990	1.00	1246
V_{FR}	1165	0.92	2	0	1.5	1.2	0.990	1.00	1279
V_{RR}	95	0.92	2	0	1.5	1.2	0.990	1.00	104
V_{NW}	6622							V =	6726
V_W	104								
VR	0.015								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	0 lc	Minimum weaving lane changes, LC_{MIN}	312 lc/h
Interchange density, ID	0.7 int/mi	Weaving lane changes, LC_W	980 lc/h
Minimum RF lane changes, LC_{RF}	0 lc/pc	Non-weaving lane changes, LC_{NW}	3166 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	4146 lc/h
Minimum RR lane changes, LC_{RR}	3 lc/pc	Non-weaving vehicle index, I_{NW}	2410

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

Weaving segment flow rate, v	6641 veh/h	Weaving intensity factor, W	0.189
Weaving segment capacity, c_w	9257 veh/h	Weaving segment speed, S	59.7 mph
Weaving segment v/c ratio	0.717	Average weaving speed, S_W	61.3 mph
Weaving segment density, D	28.2 pc/mi/ln	Average non-weaving speed, S_{NW}	59.7 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	5870 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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>4970</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1770* pc/h/ln
 S *66.2* mph
 $D = v_p / S$ *26.7* pc/mi/ln
 LOS *D*

Design (N)

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

Glossary

N - Number of lanes
 V - Hourly volume
 v_p - Flow rate
 LOS - Level of service
 DDHV - Directional design hour volume

S - Speed
 D - Density
 FFS - Free-flow speed
 BFFS - Base free-flow speed

Factor Location

E_R - Exhibits 11-10, 11-12
 E_T - Exhibits 11-10, 11-11, 11-13
 f_p - Page 11-18
 LOS, S, FFS, v_p - Exhibits 11-2, 11-3

f_{LW} - Exhibit 11-8
 f_{LC} - Exhibit 11-9
 TRD - Page 11-11

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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	3950	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:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			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

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ 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
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ 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	2040 Build 2
Project Description SW 10th Street SIMR			

Inputs

Upstream Adj Ramp	Freeway Number of Lanes, N	3	Downstream Adj Ramp
<input checked="" type="checkbox"/> Yes <input type="checkbox"/> On	Ramp Number of Lanes, N	1	<input type="checkbox"/> Yes <input type="checkbox"/> On
<input type="checkbox"/> No <input checked="" type="checkbox"/> Off	Acceleration Lane Length, L _A	300	<input checked="" type="checkbox"/> No <input type="checkbox"/> Off
L _{up} = 2400 ft	Deceleration Lane Length L _D		L _{down} = ft
V _u = 1020 veh/h	Freeway Volume, V _F	3950	V _D = veh/h
	Ramp Volume, V _R	1690	
	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	3950	0.95	Level	3	0	0.985	1.00	4220
Ramp	1690	0.92	Level	2	0	0.990	1.00	1855
UpStream	1020	0.92	Level	2	0	0.990	1.00	1120
DownStream								

Merge Areas	Diverge Areas
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Estimation of v₁₂

$V_{12} = V_F (P_{FM})$ L _{EQ} = 1646.25 (Equation 13-6 or 13-7) P _{FM} = 0.586 using Equation (Exhibit 13-6) V ₁₂ = 2472 pc/h V ₃ or V _{av34} = 1748 pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = 2472 pc/h (Equation 13-16, 13-18, or 13-19)	$V_{12} = V_R + (V_F - V_R)P_{FD}$ 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? <input type="checkbox"/> Yes <input type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)
--	--

Estimation of v₁₂

Capacity Checks

	Actual	Capacity	LOS F?
V _{FO}	6075	Exhibit 13-8	No

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 Merge Influence Area

	Actual	Max Desirable	Violation?
V _{R12}	4327	Exhibit 13-8	4600:All No

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
V ₁₂		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 = 36.5 (pc/mi/ln) LOS = E (Exhibit 13-2)	$D_R = 4.252 + 0.0086 v_{12} - 0.009 L_D$ D _R = (pc/mi/ln) LOS = (Exhibit 13-2)
---	--

Level of Service Determination (if not F)

Speed Determination

M _S = 0.586 (Exhibit 13-11)
S _R = 53.6 mph (Exhibit 13-11)
S ₀ = 65.5 mph (Exhibit 13-11)
S = 56.5 mph (Exhibit 13-13)

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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>5640</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ 2009 pc/h/ln
 S *62.4* mph
 D = v_p / S *32.2* pc/mi/ln
 LOS *D*

Design (N)

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

Glossary

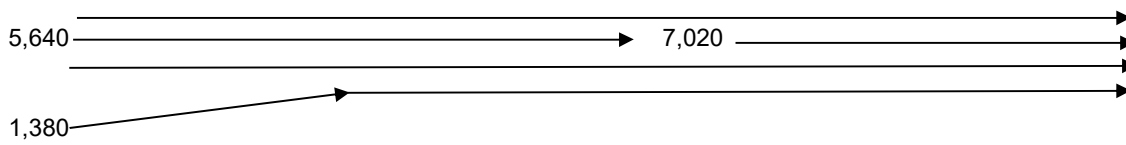
N - Number of lanes S - Speed
 V - Hourly volume D - Density
 v_p - Flow rate FFS - Free-flow speed
 LOS - Level of service BFFS - Base free-flow speed
 DDHV - Directional design hour volume

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 2



	PHF =	0.95	
	v_{fr} =	7,020	vph
	v_r =	1,380	vph
	v_f =	5,640	
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} =	$=v_{fr}/(PHF)(f_{HV})(f_P) =$	7,500 pc/h
	V_r =	$=v_r/(PHF)(f_{HV})(f_P) =$	1,467 pc/h
	V_f =	$=v_f/(PHF)(f_{HV})(f_P) =$	6,026 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	7,500	0.78	No
3	Fwy upstream of ramp (assume 70 mph free-flow speed) =	7,200	6,026	0.84	No
1	Capacity on On-Ramp (assume 45 mph free-flow speed) =	2,100	1,467	0.70	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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>7020</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1875* pc/h/ln
 S *64.7* mph
 $D = v_p / S$ *29.0* pc/mi/ln
 LOS *D*

Design (N)

Design (N)
 Design LOS
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ 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-Merge from Ex to GP
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2040 Build 2
Project Description SW 10th Street SIMR			

Inputs

Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off	Freeway Number of Lanes, N 4 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A 600 Deceleration Lane Length L _D Freeway Volume, V _F 7020 Ramp Volume, V _R 220 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 50.0	Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off L _{down} = 1150 ft V _D = 780 veh/h
L _{up} = ft		
V _u = 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	7020	0.95	Level	3	0	0.985	1.00	7500
Ramp	220	0.92	Level	2	0	0.990	1.00	242
UpStream								
DownStream	780	0.92	Level	2	0	0.990	1.00	856

Merge Areas

Diverge Areas

Estimation of v₁₂

$V_{12} = V_F (P_{FM})$
 (Equation 13-6 or 13-7)

L_{EQ} =
 P_{FM} = 0.188 using Equation (Exhibit 13-6)
 V₁₂ = 1407 pc/h
 V₃ or V_{av34} = 3046 pc/h (Equation 13-14 or 13-17)

Is V₃ or V_{av34} > 2,700 pc/h? Yes No
 Is V₃ or V_{av34} > 1.5 * V₁₂/2 Yes No
 If Yes, V_{12a} = 3000 pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v₁₂

$V_{12} = V_R + (V_F - V_R)P_{FD}$
 (Equation 13-12 or 13-13)

L_{EQ} =
 P_{FD} = using Equation (Exhibit 13-7)
 V₁₂ = pc/h
 V₃ or V_{av34} = pc/h (Equation 13-14 or 13-17)

Is V₃ or V_{av34} > 2,700 pc/h? Yes No
 Is V₃ or V_{av34} > 1.5 * V₁₂/2 Yes No
 If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity	LOS F?		Actual	Capacity	LOS F?
V _{FO}	7742	Exhibit 13-8	No	V _F		Exhibit 13-8	
				V _{FO} = V _F - V _R		Exhibit 13-8	
				V _R		Exhibit 13-10	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
V _{R12}	3242	Exhibit 13-8 4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
V ₁₂		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 = 26.9 (pc/mi/ln)
 LOS = C (Exhibit 13-2)

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

M_S = 0.361 (Exhibit 13-11)
 S_R = 59.9 mph (Exhibit 13-11)
 S₀ = 63.7 mph (Exhibit 13-11)
 S = 62.1 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)
 S_R = mph (Exhibit 13-12)
 S₀ = mph (Exhibit 13-12)
 S = mph (Exhibit 13-13)

RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 SB
Agency or Company	AECOM	Junction	Seg 11- Diverge to Express
Date Performed		Jurisdiction	
Analysis Time Period	PM	Analysis Year	2040 Build 2

Project Description SW 10th Street SIMR

Inputs			
Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off L _{up} = 1150 ft V _u = 220 veh/h	<table style="width: 100%;"> <tr> <td style="width: 50%;"> Freeway Number of Lanes, N 4 Ramp Number of Lanes, N 1 Acceleration Lane Length, L_A Deceleration Lane Length L_D 200 Freeway Volume, V_F 7240 Ramp Volume, V_R 780 Freeway Free-Flow Speed, S_{FF} 70.0 Ramp Free-Flow Speed, S_{FR} 45.0 </td> <td style="width: 50%;"> Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L_{down} = ft V_D = veh/h </td> </tr> </table>	Freeway Number of Lanes, N 4 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 7240 Ramp Volume, V _R 780 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L _{down} = ft V _D = veh/h
Freeway Number of Lanes, N 4 Ramp Number of Lanes, N 1 Acceleration Lane Length, L _A Deceleration Lane Length L _D 200 Freeway Volume, V _F 7240 Ramp Volume, V _R 780 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 45.0	Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off L _{down} = ft V _D = veh/h		

Conversion to pc/h Under Base Conditions								
(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f _{HV}	f _p	v = V/PHF x f _{HV} x f _p
Freeway	7240	0.95	Level	3	0	0.985	1.00	7735
Ramp	780	0.92	Level	2	0	0.990	1.00	856
UpStream	220	0.92	Level	2	0	0.990	1.00	242
DownStream								

Merge Areas	Diverge Areas
Estimation of v₁₂ $V_{12} = V_F (P_{FM})$ 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? <input type="checkbox"/> Yes <input type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)	Estimation of v₁₂ $V_{12} = V_R + (V_F - V_R)P_{FD}$ L _{EQ} = (Equation 13-12 or 13-13) P _{FD} = 0.436 using Equation (Exhibit 13-7) V ₁₂ = 3855 pc/h V ₃ or V _{av34} 1940 pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks				Capacity Checks			
	Actual	Capacity	LOS F?		Actual	Capacity	LOS F?
V _{FO}		Exhibit 13-8		V _F	7735	Exhibit 13-8	9600 No
				V _{FO} = V _F - V _R	6879	Exhibit 13-8	9600 No
				V _R	856	Exhibit 13-10	2100 No

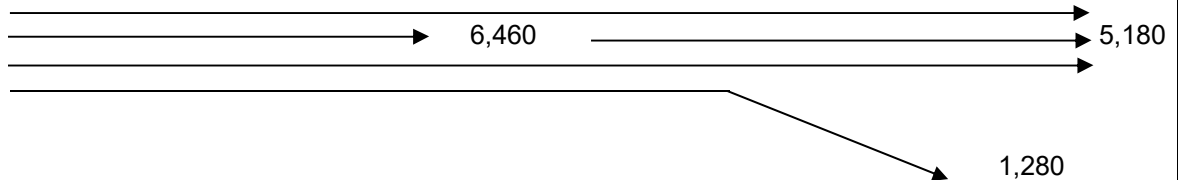
Flow Entering Merge Influence Area				Flow Entering Diverge Influence Area			
	Actual	Max Desirable	Violation?		Actual	Max Desirable	Violation?
V _{R12}		Exhibit 13-8		V ₁₂	3855	Exhibit 13-8	4400:All No

Level of Service Determination (if not F)	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)	$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$ D _R = 38.9 (pc/mi/ln) LOS = E (Exhibit 13-2)

Speed Determination	Speed Determination
M _S = (Exhibit 13-11)	D _s = 0.375 (Exhibit 13-12)
S _R = mph (Exhibit 13-11)	S _R = 59.5 mph (Exhibit 13-12)
S ₀ = mph (Exhibit 13-11)	S ₀ = 73.9 mph (Exhibit 13-12)
S = mph (Exhibit 13-13)	S = 65.2 mph (Exhibit 13-13)

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 2



PHF =	0.95	
v_{fr} =	6,460	vph
v_r =	1,280	vph
v_f =	5,180	
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} =	$=v_{fr}/(PHF)(f_{HV})(f_P) =$	6,902 pc/h
V_r =	$=v_r/(PHF)(f_{HV})(f_P) =$	1,361 pc/h
V_f =	$=v_f/(PHF)(f_{HV})(f_P) =$	5,534 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) = 30.2 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	6,902	No
3	Fwy downstream of ramp (assume 70 mph free-flow speed) =	7,200	5,534	No
1	Capacity on Off-Ramp (assume 45 mph free-flow speed) =	2,100	1,361	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 2*

Project Description *SW 10th Street SIMR*

Oper.(LOS)

Des.(N)

Planning Data

Flow Inputs

Volume, V	<i>5180</i>	veh/h	Peak-Hour Factor, PHF	<i>0.95</i>
AADT		veh/day	%Trucks and Buses, P _T	<i>3</i>
Peak-Hr Prop. of AADT, K			%RVs, P _R	<i>0</i>
Peak-Hr Direction Prop, D			General Terrain:	<i>Level</i>
DDHV = AADT x K x D		veh/h	Grade % Length	<i>mi</i>
			Up/Down %	

Calculate Flow Adjustments

f _p	<i>1.00</i>	E _R	<i>1.2</i>
E _T	<i>1.5</i>	f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	<i>0.985</i>

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)
 $v_p = (V \text{ or } DDHV) / (PHF \times N \times f_{HV} \times f_p)$ *1845* pc/h/ln
 S *65.2* mph
 $D = v_p / S$ *28.3* pc/mi/ln
 LOS *D*

Design (N)

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

Glossary

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

Factor Location

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

FREEWAY WEAVING WORKSHEET

General Information		Site Information	
Analyst		Freeway/Dir of Travel	I-95 SB
Agency/Company	AECOM	Weaving Segment Location	Seg 14- Bet Sample & Copans
Date Performed		Analysis Year	2040 Build 2
Analysis Time Period	PM		

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}	4415	0.95	3	0	1.5	1.2	0.985	1.00	4717
V_{RF}	1590	0.92	2	0	1.5	1.2	0.990	1.00	1746
V_{FR}	765	0.92	2	0	1.5	1.2	0.990	1.00	840
V_{RR}	0	0.95	0	0	1.5	1.2	1.000	1.00	0
V_{NW}	4717							V =	7303
V_W	2586								
VR	0.354								

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	7208 veh/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	6678 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.079	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}	6171 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".