

RAMPS AND RAMP JUNCTIONS WORKSHEET									
General Information					Site Information				
Analyst		JRE		Freeway/Dir of Travel		I-80 Eastbound			
Agency or Company		AECOM		Junction		Int. 303 from Route 611			
Date Performed		1/3/2014		Jurisdiction					
Analysis Time Period		A.M. Peak Hour		Analysis Year		Alt2A 2045			
Project Description Interstate 80 Reconstruction									
Inputs									
Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off L _{up} = 1750 ft V _u = 337 veh/h		Number of Lanes, N 3 Acceleration Lane Length, L _A 750 Deceleration Lane Length L _D Freeway Volume, V _F 2599 Ramp Volume, V _R 190 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 35.0				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	2599	0.94	Rolling	10	1	0.862	0.95	3376	
Ramp	190	0.94	Rolling	5	1	0.922	0.95	231	
UpStream	337	0.82	Rolling	2	0	0.971	0.95	446	
DownStream									
Merge Areas					Diverge Areas				
Estimation of v₁₂					Estimation of v₁₂				
$V_{12} = V_F (P_{FM})$ L _{EQ} = 533.10 (Equation 13-6 or 13-7) P _{FM} = 0.599 using Equation (Exhibit 13-6) V ₁₂ = 2021 pc/h V ₃ or V _{av34} = 1355 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)					$V_{12} = V_R + (V_F - V_R)P_{FD}$ 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					Capacity Checks				
	Actual	Capacity		LOS F?		Actual	Capacity		LOS F?
V _{FO}	3607	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}	2252	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 = 18.2 (pc/mi/ln) LOS = B (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 = 0.306 (Exhibit 13-11) S _R = 61.4 mph (Exhibit 13-11) S ₀ = 66.9 mph (Exhibit 13-11) S = 63.4 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)				

RAMPS AND RAMP JUNCTIONS WORKSHEET									
General Information					Site Information				
Analyst		JRE		Freeway/Dir of Travel		I-80 Eastbound			
Agency or Company		AECOM		Junction		Int. 303 from Route 611			
Date Performed		1/3/2014		Jurisdiction					
Analysis Time Period		P.M. Peak Hour		Analysis Year		Alt2A 2045			
Project Description Interstate 80 Reconstruction									
Inputs									
Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off		Number of Lanes, N 3				Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off			
		Acceleration Lane Length, L_A 750							
$L_{up} =$ 1750 ft		Deceleration Lane Length L_D				$L_{down} =$ ft			
		Freeway Volume, V_F 3275				$V_D =$ veh/h			
$V_u =$ 449 veh/h		Ramp Volume, V_R 268							
		Freeway Free-Flow Speed, S_{FF} 70.0							
		Ramp Free-Flow Speed, S_{FR} 35.0							
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	3275	0.94	Rolling	12	1	0.840	0.95	4364	
Ramp	268	0.94	Rolling	2	1	0.962	0.95	312	
UpStream	449	0.86	Rolling	3	0	0.957	0.95	574	
DownStream									
Merge Areas					Diverge Areas				
Estimation of v_{12}					Estimation of v_{12}				
$V_{12} = V_F (P_{FM})$ $L_{EQ} =$ 761.86 (Equation 13-6 or 13-7) $P_{FM} =$ 0.599 using Equation (Exhibit 13-6) $V_{12} =$ 2612 pc/h V_3 or V_{av34} 1752 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)					$V_{12} = V_R + (V_F - V_R)P_{FD}$ $L_{EQ} =$ (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					Capacity Checks				
	Actual	Capacity		LOS F?		Actual	Capacity		LOS F?
V_{FO}	4676	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}	2924	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)				
$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$ $D_R =$ 23.4 (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				
$M_S =$ 0.341 (Exhibit 13-11) $S_R =$ 60.4 mph (Exhibit 13-11) $S_0 =$ 65.5 mph (Exhibit 13-11) $S =$ 62.2 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)				

RAMPS AND RAMP JUNCTIONS WORKSHEET									
General Information					Site Information				
Analyst		JRE		Freeway/Dir of Travel		I-80 Westbound			
Agency or Company		AECOM		Junction		Int. 303 from Route 611			
Date Performed		1/3/2014		Jurisdiction					
Analysis Time Period		A.M. Peak Hour		Analysis Year		Alt2A 2045			
Project Description Interstate 80 Reconstruction									
Inputs									
Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off L _{up} = 2200 ft V _u = 106 veh/h		Number of Lanes, N 3 Acceleration Lane Length, L _A 600 Deceleration Lane Length L _D Freeway Volume, V _F 2195 Ramp Volume, V _R 173 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 35.0				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	2195	0.97	Rolling	12	1	0.840	0.95	2835	
Ramp	173	0.74	Rolling	2	0	0.971	0.95	253	
UpStream	106	0.94	Rolling	8	1	0.885	0.95	134	
DownStream									
Merge Areas					Diverge Areas				
Estimation of v₁₂					Estimation of v₁₂				
$V_{12} = V_F (P_{FM})$ L _{EQ} = 355.43 (Equation 13-6 or 13-7) P _{FM} = 0.594 using Equation (Exhibit 13-6) V ₁₂ = 1685 pc/h V ₃ or V _{av34} = 1150 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)					$V_{12} = V_R + (V_F - V_R)P_{FD}$ 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					Capacity Checks				
	Actual	Capacity		LOS F?		Actual	Capacity		LOS F?
V _{FO}	3088	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}	1938	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 = 16.7 (pc/mi/ln) LOS = B (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 = 0.306 (Exhibit 13-11) S _R = 61.4 mph (Exhibit 13-11) S ₀ = 67.7 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)				

RAMPS AND RAMP JUNCTIONS WORKSHEET									
General Information					Site Information				
Analyst		JRE		Freeway/Dir of Travel		I-80 Westbound			
Agency or Company		AECOM		Junction		Int. 303 from Route 611			
Date Performed		1/3/2014		Jurisdiction					
Analysis Time Period		P.M. Peak Hour		Analysis Year		Alt2A 2045			
Project Description Interstate 80 Reconstruction									
Inputs									
Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off L _{up} = 2200 ft V _u = 204 veh/h		Number of Lanes, N 3 Acceleration Lane Length, L _A 600 Deceleration Lane Length L _D Freeway Volume, V _F 4559 Ramp Volume, V _R 322 Freeway Free-Flow Speed, S _{FF} 70.0 Ramp Free-Flow Speed, S _{FR} 35.0				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	4559	0.97	Rolling	13	1	0.830	0.95	5962	
Ramp	322	0.87	Rolling	1	0	0.985	0.95	395	
UpStream	204	0.94	Rolling	2	1	0.962	0.95	238	
DownStream									
Merge Areas					Diverge Areas				
Estimation of v₁₂					Estimation of v₁₂				
$V_{12} = V_F (P_{FM})$ L _{EQ} = 1055.00 (Equation 13-6 or 13-7) P _{FM} = 0.594 using Equation (Exhibit 13-6) V ₁₂ = 3543 pc/h V ₃ or V _{av34} = 2419 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)					$V_{12} = V_R + (V_F - V_R)P_{FD}$ 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					Capacity Checks				
	Actual	Capacity		LOS F?		Actual	Capacity		LOS F?
V _{FO}	6357	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}	3938	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 = 32.2 (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)				
Speed Determination					Speed Determination				
M _S = 0.479 (Exhibit 13-11) S _R = 56.6 mph (Exhibit 13-11) S ₀ = 62.8 mph (Exhibit 13-11) S = 58.8 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)				

RAMPS AND RAMP JUNCTIONS WORKSHEET									
General Information					Site Information				
Analyst		JRE		Freeway/Dir of Travel		I-80 Westbound			
Agency or Company		AECOM		Junction		Int. 305 from Main St			
Date Performed		1/3/2014		Jurisdiction					
Analysis Time Period		A.M. Peak Hour		Analysis Year		Alt2A 2045			
Project Description Interstate 80 Reconstruction									
Inputs									
Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off		Number of Lanes, N 3				Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off			
		Acceleration Lane Length, L_A 1300							
$L_{up} =$ 1600 ft		Deceleration Lane Length L_D				$L_{down} =$ ft			
		Freeway Volume, V_F 1857				$V_D =$ veh/h			
$V_u =$ 891 veh/h		Ramp Volume, V_R 271							
		Freeway Free-Flow Speed, S_{FF} 70.0							
		Ramp Free-Flow Speed, S_{FR} 35.0							
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	1857	0.97	Rolling	12	1	0.840	0.95	2398	
Ramp	271	0.94	Rolling	8	1	0.885	0.95	343	
UpStream	891	0.94	Rolling	8	1	0.885	0.95	1127	
DownStream									
Merge Areas					Diverge Areas				
Estimation of v_{12}					Estimation of v_{12}				
$V_{12} = V_F (P_{FM})$ $L_{EQ} =$ 591.97 (Equation 13-6 or 13-7) $P_{FM} =$ 0.614 using Equation (Exhibit 13-6) $V_{12} =$ 1472 pc/h V_3 or V_{av34} 926 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)					$V_{12} = V_R + (V_F - V_R)P_{FD}$ $L_{EQ} =$ (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					Capacity Checks				
	Actual	Capacity		LOS F?		Actual	Capacity		LOS F?
V_{FO}	2741	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}	1815	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)				
$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$ $D_R =$ 11.3 (pc/mi/ln) LOS = B (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				
$M_S =$ 0.254 (Exhibit 13-11)					$D_S =$ (Exhibit 13-12)				
$S_R =$ 62.9 mph (Exhibit 13-11)					$S_R =$ mph (Exhibit 13-12)				
$S_0 =$ 68.5 mph (Exhibit 13-11)					$S_0 =$ mph (Exhibit 13-12)				
$S =$ 64.7 mph (Exhibit 13-13)					$S =$ mph (Exhibit 13-13)				

RAMPS AND RAMP JOCTIONS WORKSHEET									
General Information				Site Information					
Analyst		JRE		Freeway/Dir of Travel		I-80 Westbound			
Agency or Company		AECOM		Junction		Int. 305 from Main St			
Date Performed		1/3/2014		Jurisdiction					
Analysis Time Period		P.M. Peak Hour		Analysis Year		Alt2A 2045			
Project Description Interstate 80 Reconstruction									
Inputs									
Upstream Adj Ramp		Number of Lanes, N				3		Downstream Adj Ramp	
<input type="checkbox"/> Yes <input type="checkbox"/> On		Acceleration Lane Length, L _A				1300		<input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On	
<input checked="" type="checkbox"/> No <input type="checkbox"/> Off		Deceleration Lane Length L _D						<input type="checkbox"/> No <input type="checkbox"/> Off	
L _{up} = ft		Freeway Volume, V _F				4312		L _{down} = 1600 ft	
		Ramp Volume, V _R				505			
		Freeway Free-Flow Speed, S _{FF}				70.0			
V _u = veh/h		Ramp Free-Flow Speed, S _{FR}				35.0		V _D = 1758 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	4312	0.97	Rolling	13	1	0.830	0.95	5639	
Ramp	505	0.94	Rolling	2	1	0.962	0.95	588	
UpStream									
DownStream	1758	0.94	Rolling	2	1	0.962	0.95	2047	
Merge Areas					Diverge Areas				
Estimation of v₁₂					Estimation of v₁₂				
$V_{12} = V_F (P_{FM})$ L _{EQ} = (Equation 13-6 or 13-7) P _{FM} = 0.614 using Equation (Exhibit 13-6) V ₁₂ = 3462 pc/h V ₃ or V _{av34} = 2177 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)					$V_{12} = V_R + (V_F - V_R)P_{FD}$ 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					Capacity Checks				
	Actual	Capacity		LOS F?		Actual	Capacity		LOS F?
V _{FO}	6227	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}	4050	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 = 4.252 + 0.0086 V ₁₂ - 0.009 L _D				
D _R = 28.6 (pc/mi/ln)					D _R = (pc/mi/ln)				
LOS = D (Exhibit 13-2)					LOS = (Exhibit 13-2)				
Speed Determination					Speed Determination				
M _S = 0.454 (Exhibit 13-11)					D _S = (Exhibit 13-12)				
S _R = 57.3 mph (Exhibit 13-11)					S _R = mph (Exhibit 13-12)				
S ₀ = 64.0 mph (Exhibit 13-11)					S ₀ = mph (Exhibit 13-12)				
S = 59.5 mph (Exhibit 13-13)					S = mph (Exhibit 13-13)				

RAMPS AND RAMP JUNCTIONS WORKSHEET									
General Information					Site Information				
Analyst		JRE		Freeway/Dir of Travel		I-80 Westbound			
Agency or Company		AECOM		Junction		Int. 307 from Broad Street			
Date Performed		8/1/2013		Jurisdiction					
Analysis Time Period		A.M. Peak Hour		Analysis Year		Alt2A 2045			
Project Description Interstate 80 Reconstruction									
Inputs									
Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off		Number of Lanes, N 3				Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off			
		Acceleration Lane Length, L_A 1500							
$L_{up} =$ 1600 ft		Deceleration Lane Length L_D				$L_{down} =$ ft			
		Freeway Volume, V_F 2767				$V_D =$ veh/h			
$V_u =$ 360 veh/h		Ramp Volume, V_R 473							
		Freeway Free-Flow Speed, S_{FF} 70.0							
		Ramp Free-Flow Speed, S_{FR} 35.0							
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	2767	0.91	Rolling	12	1	0.840	0.95	3809	
Ramp	473	0.91	Rolling	6	0	0.917	0.95	596	
UpStream	360	0.90	Rolling	3	0	0.957	0.95	440	
DownStream									
Merge Areas					Diverge Areas				
Estimation of v_{12}					Estimation of v_{12}				
$V_{12} = V_F (P_{FM})$ $L_{EQ} =$ 1036.87 (Equation 13-6 or 13-7) $P_{FM} =$ 0.619 using Equation (Exhibit 13-6) $V_{12} =$ 2360 pc/h V_3 or V_{av34} 1449 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)					$V_{12} = V_R + (V_F - V_R)P_{FD}$ $L_{EQ} =$ (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					Capacity Checks				
	Actual	Capacity		LOS F?		Actual	Capacity		LOS F?
V_{FO}	4405	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}	2956	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)				
$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$ $D_R =$ 18.9 (pc/mi/ln) LOS = B (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				
$M_S =$ 0.291 (Exhibit 13-11)					$D_S =$ (Exhibit 13-12)				
$S_R =$ 61.9 mph (Exhibit 13-11)					$S_R =$ mph (Exhibit 13-12)				
$S_0 =$ 66.6 mph (Exhibit 13-11)					$S_0 =$ mph (Exhibit 13-12)				
$S =$ 63.3 mph (Exhibit 13-13)					$S =$ mph (Exhibit 13-13)				

RAMPS AND RAMP JUNCTIONS WORKSHEET									
General Information					Site Information				
Analyst		JRE		Freeway/Dir of Travel		I-80 Westbound			
Agency or Company		AECOM		Junction		Int. 307 from Broad Street			
Date Performed		8/1/2013		Jurisdiction					
Analysis Time Period		P.M. Peak Hour		Analysis Year		Alt2A 2045			
Project Description Interstate 80 Reconstruction									
Inputs									
Upstream Adj Ramp <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On <input type="checkbox"/> No <input checked="" type="checkbox"/> Off		Number of Lanes, N 3				Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off			
		Acceleration Lane Length, L_A 1500							
$L_{up} =$ 1600 ft		Deceleration Lane Length L_D				$L_{down} =$ ft			
		Freeway Volume, V_F 5961				$V_D =$ veh/h			
$V_u =$ 560 veh/h		Ramp Volume, V_R 790							
		Freeway Free-Flow Speed, S_{FF} 70.0							
		Ramp Free-Flow Speed, S_{FR} 35.0							
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	5961	0.96	Rolling	12	1	0.840	0.95	7778	
Ramp	790	0.89	Rolling	1	0	0.985	0.95	948	
UpStream	560	0.88	Rolling	1	0	0.985	0.95	680	
DownStream									
Merge Areas					Diverge Areas				
Estimation of v_{12}					Estimation of v_{12}				
$V_{12} = V_F (P_{FM})$ $L_{EQ} =$ 1961.56 (Equation 13-6 or 13-7) $P_{FM} =$ 0.597 using Equation (Exhibit 13-6) $V_{12} =$ 4640 pc/h V_3 or V_{av34} 3138 pc/h (Equation 13-14 or 13-17) Is V_3 or $V_{av34} > 2,700$ pc/h? <input checked="" type="checkbox"/> Yes <input 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, $V_{12a} =$ 5078 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					Capacity Checks				
	Actual	Capacity		LOS F?		Actual	Capacity		LOS F?
V_{FO}	8726	Exhibit 13-8		Yes	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}	6026	Exhibit 13-8	4600:All	Yes	V_{12}		Exhibit 13-8		
Level of Service Determination (if not F)					Level of Service Determination (if not F)				
$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$ $D_R =$ 42.6 (pc/mi/ln) LOS = F (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				
$M_S =$ 1.831 (Exhibit 13-11)					$D_S =$ (Exhibit 13-12)				
$S_R =$ 18.7 mph (Exhibit 13-11)					$S_R =$ mph (Exhibit 13-12)				
$S_0 =$ 61.1 mph (Exhibit 13-11)					$S_0 =$ mph (Exhibit 13-12)				
$S =$ 23.9 mph (Exhibit 13-13)					$S =$ mph (Exhibit 13-13)				