

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	Number of Lanes, N		3		Downstream Adj Ramp				
<input checked="" type="checkbox"/> Yes <input type="checkbox"/> On	Acceleration Lane Length, L _A		750		<input type="checkbox"/> Yes <input type="checkbox"/> On				
<input type="checkbox"/> No <input checked="" type="checkbox"/> Off	Deceleration Lane Length L _D				<input checked="" type="checkbox"/> No <input type="checkbox"/> Off				
L _{up} = 1750 ft	Freeway Volume, V _F		2599		L _{down} = ft				
V _u = 337 veh/h	Ramp Volume, V _R		190		V _D = veh/h				
	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 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 v ₁₂					Estimation of v ₁₂				
$V_{12} = V_F (P_{FM})$ 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		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)					D _S = (Exhibit 13-12)				
S _R = 61.4 mph (Exhibit 13-11)					S _R = mph (Exhibit 13-12)				
S ₀ = 66.9 mph (Exhibit 13-11)					S ₀ = mph (Exhibit 13-12)				
S = 63.4 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 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 Acceleration Lane Length, L _A Deceleration Lane Length L _D	3 750			Downstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off				
L _{up} = 1750 ft	Freeway Volume, V _F	3275			L _{down} = ft				
V _u = 449 veh/h	Ramp Volume, V _R	268			V _D = veh/h				
	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 x f _{HV} x 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		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)					D _S = (Exhibit 13-12)				
S _R = 60.4 mph (Exhibit 13-11)					S _R = mph (Exhibit 13-12)				
S ₀ = 65.5 mph (Exhibit 13-11)					S ₀ = mph (Exhibit 13-12)				
S = 62.2 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. 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 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}	3 600 4559 322 70.0 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		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)					D _S = (Exhibit 13-12)				
S _R = 56.6 mph (Exhibit 13-11)					S _R = mph (Exhibit 13-12)				
S ₀ = 62.8 mph (Exhibit 13-11)					S ₀ = mph (Exhibit 13-12)				
S = 58.8 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. 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 L _{up} = 1600 ft V _u = 891 veh/h	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}	3 1300 1857 271 70.0 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	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) S _R = 62.9 mph (Exhibit 13-11) S ₀ = 68.5 mph (Exhibit 13-11) S = 64.7 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	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			
V _u = veh/h		Ramp Volume, V _R		505		V _D = 1758 veh/h			
		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 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 v ₁₂					Estimation of v ₁₂				
$V_{12} = V_F (P_{FM})$ (Equation 13-6 or 13-7) L _{EQ} = 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)					$V_{12} = V_R + (V_F - V_R)P_{FD}$ (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? <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		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 = 28.6 (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 = 0.454 (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 L _{up} = 1600 ft V _u = 360 veh/h	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}	3 1500 2767 473 70.0 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	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 L _{up} = 1600 ft V _u = 560 veh/h	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}	3 1500 5961 790 70.0 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	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)					