

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		9/11/2014		Jurisdiction					
Analysis Time Period		A.M. Peak Hour		Analysis Year		Alt B1 Ph II 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} = 2600 ft V _u = 174 veh/h		Number of Lanes, N 3 Acceleration Lane Length, L _A 600 Deceleration Lane Length L _D Freeway Volume, V _F 2136 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	2136	0.97	Rolling	12	1	0.840	0.95	2758	
Ramp	173	0.74	Rolling	2	0	0.971	0.95	253	
UpStream	174	0.94	Rolling	8	1	0.885	0.95	220	
DownStream									
Merge Areas					Diverge Areas				
Estimation of v₁₂					Estimation of v₁₂				
$V_{12} = V_F (P_{FM})$ L _{EQ} = 338.95 (Equation 13-6 or 13-7) P _{FM} = 0.594 using Equation (Exhibit 13-6) V ₁₂ = 1639 pc/h V ₃ or V _{av34} = 1119 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}	3011	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}	1892	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 = 16.4 (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 = 0.305 (Exhibit 13-11) S _R = 61.5 mph (Exhibit 13-11) S ₀ = 67.8 mph (Exhibit 13-11) S = 63.7 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)				

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Date Performed		9/11/2014		Jurisdiction					
Analysis Time Period		P.M. Peak Hour		Analysis Year		Alt B1 Ph II 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} = 2600 ft V _u = 269 veh/h		Number of Lanes, N 3 Acceleration Lane Length, L _A 600 Deceleration Lane Length L _D Freeway Volume, V _F 4414 Ramp Volume, V _R 332 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	4414	0.97	Rolling	13	1	0.830	0.95	5772	
Ramp	332	0.87	Rolling	1	0	0.985	0.95	408	
UpStream	269	0.94	Rolling	2	1	0.962	0.95	313	
DownStream									
Merge Areas					Diverge Areas				
Estimation of v₁₂					Estimation of v₁₂				
$V_{12} = V_F (P_{FM})$ L _{EQ} = 1017.12 (Equation 13-6 or 13-7) P _{FM} = 0.594 using Equation (Exhibit 13-6) V ₁₂ = 3430 pc/h V ₃ or V _{av34} = 2342 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}	6180	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}	3838	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 = 31.5 (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 = 0.460 (Exhibit 13-11) S _R = 57.1 mph (Exhibit 13-11) S ₀ = 63.2 mph (Exhibit 13-11) S = 59.3 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		9/11/2014		Jurisdiction					
Analysis Time Period		A.M. Peak Hour		Analysis Year		Alt B1 Ph II 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} = 2700 ft V _u = 1302 veh/h		Number of Lanes, N 3 Acceleration Lane Length, L _A 1500 Deceleration Lane Length L _D Freeway Volume, V _F 1904 Ramp Volume, V _R 196 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	1904	0.97	Rolling	12	1	0.840	0.95	2459	
Ramp	196	0.94	Rolling	8	1	0.885	0.95	248	
UpStream	1302	0.94	Rolling	8	1	0.885	0.95	1648	
DownStream									
Merge Areas					Diverge Areas				
Estimation of v₁₂					Estimation of v₁₂				
$V_{12} = V_F (P_{FM})$ L _{EQ} = 673.50 (Equation 13-6 or 13-7) P _{FM} = 0.619 using Equation (Exhibit 13-6) V ₁₂ = 1523 pc/h V ₃ or V _{av34} = 936 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}	2707	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}	1771	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 = 9.8 (pc/mi/ln) LOS = A (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 = 0.239 (Exhibit 13-11) S _R = 63.3 mph (Exhibit 13-11) S ₀ = 68.4 mph (Exhibit 13-11) S = 65.0 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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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		9/11/2014		Jurisdiction					
Analysis Time Period		P.M. Peak Hour		Analysis Year		Alt B1 Ph II 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							
$L_{up} =$ 2700 ft		Deceleration Lane Length L_D				$L_{down} =$ ft			
		Freeway Volume, V_F 4069				$V_D =$ veh/h			
$V_u =$ 2603 veh/h		Ramp Volume, V_R 360							
		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	4069	0.97	Rolling	13	1	0.830	0.95	5321	
Ramp	360	0.94	Rolling	2	1	0.962	0.95	419	
UpStream	2603	0.94	Rolling	2	1	0.962	0.95	3031	
DownStream									
Merge Areas					Diverge Areas				
Estimation of v_{12}					Estimation of v_{12}				
$V_{12} = V_F (P_{FM})$ $L_{EQ} =$ 1322.56 (Equation 13-6 or 13-7) $P_{FM} =$ 0.619 using Equation (Exhibit 13-6) $V_{12} =$ 3296 pc/h V_3 or V_{av34} 2025 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}	5740	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}	3715	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)				
$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$ $D_R =$ 24.9 (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				
$M_S =$ 0.376 (Exhibit 13-11) $S_R =$ 59.5 mph (Exhibit 13-11) $S_0 =$ 64.5 mph (Exhibit 13-11) $S =$ 61.2 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 Eastbound			
Agency or Company		AECOM		Junction		Int. 304 from US 209			
Date Performed		9/11/2014		Jurisdiction					
Analysis Time Period		A.M. Peak Hour		Analysis Year		Alt B1 Ph II 2045			
Project Description Interstate 80 Reconstruction									
Inputs									
Upstream Adj Ramp <input type="checkbox"/> Yes <input type="checkbox"/> On <input checked="" type="checkbox"/> No <input type="checkbox"/> Off		Number of Lanes, N				3		Downstream Adj Ramp <input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On <input type="checkbox"/> No <input type="checkbox"/> Off	
		Acceleration Lane Length, L_A				1050			
$L_{up} =$ ft		Deceleration Lane Length L_D						$L_{down} =$ 3500 ft	
		Freeway Volume, V_F				2302			
$V_u =$ veh/h		Ramp Volume, V_R				1468		$V_D =$ 434 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	$v = V/PHF \times f_{HV} \times f_p$	
Freeway	2302	0.94	Rolling	10	1	0.862	0.95	2990	
Ramp	1468	0.94	Rolling	5	1	0.922	0.95	1784	
UpStream									
DownStream	434	0.82	Rolling	2	0	0.971	0.95	574	
Merge Areas					Diverge Areas				
Estimation of v_{12}					Estimation of v_{12}				
$V_{12} = V_F (P_{FM})$ $L_{EQ} =$ (Equation 13-6 or 13-7) $P_{FM} =$ 0.607 using Equation (Exhibit 13-6) $V_{12} =$ 1815 pc/h V_3 or V_{av34} 1175 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}	4774	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}	3599	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)				
$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$ $D_R =$ 26.1 (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				
$M_S =$ 0.390 (Exhibit 13-11) $S_R =$ 59.1 mph (Exhibit 13-11) $S_0 =$ 67.6 mph (Exhibit 13-11) $S =$ 61.0 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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